MathsWatch eBook

Questions & Answers Interleaved

HIGHER TIER

Grades D, C, B, A and A*

Clips 44 to 183, Pages 44 to 183B

The aims of MathsWatch are:

- To produce the best and most comprehensive Maths GCSE revision videos possible.
- To produce the best and most comprehensive Maths GCSE worksheets possible.
- To improve our discs, year on year.

This eBook is given to any institution which buys a minimum of 30 MathsWatch discs or has a current site licence. It is allowed to be: stored in digital format on a password-protected part of the institution's VLE or network; used by means of an IWB; photocopied for the use of the students of the purchasing institution; made into booklets and reproduced for students.

Our business model is simple - we sell discs in bulk to professionals like you so that, in turn, you can sell (or give) them to your students.

This MathsWatch eBook, with interleaved questions and answers, is our way of saying 'thank you' for your support.

MathsWatch eBook

Grade D topics

Clips 44 to 91

48 Topics

76 Pages

Grade C topics

Clips 92 to 134

43 Topics

72 Pages

Grade B topics

Clips 135 to 154

20 Topics

43 Pages

Grade A and A* topics

Clips 155 to 183

29 Topics

55 Pages

The Higher Syllabus

Grade D topics

Grade C topics

Grade B topics **Page**

Grade A and A* topics **Page**

Factors, Multiples and Primes

1) Write the factors of

a) 6 b) 16 c) 18 d) 30

2) In a pupil's book the factors of 12 are listed as

1 2 3 4 5 12

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed

30: 1, 2, 3, 5, 6, 10, 15, 30
40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).

4) Write the first four multiples of

a) 3 b) 5 c) 10 d) 15

5) In a pupil's book the first 7 multiples of 8 are listed as

8 16 22 32 40 48 54

The above list contains 2 mistakes.
Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed

4: 4, 8, 12, 16, 20
10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.

7) List the first five prime numbers

8) Using just this list of numbers:

11 18 1 4 21 24 9 3 12 2 19

find the following:

a) The prime numbers

b) The factors of 18

c) The multiples of 3

Factors, Multiples and Primes

1) Write the factors of

a) 6 — 1, 2, 3, 6

b) 16 — 1, 2, 4, 8, 16

c) 18 — 1, 2, 3, 6, 9, 18

d) 30 — 1, 2, 3, 5, 6, 10, 15, 30

2) In a pupil's book the factors of 12 are listed as

1 2 3 4 ~~8~~ 12
6

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed

30: 1, 2, 3, 5, 6, 10, 15, 30
40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).

1, 2, 5, 10

4) Write the first four multiples of

a) 3 — 3, 6, 9, 12

b) 5 — 5, 10, 15, 20

c) 10 — 10, 20, 30, 40

d) 15 — 15, 30, 45, 60

5) In a pupil's book the first 7 multiples of 8 are listed as

8 16 ~~22~~ 32 40 48 ~~54~~
24 56

The above list contains 2 mistakes.
Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed

4: 4, 8, 12, 16, 20
10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.

20

7) List the first five prime numbers

2, 3, 5, 7, 11

8) Using just this list of numbers:

11 18 1 4 21 24 9 3 12 2 19

find the following:

a) The prime numbers 2, 3, 11, 19

b) The factors of 18 1, 2, 3, 9, 18

c) The multiples of 3 3, 9, 12, 18, 21, 24

Evaluate Powers

1) Evaluate the following:

a) 2^3

b) 3^2

c) 10^4

2) Evaluate the following:

a) 2^8

b) 6^4

c) 5^6

3) Find the value of

a) $2^4 + 3^2$

b) $5^2 - 2^3$

c) $1^2 + 2^2 + 3^2$

4) Find the value of

a) $5^4 + 6^3$

b) $3^4 \times 2^5$

c) $9^3 - 6^3$

5) Find the value of

$2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$

Evaluate Powers

1) Evaluate the following:

a) 2^3 8

b) 3^2 9

c) 10^4 10000

2) Evaluate the following:

a) 2^8 256

b) 6^4 1296

c) 5^6 15625

3) Find the value of

a) $2^4 + 3^2$ 25

b) $5^2 - 2^3$ 17

c) $1^2 + 2^2 + 3^2$ 14

4) Find the value of

a) $5^4 + 6^3$ 841

b) $3^4 \times 2^5$ 2592

c) $9^3 - 6^3$ 513

5) Find the value of

$2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$ 666

Understanding Squares, Cubes & Roots

1) What is the value of 5^2?

2) What is the value of 8^2?

3) These are the first five square numbers: 1, 4, 9, 16, 25

a) What is the sixth square number?

b) What is the 10th square number?

4) Which square number lies between 60 and 70?

5) What is the value of 2^3?

6) What is the value of 4^3?

7) Work out $1^3 + 2^3 + 3^3$

8) Work out $\sqrt{25}$

9) Work out $\sqrt{49}$

10) Work out the value of $\sqrt{121} \times \sqrt{121}$

11) Match together cards with the same answer

9^2	$\sqrt{9}$	81	5^3
2^5	125	32	3

Understanding Squares, Cubes & Roots

1) What is the value of 5^2? 25

2) What is the value of 8^2? 64

3) These are the first five square numbers: 1, 4, 9, 16, 25

a) What is the sixth square number? 36

b) What is the 10th square number? 100

4) Which square number lies between 60 and 70? 64

5) What is the value of 2^3? 8

6) What is the value of 4^3? 64

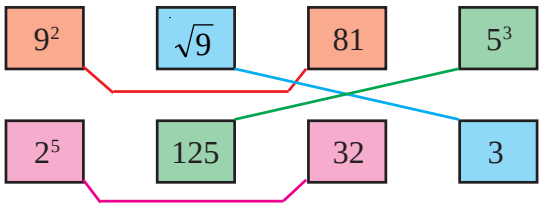
7) Work out $1^3 + 2^3 + 3^3$ 36

8) Work out $\sqrt{25}$ 5

9) Work out $\sqrt{49}$ 7

10) Work out the value of $\sqrt{121} \times \sqrt{121}$ 121

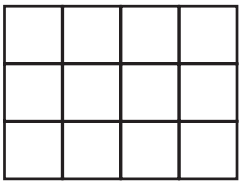
11) Match together cards with the same answer

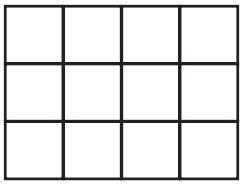


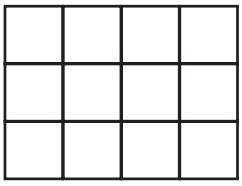
Equivalent Fractions

1) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

$\frac{8}{12}$ 

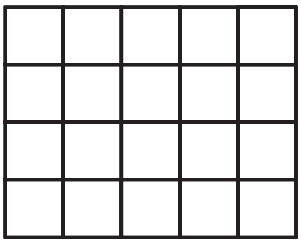
$\frac{4}{6}$ 

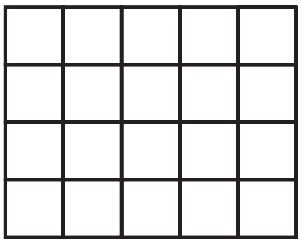
$\frac{2}{3}$ 

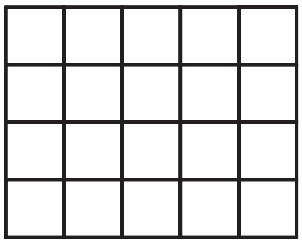
b) What do you notice about how many little squares are shaded in each grid?

2) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

$\frac{2}{5}$ 

$\frac{4}{10}$ 

$\frac{8}{20}$ 

b) What do you notice about how many little squares are shaded in each grid?

3) Find the missing values in these equivalent fractions.

$$\frac{1}{2} = \frac{2}{\square} = \frac{3}{\square} = \frac{4}{\square}$$

4) Find the missing values in these equivalent fractions.

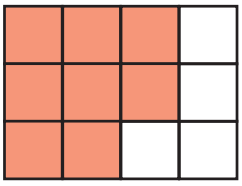
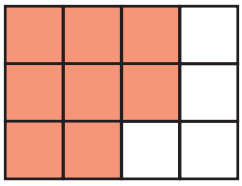
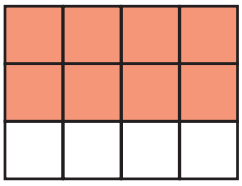
$$\frac{2}{5} = \frac{6}{\square} = \frac{\square}{30} = \frac{14}{\square}$$

5) How do you know that $\frac{3}{7}$ is not equivalent to $\frac{25}{56}$?

Equivalent Fractions

1) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

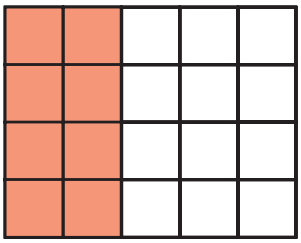
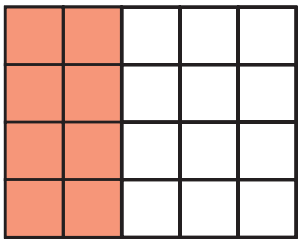
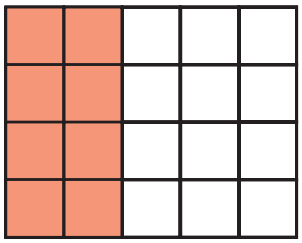
$\frac{8}{12}$  $\frac{4}{6}$  $\frac{2}{3}$ 

b) What do you notice about how many little squares are shaded in each grid?

8 squares in each

2) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

$\frac{2}{5}$  $\frac{4}{10}$  $\frac{8}{20}$ 

b) What do you notice about how many little squares are shaded in each grid?

8 squares in each

3) Find the missing values in these equivalent fractions.

$$\frac{1}{2} = \frac{2}{\boxed{4}} = \frac{3}{\boxed{6}} = \frac{4}{\boxed{8}}$$

4) Find the missing values in these equivalent fractions.

$$\frac{2}{5} = \frac{6}{\boxed{15}} = \frac{\boxed{12}}{30} = \frac{14}{\boxed{35}}$$

5) How do you know that $\frac{3}{7}$ is not equivalent to $\frac{25}{56}$?

You have to multiply 7 by 8 to get 56 but when you multiply 3 by 8 you get 24 not 25

Simplification of Fractions

1) Write the following fractions in their simplest forms

a) $\frac{2}{4}$

b) $\frac{5}{10}$

c) $\frac{4}{6}$

d) $\frac{6}{9}$

e) $\frac{12}{15}$

f) $\frac{8}{12}$

g) $\frac{15}{20}$

2) Write the following fractions in their simplest forms

a) $\frac{9}{30}$

b) $\frac{14}{18}$

c) $\frac{7}{49}$

d) $\frac{48}{72}$

e) $\frac{60}{75}$

f) $\frac{15}{27}$

g) $\frac{72}{96}$

Simplification of Fractions

1) Write the following fractions in their simplest forms

a) $\frac{2}{4}$ $\frac{1}{2}$

b) $\frac{5}{10}$ $\frac{1}{2}$

c) $\frac{4}{6}$ $\frac{2}{3}$

d) $\frac{6}{9}$ $\frac{2}{3}$

e) $\frac{12}{15}$ $\frac{4}{5}$

f) $\frac{8}{12}$ $\frac{2}{3}$

g) $\frac{15}{20}$ $\frac{3}{4}$

2) Write the following fractions in their simplest forms

a) $\frac{9}{30}$ $\frac{3}{10}$

b) $\frac{14}{18}$ $\frac{7}{8}$

c) $\frac{7}{49}$ $\frac{1}{7}$

d) $\frac{48}{72}$ $\frac{2}{3}$

e) $\frac{60}{75}$ $\frac{4}{5}$

f) $\frac{15}{27}$ $\frac{5}{9}$

g) $\frac{72}{96}$ $\frac{3}{4}$

Ordering Fractions

1) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{1}{3}$

b) $\frac{3}{5}$ $\frac{2}{3}$

c) $\frac{1}{2}$ $\frac{3}{8}$

2) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{8}$

b) $\frac{3}{5}$ $\frac{1}{2}$ $\frac{3}{4}$

c) $\frac{5}{6}$ $\frac{2}{3}$ $\frac{3}{4}$

3) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{2}{3}$ $\frac{7}{12}$ $\frac{3}{4}$ $\frac{5}{6}$

b) $\frac{5}{8}$ $\frac{2}{3}$ $\frac{3}{24}$ $\frac{7}{12}$

c) $\frac{6}{10}$ $\frac{4}{5}$ $\frac{5}{12}$ $\frac{8}{15}$

4) Ben spent his pocket money this way:

$\frac{7}{20}$ on magazines

$\frac{4}{10}$ on chocolates

$\frac{1}{4}$ on games

Order the items Ben bought by value, largest first.
Show all your working.

Ordering Fractions

1) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{3}{6}$ $\frac{1}{3}$ $\frac{2}{6}$ $\frac{1}{3}$ $\frac{1}{2}$

b) $\frac{3}{5}$ $\frac{9}{15}$ $\frac{2}{3}$ $\frac{10}{15}$ $\frac{3}{5}$ $\frac{2}{3}$

c) $\frac{1}{2}$ $\frac{4}{8}$ $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$ $\frac{4}{8}$

2) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{4}{8}$ $\frac{1}{4}$ $\frac{2}{8}$ $\frac{3}{8}$ $\frac{3}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$

b) $\frac{3}{5}$ $\frac{12}{20}$ $\frac{1}{2}$ $\frac{10}{20}$ $\frac{3}{4}$ $\frac{15}{20}$ $\frac{1}{2}$ $\frac{3}{5}$ $\frac{3}{4}$

c) $\frac{5}{6}$ $\frac{10}{12}$ $\frac{2}{3}$ $\frac{8}{12}$ $\frac{3}{4}$ $\frac{9}{12}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$

3) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{2}{3}$ $\frac{8}{12}$ $\frac{7}{12}$ $\frac{7}{12}$ $\frac{3}{4}$ $\frac{9}{12}$ $\frac{5}{6}$ $\frac{10}{12}$ $\frac{7}{12}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$

b) $\frac{5}{8}$ $\frac{15}{24}$ $\frac{2}{3}$ $\frac{16}{24}$ $\frac{3}{24}$ $\frac{3}{24}$ $\frac{7}{12}$ $\frac{14}{24}$ $\frac{3}{24}$ $\frac{7}{12}$ $\frac{5}{8}$ $\frac{2}{3}$

c) $\frac{6}{10}$ $\frac{36}{60}$ $\frac{4}{5}$ $\frac{48}{60}$ $\frac{5}{12}$ $\frac{25}{60}$ $\frac{8}{15}$ $\frac{32}{60}$ $\frac{5}{12}$ $\frac{8}{15}$ $\frac{6}{10}$ $\frac{4}{5}$

4) Ben spent his pocket money this way:

$\frac{7}{20}$ on magazines $\frac{7}{20}$

$\frac{4}{10}$ on chocolates $\frac{8}{20}$

$\frac{1}{4}$ on games $\frac{5}{20}$

Order the items Ben bought by value, largest first. Chocolates, magazines, games
Show all your working.

Value for Money

1) Which of the following offer better value for money?
Working must be shown

a) 200ml of toothpaste for 50p or 400ml of toothpaste for 90p

b) 600g of bananas for 70p or 200g of bananas for 22p

c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50

d) 60 teabags for £1.62 or 40 teabags for £0.96

2) Which of these is the best buy?

20 exercise books for £4.00	35 exercise books for £7.80

3) Hamza needs to buy 2 litres of paint.
At the shop he gets two choices:
500ml for £2.55 or 1 litre for £4.79.

a) Work out which of these would be the best buy for Hamza.

b) How much does he save if he buys the 'best buy' rather than the 'worst buy'?

You must show all your working.

4) Honey pots are sold in two sizes.
A small pot costs 45p and weighs 450g.
A large pot costs 80p and weighs 850g.

Which pot of honey is better value for money?
You must show all your working.

Value for Money

1) Which of the following offer better value for money?
Working must be shown

a) 200ml of toothpaste for 50p or 400ml of toothpaste for 90p

× 2
400ml of toothpaste for £1.00

b) 600g of bananas for 70p or 200g of bananas for 22p

× 3
600g of bananas for 66p

c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50

÷ 2 ÷ 5
1 litre of paint for 80p or 1 litre of paint for 70p

d) 60 teabags for £1.62 or 40 teabags for £0.96

× 2 × 3
120 teabags for £3.24 or 120 teabags for £2.88

2) Which of these is the best buy?

20 exercise books for £4.00	35 exercise books for £7.80
400 ÷ 20 = 20	780 ÷ 35 = 22.3
20p per book	22p per book

3) Hamza needs to buy 2 litres of paint.

At the shop he gets two choices:

500ml for £2.55 or 1 litre for £4.79.

× 2
1 litre of paint for £5.10

a) Work out which of these would be the best buy for Hamza.

1 litre of paint for £4.79

b) How much does he save if he buys the 'best buy' rather than the 'worst buy'?

£0.62 or 62p

You must show all your working.

£10.20
− £ 9.58
£0.31

4) Honey pots are sold in two sizes.

A small pot costs 45p and weighs 450g. 45 ÷ 450 = 0.1p per g
A large pot costs 80p and weighs 850g. 80 ÷ 850 = 0.09p per g

Which pot of honey is better value for money? Large pot at 80p for 850g
You must show all your working.

Find a Percentage with a Calculator

1) Work out:

a) 21% of £340

b) 64% of £1080

c) 36% of £800

d) 98% of £13

2) Work out:

a) 17.5% of £58

b) 20% of £5.40

c) 61.7% of £2000

d) 17.5% of £68.40

3) A computer costs £406 plus VAT at 20%.
Work out the total cost of the computer.

4) A car is usually priced at £9800 but now has a discount of 8%.
What is the new price of the car?

5) 9500 people attend a festival and 22% of them are children.
How many children are at the festival?

6) 65% of a car, by weight, is steel and iron.
If a car weighs 1100 kg, what is the weight of steel and iron in the car?

7) Tony earns £17800 per year and receives a 3.8% pay rise.
How much does he now earn?

Find a Percentage with a Calculator

1) Work out:

a) 21% of £340 £71.40

b) 64% of £1080 £691.20

c) 36% of £800 £288

d) 98% of £13 £12.74

2) Work out:

a) 17.5% of £58 £10.15

b) 20% of £5.40 £1.08

c) 61.7% of £2000 £1234

d) 17.5% of £68.40 £11.97

3) A computer costs £406 plus VAT at 20%.
Work out the total cost of the computer. £487.20

4) A car is usually priced at £9800 but now has a discount of 8%.
What is the new price of the car? £9016

5) 9500 people attend a festival and 22% of them are children.
How many children are at the festival? 2090

6) 65% of a car, by weight, is steel and iron.
If a car weighs 1100 kg, what is the weight of steel and iron in the car? 715 kg

7) Tony earns £17800 per year and receives a 3.8% pay rise.
How much does he now earn? £18476.40

Find a Percentage without a Calculator

1) Work out:

a) 10% of £170

b) 10% of £6800

c) 10% of £923

d) 10% of £16

2) Work out:

a) 20% of £60

b) 30% of £90

c) 15% of £800

d) 15% of £68

3) Work out:

a) 35% of £80

b) 90% of £160

c) 17.5% of £600

d) 17.5% of £850

4) Work out:

a) 15% of £4.60

b) 40% of £2.80

c) 17.5% of £3.20

d) 97.5% of £24

5) The normal price of a jacket is £54.
In a sale, the price is reduced by 30%
What is the sale price?

6) A football costs £14 plus 20% VAT.
How much is the football?

Find a Percentage without a Calculator

1) Work out:

a) 10% of £170 £17

b) 10% of £6800 £680

c) 10% of £923 £92.30

d) 10% of £16 £1.60

2) Work out:

a) 20% of £60 £12

b) 30% of £90 £27

c) 15% of £800 £120

d) 15% of £68 £10.20

3) Work out:

a) 35% of £80 £28

b) 90% of £160 £144

c) 17.5% of £600 £105

d) 17.5% of £850 £148.75

4) Work out:

a) 15% of £4.60 £0.69

b) 40% of £2.80 £1.12

c) 17.5% of £3.20 £0.56

d) 97.5% of £24 £23.40

5) The normal price of a jacket is £54.
In a sale, the price is reduced by 30%
What is the sale price? £37.80

6) A football costs £14 plus 20% VAT.
How much is the football? £16.80

Change to a Percentage with a Calculator

1) Write the following as percentages, giving all your answers to 1 decimal place.

   a) 12 out of 34

   b) 62 out of 85

   c) 113 out of 153

   d) 2150 out of 3452

2) Sarah sat a Science test and got a score of 64 marks out of 112 possible marks.

   What was her mark as a percentage?
   Give your answer to 1 decimal place.

3) In a class of 32 students, 18 of them are boys.

   What percentage of the class are boys?
   Give your answer to 1 decimal place.

4) In a French class there are 13 girls and 6 boys.

   What percentage of the class are girls?
   Give your answer to 1 decimal place.

5) A new car usually costs £8500.

   Henry gets a discount of £1000.

   What is the discount as a percentage of the usual cost?
   Give your answer to 1 decimal place.

6) Write out £148 as a percentage of £600.
   Give your answer to 1 decimal place.

7) In a wood there are 200 oak trees, 650 silver birch trees and 400 wild cherry trees.

   What percentage of the trees are oak trees?

8) In England in 2010 there were 68820 deaths caused by cancer.

   Of these deaths, 37500 were caused by smoking.

   What percentage of deaths due to cancer were caused by smoking?
   Give your answer to 1 decimal place.

Change to a Percentage with a Calculator

1) Write the following as percentages, giving all your answers to 1 decimal place.

a) 12 out of 34 35.3%

b) 62 out of 85 72.9%

c) 113 out of 153 73.9%

d) 2150 out of 3452 62.3%

2) Sarah sat a Science test and got a score of 64 marks out of 112 possible marks.

What was her mark as a percentage? 57.1%
Give your answer to 1 decimal place.

3) In a class of 32 students, 18 of them are boys.

What percentage of the class are boys? 56.3%
Give your answer to 1 decimal place.

4) In a French class there are 13 girls and 6 boys.

What percentage of the class are girls? 68.4%
Give your answer to 1 decimal place.

5) A new car usually costs £8500.

Henry gets a discount of £1000.

What is the discount as a percentage of the usual cost? 11.8%
Give your answer to 1 decimal place.

6) Write out £148 as a percentage of £600. 24.7%
Give your answer to 1 decimal place.

7) In a wood there are 200 oak trees, 650 silver birch trees and 400 wild cherry trees.

What percentage of the trees are oak trees? 16%

8) In England in 2010 there were 68820 deaths caused by cancer.

Of these deaths, 37500 were caused by smoking.

What percentage of deaths due to cancer were caused by smoking? 54.5%
Give your answer to 1 decimal place.

Change to a Percentage without a Calculator

1) Write the following as percentages.

a) 12 out of 50

b) 15 out of 25

c) 8 out of 10

d) 11 out of 20

e) 4 out of 5

f) 32 out of 40

g) 12 out of 80

h) 640 out of 800

i) 36 out of 60

2) Tim got 17 out of 20 in a French test.
Write 17 out of 20 as a percentage.

3) Write £19 as a percentage of £25

4) Work out £14 as a percentage of £40

5) A baker burnt 12 loaves out of the 200 loaves he baked.
What percentage of the 200 loaves did he burn?

6) What is £380 as a percentage of £400?

7) What is £22 as a percentage of £40?

8) If there are 9 girls and 11 boys in a class, what percentage of the class are girls?

Change to a Percentage without a Calculator

1) Write the following as percentages.

a) 12 out of 50 24%

b) 15 out of 25 60%

c) 8 out of 10 80%

d) 11 out of 20 55%

e) 4 out of 5 80%

f) 32 out of 40 80%

g) 12 out of 80 15%

h) 640 out of 800 80%

i) 36 out of 60 60%

2) Tim got 17 out of 20 in a French test.
Write 17 out of 20 as a percentage. 85%

3) Write £19 as a percentage of £25 76%

4) Work out £14 as a percentage of £40 35%

5) A baker burnt 12 loaves out of the 200 loaves he baked.
What percentage of the 200 loaves did he burn? 6%

6) What is £380 as a percentage of £400? 95%

7) What is £22 as a percentage of £40? 55%

8) If there are 9 girls and 11 boys in a class, what percentage of the class are girls? 45%

Finding a Fraction of an Amount

1) Work out these amounts.

a) $\frac{3}{4}$ of £20 b) $\frac{2}{3}$ of 60 kg c) $\frac{3}{8} \times 24$

d) $150 \times \frac{2}{3}$ e) $\frac{2}{9}$ of 180 cm f) $49 \times \frac{4}{7}$

g) $60 \times \frac{1}{4}$ h) $\frac{5}{8}$ of £48 i) $4000 \times \frac{7}{8}$

2) There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

How many apples have maggots in them?

3) Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

At midday they had already travelled $\frac{5}{7}$ of the total distance.

What distance, in km, had they travelled by midday?

4) A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

What was the selling price?

5) Yesterday Thomas travelled a total of 175 miles.

He travelled $\frac{2}{5}$ of this distance in the morning.

How many miles did he travel during the rest of the day?

6) Debra received her £15 pocket money on Saturday.

She spent $\frac{1}{3}$ of her pocket money on magazines.

She spent $\frac{2}{5}$ of her pocket money on a necklace.

How much of the £15 did she have left?

Finding a Fraction of an Amount

1) Work out these amounts.

a) $\frac{3}{4}$ of £20 £15

b) $\frac{2}{3}$ of 60 kg 40 kg

c) $\frac{3}{8} \times 24$ 9

d) $150 \times \frac{2}{3}$ 100

e) $\frac{2}{9}$ of 180 cm 40 cm

f) $49 \times \frac{4}{7}$ 28

g) $60 \times \frac{1}{4}$ 15

h) $\frac{5}{8}$ of £48 £30

i) $4000 \times \frac{7}{8}$ 3 500

2) There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

How many apples have maggots in them? 360 apples

3) Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

At midday they had already travelled $\frac{5}{7}$ of the total distance.

What distance, in km, had they travelled by midday? 550 km

4) A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

What was the selling price? £21

5) Yesterday Thomas travelled a total of 175 miles.

He travelled $\frac{2}{5}$ of this distance in the morning.

How many miles did he travel during the rest of the day? 105 miles

$\frac{2}{5}$ of 175 miles is 70 miles
175 - 70 = 105

6) Debra received her £15 pocket money on Saturday.

She spent $\frac{1}{3}$ of her pocket money on magazines.

She spent $\frac{2}{5}$ of her pocket money on a necklace.

How much of the £15 did she have left? £4

$\frac{1}{3}$ of £15 is £5

$\frac{2}{5}$ of £15 is £6

15 - 5 - 6 = 4

Addition and Subtraction of Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{7} + \frac{3}{7}$

b) $\frac{4}{9} + \frac{1}{9}$

2) Work out the following:

a) $\frac{1}{5} + \frac{3}{4}$

b) $\frac{3}{8} + \frac{1}{4}$

c) $\frac{2}{3} + \frac{3}{10}$

d) $\frac{1}{2} + \frac{2}{5}$

3) Work out the following:

a) $\frac{2}{3} + \frac{1}{2}$

b) $\frac{3}{5} + \frac{2}{3}$

c) $\frac{5}{8} + \frac{3}{4}$

d) $\frac{5}{7} + \frac{2}{5}$

4) Work out the following:

a) $2\frac{1}{2} + 1\frac{3}{4}$

b) $1\frac{2}{5} + \frac{2}{3}$

c) $2\frac{1}{6} + 1\frac{1}{2}$

d) $1\frac{3}{7} + \frac{2}{5}$

5) Work out the following:

a) $\frac{3}{4} - \frac{1}{2}$

b) $\frac{5}{7} - \frac{2}{3}$

c) $\frac{5}{8} - \frac{1}{3}$

d) $\frac{8}{9} - \frac{2}{3}$

6) Work out the following:

a) $2\frac{1}{2} - 1\frac{3}{4}$

b) $1\frac{2}{3} - \frac{3}{4}$

c) $3\frac{2}{5} - 1\frac{1}{2}$

d) $2\frac{3}{8} - \frac{3}{5}$

7) Ted received his pocket money on Friday.

He spent $\frac{3}{5}$ of his pocket money on games.

He spent $\frac{1}{10}$ of his pocket money on magazines.

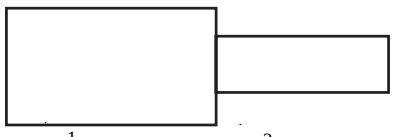
What fraction of his pocket money did he have left?

8) Maisie buys a bag of flour.

She uses $\frac{1}{4}$ to bake a cake and $\frac{2}{5}$ to make a loaf.

a) What fraction of the bag of flour was used?
b) What fraction of the bag of flour is left?

9) Work out the total length of this shape.
Give your answer as a mixed number.



$\leftarrow 3\frac{1}{4}$ inches $\rightarrow\leftarrow 2\frac{2}{3}$ inches $\rightarrow$

Addition and Subtraction of Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{7} + \frac{3}{7}$ $\frac{4}{7}$

b) $\frac{4}{9} + \frac{1}{9}$ $\frac{5}{9}$

2) Work out the following:

a) $\frac{1}{5} + \frac{3}{4}$ $\frac{19}{20}$

b) $\frac{3}{8} + \frac{1}{4}$ $\frac{5}{8}$

c) $\frac{2}{3} + \frac{3}{10}$ $\frac{29}{30}$

d) $\frac{1}{2} + \frac{2}{5}$ $\frac{9}{10}$

3) Work out the following:

a) $\frac{2}{3} + \frac{1}{2}$ $1\frac{1}{6}$

b) $\frac{3}{5} + \frac{2}{3}$ $1\frac{4}{15}$

c) $\frac{5}{8} + \frac{3}{4}$ $1\frac{3}{8}$

d) $\frac{5}{7} + \frac{2}{5}$ $1\frac{4}{35}$

4) Work out the following:

a) $2\frac{1}{2} + 1\frac{3}{4}$ $4\frac{1}{4}$

b) $1\frac{2}{5} + \frac{2}{3}$ $2\frac{1}{15}$

c) $2\frac{1}{6} + 1\frac{1}{2}$ $3\frac{2}{3}$

d) $1\frac{3}{7} + \frac{2}{5}$ $1\frac{29}{35}$

5) Work out the following:

a) $\frac{3}{4} - \frac{1}{2}$ $\frac{1}{4}$

b) $\frac{5}{7} - \frac{2}{3}$ $\frac{1}{21}$

c) $\frac{5}{8} - \frac{1}{3}$ $\frac{7}{24}$

d) $\frac{8}{9} - \frac{2}{3}$ $\frac{2}{9}$

6) Work out the following:

a) $2\frac{1}{2} - 1\frac{3}{4}$ $\frac{3}{4}$

b) $1\frac{2}{3} - \frac{3}{4}$ $\frac{11}{12}$

c) $3\frac{2}{5} - 1\frac{1}{2}$ $1\frac{9}{10}$

d) $2\frac{3}{8} - \frac{3}{5}$ $1\frac{31}{40}$

7) Ted received his pocket money on Friday.

He spent $\frac{3}{5}$ of his pocket money on games.

He spent $\frac{1}{10}$ of his pocket money on magazines.

What fraction of his pocket money did he have left? $\frac{3}{10}$

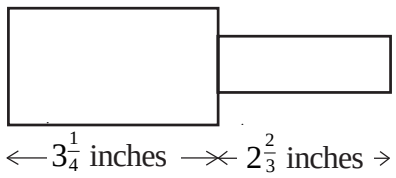
8) Maisie buys a bag of flour.

She uses $\frac{1}{4}$ to bake a cake and $\frac{2}{5}$ to make a loaf.

a) What fraction of the bag of flour was used? $\frac{13}{20}$

b) What fraction of the bag of flour is left? $\frac{7}{20}$

9) Work out the total length of this shape. $5\frac{11}{12}$
Give your answer as a mixed number.



Multiplication and Division of Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{2} \times \frac{1}{2}$

b) $\frac{2}{3} \times \frac{1}{3}$

c) $\frac{3}{5} \times \frac{2}{7}$

d) $\frac{4}{7} \times \frac{5}{9}$

2) Work out the following:

a) $\frac{1}{2} \times \frac{2}{3}$

b) $\frac{3}{4} \times \frac{8}{11}$

c) $\frac{2}{9} \times \frac{3}{4}$

d) $\frac{4}{5} \times \frac{1}{12}$

3) Work out the following:

a) $1\frac{1}{2} \times \frac{1}{3}$

b) $\frac{2}{3} \times 2\frac{2}{5}$

c) $3\frac{1}{2} \times 1\frac{1}{2}$

d) $1\frac{2}{7} \times 3\frac{1}{3}$

4) Work out the following:

a) $\frac{2}{5} \div \frac{3}{4}$

b) $\frac{1}{7} \div \frac{3}{5}$

c) $\frac{4}{9} \div \frac{1}{2}$

d) $\frac{3}{10} \div \frac{5}{9}$

5) Work out the following:

a) $\frac{1}{2} \div \frac{1}{3}$

b) $\frac{3}{7} \div \frac{4}{7}$

c) $\frac{1}{9} \div \frac{2}{3}$

d) $\frac{2}{5} \div \frac{3}{10}$

6) Work out the following:

a) $1\frac{1}{3} \div \frac{1}{4}$

b) $\frac{3}{5} \div 2\frac{2}{3}$

c) $3\frac{2}{3} \div 1\frac{1}{5}$

d) $4\frac{1}{2} \div 1\frac{1}{2}$

Multiplication and Division of Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{2} \times \frac{1}{2}$ $\quad \frac{1}{4}$

b) $\frac{2}{3} \times \frac{1}{3}$ $\quad \frac{2}{9}$

c) $\frac{3}{5} \times \frac{2}{7}$ $\quad \frac{6}{35}$

d) $\frac{4}{7} \times \frac{5}{9}$ $\quad \frac{20}{63}$

2) Work out the following:

a) $\frac{1}{2} \times \frac{2}{3}$ $\quad \frac{1}{3}$

b) $\frac{3}{4} \times \frac{8}{11}$ $\quad \frac{6}{11}$

c) $\frac{2}{9} \times \frac{3}{4}$ $\quad \frac{1}{6}$

d) $\frac{4}{5} \times \frac{1}{12}$ $\quad \frac{1}{15}$

3) Work out the following:

a) $1\frac{1}{2} \times \frac{1}{3}$ $\quad \frac{1}{2}$

b) $\frac{2}{3} \times 2\frac{2}{5}$ $\quad 1\frac{3}{5}$

c) $3\frac{1}{2} \times 1\frac{1}{2}$ $\quad 5\frac{1}{4}$

d) $1\frac{2}{7} \times 3\frac{1}{3}$ $\quad 4\frac{2}{7}$

4) Work out the following:

a) $\frac{2}{5} \div \frac{3}{4}$ $\quad \frac{8}{15}$

b) $\frac{1}{7} \div \frac{3}{5}$ $\quad \frac{5}{21}$

c) $\frac{4}{9} \div \frac{1}{2}$ $\quad \frac{8}{9}$

d) $\frac{3}{10} \div \frac{5}{9}$ $\quad \frac{27}{50}$

5) Work out the following:

a) $\frac{1}{2} \div \frac{1}{3}$ $\quad 1\frac{1}{2}$

b) $\frac{3}{7} \div \frac{4}{7}$ $\quad \frac{3}{4}$

c) $\frac{1}{9} \div \frac{2}{3}$ $\quad \frac{1}{6}$

d) $\frac{2}{5} \div \frac{3}{10}$ $\quad 1\frac{1}{3}$

6) Work out the following:

a) $1\frac{1}{3} \div \frac{1}{4}$ $\quad 5\frac{1}{3}$

b) $\frac{3}{5} \div 2\frac{2}{3}$ $\quad \frac{9}{40}$

c) $3\frac{2}{3} \div 1\frac{1}{5}$ $\quad 3\frac{1}{18}$

d) $4\frac{1}{2} \div 1\frac{1}{2}$ $\quad 3$

Change Fractions to Decimals

Write the following fractions as decimals

1) $\frac{3}{10}$

2) $\frac{7}{10}$

3) $\frac{9}{100}$

4) $\frac{1}{2}$

5) $\frac{3}{4}$

6) $\frac{2}{5}$

7) $\frac{7}{20}$

8) $\frac{1}{3}$

9) $\frac{1}{8}$

10) $\frac{5}{8}$

Change Fractions to Decimals

Write the following fractions as decimals

1) $\frac{3}{10}$ 0.3

2) $\frac{7}{10}$ 0.7

3) $\frac{9}{100}$ 0.09

4) $\frac{1}{2}$ 0.5

5) $\frac{3}{4}$ 0.75

6) $\frac{2}{5}$ 0.4

7) $\frac{7}{20}$ 0.35

8) $\frac{1}{3}$ $0.\dot{3}$

9) $\frac{1}{8}$ 0.125

10) $\frac{5}{8}$ 0.625

BODMAS/BIDMAS

Work out the following.  for all questions.

1) $6 \times 5 + 2$

2) $2 + 6 \times 5$

3) $35 - 4 \times 3$

4) $48 \div (14 - 2)$

5) $27 \div (3 + 6)$

6) $27 \div 3 + 6$

7) $(9 + 2) \times 2 + 5$

8) $4 \times (1 + 4) - 6$

9) $6 \times 4 - 3 \times 5$

10) $\dfrac{9+3}{4+2}$

11) $\dfrac{23+9}{7-3}$

12) $\dfrac{7-2^2}{4^2-15}$

13) $\dfrac{5^2+3}{2\times 7}$

14) $\dfrac{5\times 6-4}{13}$

15) $\dfrac{8\times 2-4}{3+1^2}$

16) $\dfrac{12-3\times 2}{14\div 7}$

17) $\dfrac{20-3^2}{10-(5+4)}$

18) $\dfrac{3+9\times 8}{1+6\times 4}$

BODMAS/BIDMAS

Work out the following.  for all questions.

1) $6 \times 5 + 2$ = 32 — 30 + 2 = 32

2) $2 + 6 \times 5$ = 32 — 2 + 30 = 32

3) $35 - 4 \times 3$ = 23 — 35 - 12 = 23

4) $48 \div (14 - 2)$ = 4 — 48 ÷ 12 = 4

5) $27 \div (3 + 6)$ = 3 — 27 ÷ 9 = 3

6) $27 \div 3 + 6$ = 15 — 9 + 6 = 15

7) $(9 + 2) \times 2 + 5$ = 27 — 11 × 2 + 5 , 22 + 5 = 27

8) $4 \times (1 + 4) - 6$ = 14 — 4 × 5 - 6 , 20 - 6 = 14

9) $6 \times 4 - 3 \times 5$ = 9 — 24 - 15 = 9

10) $\frac{9+3}{4+2}$ = 2 — $\frac{12}{6}$ = 2

11) $\frac{23+9}{7-3}$ = 8 — $\frac{32}{4}$ = 8

12) $\frac{7-2^2}{4^2-15}$ = 3 — $\frac{7 - 4}{16 - 15}$, $\frac{3}{1}$ = 3

13) $\frac{5^2+3}{2\times 7}$ = 2 — $\frac{25 + 3}{14}$, $\frac{28}{14}$ = 2

14) $\frac{5\times 6-4}{13}$ = 2 — $\frac{30 - 4}{13}$, $\frac{26}{13}$ = 2

15) $\frac{8\times 2-4}{3+1^2}$ = 3 — $\frac{16 - 4}{3 + 1}$, $\frac{12}{4}$ = 3

16) $\frac{12-3\times 2}{14\div 7}$ = 3 — $\frac{12 - 6}{2}$, $\frac{6}{2}$ = 3

17) $\frac{20-3^2}{10-(5+4)}$ = 11 — $\frac{20 - 9}{10 - 9}$, $\frac{11}{1}$ = 11

18) $\frac{3+9\times 8}{1+6\times 4}$ = 3 — $\frac{3 + 72}{1 + 24}$, $\frac{75}{25}$ = 3

Long Multiplication with Decimals

1) Work out

a) £1.42 × 3

b) £2.64 × 7

c) £213 × 16

d) £32.40 × 23

2) David buys 5 books for £8.75 each.
How much does he pay?

3) A DVD costs £12.25.
Work out the cost of 9 of these DVDs.

4) John takes 27 boxes out of his van.
The weight of each box is 41.7 kg.
Work out the total weight of the 27 boxes.

5) Nina bought 43 teddy bears at £9.35 each.
Work out the total amount she paid.

6) Elliott goes shopping.
He buys
0.5 kg of pears at £0.84 per kg.
2.5 kg of grapes at £1.89 per kg.
6 kg of potatoes at £0.25 per kg.

How much does he pay?

7) Brian hires a car for 3 days.
Tariffs are:
£44.80 for the first day and
£37.50 for each extra day.

How much does he pay?

Long Multiplication with Decimals

1) Work out

a) £1.42 × 3 £4.26

b) £2.64 × 7 £18.48

c) £213 × 16 £3408

d) £32.40 × 23 £745.20

2) David buys 5 books for £8.75 each.
How much does he pay? £43.75

3) A DVD costs £12.25.
Work out the cost of 9 of these DVDs. £110.25

4) John takes 27 boxes out of his van.
The weight of each box is 41.7 kg.
Work out the total weight of the 27 boxes. 1 125.9 kg

5) Nina bought 43 teddy bears at £9.35 each.
Work out the total amount she paid. £402.05

6) Elliott goes shopping.
He buys

0.5 kg of pears at £0.84 per kg.	£0.42
2.5 kg of grapes at £1.89 per kg.	£4.73
6 kg of potatoes at £0.25 per kg.	+ £1.50

How much does he pay? £6.65

7) Brian hires a car for 3 days.
Tariffs are:

£44.80 for the first day and	£44.80
£37.50 for each extra day.	£37.50
	+ £37.50

How much does he pay? £119.80

Ratio

1) Write the following ratios in their simplest form:

a) 6 : 9

b) 10 : 5

c) 7 : 21

d) 4 : 24

e) 12 : 40

f) 4 : 2 : 8

g) 18 : 63 : 9

2) Write the missing value in these equivalent ratios:

a) 3 : 5 = 12 : $\square$

b) 4 : 9 = $\square$: 27

c) $\square$: 7 = 16 : 14

3) The ratio of girls to boys in a class is 4 : 5.

What fraction of the class are girls?

4) A model of a plane is made using a scale of 1 : 5.

a) If the real length of the plane is 20 m, what is the length of the model?

b) If the wings of the model are 1.2 m long, what is the actual length of the wings on the plane?

Ratio

1) Write the following ratios in their simplest form:

a) 6 : 9 2 : 3

b) 10 : 5 2 : 1

c) 7 : 21 1 : 3

d) 4 : 24 1 : 6

e) 12 : 40 3 : 10

f) 4 : 2 : 8 2 : 1 : 4

g) 18 : 63 : 9 2 : 7 : 1

2) Write the missing value in these equivalent ratios:

a) 3 : 5 = 12 : 20

b) 4 : 9 = 12 : 27

c) 8 : 7 = 16 : 14

3) The ratio of girls to boys in a class is 4 : 5.

What fraction of the class are girls? $\frac{4}{9}$

4) A model of a plane is made using a scale of 1 : 5.

a) If the real length of the plane is 20 m, what is the length of the model? 4 m

b) If the wings of the model are 1.2 m long, what is the actual length of the wings on the plane? 6 m

Proportion Recipe Type Questions

1) Here are the ingredients needed to make 8 pancakes.
James makes 24 pancakes.

Pancakes
Ingredients to make **8** pancakes

250 ml milk
1 egg
140 g flour
5 g butter

a) Work out how much milk he needs.

Kate makes 12 pancakes.

b) Work out how much flour she needs.

2) Here are the ingredients for making fish pie for 6 people.

Fish pie for 6 people

180 g flour
240 g fish
80 g butter
4 eggs
180 ml milk

Jill makes a fish pie for 3 people.
a) Work out how much flour she needs.

Tim makes a fish pie for 15 people.

b) Work out how much milk he needs.

3) Here are the ingredients for making pineapple sorbet for **6** people.

Pineapple sorbet for 6 people

800 g of pineapple
4 egg whites
½ lemon
100 g caster sugar

Trevor makes pineapple sorbet for 18 people.

a) Work out how much caster sugar he uses.

Sid makes a pineapple sorbet.
He uses 2 lemons.

b) Work out how many people he makes pineapple sorbet for.

Proportion Recipe Type Questions

1) Here are the ingredients needed to make 8 pancakes.
James makes 24 pancakes.

Pancakes
Ingredients to make **8** pancakes

250 ml milk
1 egg
140 g flour
5 g butter

a) Work out how much milk he needs. 750 ml

Kate makes 12 pancakes.

b) Work out how much flour she needs. 210 g

2) Here are the ingredients for making fish pie for 6 people.

Fish pie for 6 people

180 g flour
240 g fish
80 g butter
4 eggs
180 ml milk

Jill makes a fish pie for 3 people.
a) Work out how much flour she needs. 90 g

Tim makes a fish pie for 15 people.

b) Work out how much milk he needs. 450 ml

3) Here are the ingredients for making pineapple sorbet for **6** people.

Pineapple sorbet for 6 people

800 g of pineapple
4 egg whites
½ lemon
100 g caster sugar

Trevor makes pineapple sorbet for 18 people.

a) Work out how much caster sugar he uses. 300 g

Sid makes a pineapple sorbet.
He uses 2 lemons.

b) Work out how many people he makes pineapple sorbet for. 24 people

Hard Calculator Questions

1) Use your calculator to work out

$$\frac{23.7 \times 14.2}{8.4 \times 3.2}$$

Write down all the figures on your calculator display.

2) Use your calculator to work out

$$\frac{\sqrt{21.4}}{5.7 - 2.35}$$

Write down all the figures on your calculator display.

3) Work out $\dfrac{5.8 + 4.65}{3.1^2 + 1.62}$

Write down all the figures on your calculator display.

4) Use your calculator to work out the value of

$$\frac{9.2 \times 16.3}{9.4 - 5.71}$$

Write down all the digits from your calculator.
Give your answer as a decimal.

5) Use your calculator to work out

$$\frac{3}{2.1 + 3.45}$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

6) Use your calculator to work out

$$\frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}}$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

7) Use a calculator to work out

$$\sqrt{\frac{22.4 \times 13.9}{3.6}}$$

Write down all the figures on your calculator display.

Hard Calculator Questions

1) Use your calculator to work out

$$\frac{23.7 \times 14.2}{8.4 \times 3.2} \quad \frac{336.54}{26.88} \quad 12.52008929$$

Write down all the figures on your calculator display.

2) Use your calculator to work out

$$\frac{\sqrt{21.4}}{5.7 - 2.35} \quad \frac{4.626013402}{3.35} \quad 1.380899523$$

Write down all the figures on your calculator display.

3) Work out $\frac{5.8 + 4.65}{3.1^2 + 1.62}$ $\frac{10.45}{11.23}$ 0.9305431879

Write down all the figures on your calculator display.

4) Use your calculator to work out the value of

$$\frac{9.2 \times 16.3}{9.4 - 5.71} \quad \frac{149.96}{3.69} \quad 40.6395664$$

Write down all the digits from your calculator.
Give your answer as a decimal.

5) Use your calculator to work out

$$\frac{3}{2.1 + 3.45} \quad \frac{3}{5.55} \quad 0.5405405405$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

6) Use your calculator to work out

$$\frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}} \quad \frac{15^2 - 12^2}{\sqrt{(9.6 - 3.87)}} \quad \frac{81}{2.393741841} \quad 33.83823544$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

7) Use a calculator to work out

$$\sqrt{\frac{22.4 \times 13.9}{3.6}} \quad \sqrt{\frac{311.36}{3.6}} \quad 9.299940263$$

Write down all the figures on your calculator display.

Money Exchange Questions

1) Lance goes on holiday to France.
The exchange rate is £1 = 1.15 Euros.

He changes £350 into Euros.

a) How many Euros should he get?

In France, Lance buys a digital camera for 115 Euros.

b) Work out the cost of the camera in pounds.

2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
In England, an identical pair of sunglasses costs £59.99.
The exchange rate is £1 = 1.40 Euros.

In which country were the glasses the cheapest, and by how much?
Show all your working.

3) Luke buys a pair of trainers in Switzerland.
He can pay either 86 Swiss Francs or 56 Euros.
The exchange rates are:
£1 = 2.10 Swiss Francs
£1 = 1.40 Euros

Which currency should he choose to get the best price, and how much would he save?
Give your answer in pounds (£).

4) The exchange rate in London is £1 = €1.14
The exchange rate in Paris is €1 = £0.86

Tony wants to change some pounds into euros.

In which of these cities would Tony get the most euros?
All working must be shown.

5) The total cost of 5 kg of potatoes and 2 kg of carrots is £4.88.
3 kg of potatoes cost £1.98.

Work out the cost of 1 kg of carrots.

Money Exchange Questions

1) Lance goes on holiday to France.
The exchange rate is £1 = 1.15 Euros.

He changes £350 into Euros.

a) How many Euros should he get? €402.50 350 × 1.15 = 402.50

In France, Lance buys a digital camera for 115 Euros.

b) Work out the cost of the camera in pounds. £100 115 ÷ 1.15 = 100

2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
In England, an identical pair of sunglasses costs £59.99.
The exchange rate is £1 = 1.40 Euros.

In which country were the glasses the cheapest, and by how much?
Show all your working. Spain, by £4.99

77 ÷ 1.40 = 55 59.99 - 55.00 = 4.99

3) Luke buys a pair of trainers in Switzerland.
He can pay either 86 Swiss Francs or 56 Euros.
The exchange rates are:
£1 = 2.10 Swiss Francs
£1 = 1.40 Euros

Which currency should he choose to get the best price, and how much would he save?
Give your answer in pounds (£). Euros, saving £0.95

86 ÷ 2.10 = 40.95 56 ÷ 1.40 = 40

4) The exchange rate in London is £1 = €1.14
The exchange rate in Paris is €1 = £0.86

eg Suppose Tony changes £100.
In London he would get 100 × 1.14 = €114
In Paris he would get 100 ÷ 0.86 = €116.28

Tony wants to change some pounds into euros.

In which of these cities would Tony get the most euros?
All working must be shown. Paris

5) The total cost of 5 kg of potatoes and 2 kg of carrots is £4.88.
3 kg of potatoes cost £1.98.

Work out the cost of 1 kg of carrots. £0.79

1.98 ÷ 3 = 0.66 5 × 0.66 = 3.30 4.88 - 3.30 = 1.58 1.58 ÷ 2 = 0.79

Money Exchange Questions

1) The cost of 4 kg of bananas is £5.80.
The total cost of 3 kg of bananas and 1.5 kg of pears is £5.61.

Work out the cost of 1 kg of pears.

2) In July 2007, Peter hired a car in Italy.
The cost of hiring the car was £620
The exchange rate was £1 = €1.25

a) Work out the cost of hiring the car in euros (€).

Peter bought some perfume in Italy.
The cost of the perfume in Italy was €50
The cost of the same perfume in London was £42

The exchange rate was still £1 = €1.25

b) Work out the difference between the cost of the perfume in Italy and the cost of the perfume in London.
Give your answer in pounds (£).

3) Jill wants to work out how much tax she needs to pay.

Last year she earned £19000

She does not pay Income tax on the first £6475 she earned.
She pays tax of 20 pence for each pound she earned above £6475.

She pays the tax in two equal half-yearly instalments.

a) How much Income tax does Jill pay in her first half-yearly instalment?

Jill wants to know what percentage of her earnings she pays in tax.

b) Calculate the Income tax Jill has to pay as a percentage of her earnings last year.
Give your answer correct to 1 decimal place.

Money Exchange Questions

1) The cost of 4 kg of bananas is £5.80.
The total cost of 3 kg of bananas and 1.5 kg of pears is £5.61.

Work out the cost of 1 kg of pears. £0.84

5.80 ÷ 4 = 1.45
3 × 1.45 = 4.35
5.61 - 4.35 = 1.26
1.26 ÷ 1.5 = 0.84

2) In July 2007, Peter hired a car in Italy.
The cost of hiring the car was £620
The exchange rate was £1 = €1.25

a) Work out the cost of hiring the car in euros (€). €775

Peter bought some perfume in Italy.
The cost of the perfume in Italy was €50
The cost of the same perfume in London was £42

The exchange rate was still £1 = €1.25

b) Work out the difference between the cost of the perfume in Italy and the cost of the perfume in London.
Give your answer in pounds (£). £2 more in London

Cost in Italy = £40
Cost in London = £42

3) Jill wants to work out how much tax she needs to pay.

Last year she earned £19000

She does not pay Income tax on the first £6475 she earned.
She pays tax of 20 pence for each pound she earned above £6475.

She pays the tax in two equal half-yearly instalments.

a) How much Income tax does Jill pay in her first half-yearly instalment? £1252.50

Jill wants to know what percentage of her earnings she pays in tax.

b) Calculate the Income tax Jill has to pay as a percentage of her earnings last year. 13.2%
Give your answer correct to 1 decimal place.

Generate a Sequence from the *N*th Term

1) The *n*th term of a number sequence is $2n + 5$

Write down the first three terms of the sequence.

2) The *n*th term of a number sequence is $3n - 1$

Write down the first four terms of the sequence.

3) The *n*th term of a number sequence is $3n + 2$

Write down the first four terms of the sequence.

4) The *n*th term of a number sequence is $5n - 7$

Write down the first four terms of the sequence.

5) The *n*th term of a number sequence is n^2

Write down the first three terms of the sequence.

6) The *n*th term of a number sequence is $n^2 + 3$

Write down the first three terms of the sequence.

7) The *n*th term of a number sequence is $11 - n^2$

a) Find the third term of this sequence.

b) Find the fifth term of this sequence.

8) The *n*th term of a number sequence is $n^2 + n$

a) Find the third term of this sequence.

b) Find the fifth term of this sequence.

Generate a Sequence from the *N*th Term

1) The *n*th term of a number sequence is $2n + 5$

Write down the first three terms of the sequence. 7, 9, 11

2) The *n*th term of a number sequence is $3n - 1$

Write down the first four terms of the sequence. 2, 5, 8, 11

3) The *n*th term of a number sequence is $3n + 2$

Write down the first four terms of the sequence. 5, 8, 11, 14

4) The *n*th term of a number sequence is $5n - 7$

Write down the first four terms of the sequence. -2, 3, 8, 13

5) The *n*th term of a number sequence is n^2

Write down the first three terms of the sequence. 1, 4, 9

6) The *n*th term of a number sequence is $n^2 + 3$

Write down the first three terms of the sequence. 4, 7, 12

7) The *n*th term of a number sequence is $11 - n^2$

a) Find the third term of this sequence. 2

b) Find the fifth term of this sequence. -14

8) The *n*th term of a number sequence is $n^2 + n$

a) Find the third term of this sequence. 12

b) Find the fifth term of this sequence. 30

Substitution

1) $y = 5x$

a) Work out the value of y when $x = 3$

b) Work out the value of y when $x = -2$

2) $y = 2x + 7$

a) Work out the value of y when $x = 4$

b) Work out the value of y when $x = -3$

3) $y = 2x + 4t$

$x = 6$

$t = 1$

Work out the value of y.

4) $y = 2a - 3b$

$a = 4$

$b = -2$

Work out the value of y.

5) $v = 3a + 5b$

$a = 6$

$b = -3$

Work out the value of v.

6) $y = x^2$

a) Work out the value of y when $x = 6$

b) Work out the value of y when $x = -4$

7) $y = 2x^2$

a) Work out the value of y when $x = 5$

b) Work out the value of y when $x = -3$

8) $y = 3x^2 + 2x$

a) Work out the value of y when $x = 2$

b) Work out the value of y when $x = -4$

9) $v = u^2 + 5as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v.

10) $y = p - 2qx^2$

$p = -10$

$q = 2$

$x = -5$

Work out the value of y.

11) $v^2 = u^2 + 2as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v.

12) $v^2 = u^2 + 2as$

$u = 3$
$a = 9.8$
$s = 12$

Work out the value of v.
Give your answer correct to 1 decimal place

13) $s = ut + 0.5at^2$

$a = 9.8$
$t = 5$
$u = 7$

Work out the value of s.

Substitution

1) $y = 5x$

a) Work out the value of y when $x = 3$ 15

b) Work out the value of y when $x = -2$ -10

2) $y = 2x + 7$

a) Work out the value of y when $x = 4$ 15

b) Work out the value of y when $x = -3$ 1

3) $y = 2x + 4t$

$x = 6$

$t = 1$

Work out the value of y. 16

4) $y = 2a - 3b$

$a = 4$

$b = -2$

Work out the value of y. 14

5) $v = 3a + 5b$

$a = 6$

$b = -3$

Work out the value of v. 3

6) $y = x^2$

a) Work out the value of y when $x = 6$ 36

b) Work out the value of y when $x = -4$ 16

7) $y = 2x^2$

a) Work out the value of y when $x = 5$ 50

b) Work out the value of y when $x = -3$ 18

8) $y = 3x^2 + 2x$

a) Work out the value of y when $x = 2$ 16

b) Work out the value of y when $x = -4$ 40

9) $v = u^2 + 5as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v.
148.5

10) $y = p - 2qx^2$

$p = -10$

$q = 2$

$x = -5$

Work out the value of y.
-110

11) $v^2 = u^2 + 2as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v. 9

12) $v^2 = u^2 + 2as$

$u = 3$
$a = 9.8$
$s = 12$

Work out the value of v. 15.6
Give your answer correct to 1 decimal place

13) $s = ut + 0.5at^2$

$a = 9.8$
$t = 5$
$u = 7$

Work out the value of s.
157.5

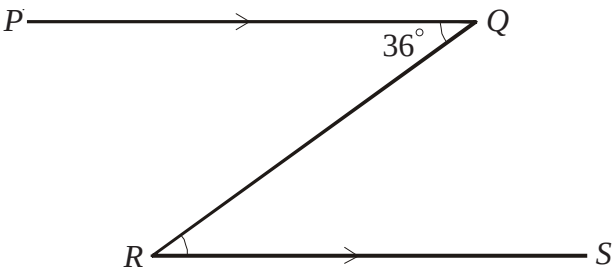
Parallel Lines and Angles

1) Line *PQ* is parallel to line *RS*.

If angle *PQR* is equal to 36°

a) What is the size of angle *QRS*?

b) Give a reason for your answer.

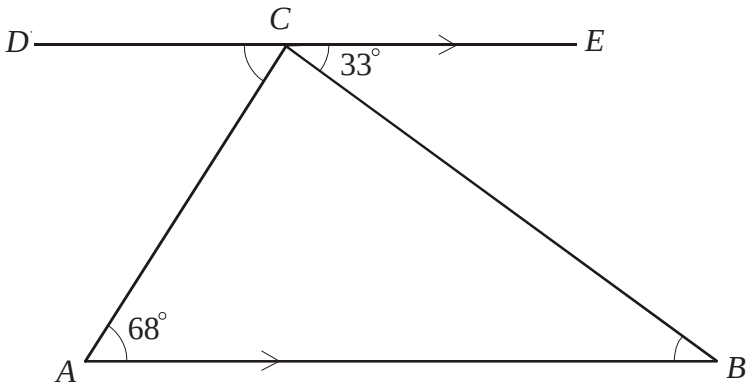


2) Line *DCE* is parallel to line *AB*

a) Find the size of angle *ABC*

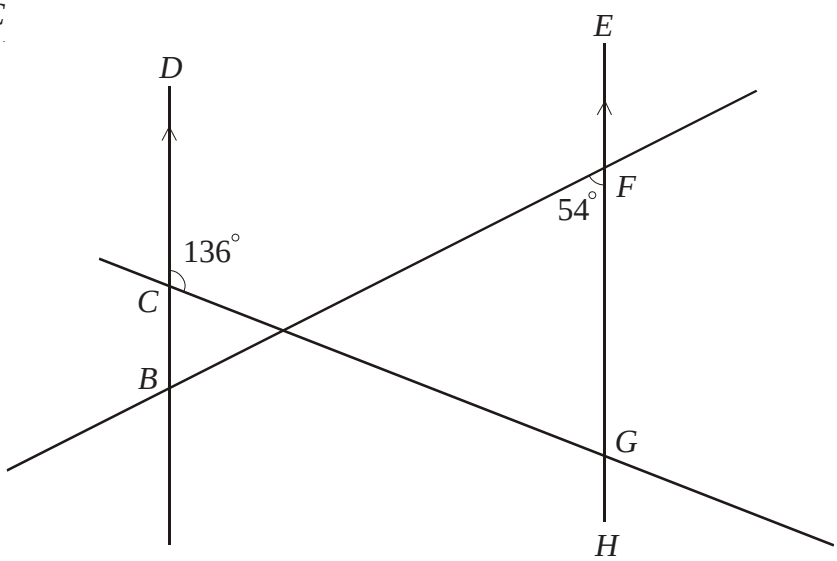
b) Find the size of angle *DCA*

c) Calculate the size of angle *ACB*



3) a) Find the size of angle *DBF*

b) Find the size of angle *HGC*



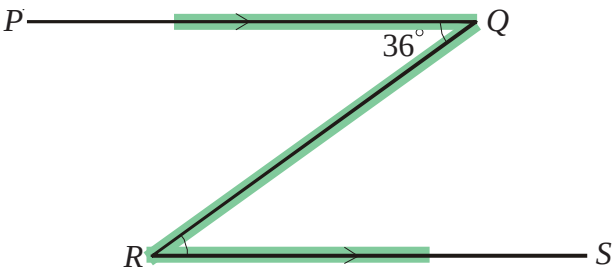
Parallel Lines and Angles

1) Line PQ is parallel to line RS.

If angle PQR is equal to 36°

a) What is the size of angle QRS? 36°

b) Give a reason for your answer. Alternate angles are equal



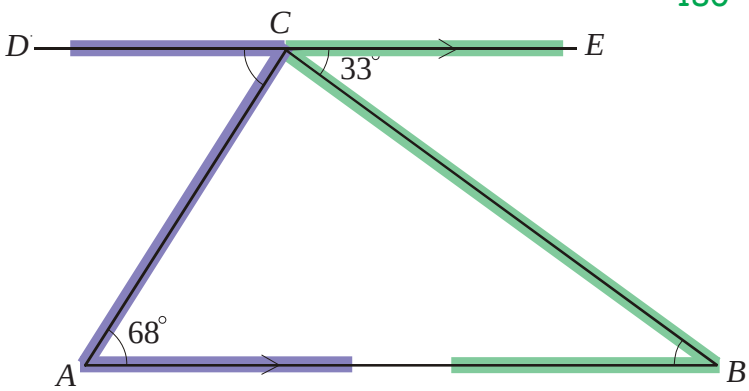
2) Line DCE is parallel to line AB

a) Find the size of angle ABC 33°

b) Find the size of angle DCA 68°

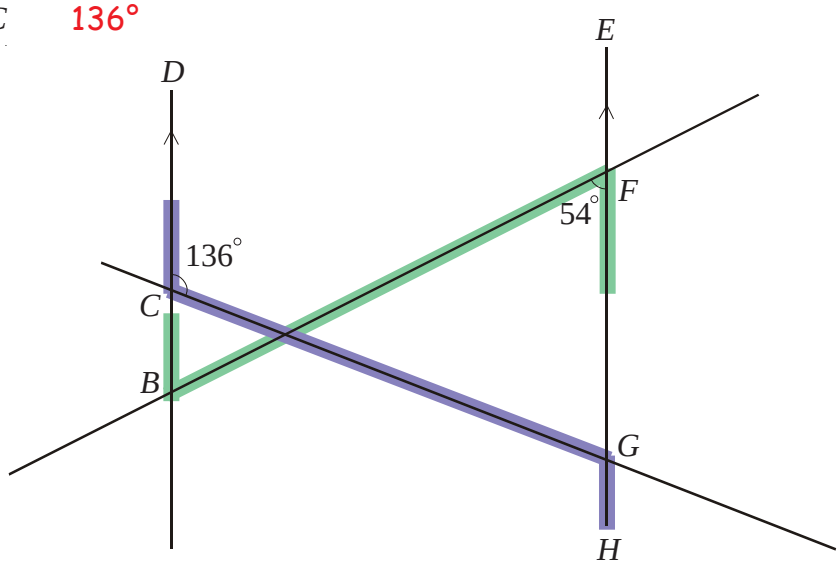
c) Calculate the size of angle ACB 79°

DCE is straight line
180° – 68° – 33° = 79°



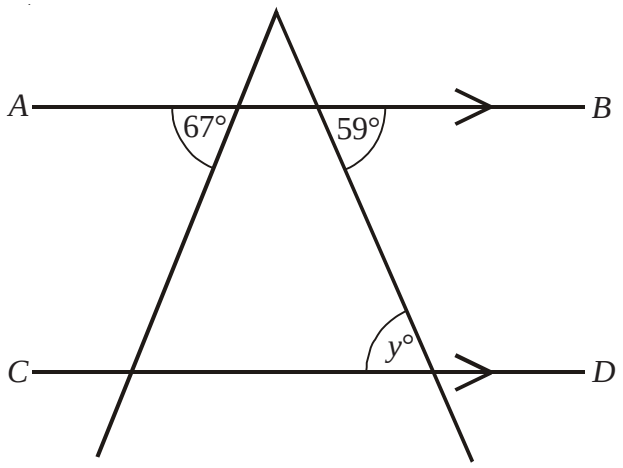
3) a) Find the size of angle DBF 54°

b) Find the size of angle HGC 136°



Parallel Lines and Angles

1)

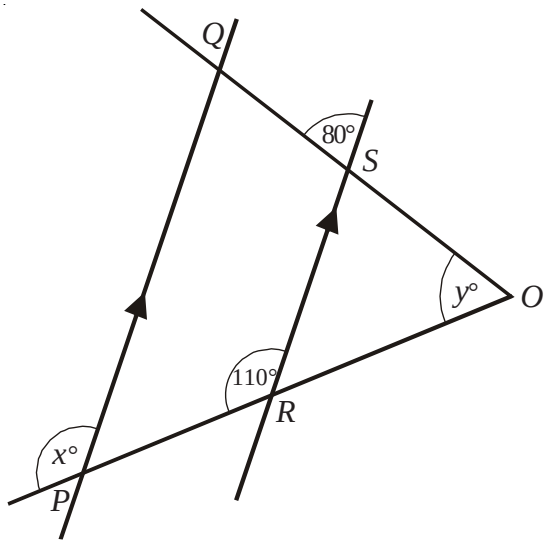


AB is parallel to *CD*.

(i) Write down the value of *y*.

(ii) Give a reason for your answer.

2)



PQ is parallel to *RS*.

OSQ and *ORP* are straight lines.

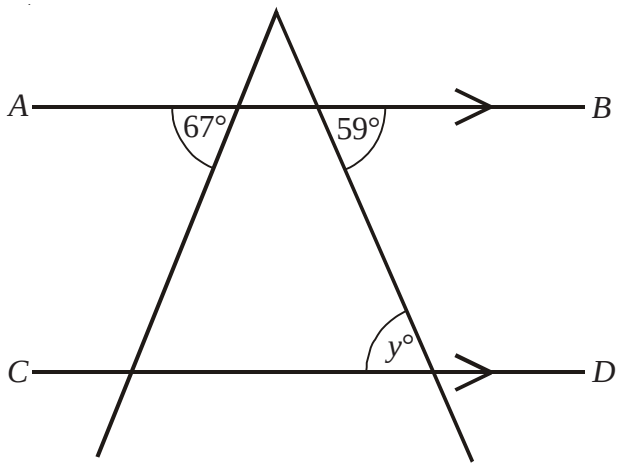
a) (i) Write down the value of *x*.

(ii) Give a reason for your answer.

b) Work out the value of *y*.

Parallel Lines and Angles

1)

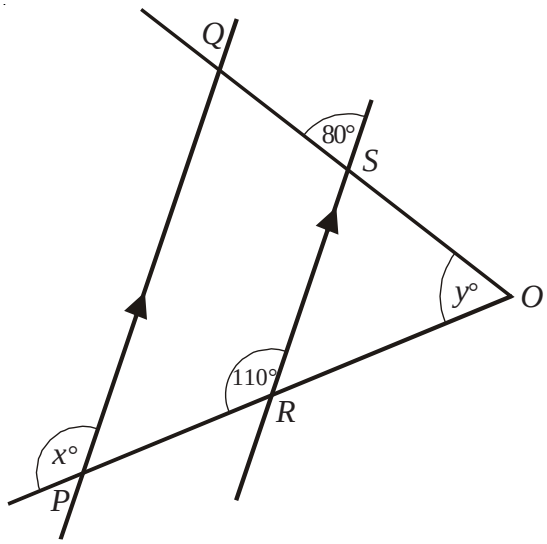


AB is parallel to *CD*.

(i) Write down the value of *y*. 59°

(ii) Give a reason for your answer. Alternate angles are equal

2)



PQ is parallel to *RS*.

OSQ and *ORP* are straight lines.

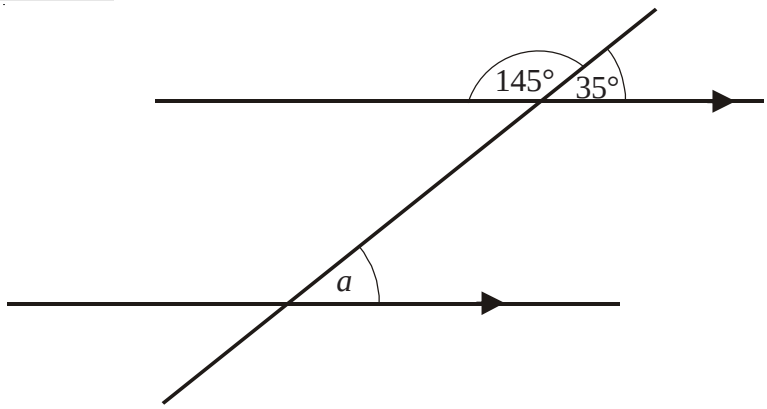
a) (i) Write down the value of *x*. 110°

(ii) Give a reason for your answer. Corresponding angles are equal

b) Work out the value of *y*. 30°

Parallel Lines and Angles

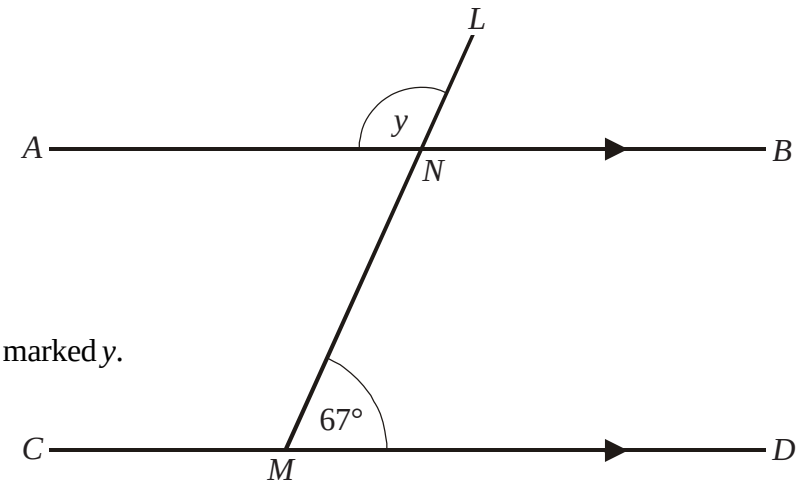
1)



(i) Write down the size of the angle marked *a*.

(ii) Give a reason for your answer.

2)

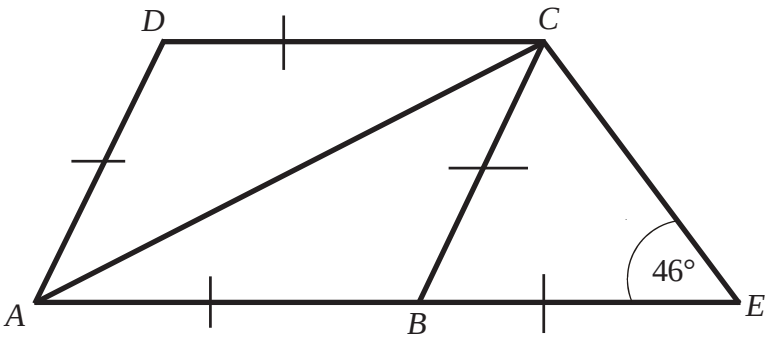


ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 67°

(i) Work out the size of the angle marked *y*.

(ii) Give reasons for your answer.

3)

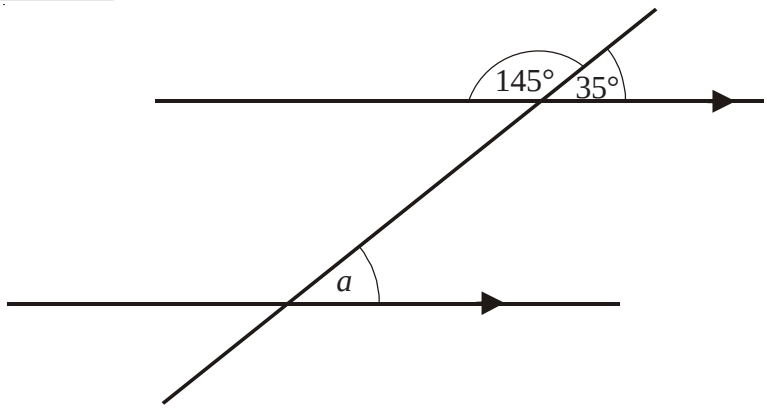


ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

Work out the size of angle *DCA*.

Parallel Lines and Angles

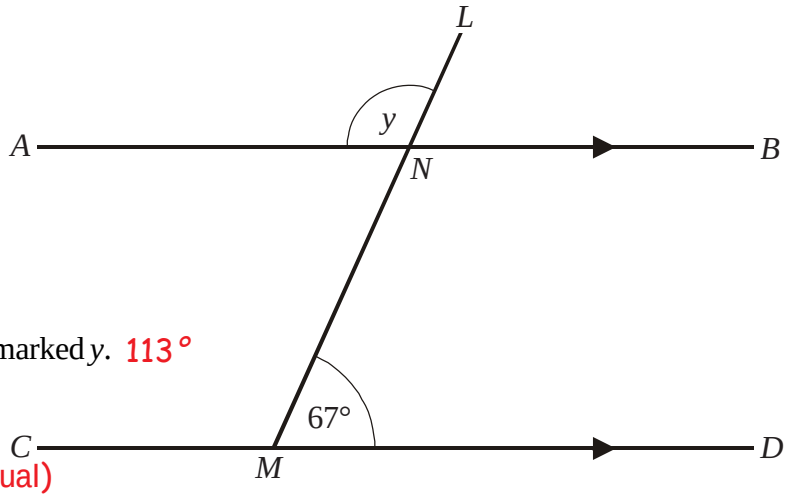
1)



(i) Write down the size of the angle marked *a*. 35°

(ii) Give a reason for your answer. Corresponding angles are equal

2)



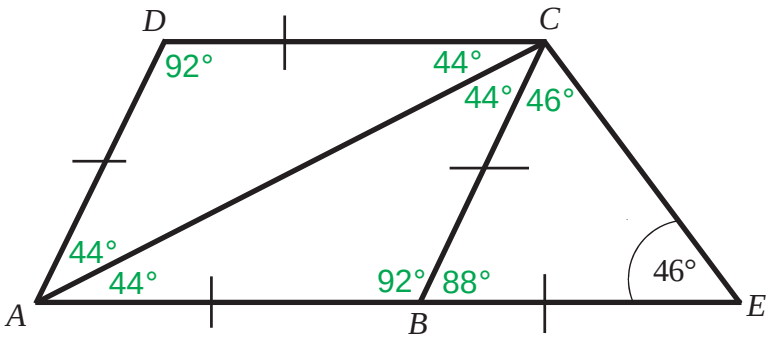
ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 67°

(i) Work out the size of the angle marked *y*. 113°

(ii) Give reasons for your answer.

Angle *LNB* = 67°
(corresponding angles are equal)
y = 113° (angles on a straight line add up to 180°)

3)

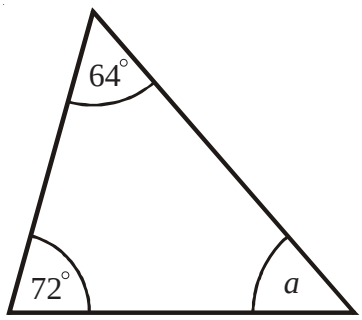


ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

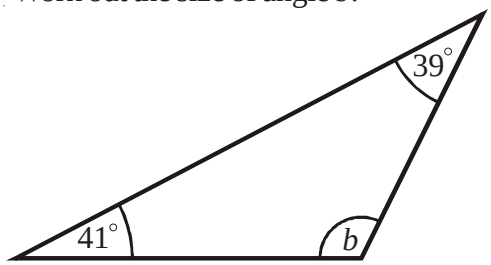
Work out the size of angle *DCA*. 44°

Angle Sum of a Triangle

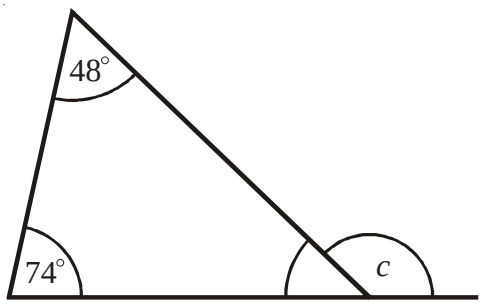
1) Work out the size of angle *a*.



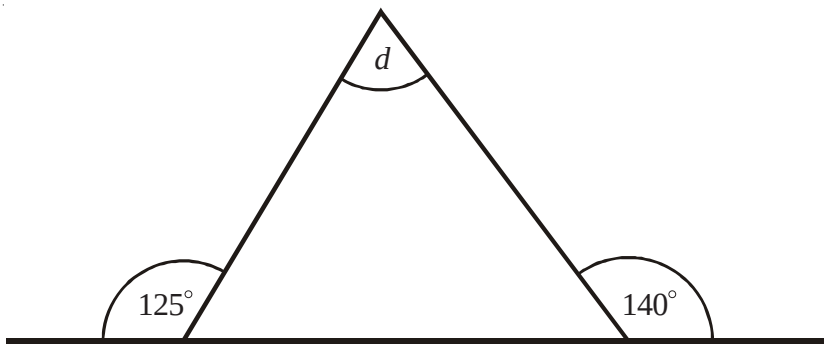
2) Work out the size of angle *b*.



3) Work out the size of angle *c*.

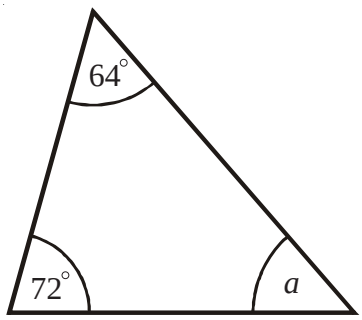


4) Work out the size of angle *d*.

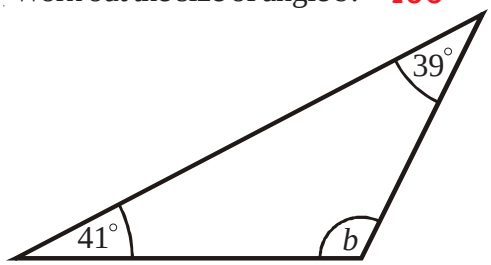


Angle Sum of a Triangle

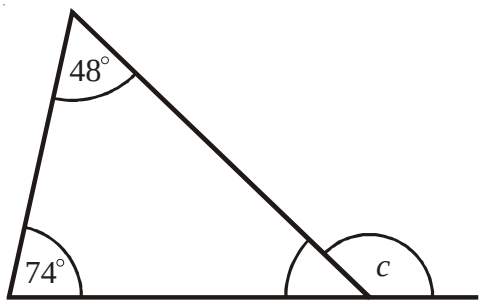
1) Work out the size of angle *a*. 44°



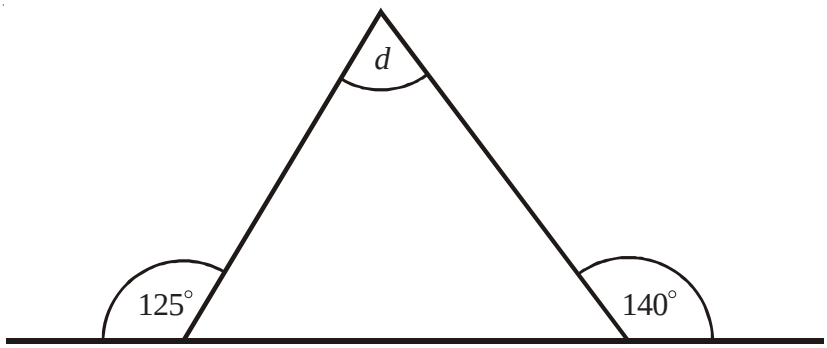
2) Work out the size of angle *b*. 100°



3) Work out the size of angle *c*. 122°



4) Work out the size of angle *d*. 85°



Properties of Special Triangles

1) *ABC* is a triangle.

a) Find the size of angle *A*.

b) Triangle *ABC* is equilateral.

Explain why.

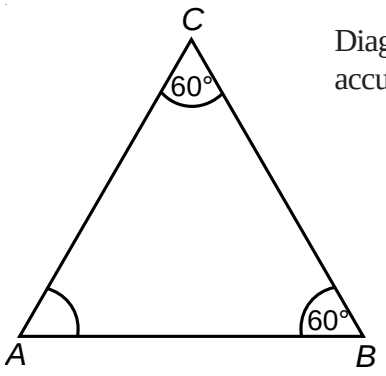


Diagram **NOT** accurately drawn

2) *BCD* is a triangle.

ABC is a straight line.

Angle *CBD* = 70°.

BD = *CD*.

a) (i) Work out the value of *x*.

(ii) Give a reason for your answer.

b) (i) Work out the value of *y*.

(ii) Give reasons for your answer.

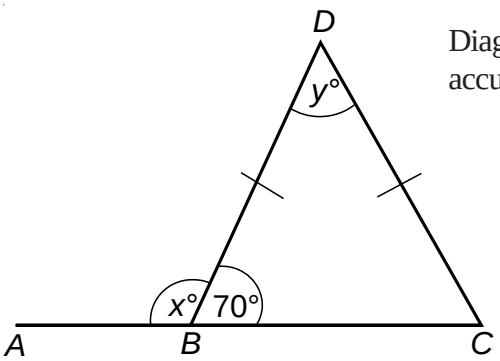


Diagram **NOT** accurately drawn

3) The diagram shows a 5-sided shape.

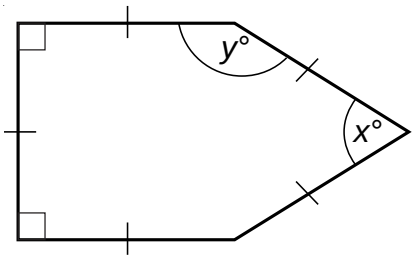
All the sides of the shape are equal in length.

a) (i) Find the value of *x*.

(ii) Give a reason for your answer.

b) (i) Work out the value of *y*.

(ii) Explain your answer.



Properties of Special Triangles

1) *ABC* is a triangle.

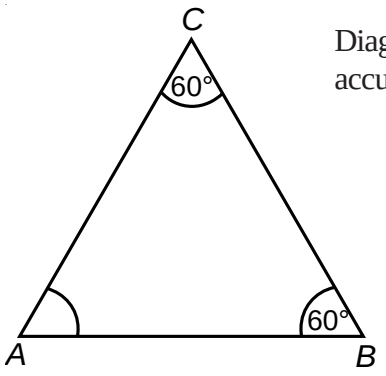


Diagram **NOT** accurately drawn

a) Find the size of angle *A*. 180 - 60 - 60
Angle *A* is 60°

b) Triangle *ABC* is equilateral.

Explain why.
Triangle *ABC* is equilateral because all three angles are 60°.

2) *BCD* is a triangle.

ABC is a straight line.

Angle *CBD* = 70°.

BD = *CD*.

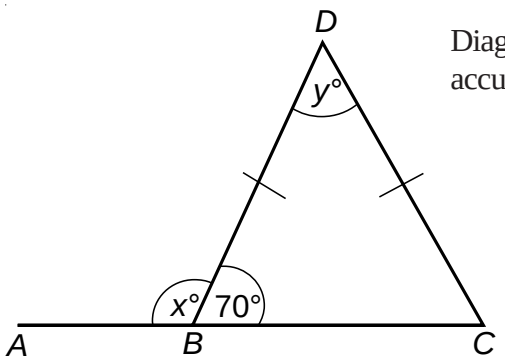


Diagram **NOT** accurately drawn

a) (i) Work out the value of *x*.
$x = 110°$ 180 – 70

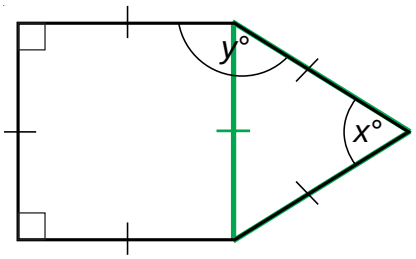
(ii) Give a reason for your answer.
Angles on a straight line add up to 180°.

b) (i) Work out the value of *y*.
$y = 40°$ 180 – 70 – 70

(ii) Give reasons for your answer.
Base angles of an isosceles triangle are equal.
180° in a triangle.

3) The diagram shows a 5-sided shape.

All the sides of the shape are equal in length.



a) (i) Find the value of *x*.
$x = 60°$

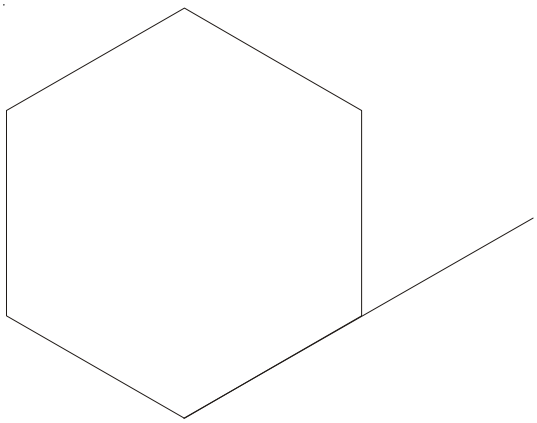
(ii) Give a reason for your answer.
The triangle in the diagram is equilateral.

b) (i) Work out the value of *y*.
$y = 150°$

(ii) Explain your answer.
Angle *y* is made up of the angle in the square and the angle in the equilateral triangle. This is 90° + 60° = 150°.

Angles of Regular Polygons

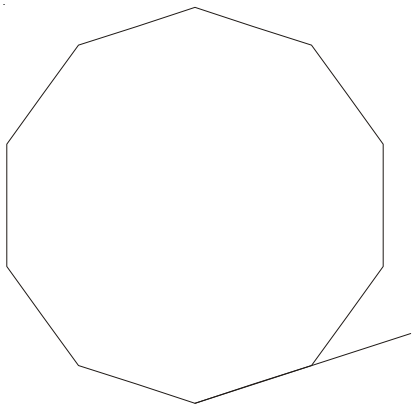
1)



a) Work out the size of an **exterior** angle of a regular hexagon.

b) Work out the size of an **interior** angle of a regular hexagon.

2)



a) Name the regular polygon, above.

b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.

3) The size of each **exterior** angle of a regular polygon is 90°.
Work out the number of sides of the regular polygon.

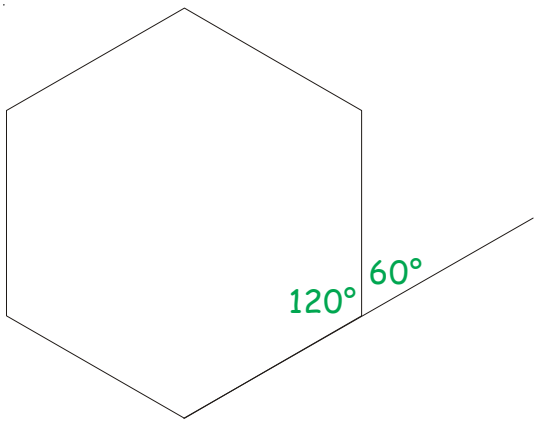
4) The size of each **exterior** angle of a regular polygon is 40°.
Work out the number of sides of the regular polygon.

5) The size of each **interior** angle of a regular polygon is 120°.
Work out the number of sides of the regular polygon.

6) The size of each **interior** angle of a regular polygon is 150°.
Work out the number of sides of the regular polygon.

Angles of Regular Polygons

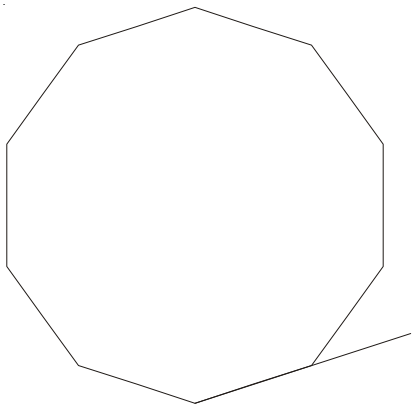
1)



a) Work out the size of an **exterior** angle of a regular hexagon. 60° 360 ÷ 6

b) Work out the size of an **interior** angle of a regular hexagon. 120° 180 – 60

2)



a) Name the regular polygon, above. Decagon

b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.

Exterior angle = 36° Interior angle = 144°
360 ÷ 10 180 – 36

3) The size of each **exterior** angle of a regular polygon is 90°.
Work out the number of sides of the regular polygon. 4 sides 360 ÷ ? = 90

4) The size of each **exterior** angle of a regular polygon is 40°.
Work out the number of sides of the regular polygon. 9 sides 360 ÷ ? = 40

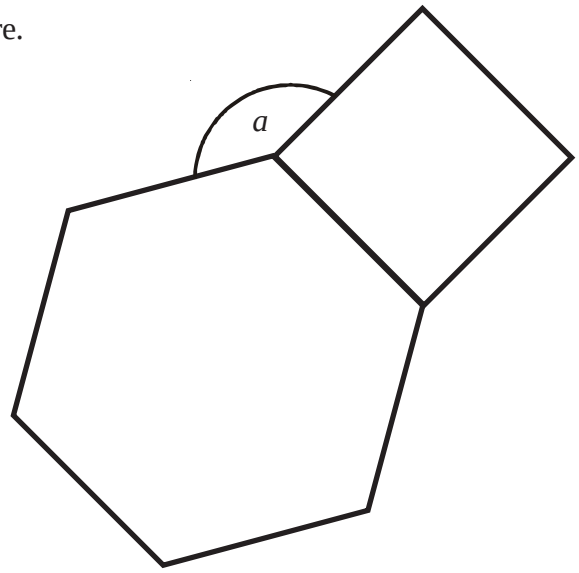
5) The size of each **interior** angle of a regular polygon is 120°.
Work out the number of sides of the regular polygon. 6 sides
Interior angle = 120, exterior angle = 60, 360 ÷ ? = 60

6) The size of each **interior** angle of a regular polygon is 150°.
Work out the number of sides of the regular polygon. 12 sides
Interior angle = 150, exterior angle = 30, 360 ÷ ? = 30

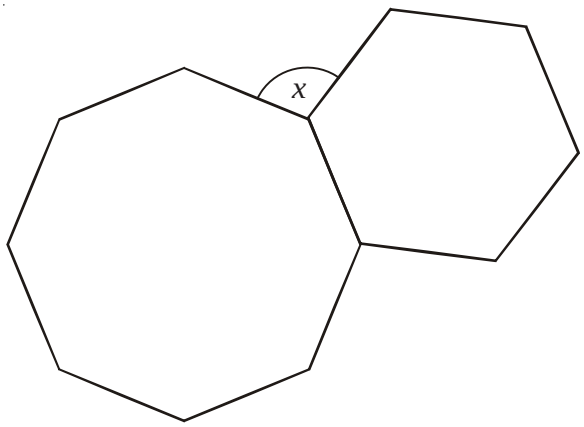
Angles of Regular Polygons

1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*.



2)

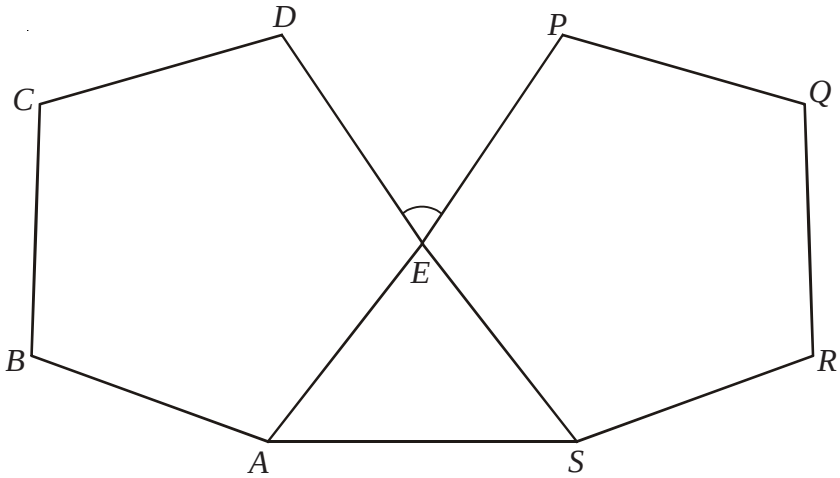


The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle *x*.

3) *ABCDE* and *PQRSE* are regular pentagons.
AES is an equilateral triangle.

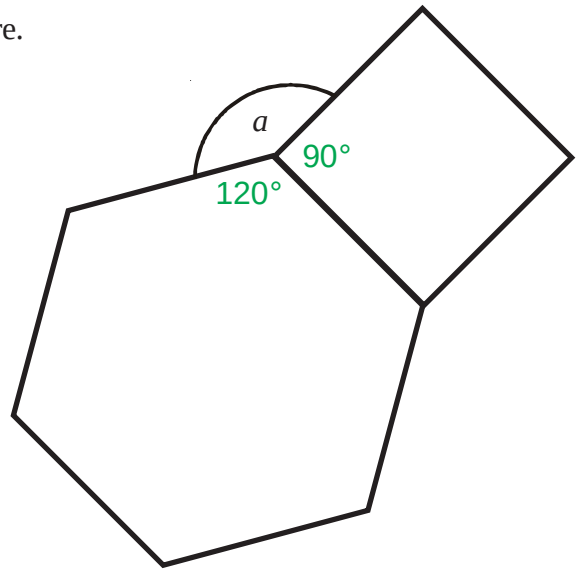
Work out the size of angle *DEP*.



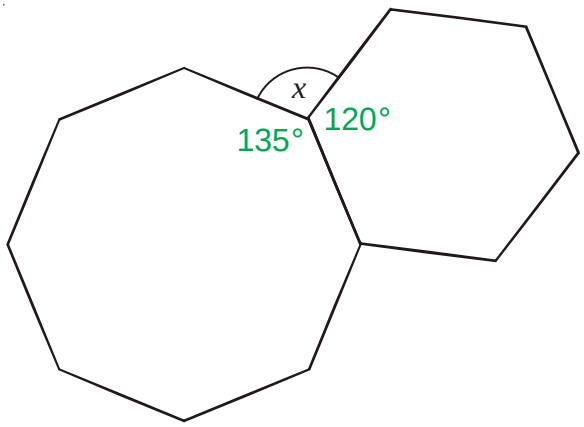
Angles of Regular Polygons

1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*. 150°



2)

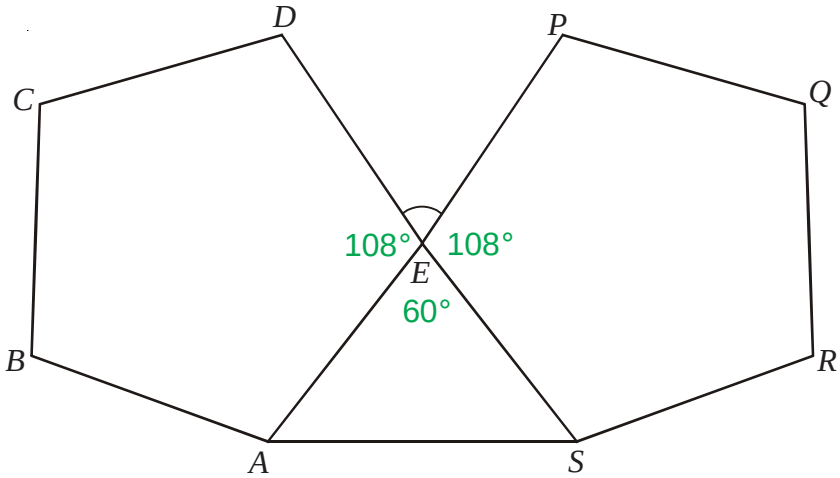


The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle *x*. 105°

3) *ABCDE* and *PQRSE* are regular pentagons.
AES is an equilateral triangle.

Work out the size of angle *DEP*. 84°



 Clip 71

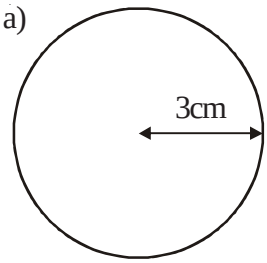
Grade D questions

Area of a Circle

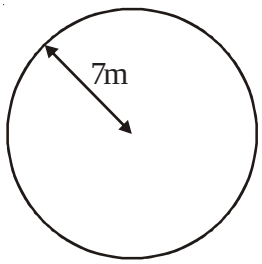
Take π to be 3.142 for all questions.

1) Find the areas of the following shapes.

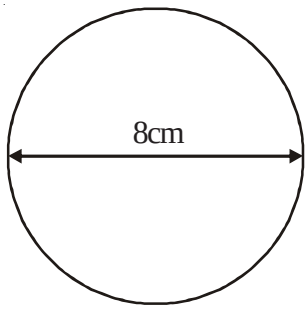
a)



b)

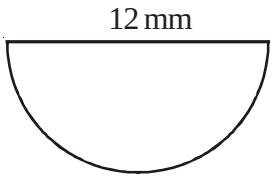


c)

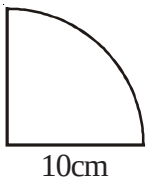


2) Work out the areas of the following shapes.

a)

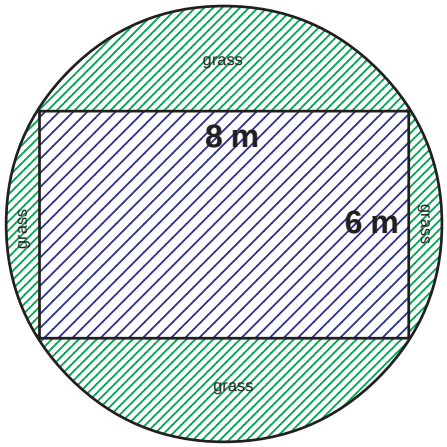


b)



3) The diagram shows a circular garden comprising a rectangular pond enclosed by grass.
The circular garden has a diameter of 10 m.
The rectangular pond measures 8 m by 6 m.

Work out the area of the garden covered in grass.
Give your answer to the nearest m^2.



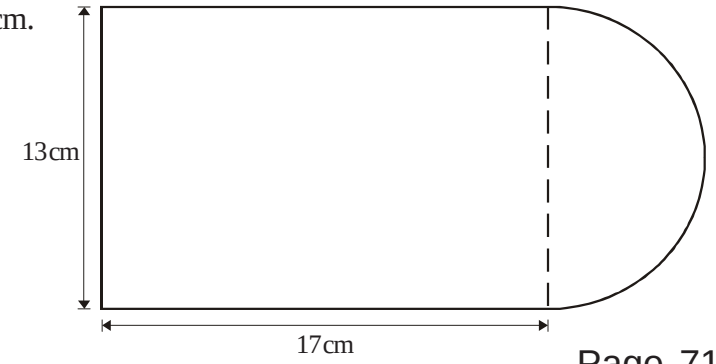
4) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the area of the top of the table.

b) Work out the area of the base of the table.

5) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 13 cm.
The length of the rectangle is 17 cm.

Calculate the area of the shape.
Give your answer correct to
3 significant figures.

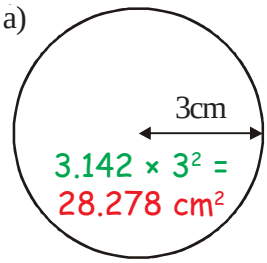


Area of a Circle

Take π to be 3.142 for all questions.

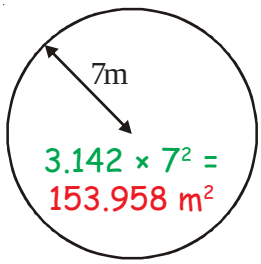
1) Find the areas of the following shapes.

a)



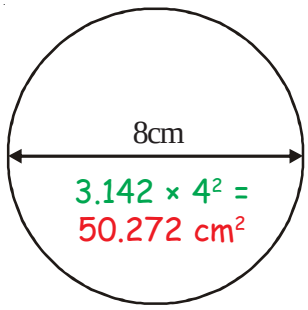
$3.142 \times 3^2 =$
$28.278\ cm^2$

b)



$3.142 \times 7^2 =$
$153.958\ m^2$

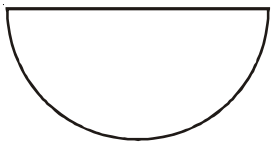
c)



$3.142 \times 4^2 =$
$50.272\ cm^2$

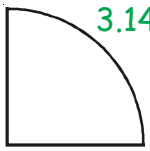
2) Work out the areas of the following shapes.

a)



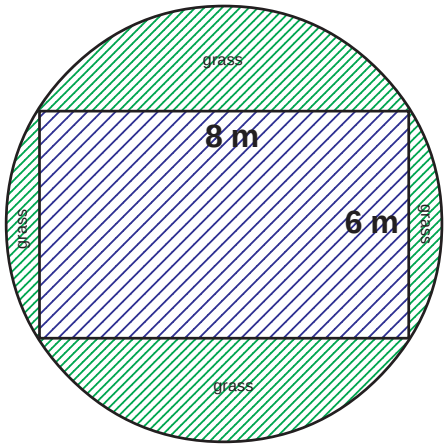
$3.142 \times 6^2 = 113.112$
$113.112 \div 2 =$
$56.556\ mm^2$

b)



$3.142 \times 10^2 = 314.2$
$314.2 \div 4 =$
$78.55\ cm^2$

3) The diagram shows a circular garden comprising a rectangular pond enclosed by grass.
The circular garden has a diameter of 10 m.
The rectangular pond measures 8 m by 6 m.



Work out the area of the garden covered in grass.
Give your answer to the nearest m^2.

$31\ m^2$ to the nearest metre

Circular garden area: $3.142 \times 5^2 = 78.55$
Rectangular pond area: $8 \times 6 = 48$
$78.55 - 48 = 30.55$

4) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the area of the top of the table.

3.142×60^2

$11\,311.2\ cm^2$

b) Work out the area of the base of the table.

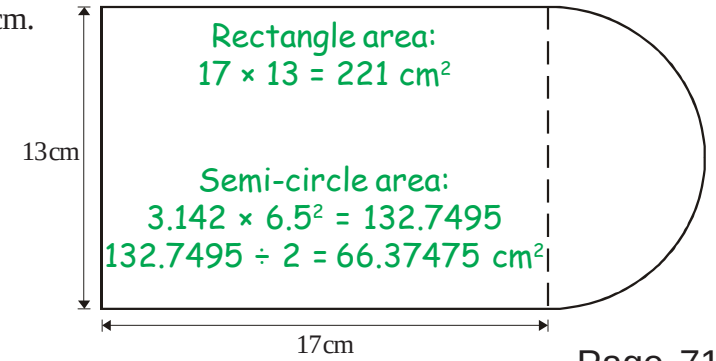
3.142×15^2

$706.95\ cm^2$

5) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 13 cm.
The length of the rectangle is 17 cm.

Calculate the area of the shape.
Give your answer correct to 3 significant figures. $287\ cm^2$

$221 + 66.37475 = 287.37475$

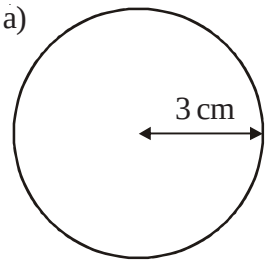


Circumference of a Circle

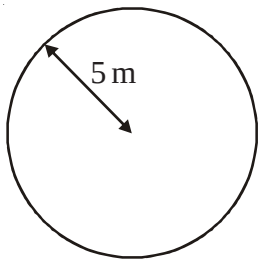
Take π to be 3.142 for all questions.

1) Find the circumference of the following shapes.

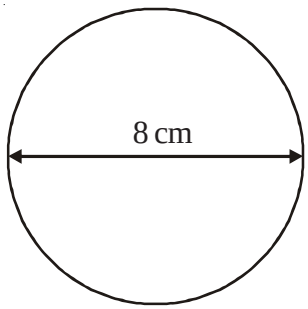
a)



b)

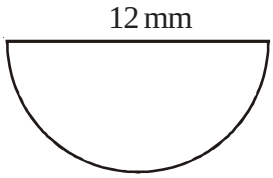


c)

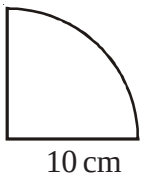


2) Work out the perimeter of the following shapes.

a)



b)



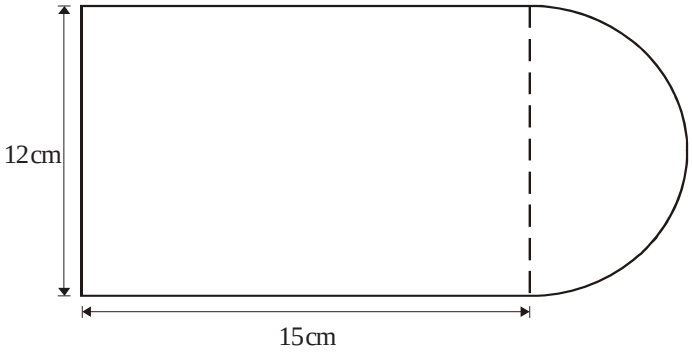
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the circumference of the top of the table.

b) Work out the circumference of the base of the table.

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

Calculate the perimeter of the shape.
Give your answer correct to
3 significant figures.

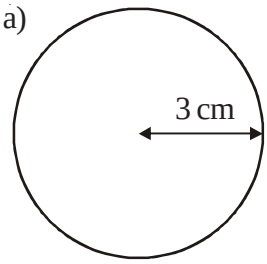


Circumference of a Circle

Take π to be 3.142 for all questions.

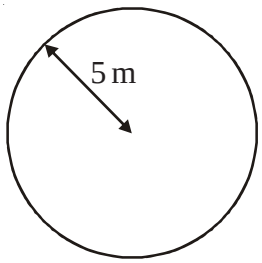
1) Find the circumference of the following shapes.

a) C = 18.852 cm



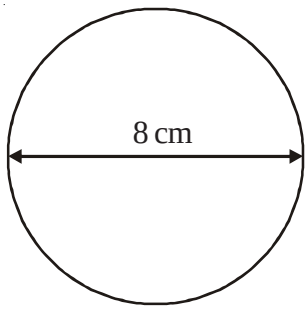
C = 2 × 3.142 × 3

b) C = 31.42 m



C = 2 × 3.142 × 5

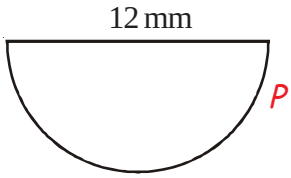
c) C = 25.136 cm



C = 2 × 3.142 × 4

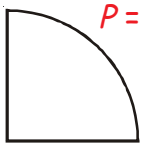
2) Work out the perimeter of the following shapes.

a)



P = 30.852 mm

b) P = 35.71 cm



3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the circumference of the top of the table.

C = 377.04 cm

b) Work out the circumference of the base of the table.

C = 94.26 cm

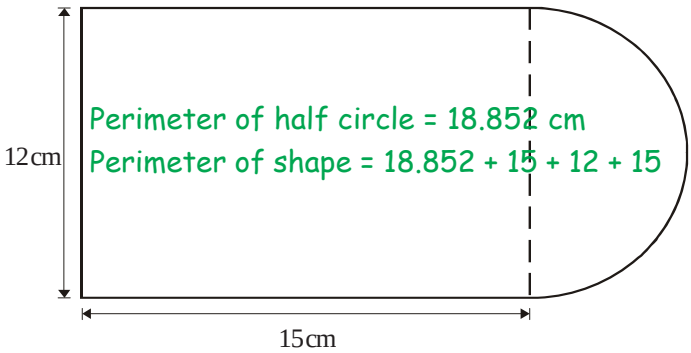
C = 2 × 3.142 × 60

C = 2 × 3.142 × 15

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

Calculate the perimeter of the shape.
Give your answer correct to
3 significant figures.

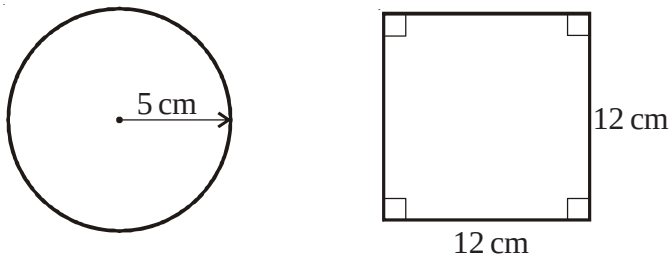
P = 60.9 cm



Perimeter of half circle = 18.852 cm
Perimeter of shape = 18.852 + 15 + 12 + 15

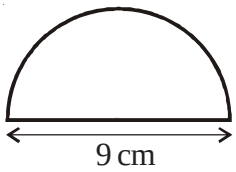
Area and Circumference of Circles

1) A circle has a radius of 5 cm.
A square has sides of length 12 cm.



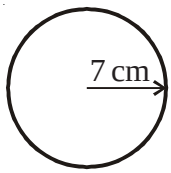
Work out the difference between the area of the circle and the area of the square if you take π to be 3.

2) Here is a tile in the shape of a semi-circle.



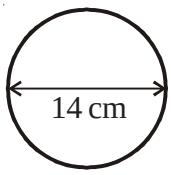
The diameter of the semi-circle is 9 cm.
Work out the perimeter of the tile.
Give your answer correct to two decimal places.

3) A circle has a radius of 7 cm.



Work out the area of the circle.
Give your answer correct to three significant figures.

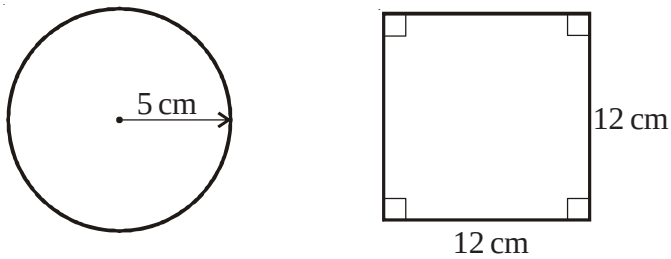
4) A circle has a diameter of 14 cm.



Work out the circumference of the circle.
Give your answer correct to three significant figures.

Area and Circumference of Circles

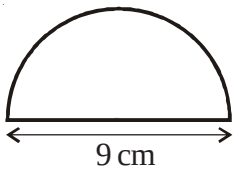
1) A circle has a radius of 5 cm.
A square has sides of length 12 cm.



Work out the difference between the area of the circle and the area of the square if you take π to be 3. 69 cm^2 difference

Area of circle = 75
Area of square = 144

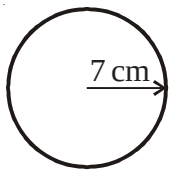
2) Here is a tile in the shape of a semi-circle.



The diameter of the semi-circle is 9 cm.
Work out the perimeter of the tile.
Give your answer correct to two decimal places. 23.14 cm

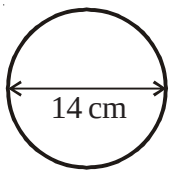
14.139 + 9

3) A circle has a radius of 7 cm.



Work out the area of the circle. 154 cm^2
Give your answer correct to three significant figures.

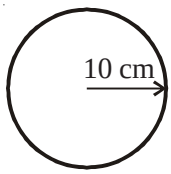
4) A circle has a diameter of 14 cm.



Work out the circumference of the circle. 44.0 cm
Give your answer correct to three significant figures.

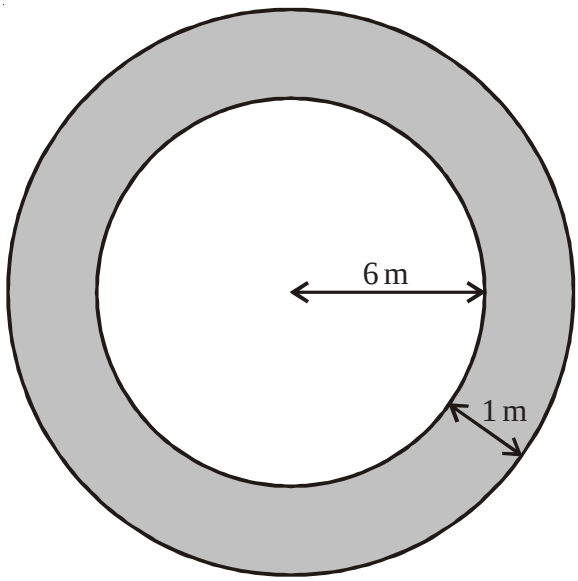
Area and Circumference of Circles

1) The radius of a circle is 10 cm.



Work out the area of this circle.
Take π to be 3.14

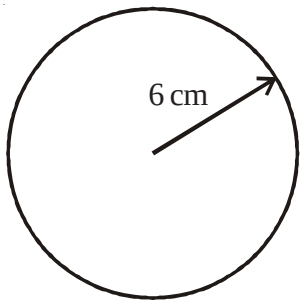
2) The diagram shows a circular pond with a path around it.



The pond has a radius of 6 m.
The path has a width of 1 m.

Work out the area of the path.
Give your answer correct to 3 significant figures.

3) The diagram shows a CD which has a radius of 6 cm.



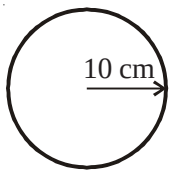
a) Work out the circumference of the CD.
Give your answer correct to 3 significant figures.

CDs of this size are cut from rectangular sheets of plastic.
Each sheet is 1 metre long and 50 cm wide.

b) Work out the greatest number of CDs which can be cut from one rectangular sheet.

Area and Circumference of Circles

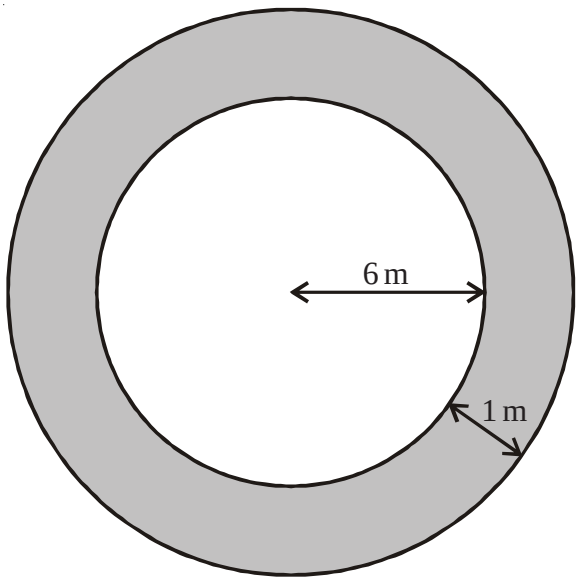
1) The radius of a circle is 10 cm.



Work out the area of this circle. 314 cm^2

Take π to be 3.14

2) The diagram shows a circular pond with a path around it.



The pond has a radius of 6 m.

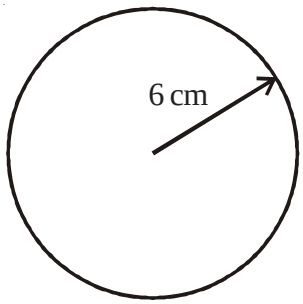
The path has a width of 1 m.

Work out the area of the path. 40.8 m^2

Give your answer correct to 3 significant figures.

153.958 – 113.112

3) The diagram shows a CD which has a radius of 6 cm.

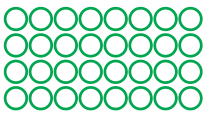


a) Work out the circumference of the CD. 37.7 cm
Give your answer correct to 3 significant figures.

CDs of this size are cut from rectangular sheets of plastic.

Each sheet is 1 metre long and 50 cm wide.

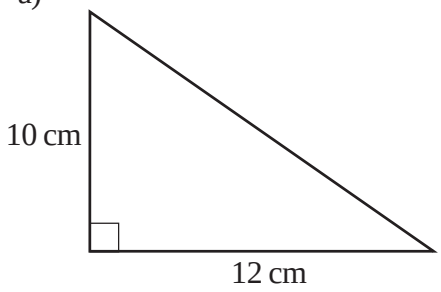
b) Work out the greatest number of CDs which can be cut from one rectangular sheet. 32



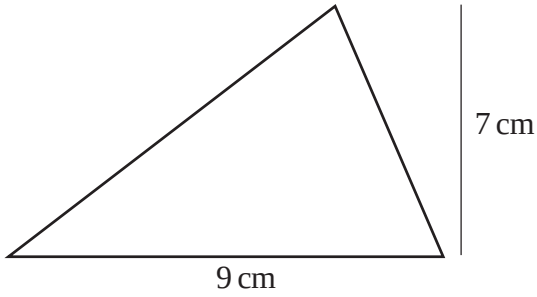
Area

1) Find the areas of these two triangles.

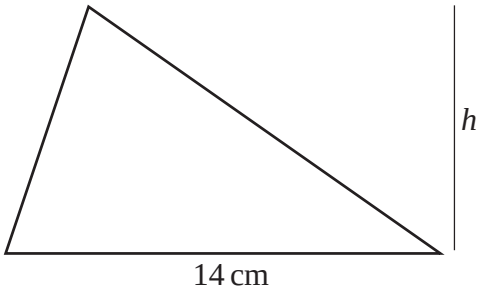
a)



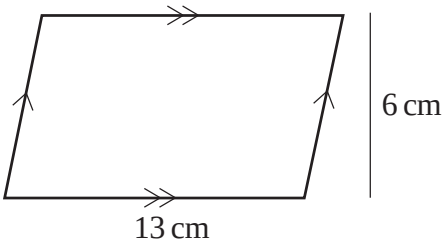
b)



2) The area of this triangle is 70 cm^2.
Find its height, h.

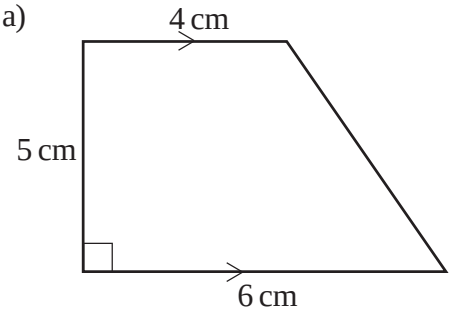


3) Find the area of the parallelogram.

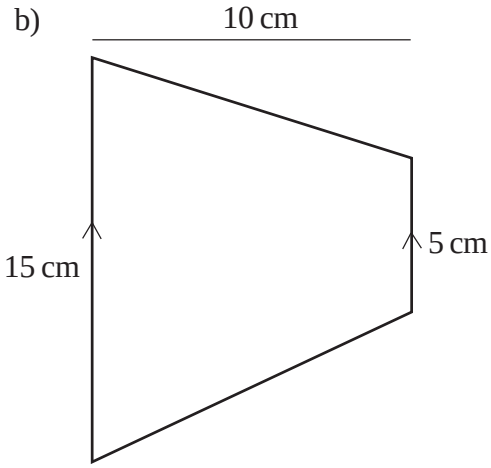


4) Find the area of these two trapeziums.

a)



b)

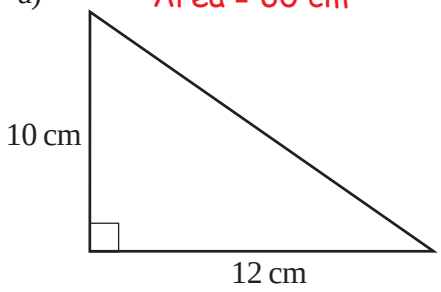


Area of trapezium = $\frac{1}{2}(a + b)h$

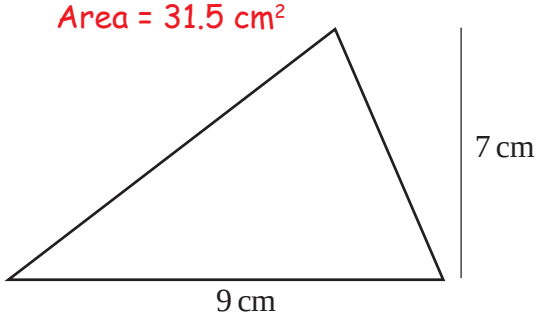
Area

1) Find the areas of these two triangles.

a) Area = 60 cm²

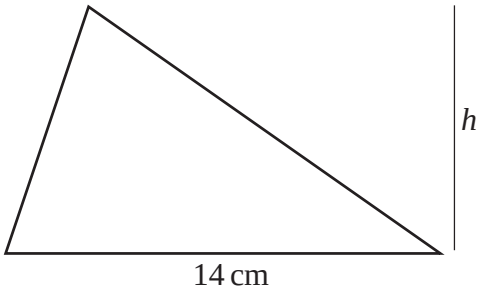


b) Area = 31.5 cm²



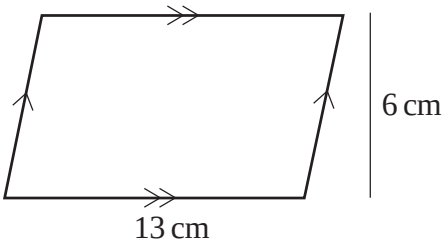
2) The area of this triangle is 70 cm².
Find its height, *h*.

h = 10 cm



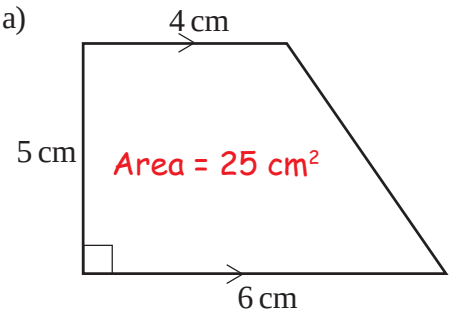
3) Find the area of the parallelogram.

Area = 78 cm²

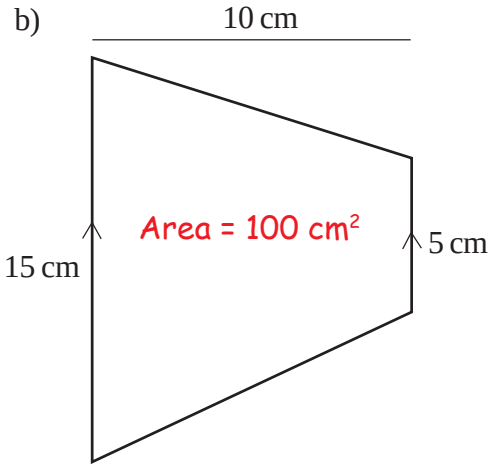


4) Find the area of these two trapeziums.

a)



b)

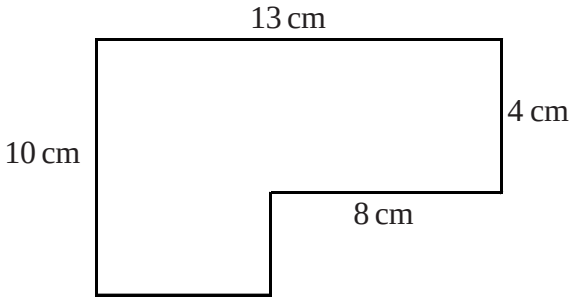


Area of trapezium = $\frac{1}{2}(a + b)h$

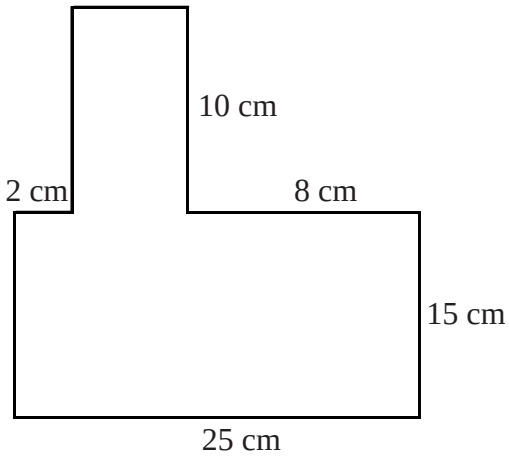
Area

1) Find the area of each shape.

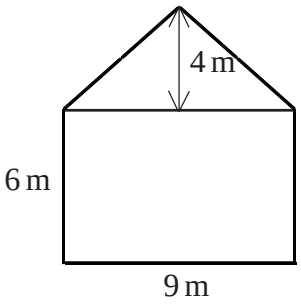
a)



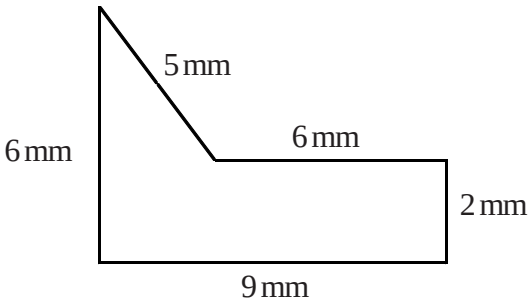
b)



c)

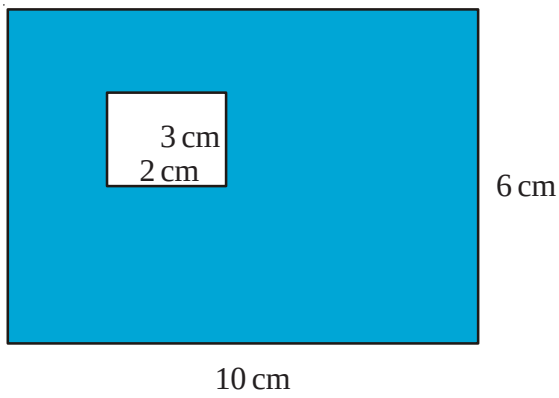


d)

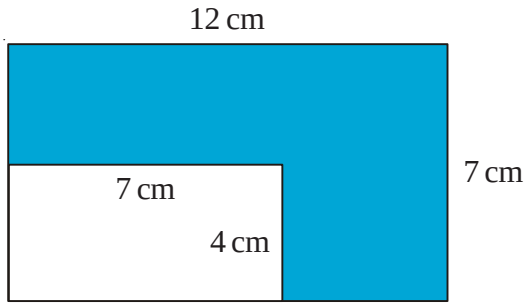


2) Find the shaded area of each shape.

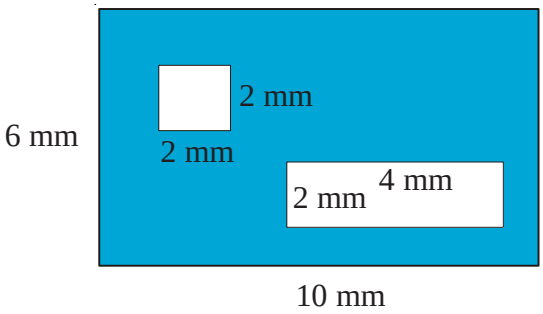
a)



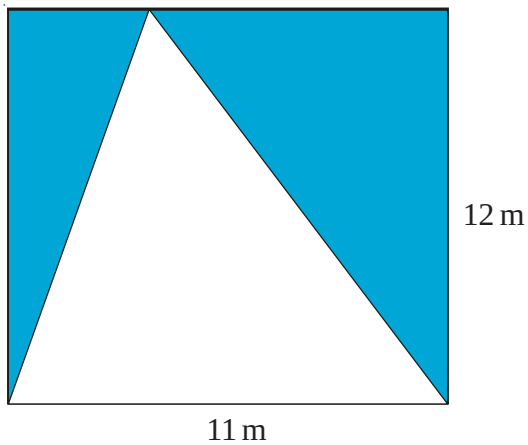
b)



c)



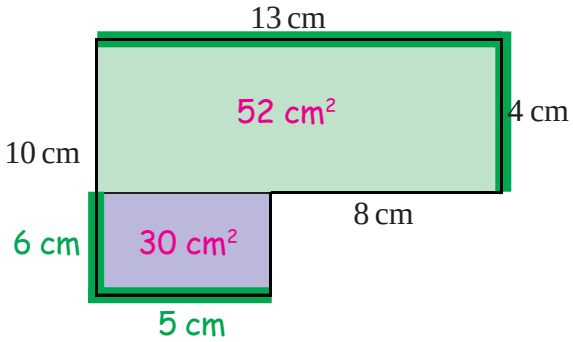
d)



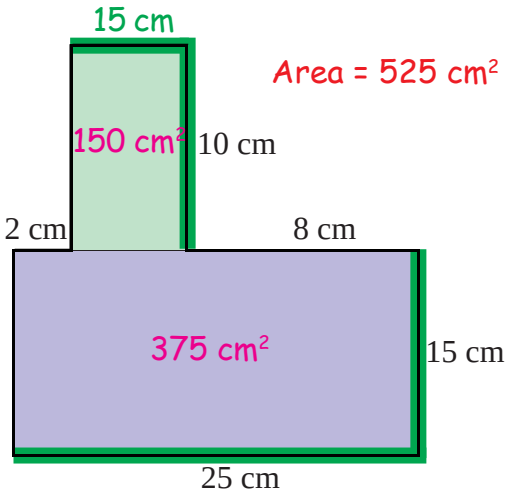
Area

1) Find the area of each shape.

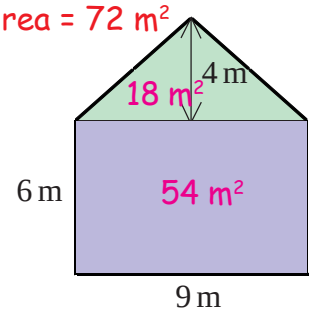
a) Area = 82 cm²



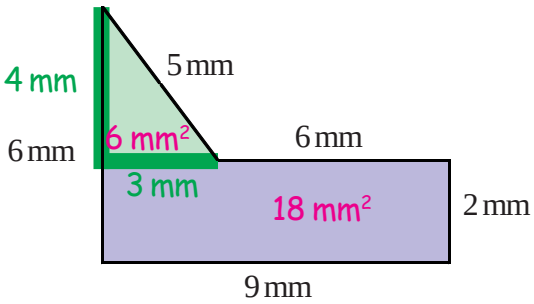
b) Area = 525 cm²



c) Area = 72 m²

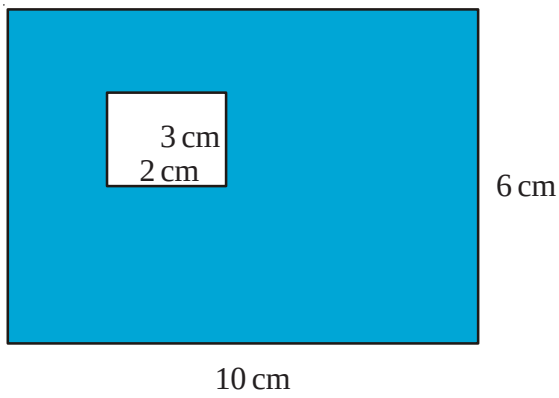


d) Area = 24 mm²

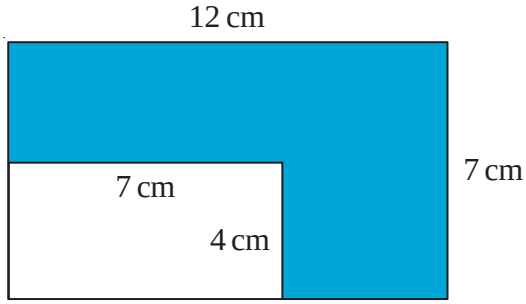


2) Find the shaded area of each shape.

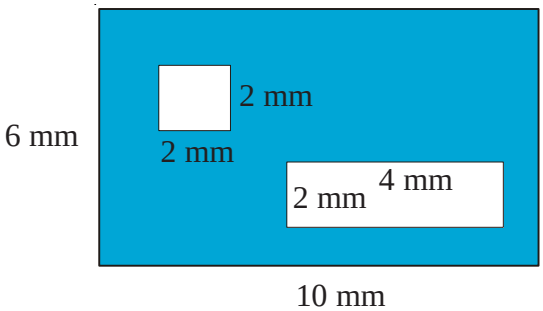
a) Area = 54 cm² (60 – 6)



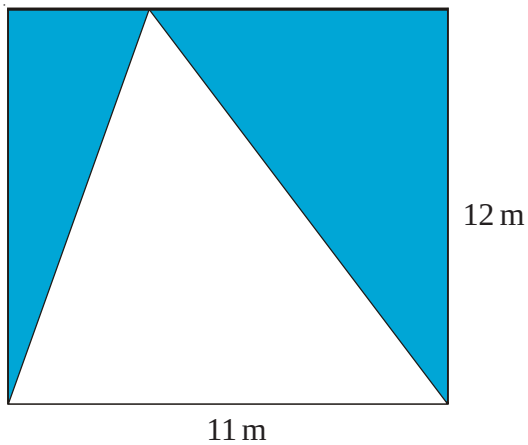
b) Area = 56 cm² (84 – 28)



c) Area = 48 mm² (60 – 4 – 8)



d) Area = 66 m² (132 – 66)



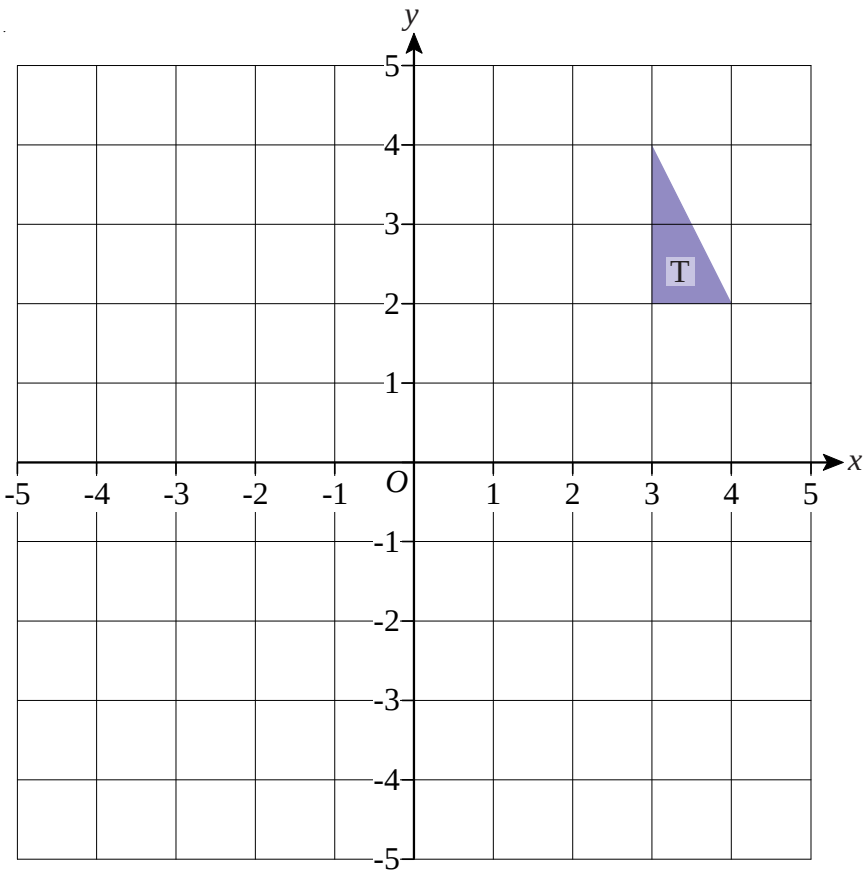
 Clip 74

Grade D questions

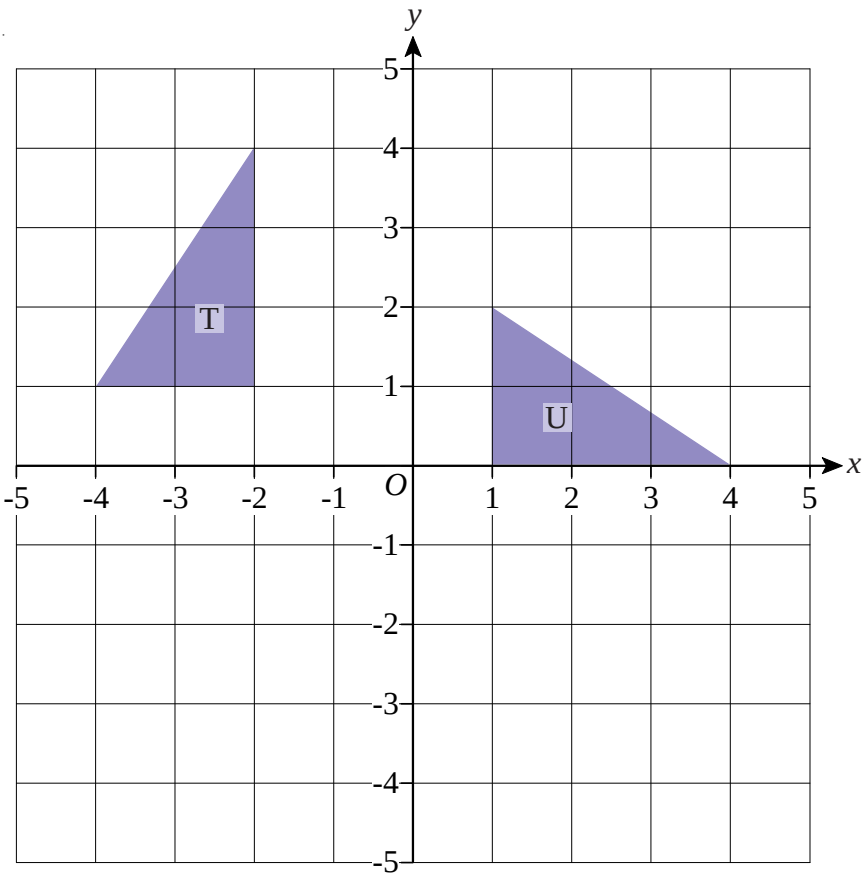
Rotations

1) a) Rotate triangle T 90° anti-clockwise about the point (0, 0).
Label your new triangle U.

b) Rotate triangle T 180° about the point (2, 0).
Label your new triangle V.



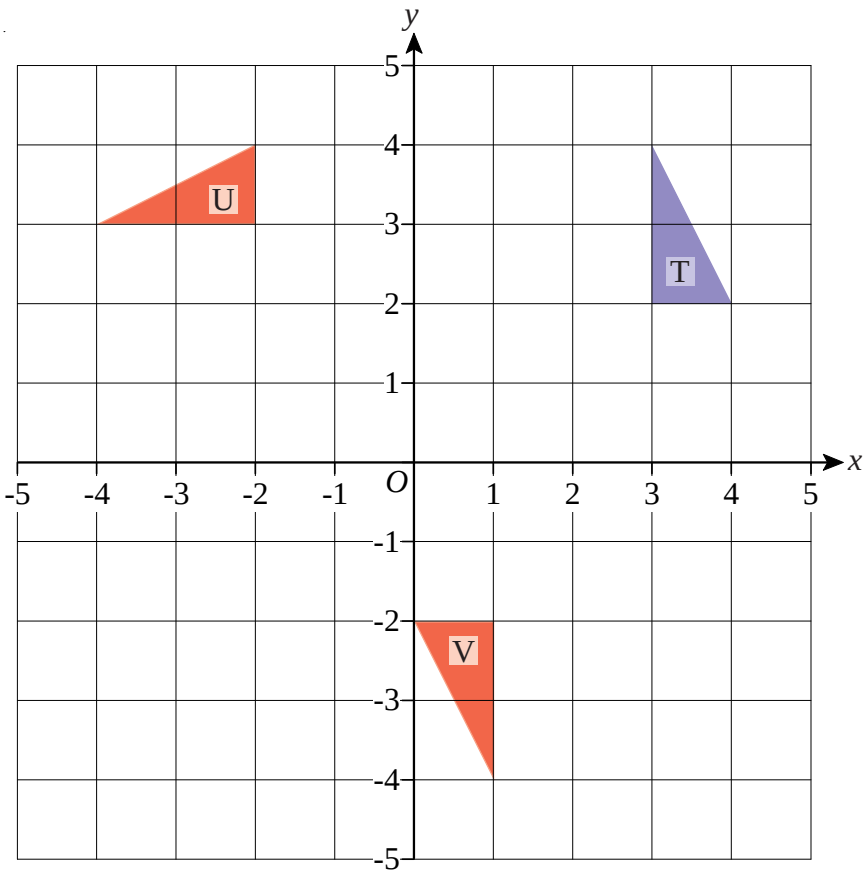
2) Describe fully the single transformation which maps triangle T to triangle U.



Rotations

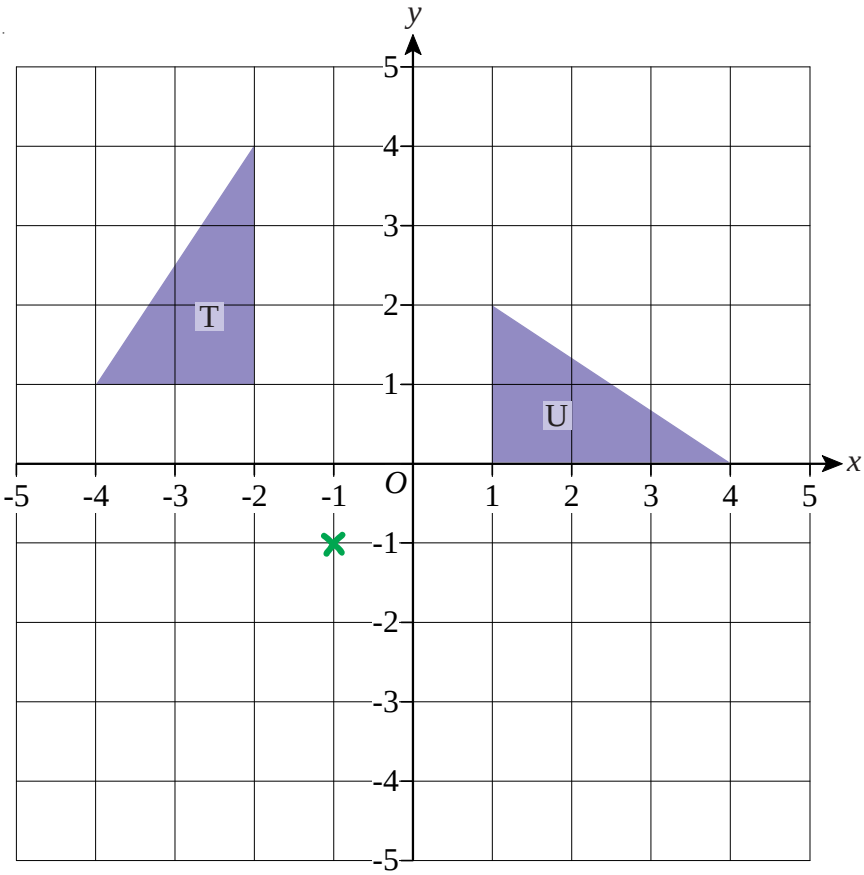
1) a) Rotate triangle T 90° anti-clockwise about the point (0, 0).
Label your new triangle U.

b) Rotate triangle T 180° about the point (2, 0).
Label your new triangle V.



2) Describe fully the single transformation which maps triangle T to triangle U.

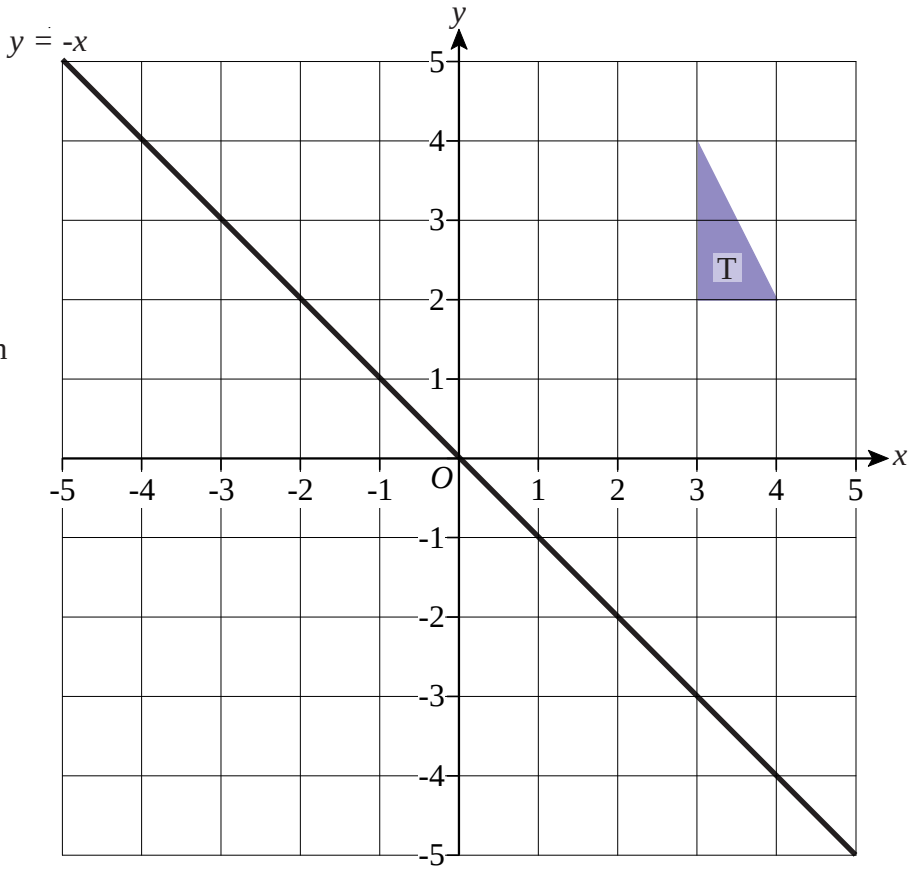
Rotation,
90° clockwise,
centre of rotation (-1, -1)



Reflections

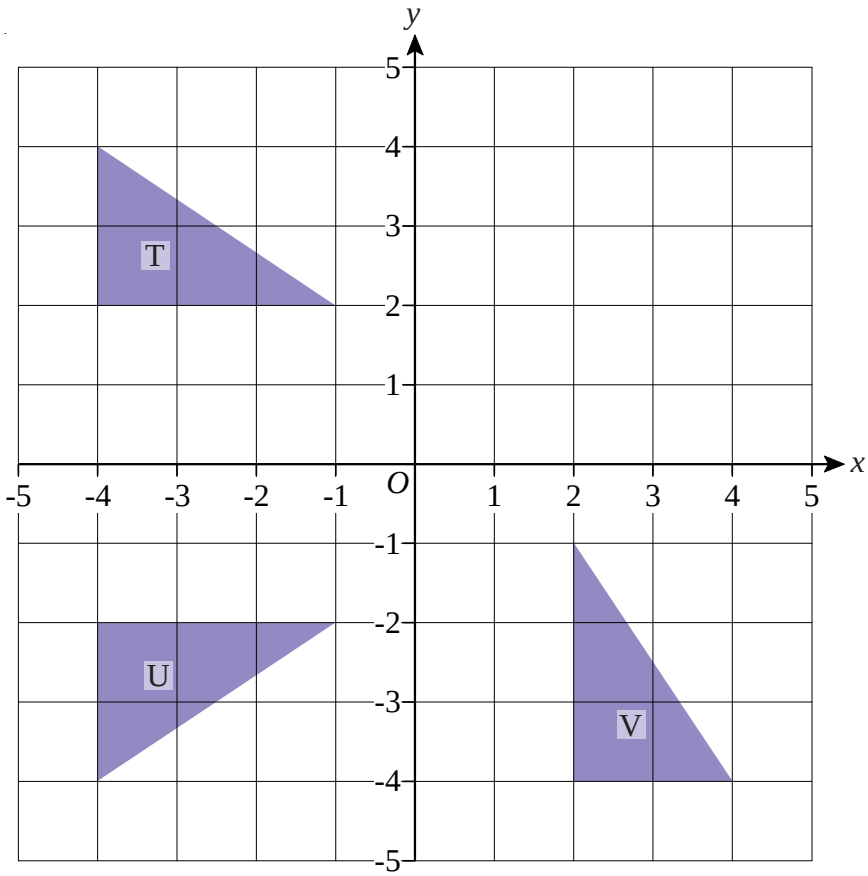
1) a) Reflect triangle T in the x axis.
Label your new triangle U.

b) Reflect triangle T in the line with equation $y = -x$.
Label your new triangle V.



2) a) Describe fully the single transformation which maps triangle T to triangle U.

b) Describe fully the single transformation which maps triangle T to triangle V.



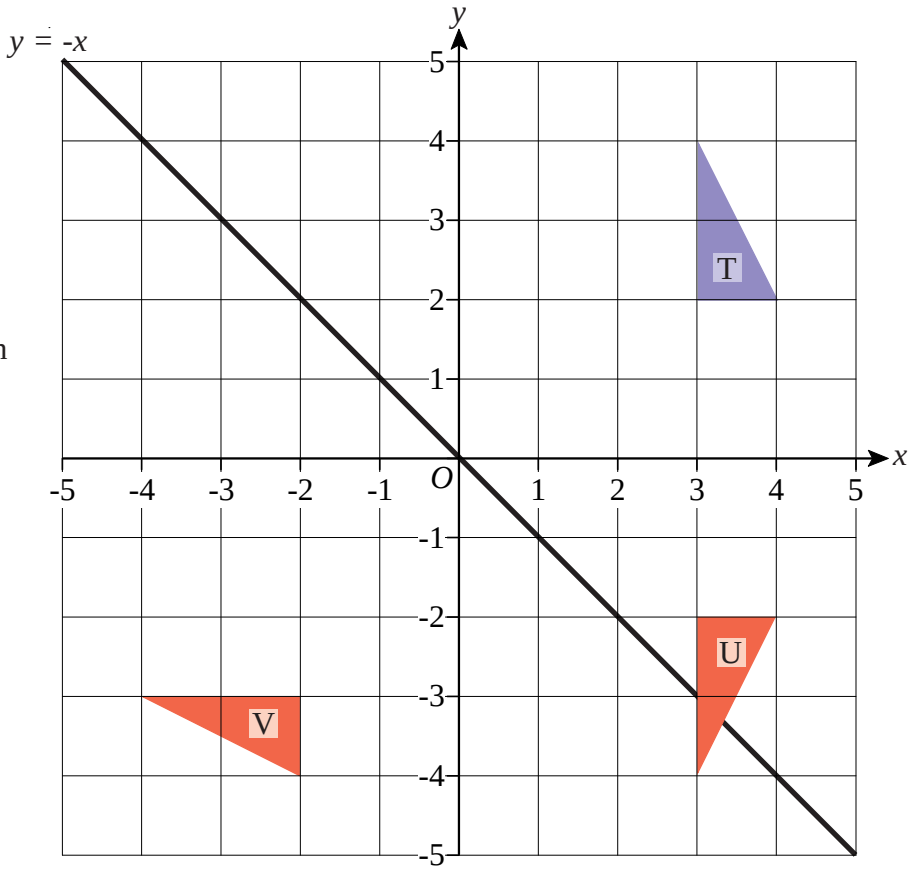
 Clip 75

Grade D questions

Reflections

1) a) Reflect triangle T in the x axis.
Label your new triangle U.

b) Reflect triangle T in the line with equation $y = -x$.
Label your new triangle V.

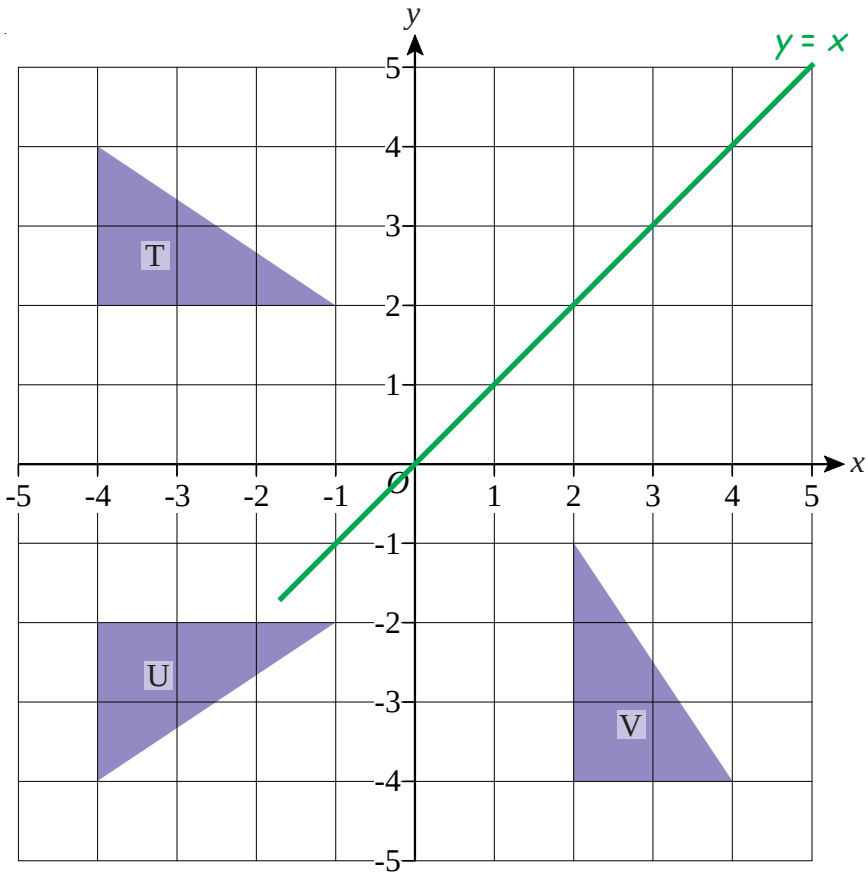


2) a) Describe fully the single transformation which maps triangle T to triangle U.

Reflection in the x axis.

b) Describe fully the single transformation which maps triangle T to triangle V.

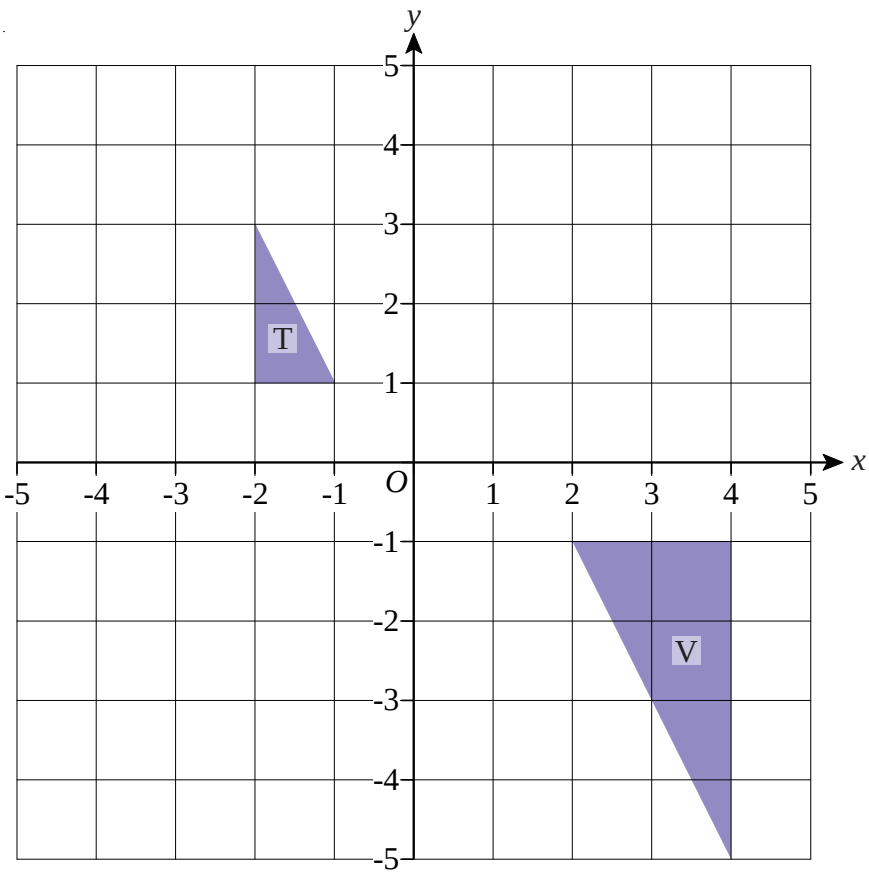
Reflection in the $y = x$ line.



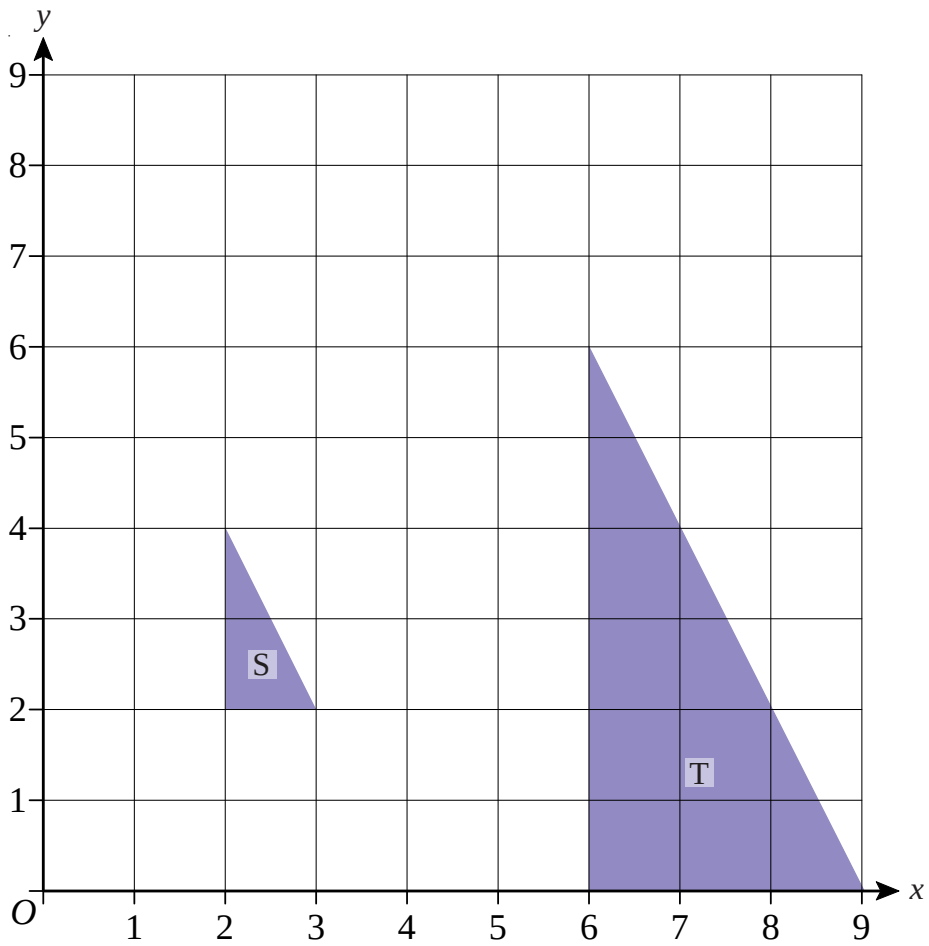
Enlargements

1) a) Enlarge triangle T by scale factor 2 using point (-5, 2) as the centre of enlargement.
Label your new triangle U.

b) Enlarge triangle V by scale factor a half using the point (-2, -3) as the centre of enlargement.
Label your new triangle W.



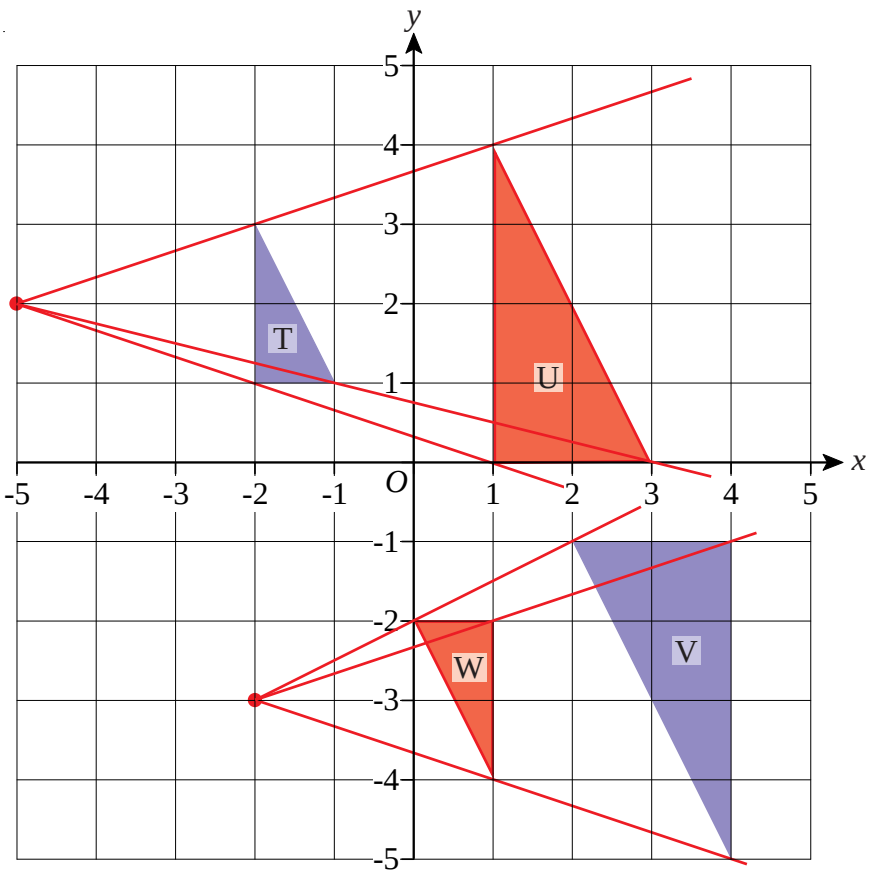
2) Describe fully the single transformation which maps triangle S to triangle T.



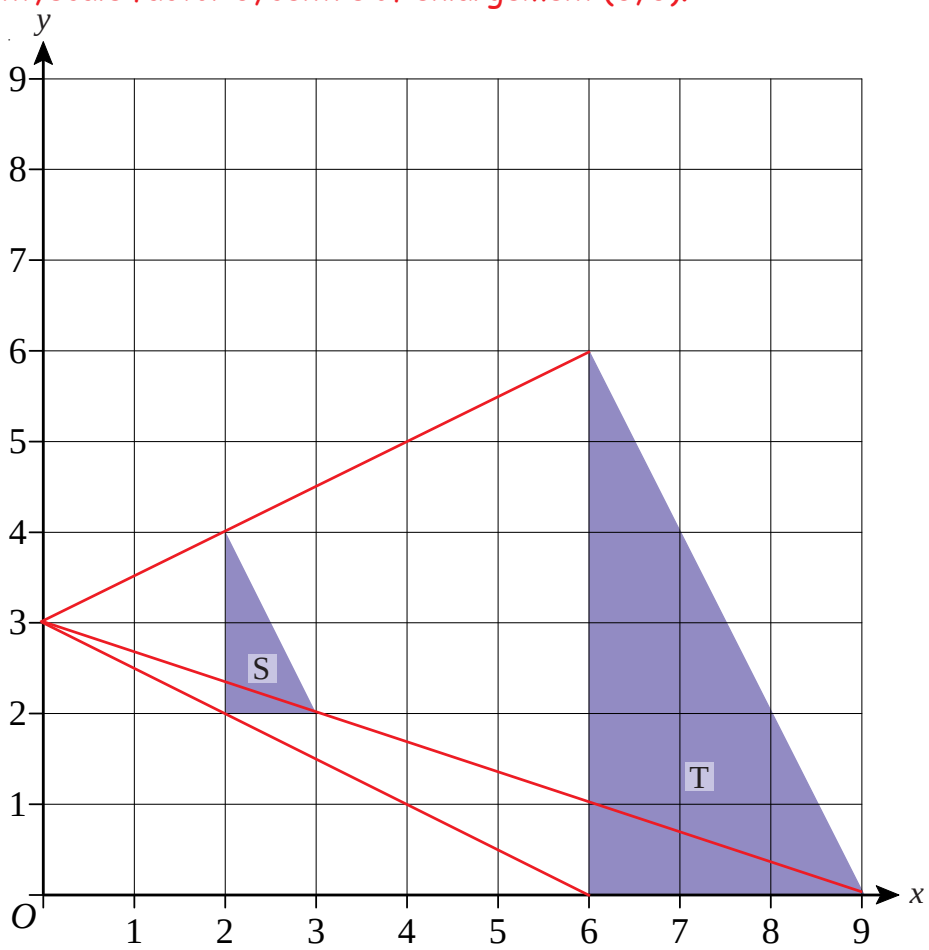
Enlargements

1) a) Enlarge triangle T by scale factor 2 using point (-5, 2) as the centre of enlargement.
Label your new triangle U.

b) Enlarge triangle V by scale factor a half using the point (-2, -3) as the centre of enlargement.
Label your new triangle W.



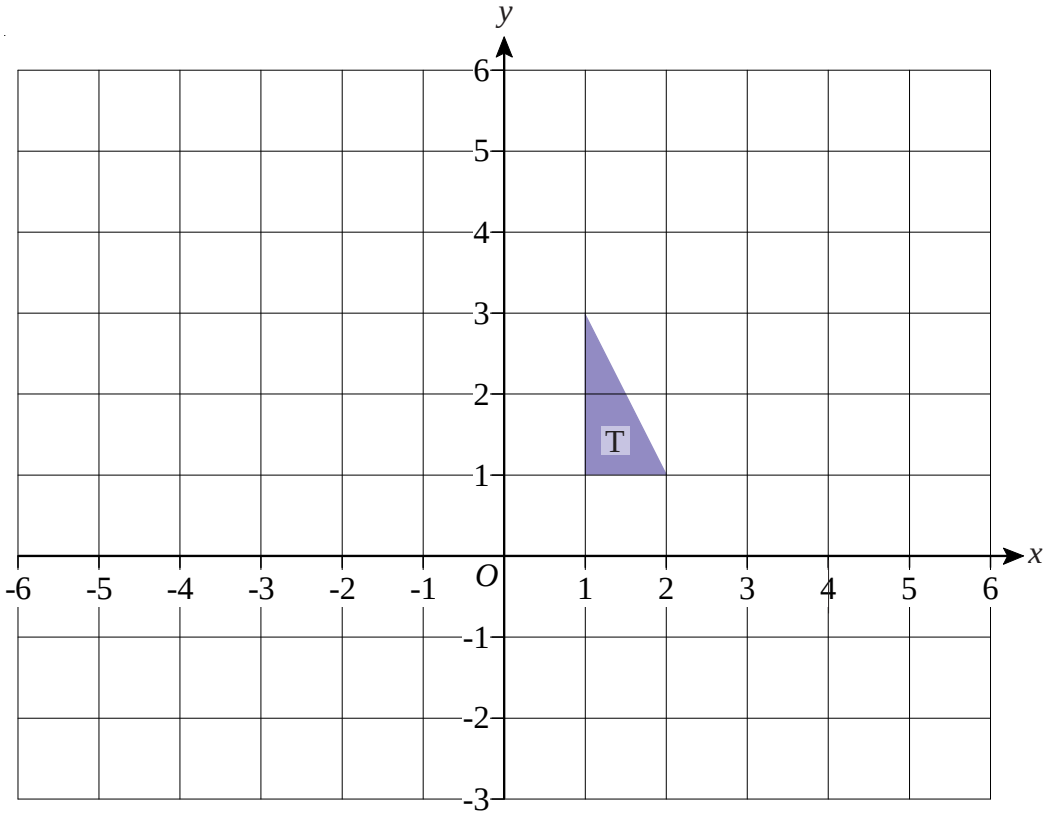
2) Describe fully the single transformation which maps triangle S to triangle T.
Enlargement, scale factor 3, centre of enlargement (0, 3).



Translations

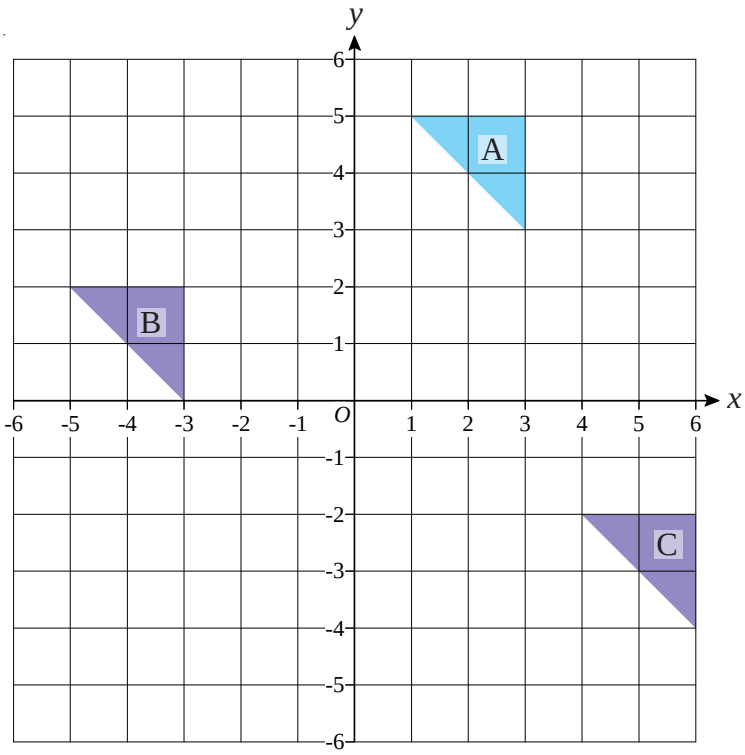
1) a) Translate triangle T by vector $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$ and label it U.

b) Translate triangle T by vector $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and label it V.



2) a) Describe fully the single transformation which maps triangle A to triangle B.

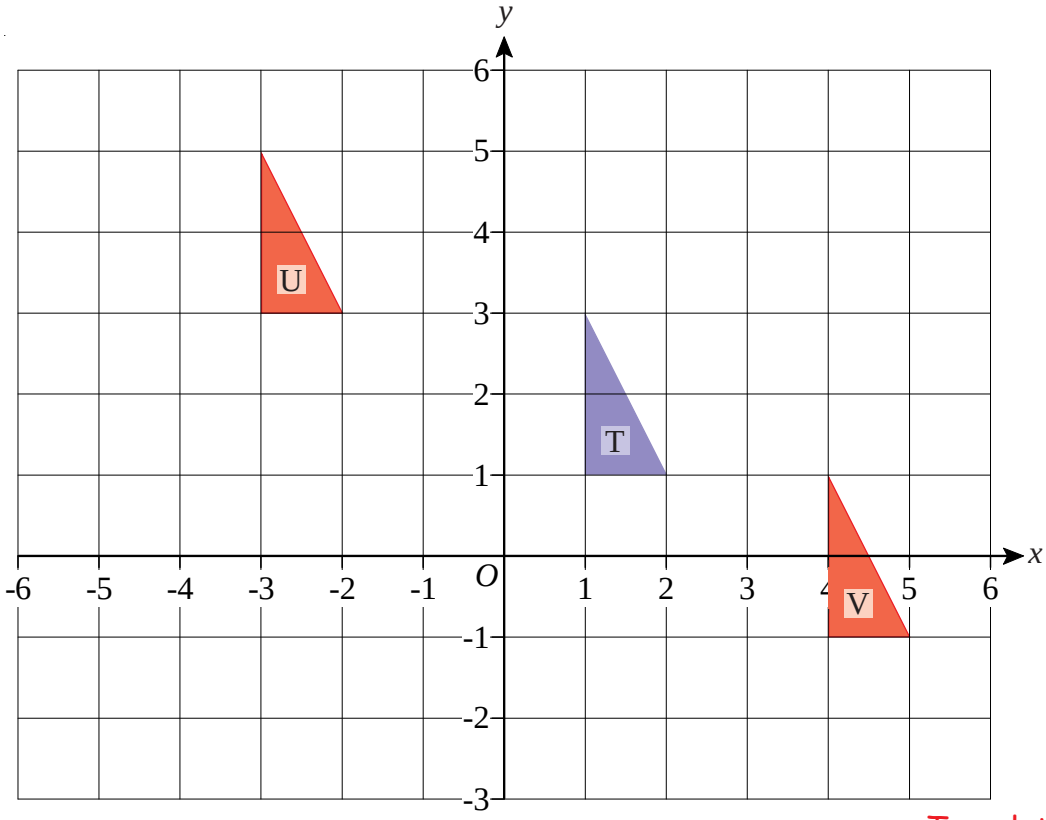
b) Describe fully the single transformation which maps triangle A to triangle C.



Translations

1) a) Translate triangle T by vector $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$ and label it U.

b) Translate triangle T by vector $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and label it V.

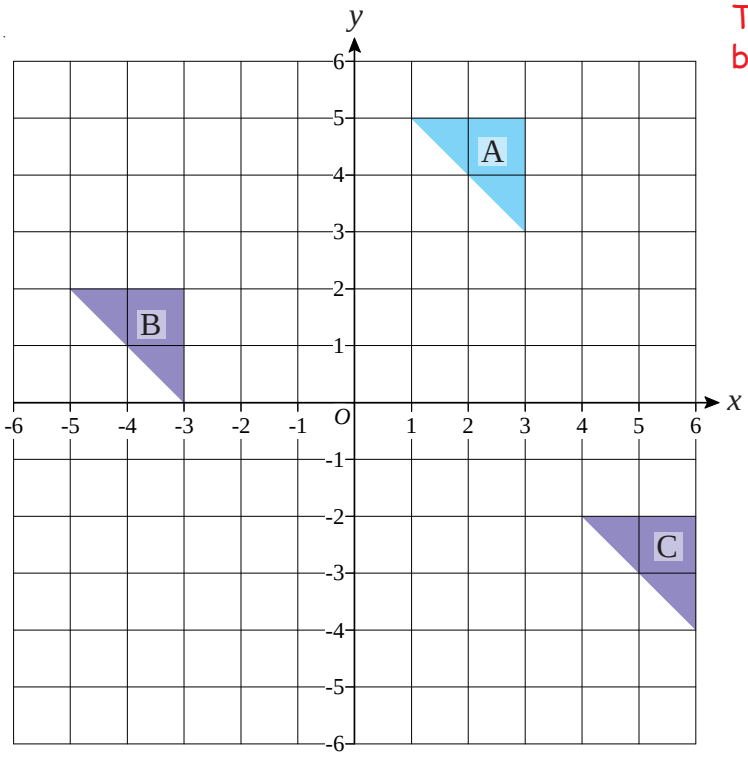


Translation by vector $\begin{bmatrix} -6 \\ -3 \end{bmatrix}$

2) a) Describe fully the single transformation which maps triangle A to triangle B.

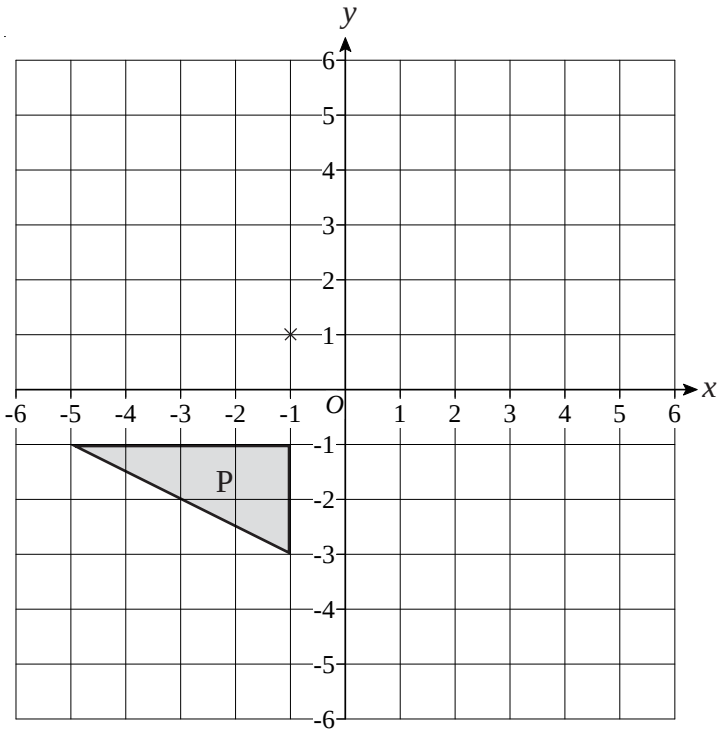
b) Describe fully the single transformation which maps triangle A to triangle C.

Translation by vector $\begin{bmatrix} 3 \\ -7 \end{bmatrix}$



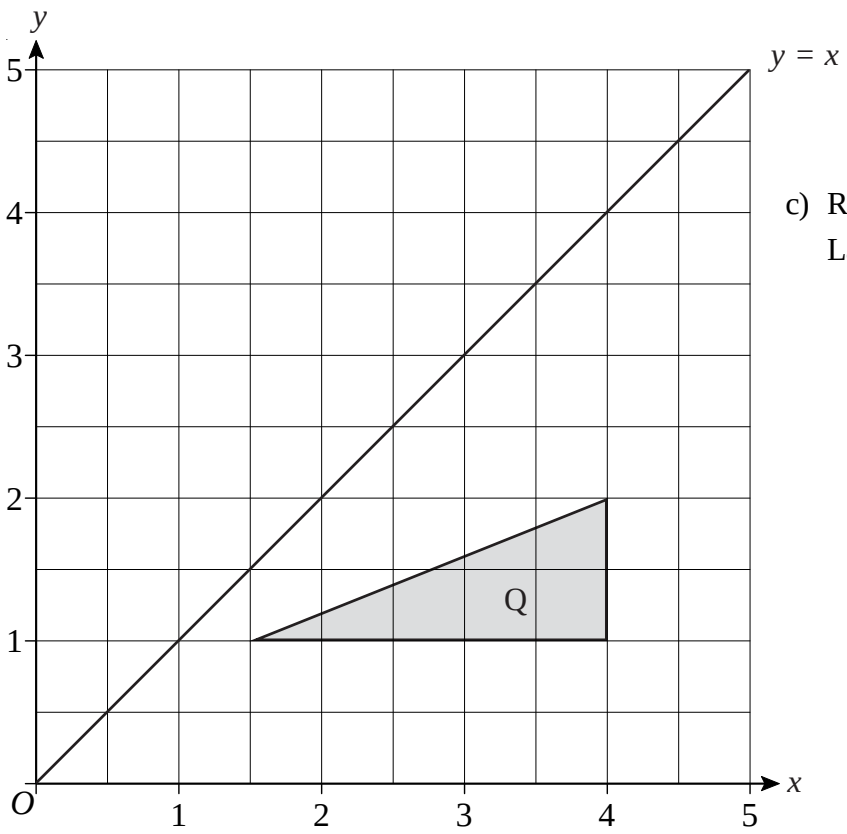
Transformations

1)



a) Rotate triangle P 180° about the point (-1, 1).
Label the new triangle A.

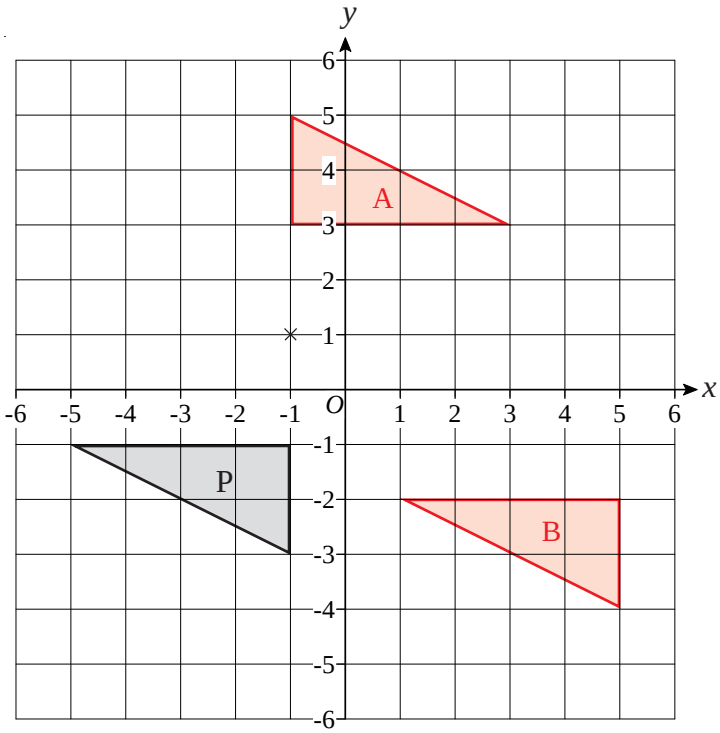
b) Translate triangle P by the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$
Label the new triangle B.



c) Reflect triangle Q in the line $y = x$.
Label the new triangle C.

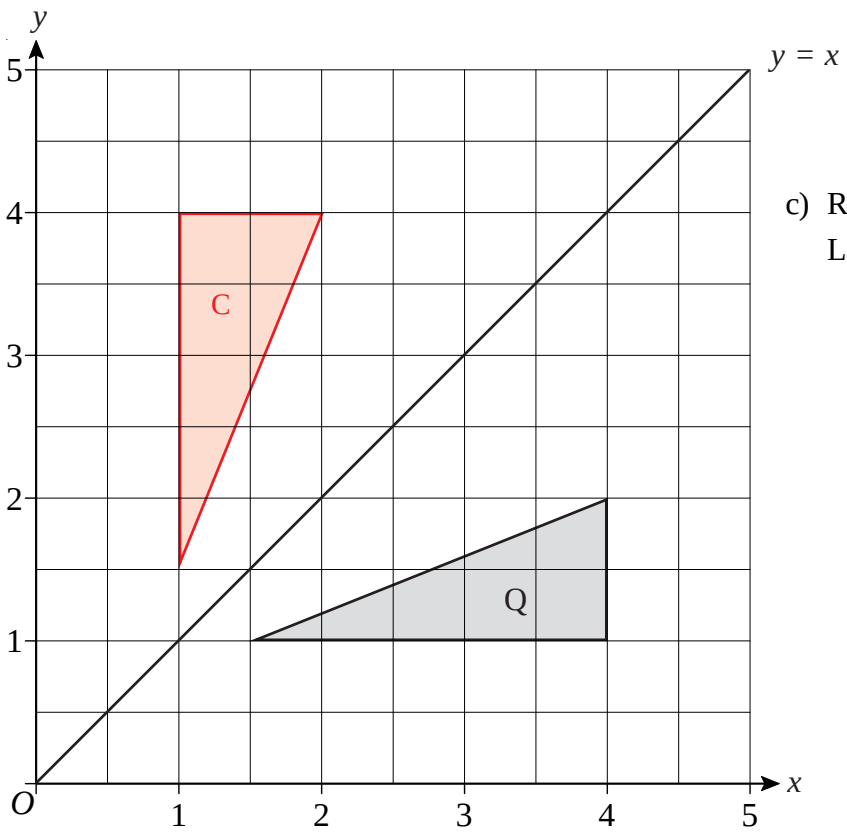
Transformations

1)



a) Rotate triangle P 180° about the point (-1, 1).
Label the new triangle A.

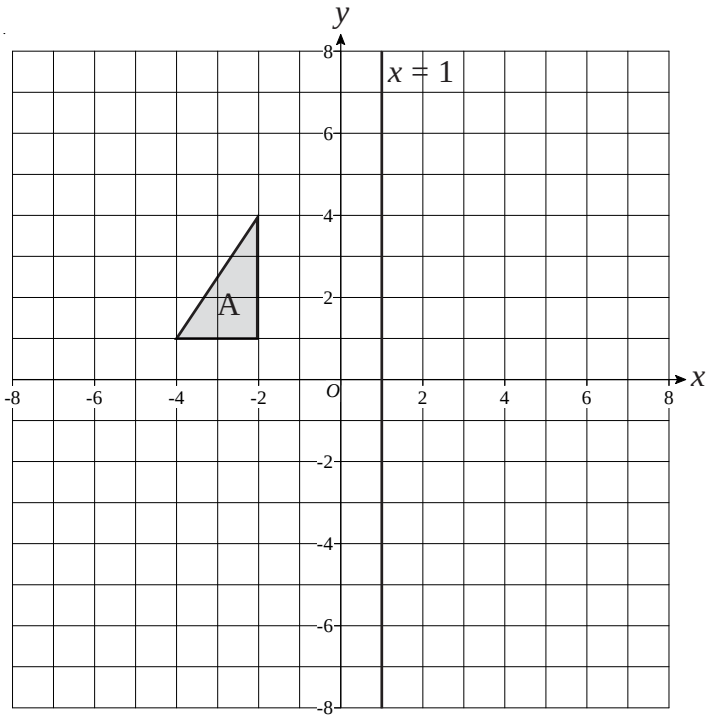
b) Translate triangle P by the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$
Label the new triangle B.



c) Reflect triangle Q in the line $y = x$.
Label the new triangle C.

Transformations

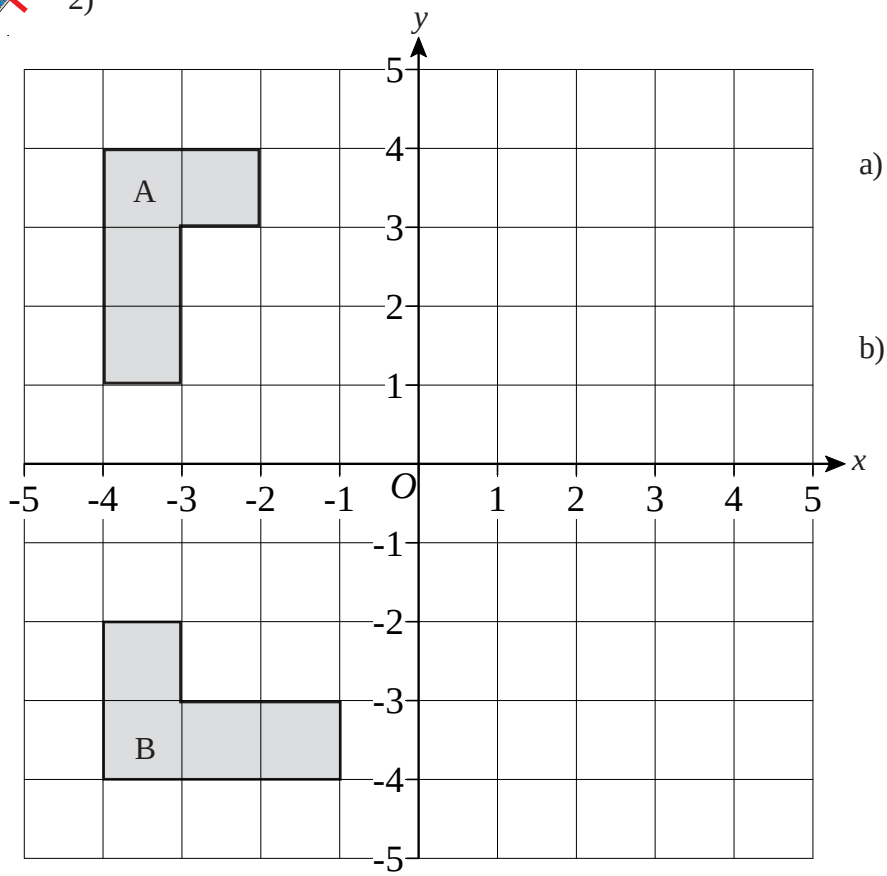
1)



Triangle A is reflected in the *x*-axis to give triangle B.
Triangle B is reflected in the line $x = 1$ to give triangle C.

Describe fully the **single** transformation that takes triangle A to triangle C.

2)

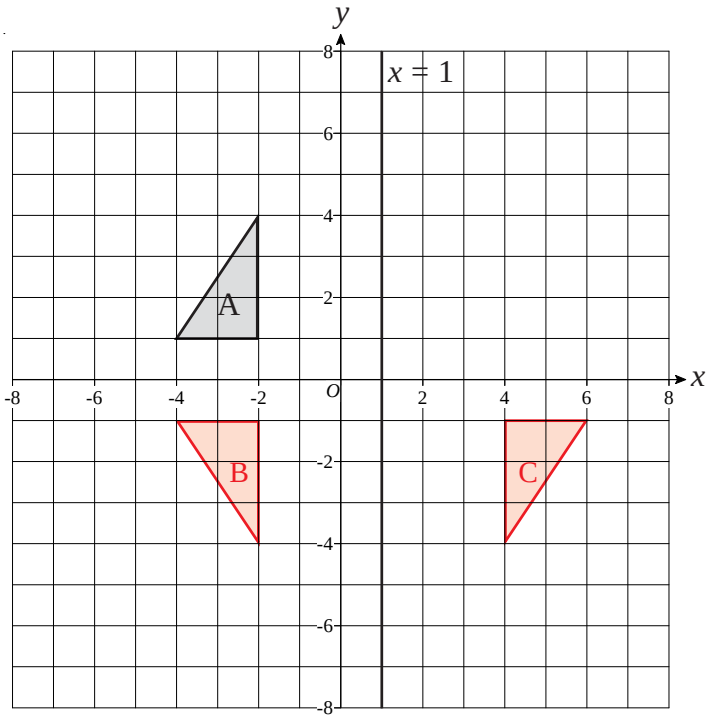


a) Reflect shape A in the *y*-axis.

b) Describe fully the **single** transformation which takes shape A to shape B.

Transformations

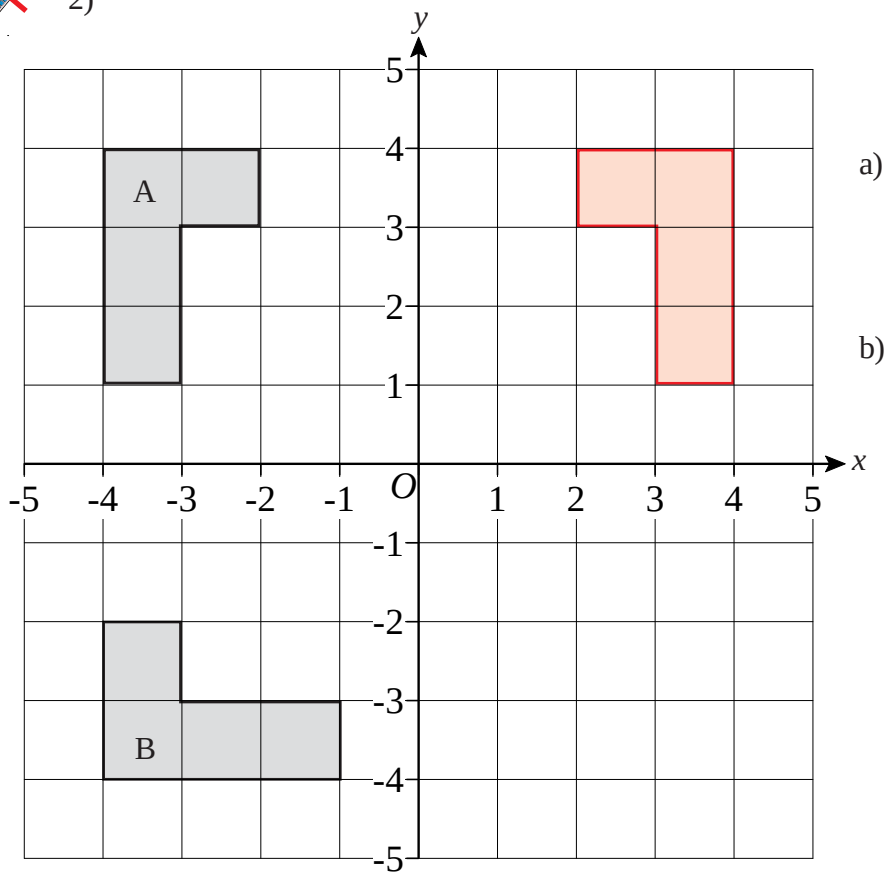
1)



Triangle A is reflected in the x-axis to give triangle B.
Triangle B is reflected in the line $x = 1$ to give triangle C.

Describe fully the **single** transformation that takes triangle A to triangle C.
Rotation of 180° about the point (1, 0)

2)

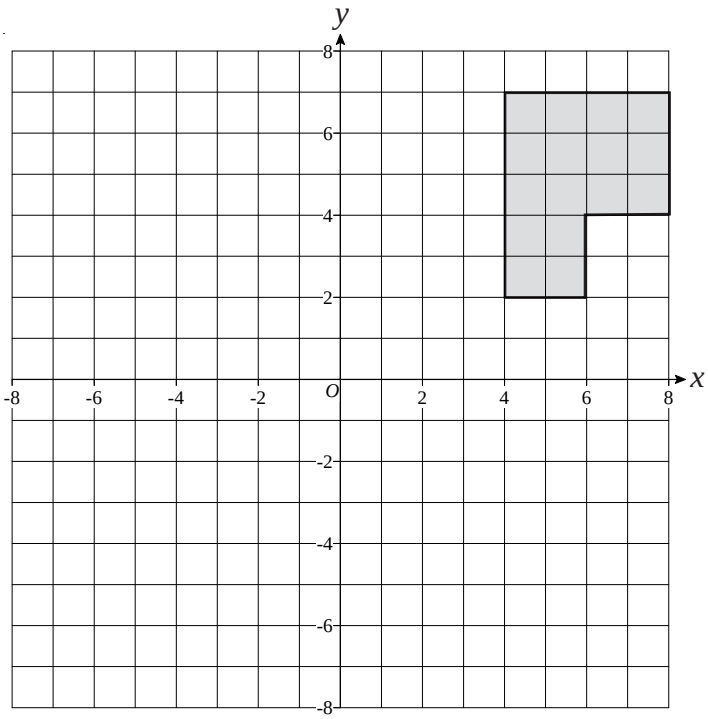


a) Reflect shape A in the y-axis.

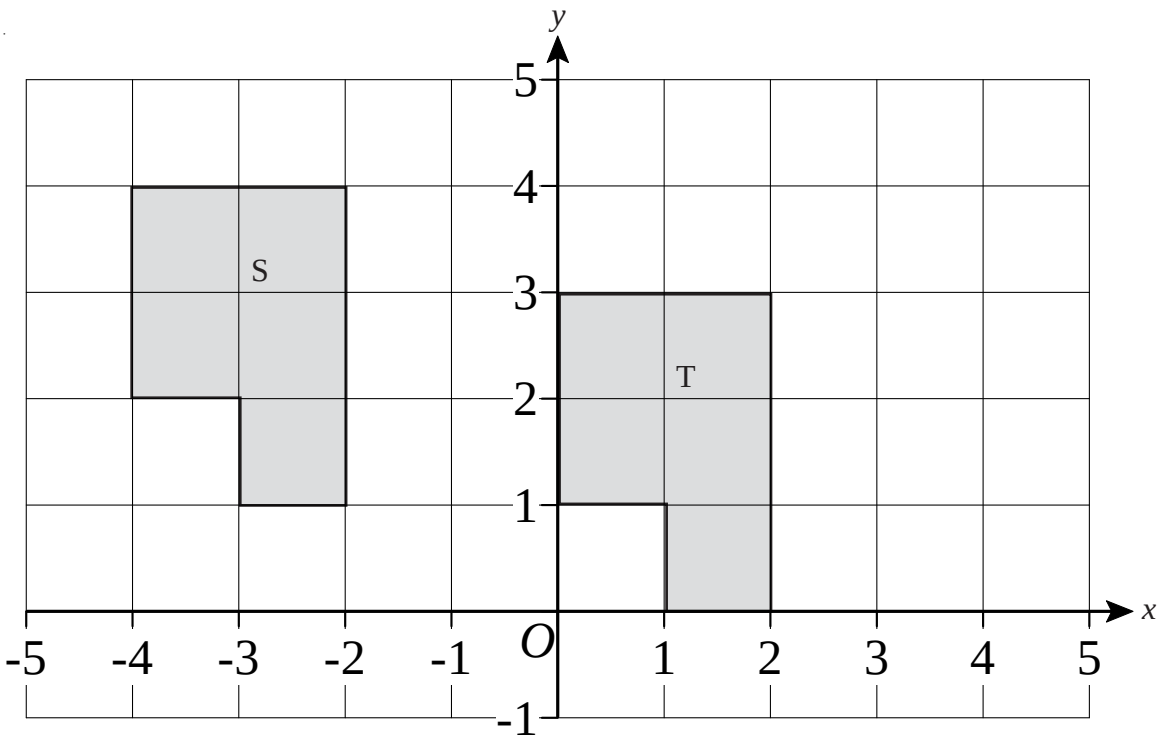
b) Describe fully the **single** transformation which takes shape A to shape B.
Rotation of 90° anticlockwise about the point (0, 0)

Transformations

1)



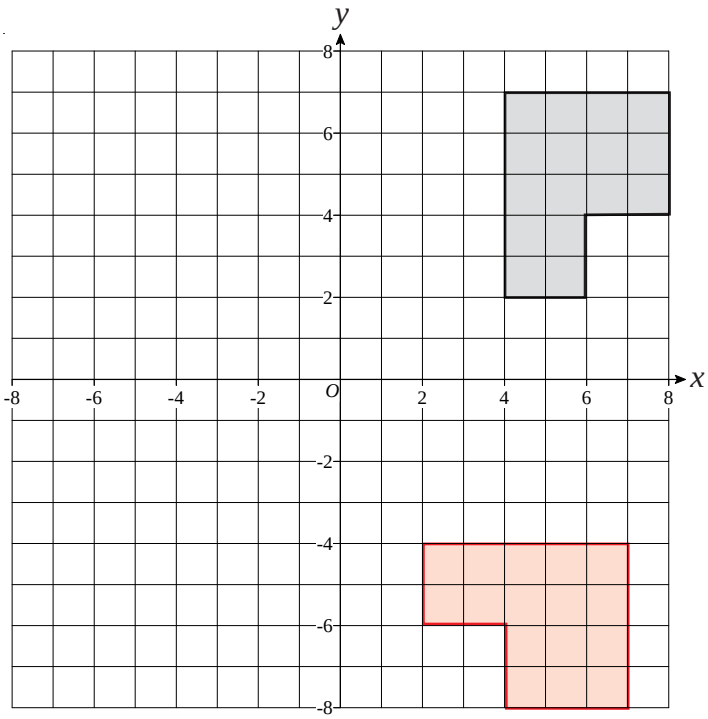
a) Rotate the shaded shape 90° clockwise about the point *0*.



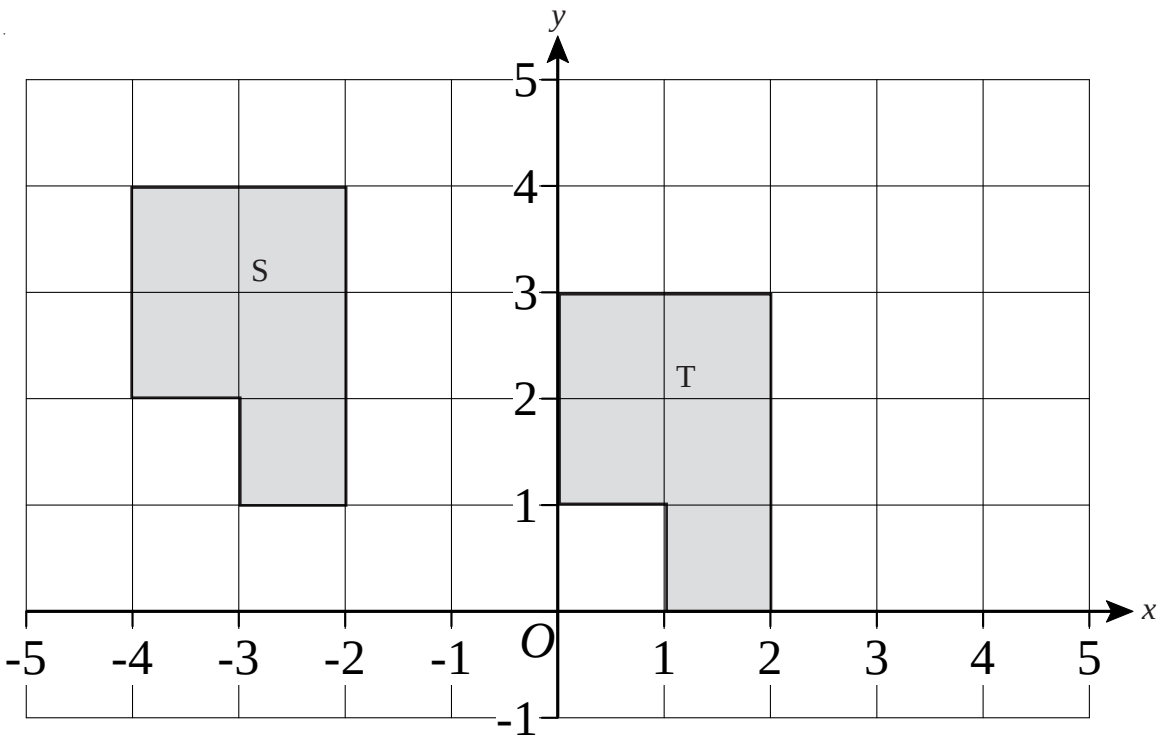
b) Describe fully the single transformation that will map shape S onto shape T.

Transformations

1)



a) Rotate the shaded shape 90° clockwise about the point *0*.

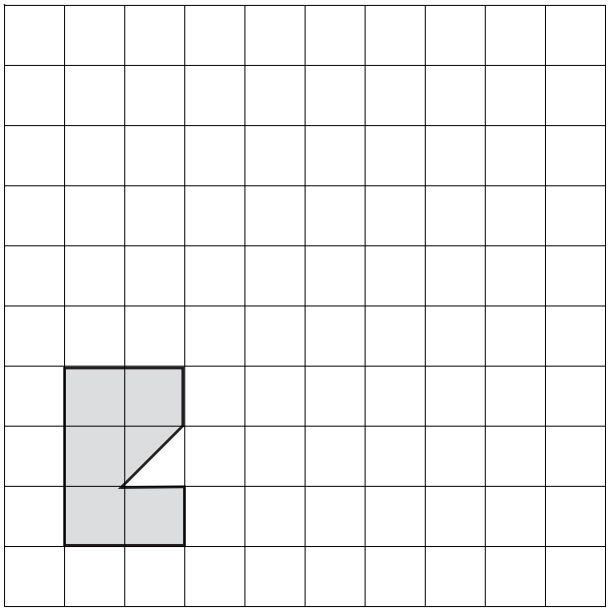


b) Describe fully the single transformation that will map shape S onto shape T.

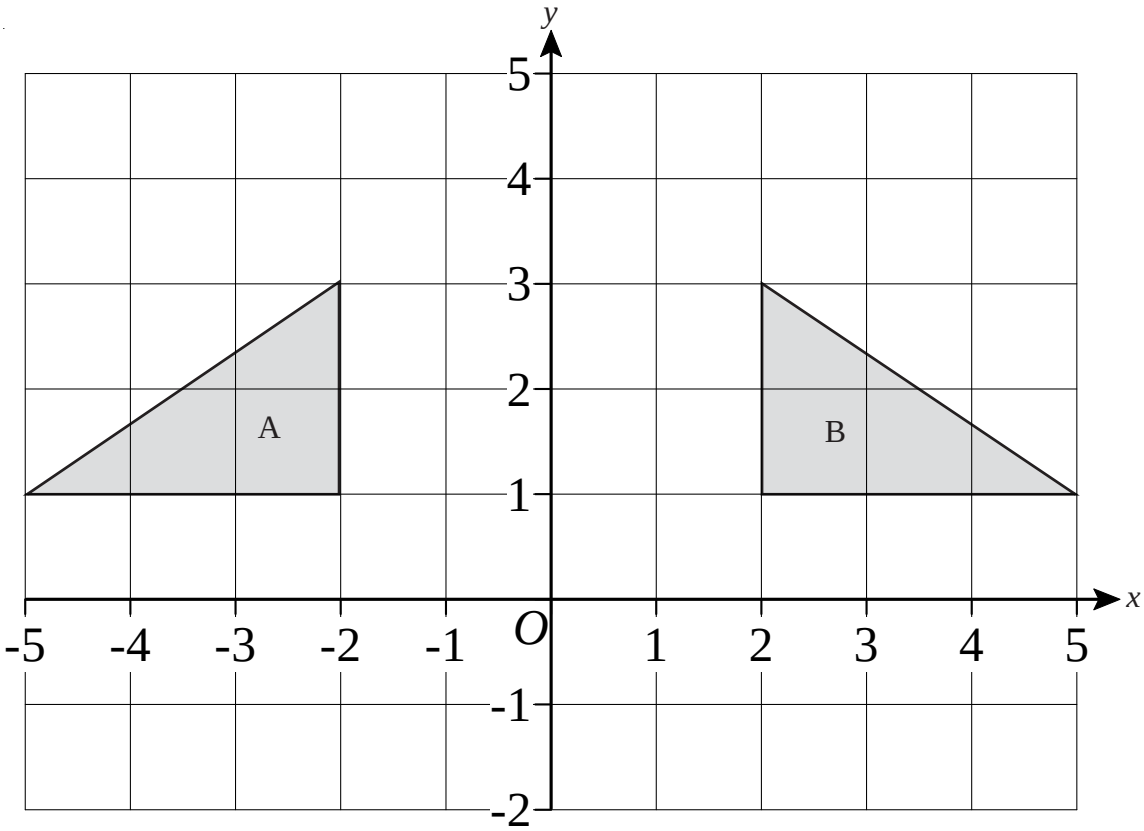
Translate shape S by the vector $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$

Transformations

1)



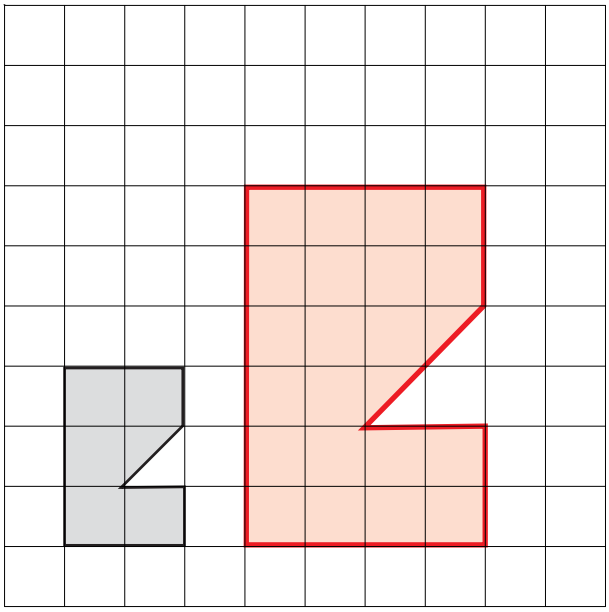
a) On the grid, draw an enlargement, scale factor 2, of the shaded shape.



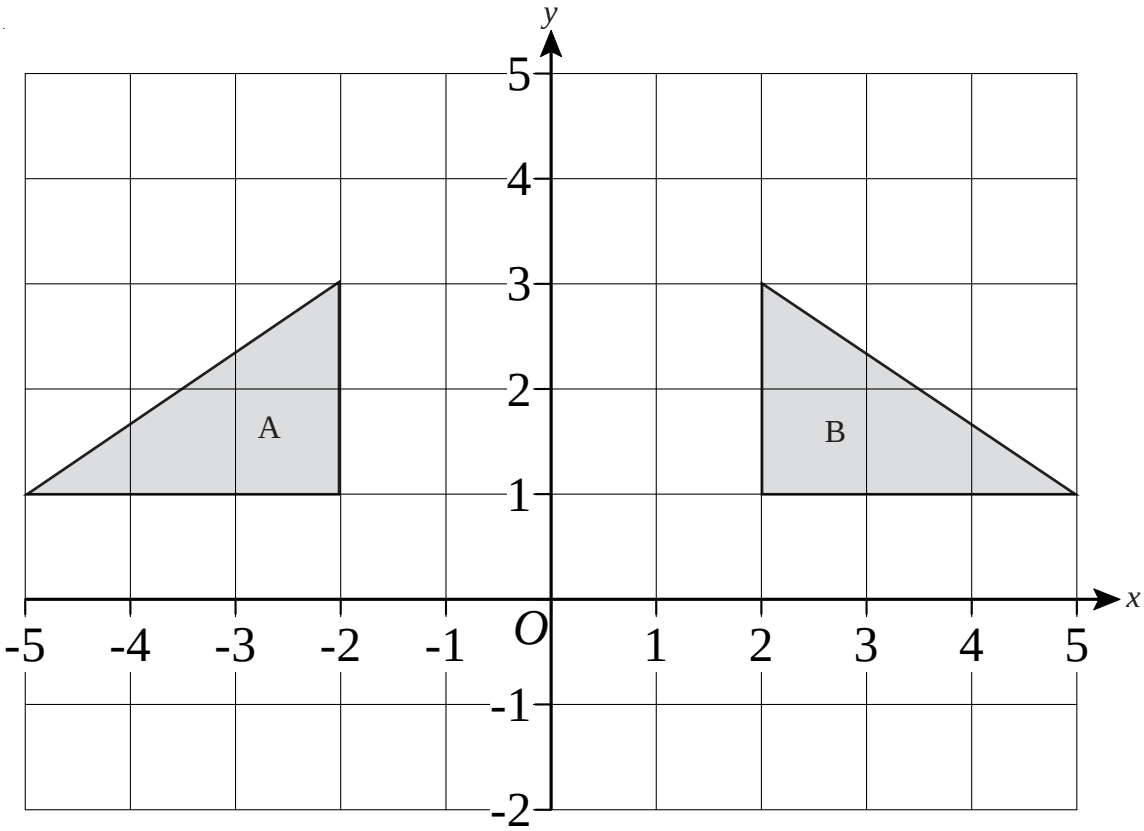
b) Describe fully the single transformation that maps triangle A onto triangle B.

Transformations

1)



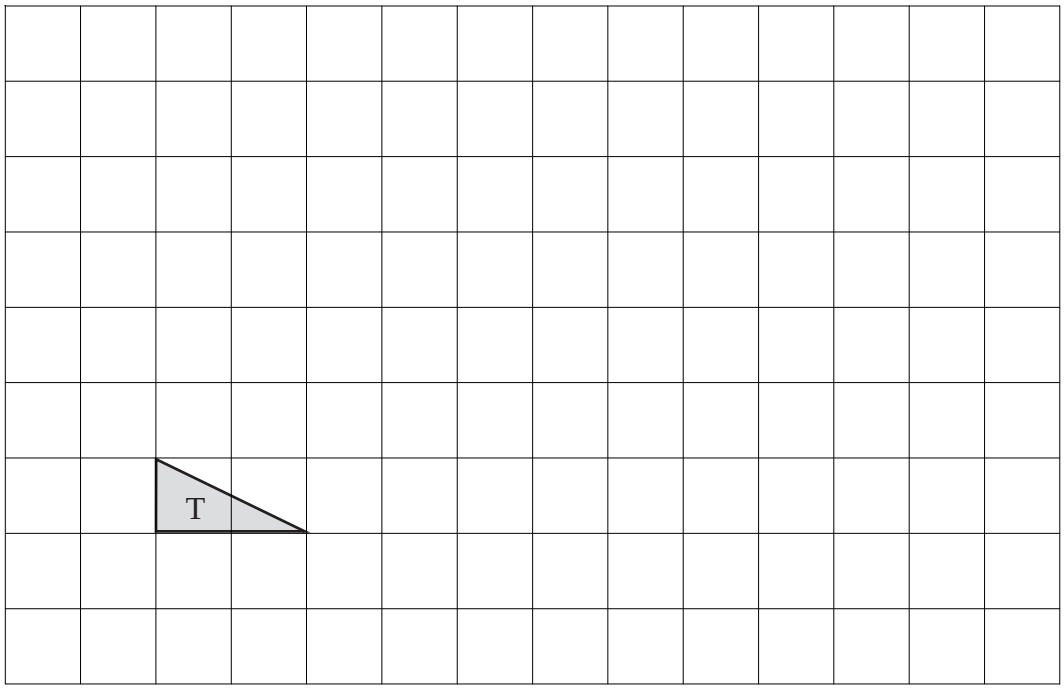
a) On the grid, draw an enlargement, scale factor 2, of the shaded shape.



b) Describe fully the single transformation that maps triangle A onto triangle B.
Reflection in the *y* - axis

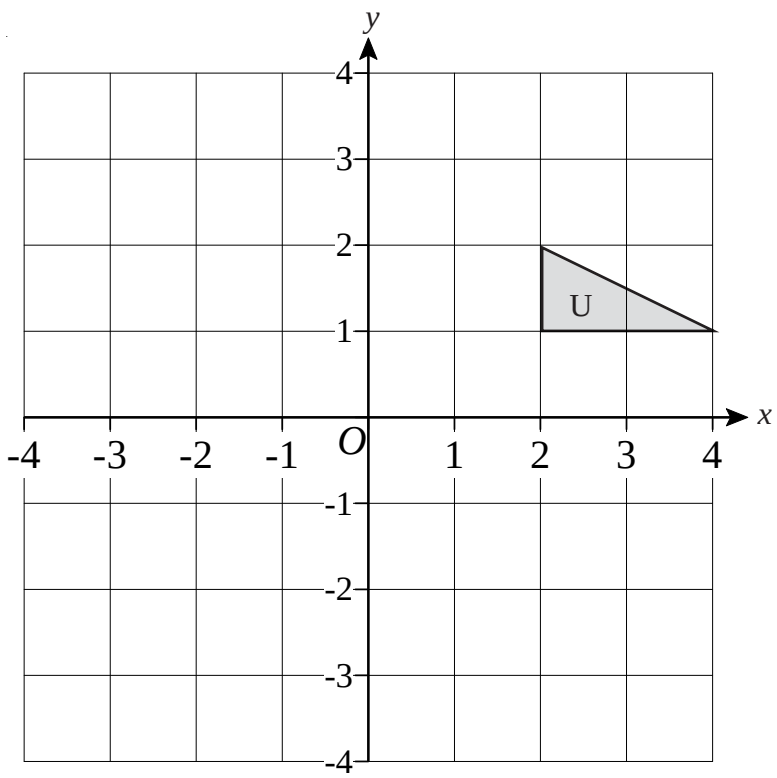
Transformations

1)



Triangle T has been drawn on a grid.

a) On the grid, draw an enlargement of the triangle T with scale factor 3.

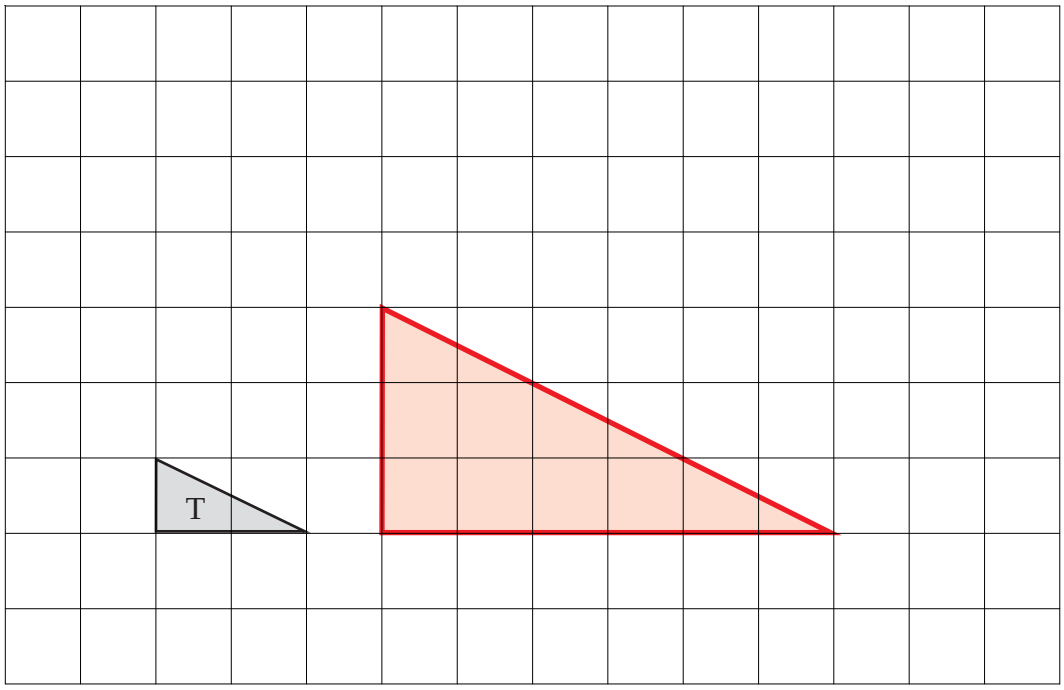


Triangle U has been drawn on a grid.

b) On the grid, rotate triangle U 90° clockwise about the centre *O*.

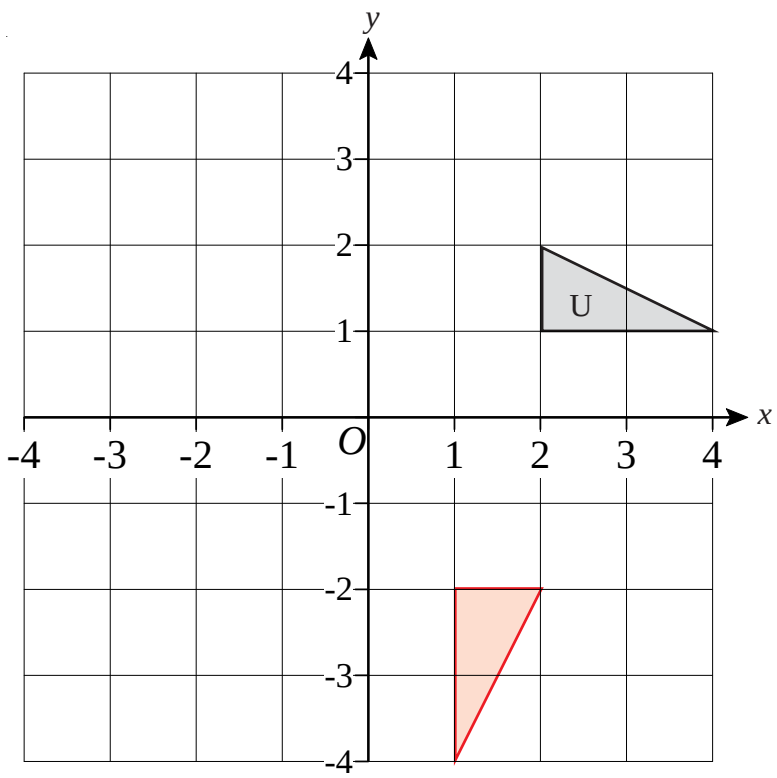
Transformations

1)



Triangle T has been drawn on a grid.

a) On the grid, draw an enlargement of the triangle T with scale factor 3.

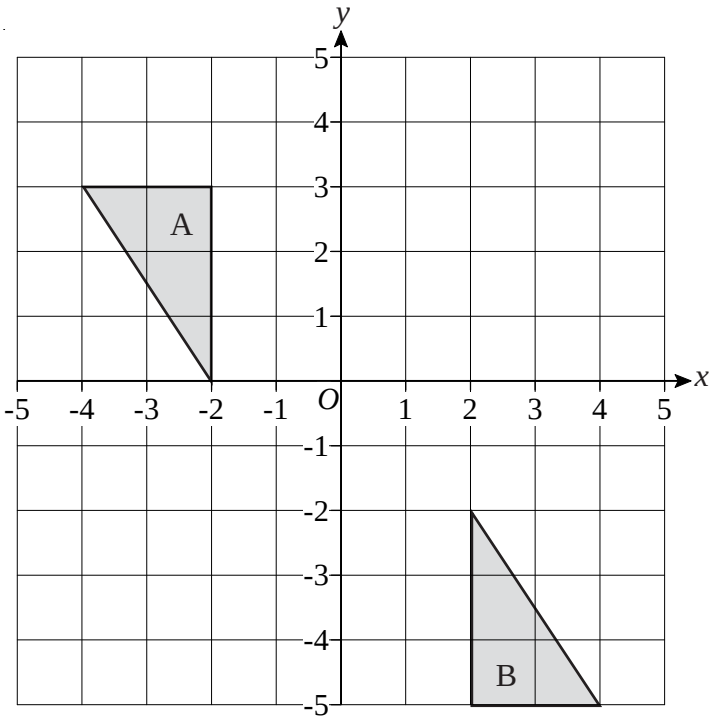


Triangle U has been drawn on a grid.

b) On the grid, rotate triangle U 90° clockwise about the centre *O*.

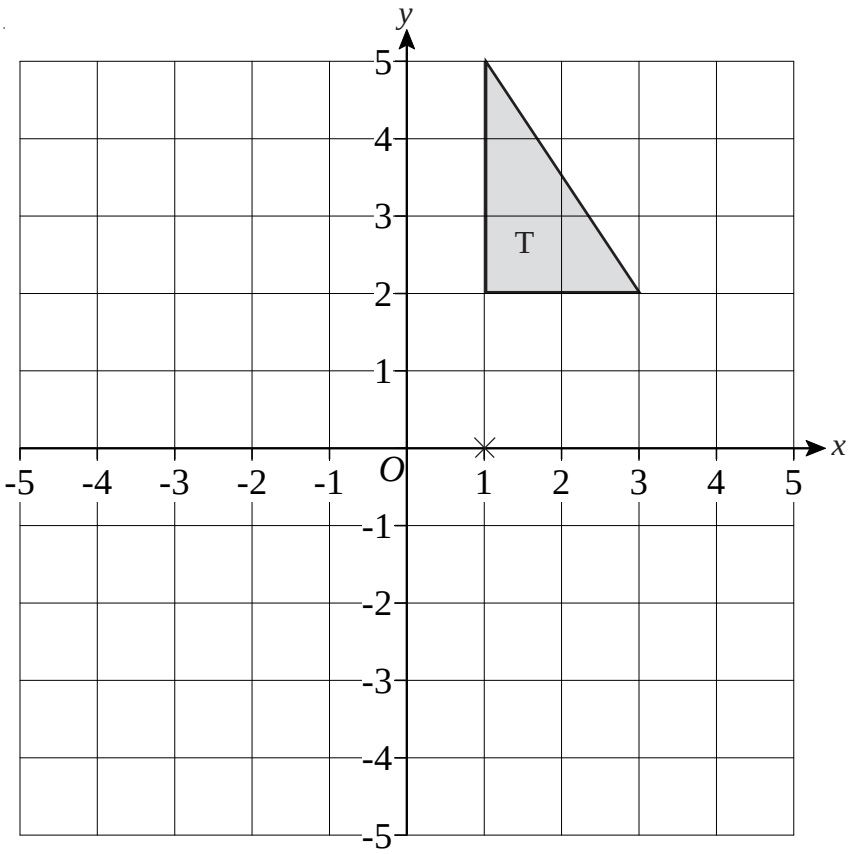
Transformations

1)



Describe fully the single transformation that maps triangle A onto triangle B.

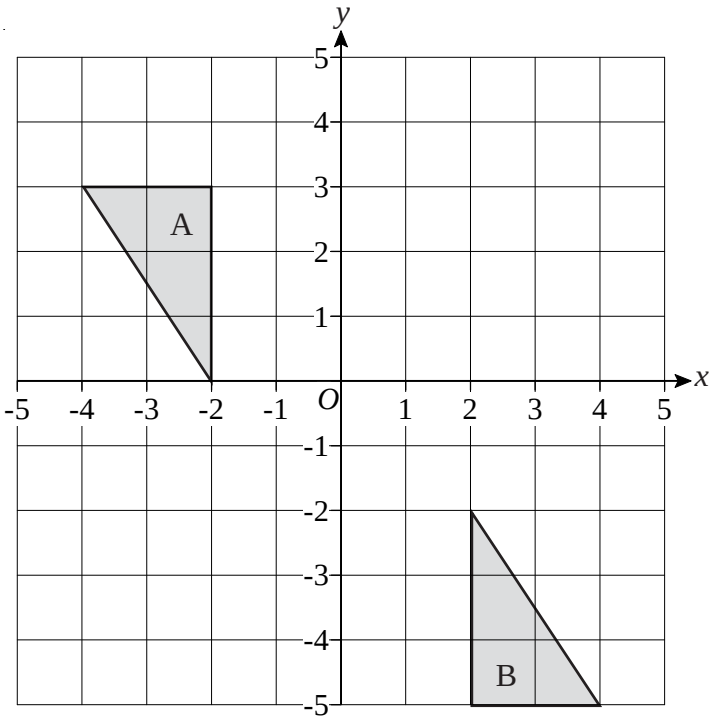
2)



Triangle T has been drawn on the grid.
Rotate triangle T 180° about the point (1, 0)
Label the new triangle A.

Transformations

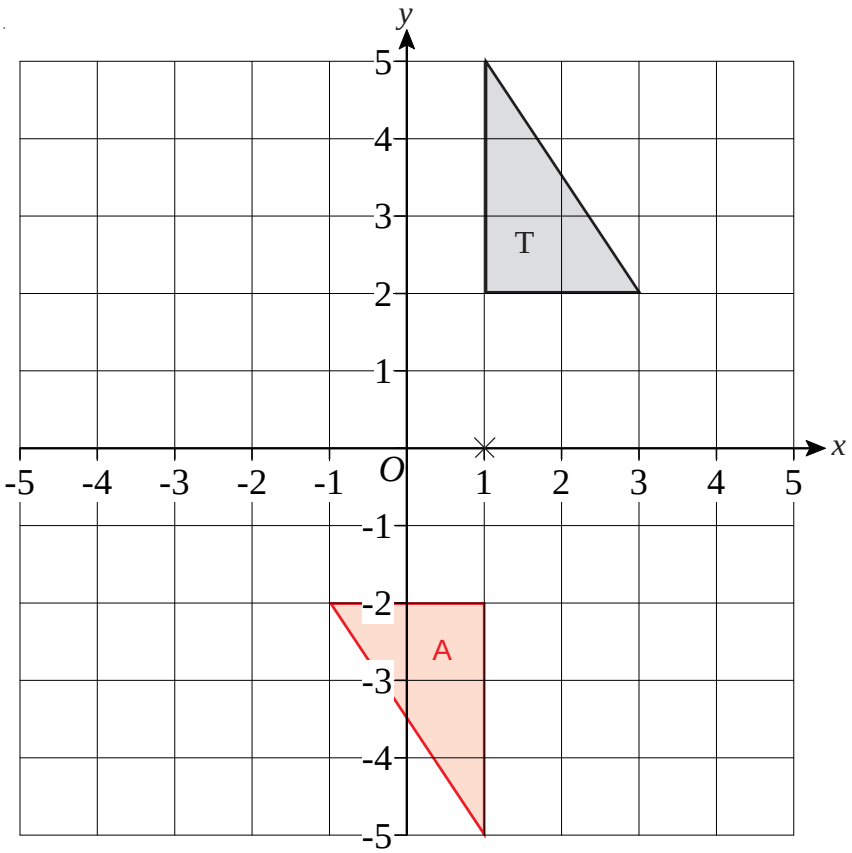
1)



Describe fully the single transformation that maps triangle A onto triangle B.

Rotation of 180° about the point (0, -1)

2)



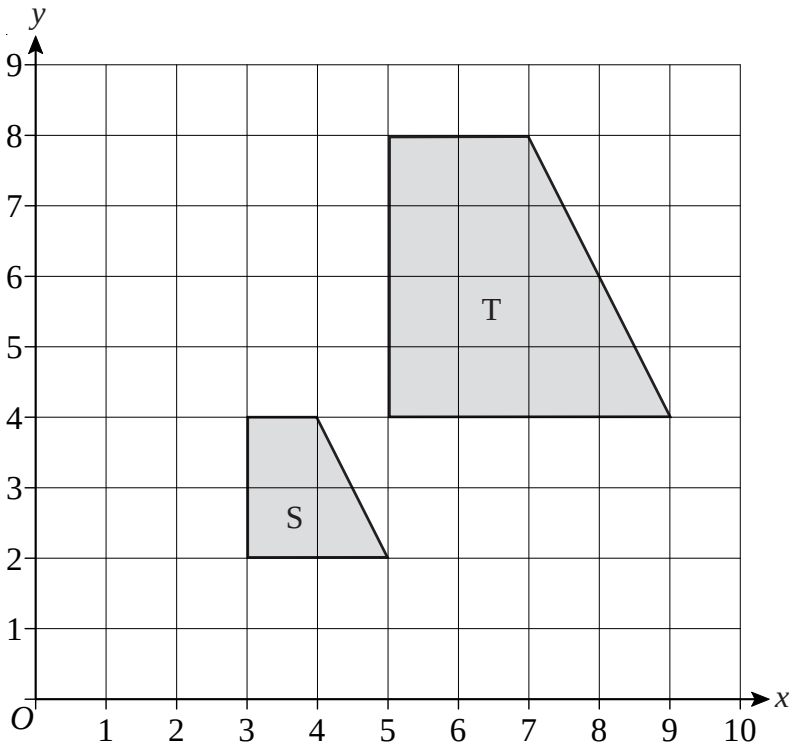
Triangle T has been drawn on the grid.

Rotate triangle T 180° about the point (1, 0)

Label the new triangle A.

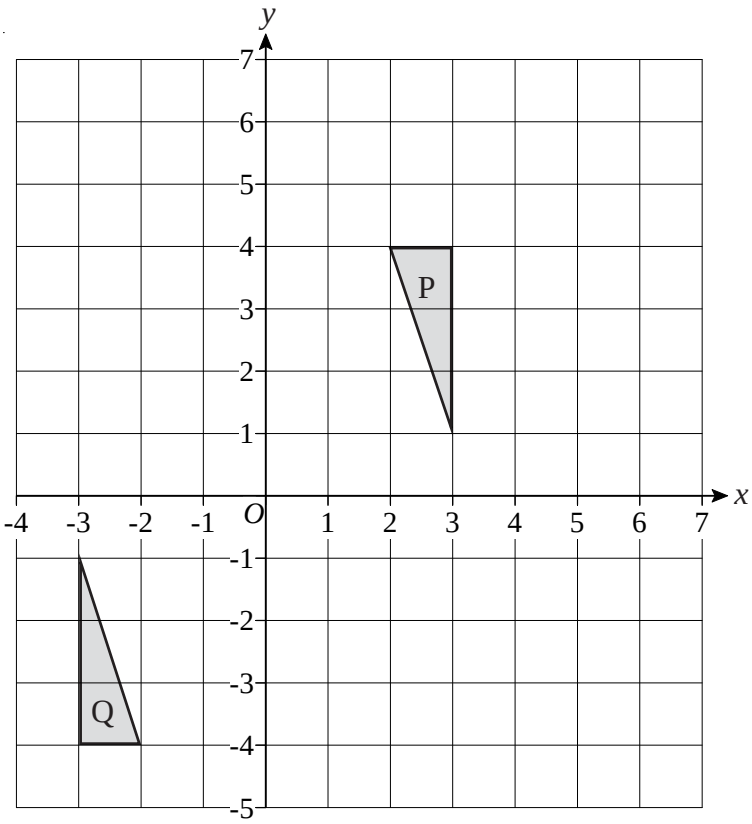
Transformations

1)



Describe fully the single transformation which maps shape S onto shape T.

2)



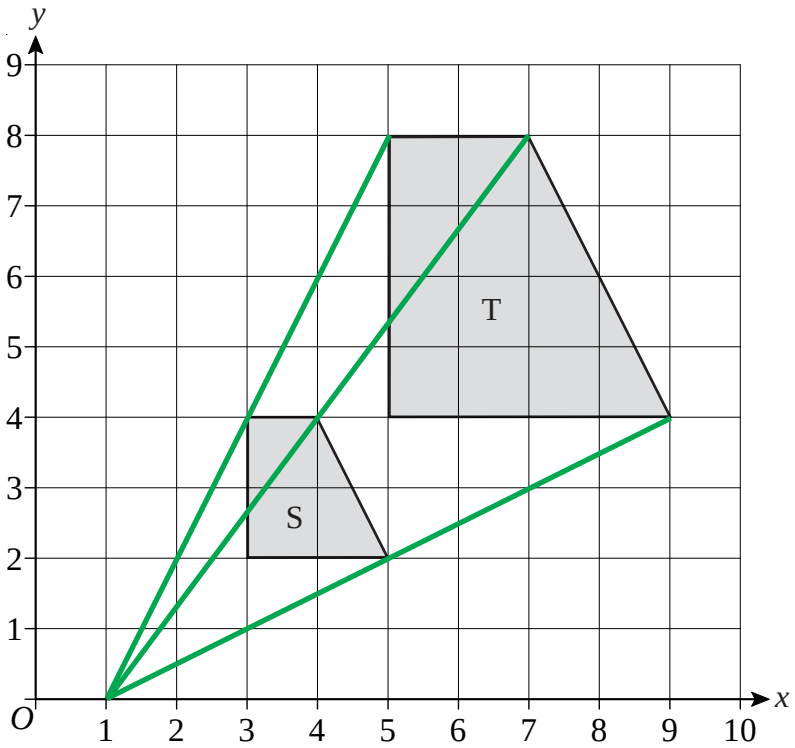
Triangle P and triangle Q are drawn on the grid.

a) Describe fully the single transformation which maps triangle P onto triangle Q.

b) Translate triangle P by the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$
Label the new triangle R.

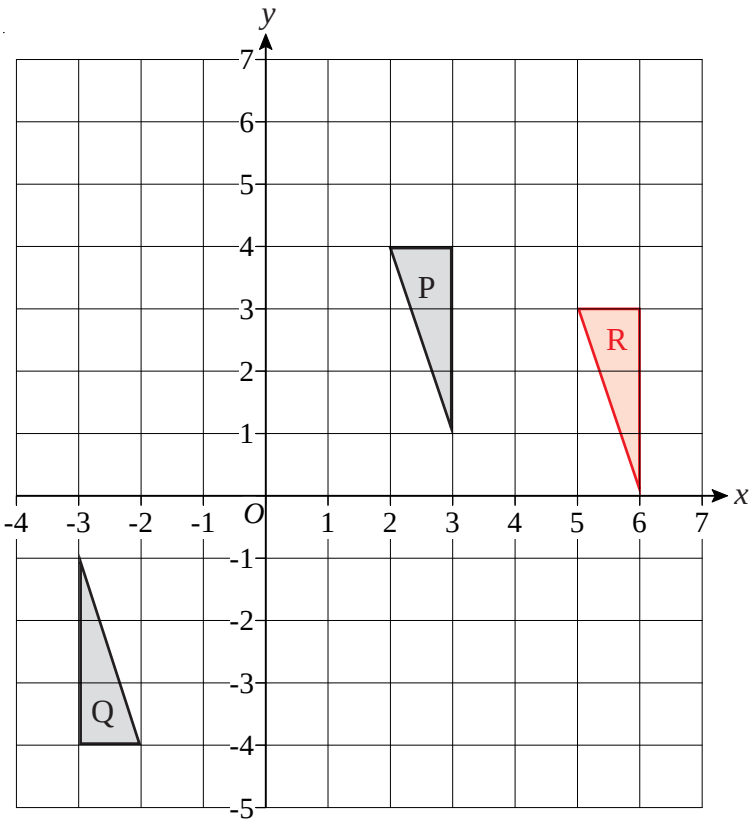
Transformations

1)



Describe fully the single transformation which maps shape S onto shape T.
Enlargement scale factor 2 with (1, 0) as the centre of enlargement.

2)



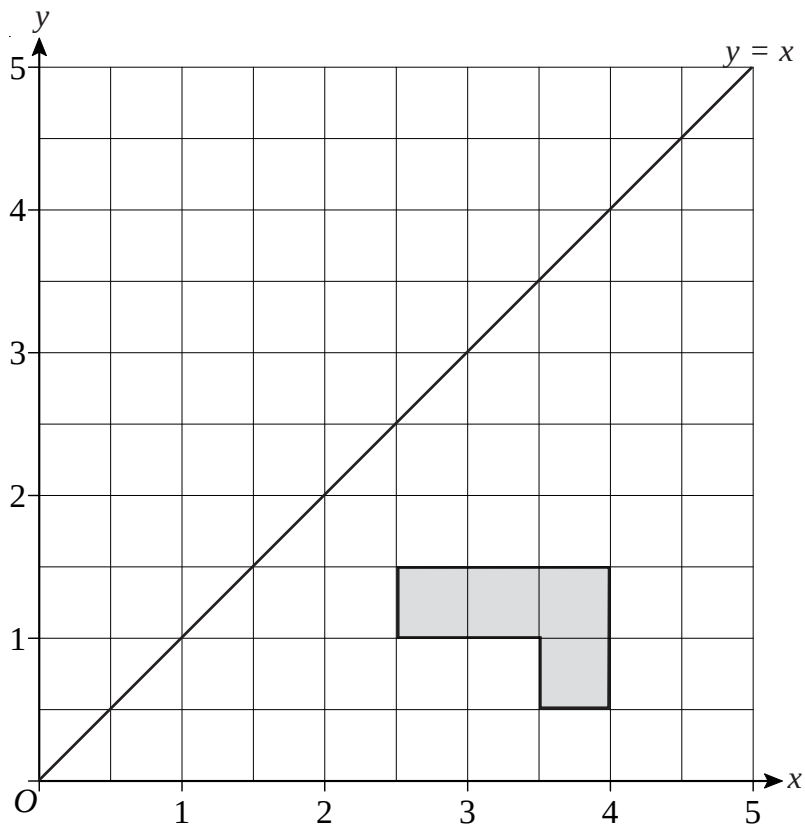
Triangle P and triangle Q are drawn on the grid.

a) Describe fully the single transformation which maps triangle P onto triangle Q.
Rotation of 180° about the point (0, 0)

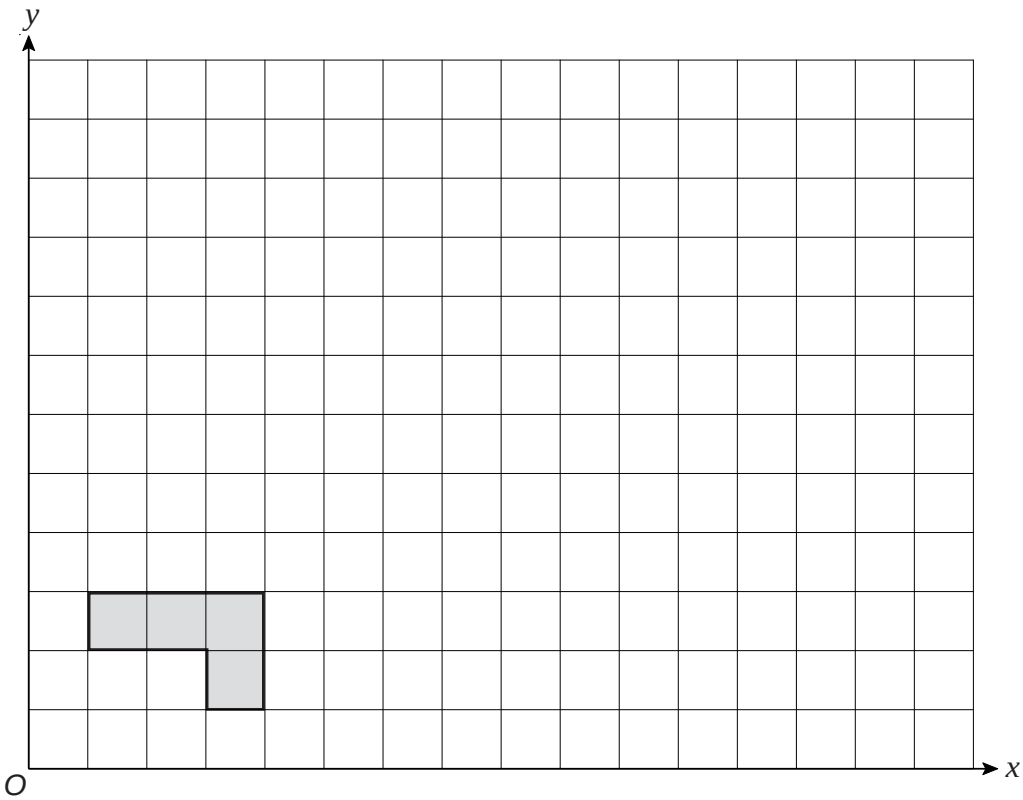
b) Translate triangle P by the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$
Label the new triangle R.

Transformations

1)



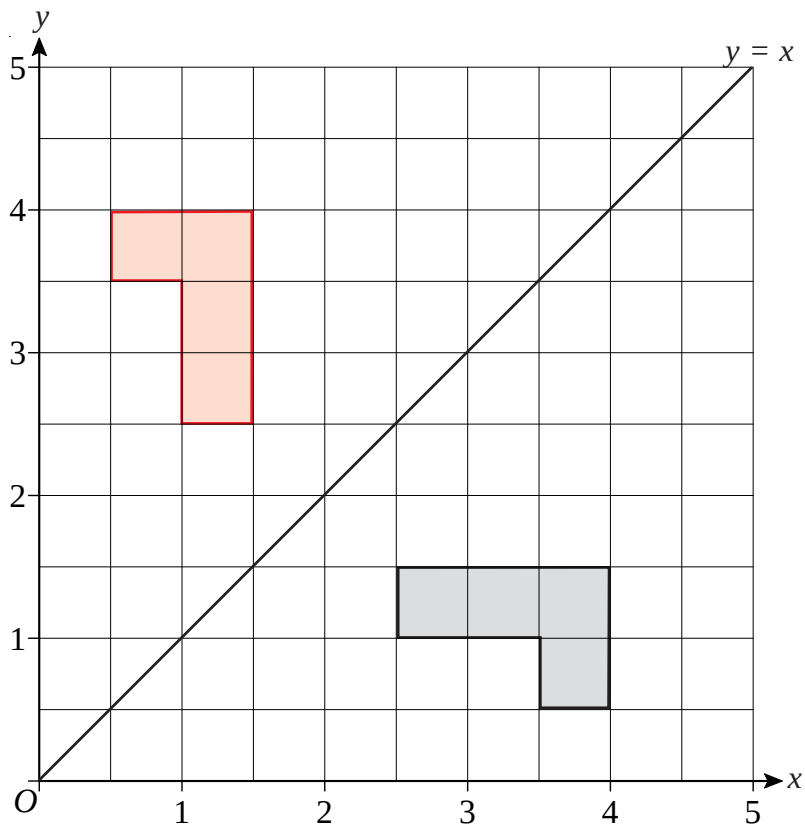
a) Reflect the shaded shape in the line $y = x$.



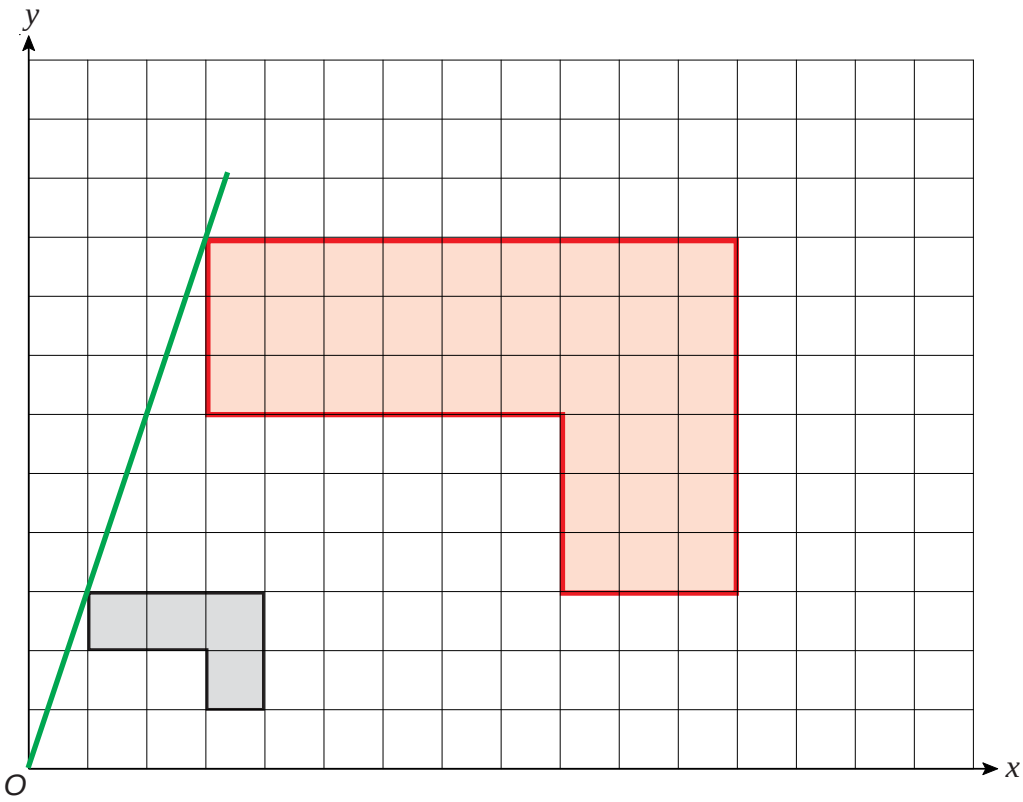
b) On the grid, enlarge the shaded shape by a scale factor of 3, centre O.

Transformations

1)



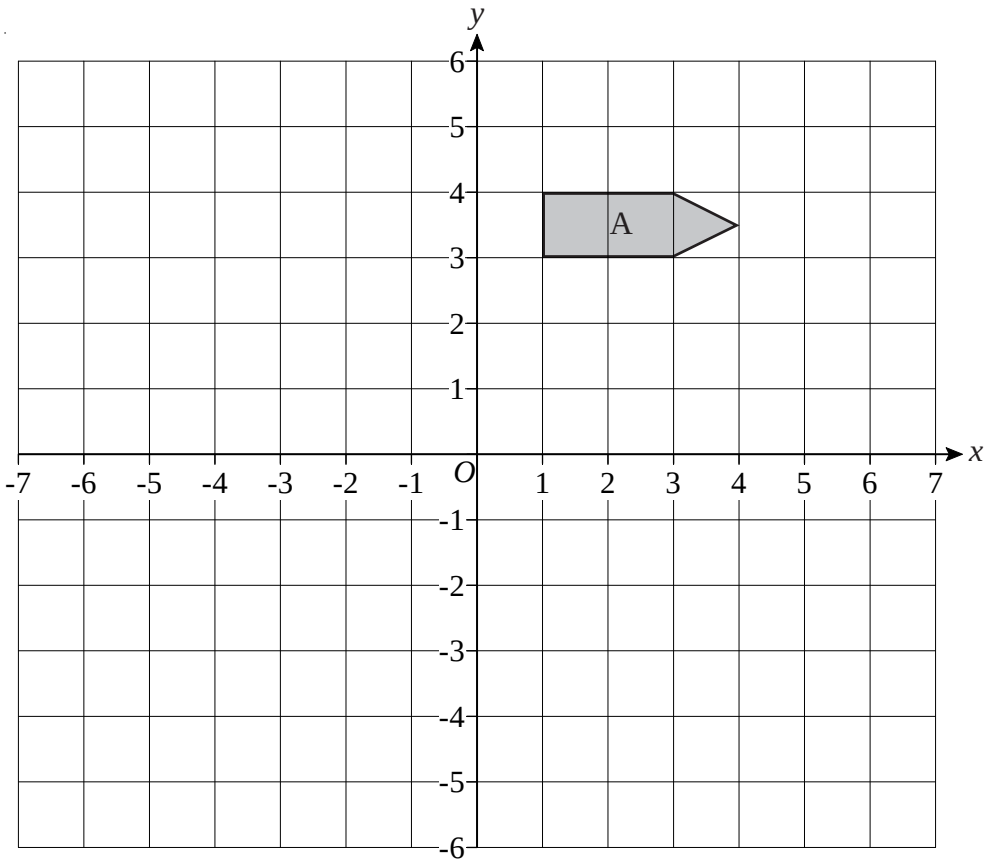
a) Reflect the shaded shape in the line $y = x$.



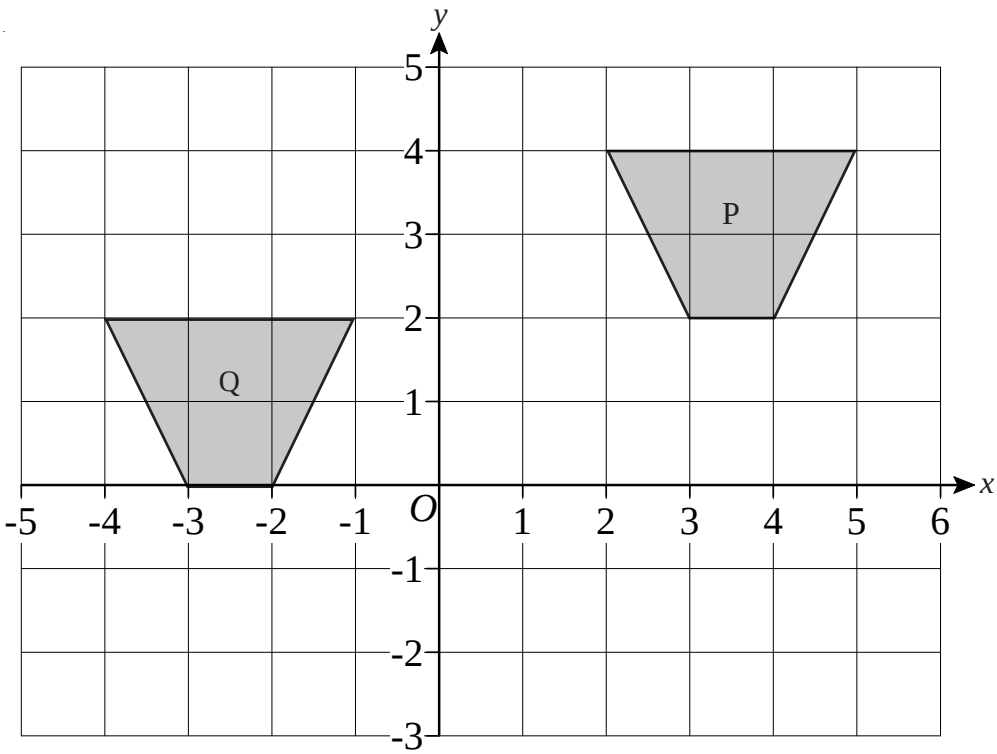
b) On the grid, enlarge the shaded shape by a scale factor of 3, centre O.

Transformations

1)



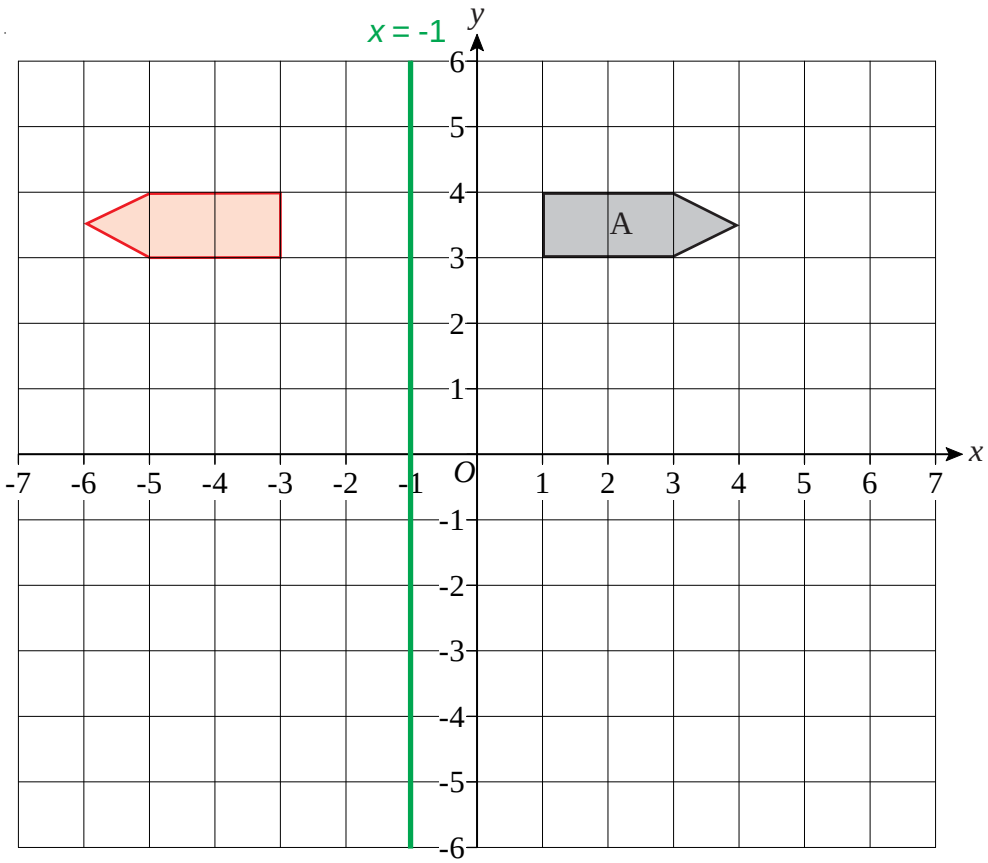
a) On the grid above, reflect shape A in the line $x = -1$



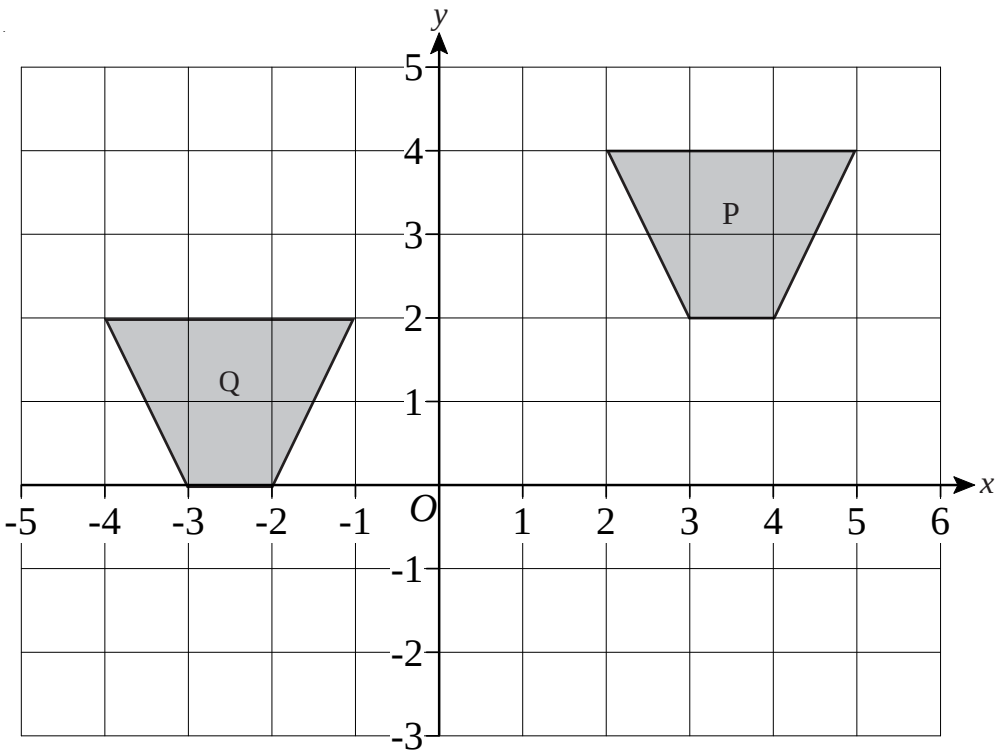
b) Describe fully the single transformation that will map shape P onto shape Q.

Transformations

1)



a) On the grid above, reflect shape A in the line $x = -1$

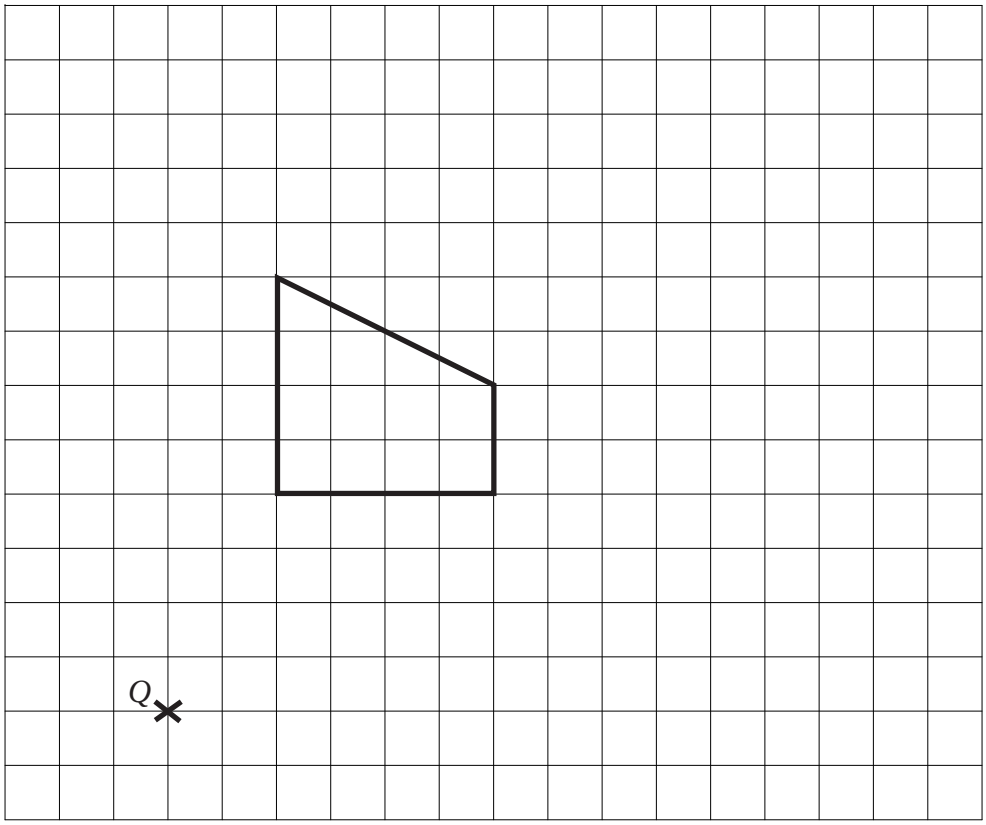


b) Describe fully the single transformation that will map shape P onto shape Q.

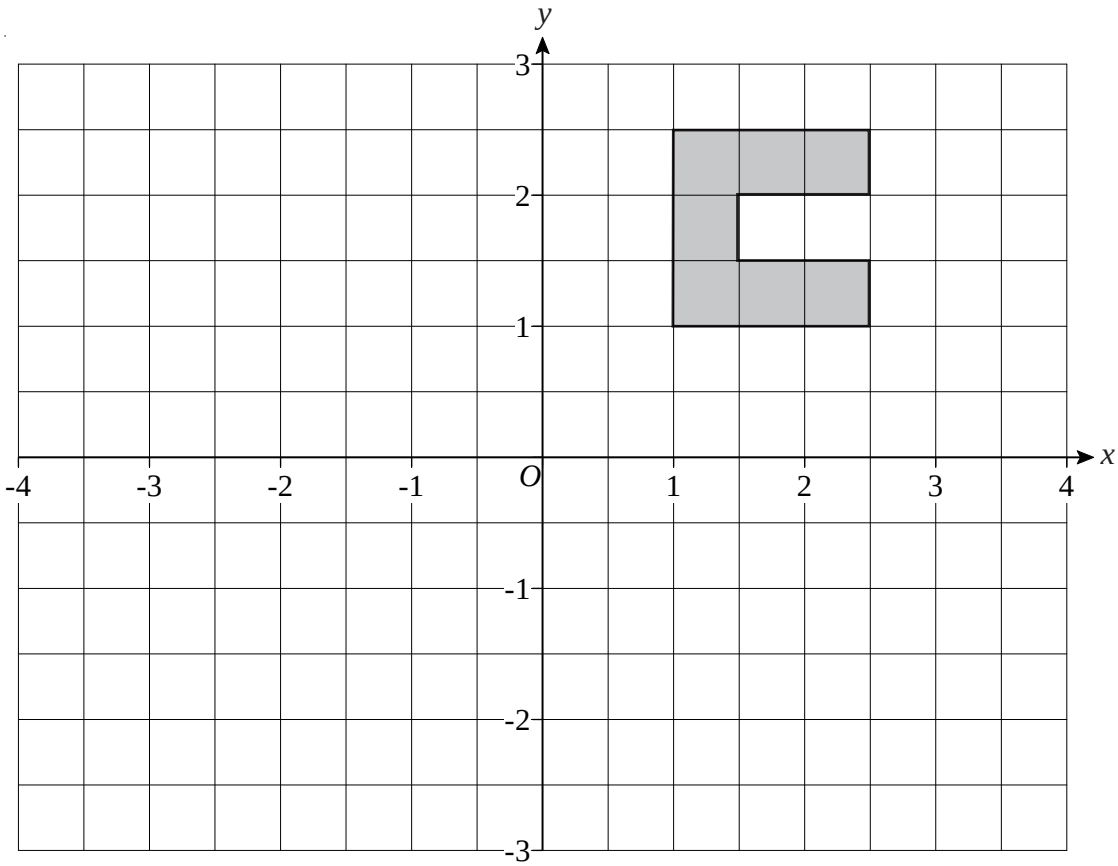
Translation by vector $\begin{pmatrix} -6 \\ -2 \end{pmatrix}$

Transformations

1)



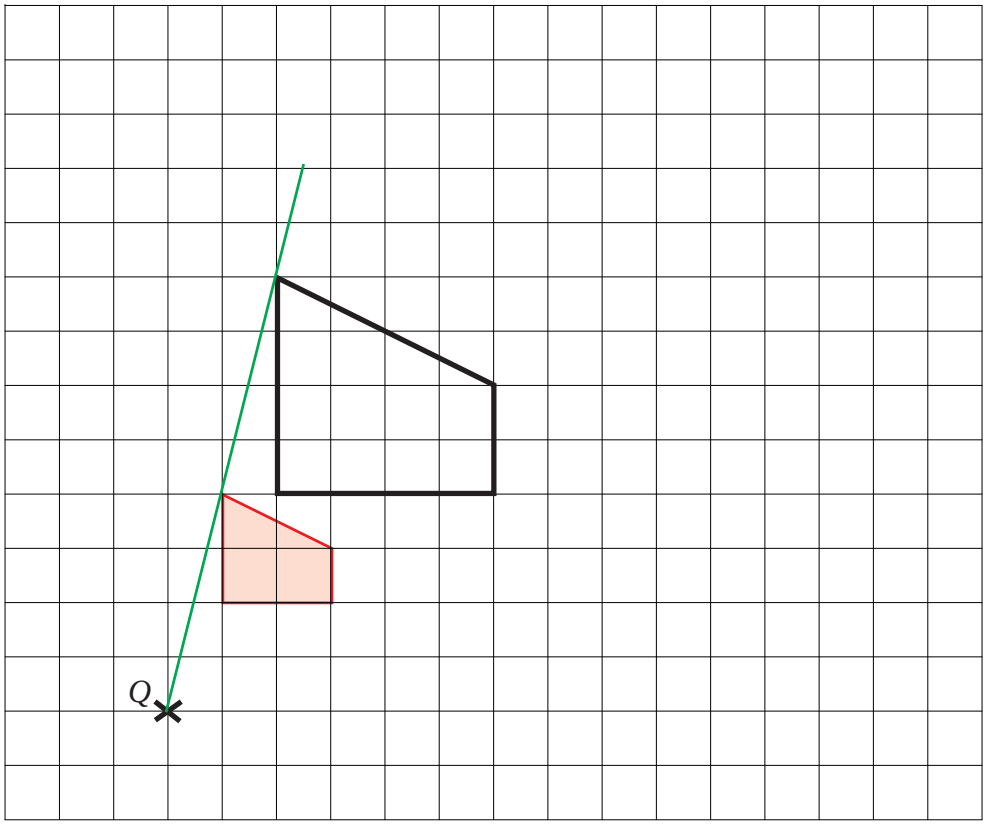
a) On the grid, enlarge the shape with scale factor $\frac{1}{2}$, centre Q.



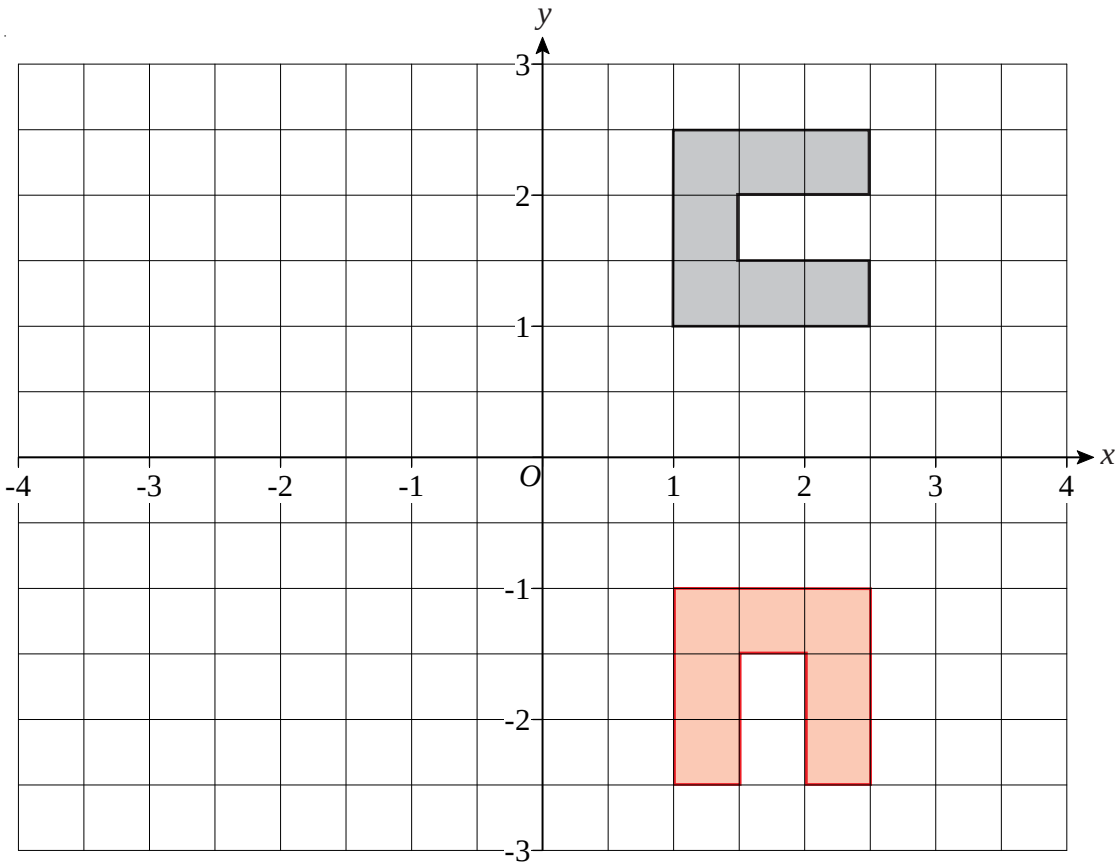
b) Rotate the shape 90° clockwise, centre O.

Transformations

1)



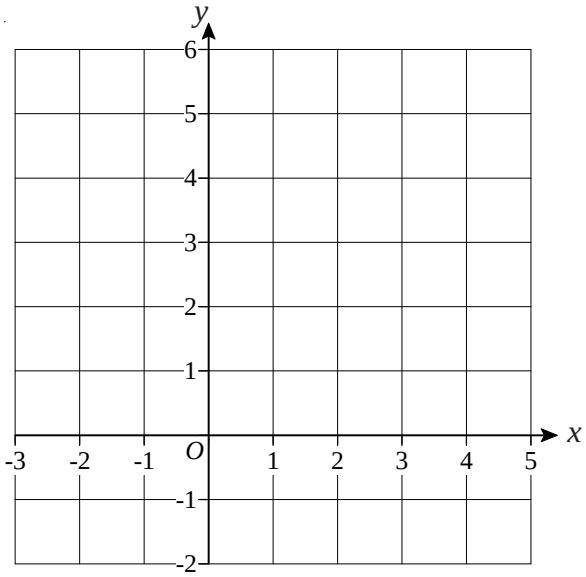
a) On the grid, enlarge the shape with scale factor $\frac{1}{2}$, centre Q.



b) Rotate the shape 90° clockwise, centre O.

Finding the Midpoint of a Line

1) Find the midpoint of *A* and *B* where *A* has coordinates (-2, 5) and *B* has coordinates (4, -1).



2) Find the midpoint of *A* and *B* where *A* has coordinates (2, 0) and *B* has coordinates (8, 6).

3) Find the midpoint of *A* and *B* where *A* has coordinates (-4, -2) and *B* has coordinates (2, 4).

4) Find the midpoint of *A* and *B* where *A* has coordinates (-3, -2) and *B* has coordinates (7, 5).

5) Find the midpoint of *A* and *B* where *A* has coordinates (2, -5) and *B* has coordinates (7, 4).

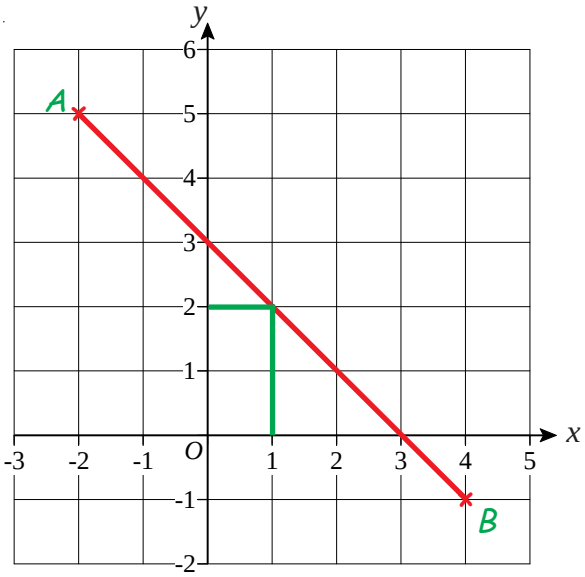
6) Find the midpoint of *A* and *B* where *A* has coordinates (-7, -4) and *B* has coordinates (-2, -1).

7) The midpoint of *A* and *B* is at (1, 3).
The coordinates of *A* are (-2, 4).
Work out the coordinates of *B*.

8) The midpoint of *A* and *B* is at (3.5, 2.5).
The coordinates of *A* are (2, 5).
Work out the coordinates of *B*.

Finding the Midpoint of a Line

1) Find the midpoint of *A* and *B* where *A* has coordinates (-2, 5) and *B* has coordinates (4, -1). Midpoint at (1, 2)



2) Find the midpoint of *A* and *B* where *A* has coordinates (2, 0) and *B* has coordinates (8, 6). Midpoint at (5, 3)

x (2 + 8) ÷ 2 = 5
y (0 + 6) ÷ 2 = 3

3) Find the midpoint of *A* and *B* where *A* has coordinates (-4, -2) and *B* has coordinates (2, 4). Midpoint at (-1, 1)

x (-4 + 2) ÷ 2 = -1
y (-2 + 4) ÷ 2 = 1

4) Find the midpoint of *A* and *B* where *A* has coordinates (-3, -2) and *B* has coordinates (7, 5). Midpoint at (2, 1.5)

x (-3 + 7) ÷ 2 = 2
y (-2 + 5) ÷ 2 = 1.5

5) Find the midpoint of *A* and *B* where *A* has coordinates (2, -5) and *B* has coordinates (7, 4). Midpoint at (4.5, -0.5)

x (2 + 7) ÷ 2 = 4.5
y (-5 + 4) ÷ 2 = -0.5

6) Find the midpoint of *A* and *B* where *A* has coordinates (-7, -4) and *B* has coordinates (-2, -1). Midpoint at (-4.5, -2.5)

x (-7 + -2) ÷ 2 = -4.5
y (-4 + -1) ÷ 2 = -2.5

7) The midpoint of *A* and *B* is at (1, 3).
The coordinates of *A* are (-2, 4).
Work out the coordinates of *B*. (4, 2)

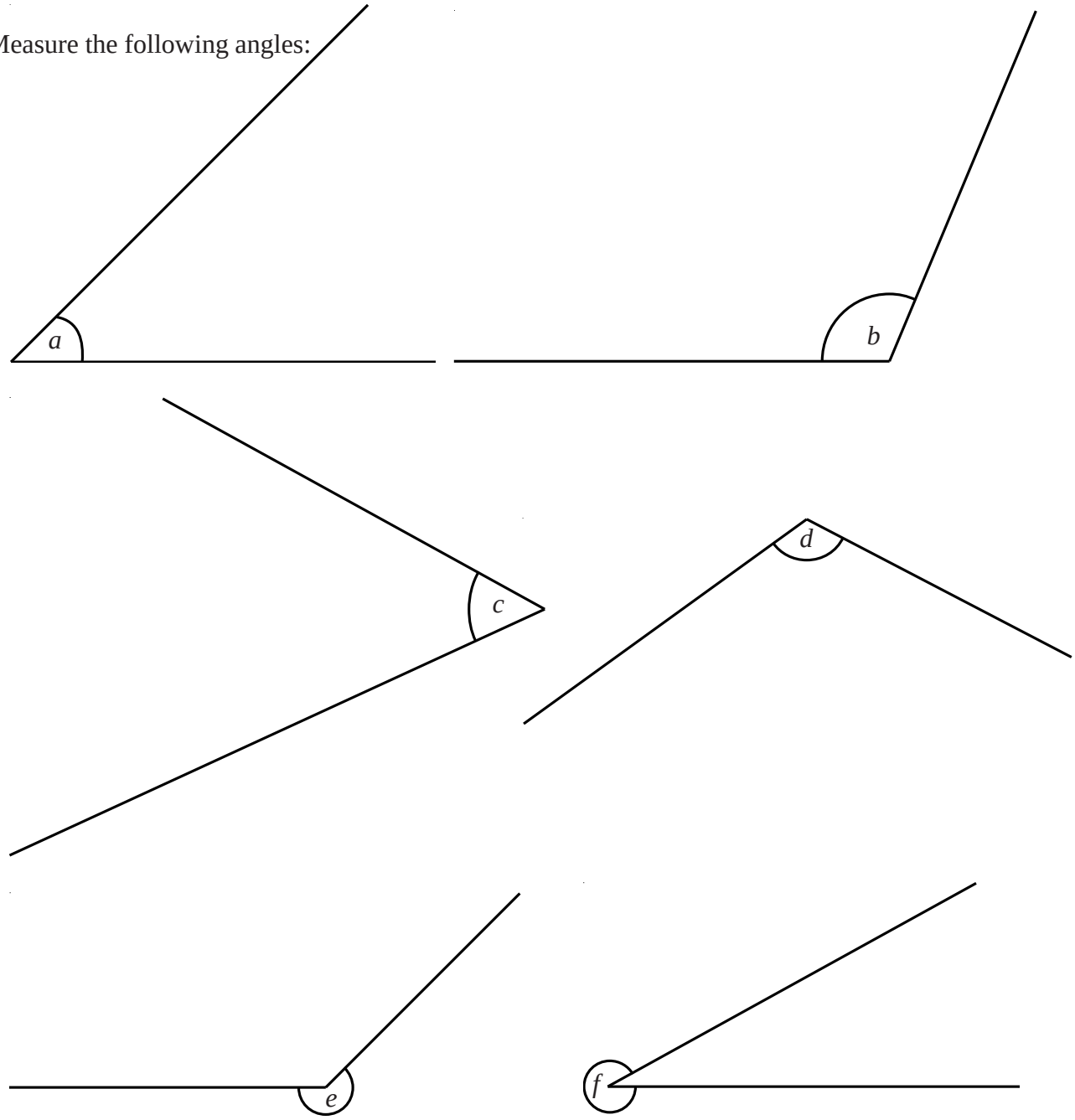
x (-2 + ?) ÷ 2 = 1
y (4 + ?) ÷ 2 = 3

8) The midpoint of *A* and *B* is at (3.5, 2.5).
The coordinates of *A* are (2, 5).
Work out the coordinates of *B*. (5, 0)

x (2 + ?) ÷ 2 = 3.5
y (5 + ?) ÷ 2 = 2.5

Measuring and Drawing Angles

1) Measure the following angles:

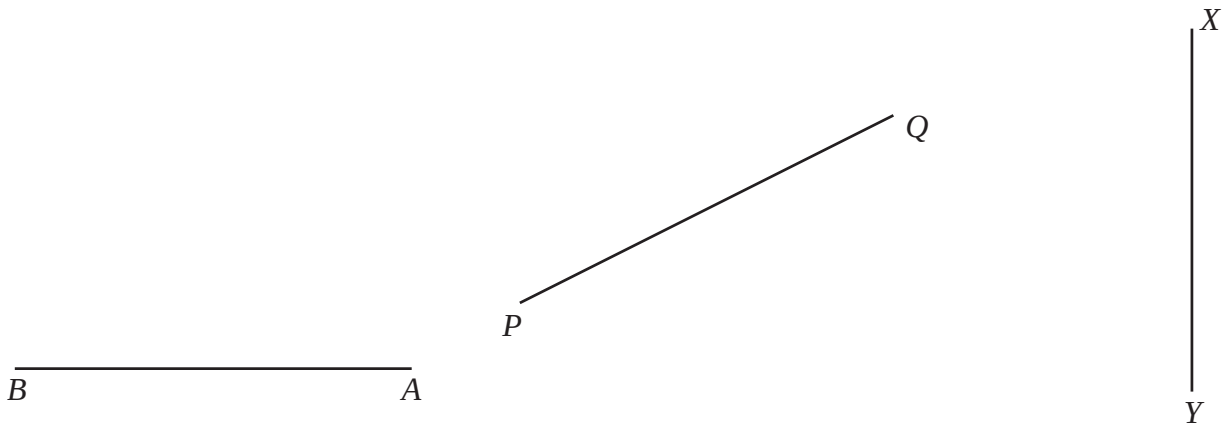


2) Draw the following angles:

a) Angle $ABC = 60°$

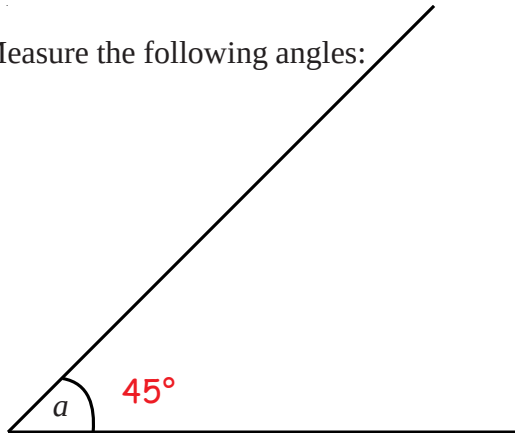
b) Angle $PQR = 127°$

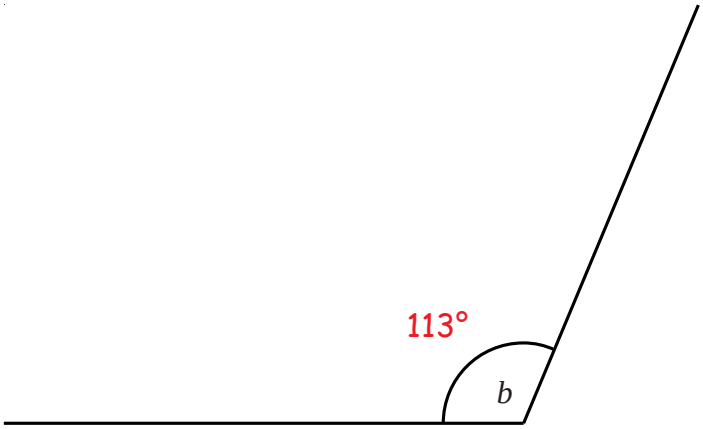
c) Angle $XYZ = 275°$

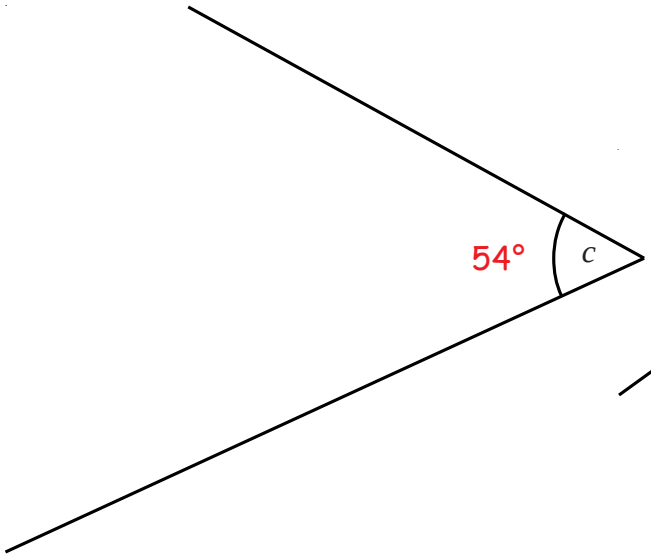


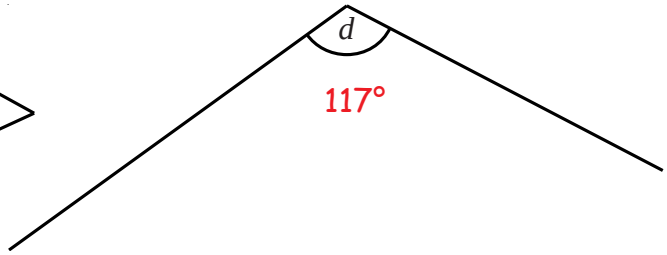
Measuring and Drawing Angles

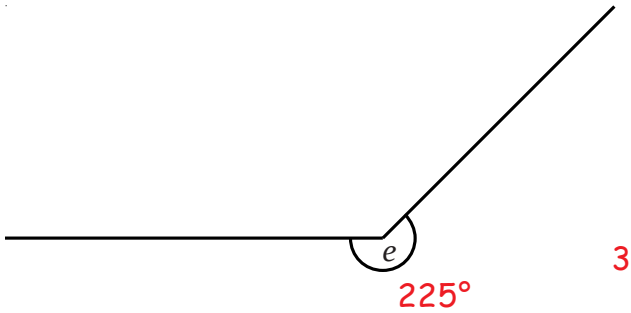
1) Measure the following angles:

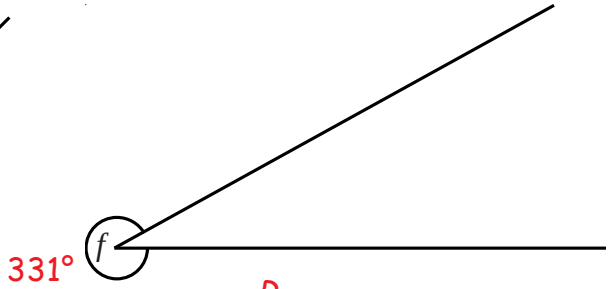






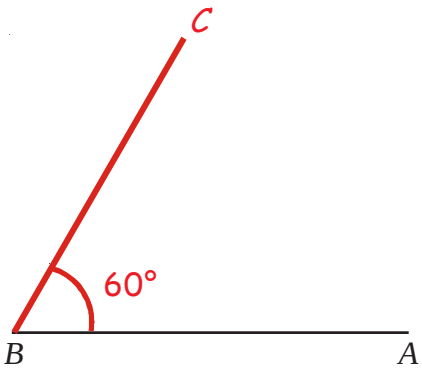




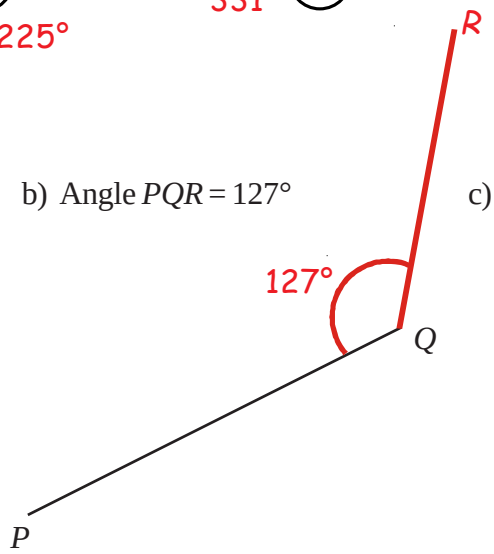


2) Draw the following angles:

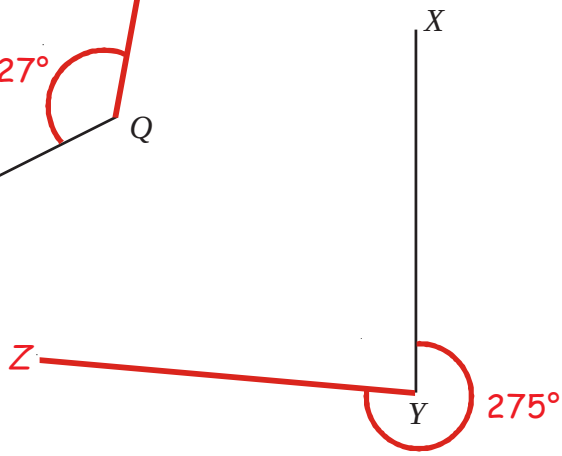
a) Angle $ABC = 60°$



b) Angle $PQR = 127°$



c) Angle $XYZ = 275°$



Drawing Triangles

1) The diagram shows a sketch of triangle *ABC*.

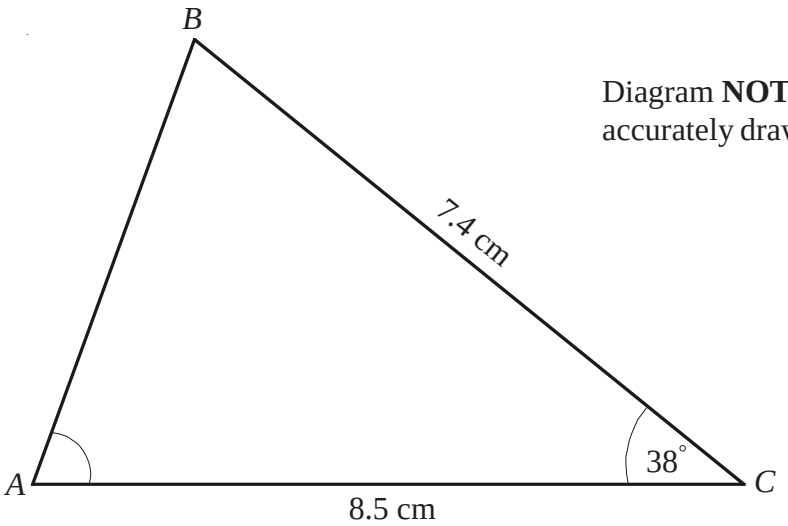


Diagram **NOT** accurately drawn

BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram.

2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.
You must show all construction lines.

3) The diagram shows a sketch of triangle *PQR*.

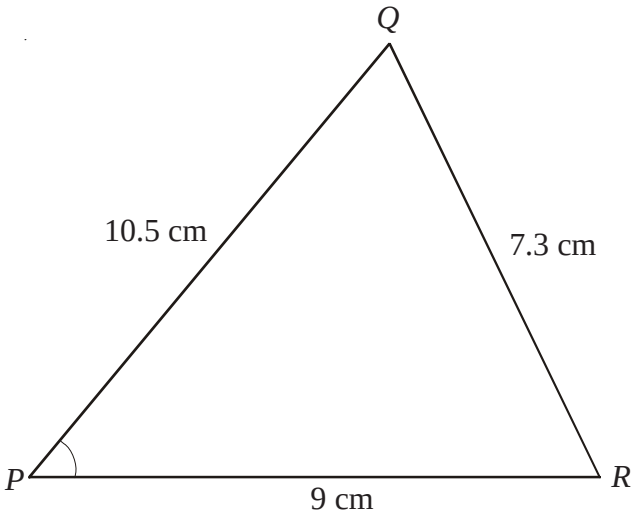


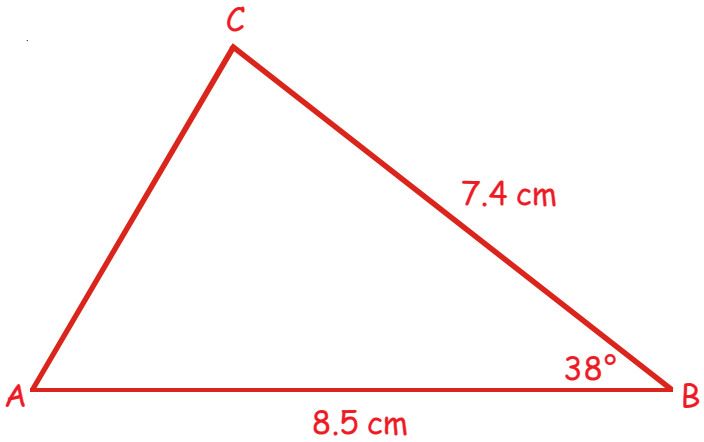
Diagram **NOT** accurately drawn

a) Use ruler and compasses to make an accurate drawing of triangle *PQR*.

b) Measure angle *P*.

Drawing Triangles

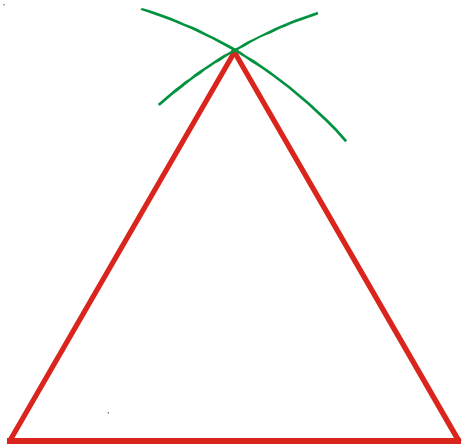
1) The diagram shows a sketch of triangle ABC.



a) Make an accurate drawing of triangle ABC.

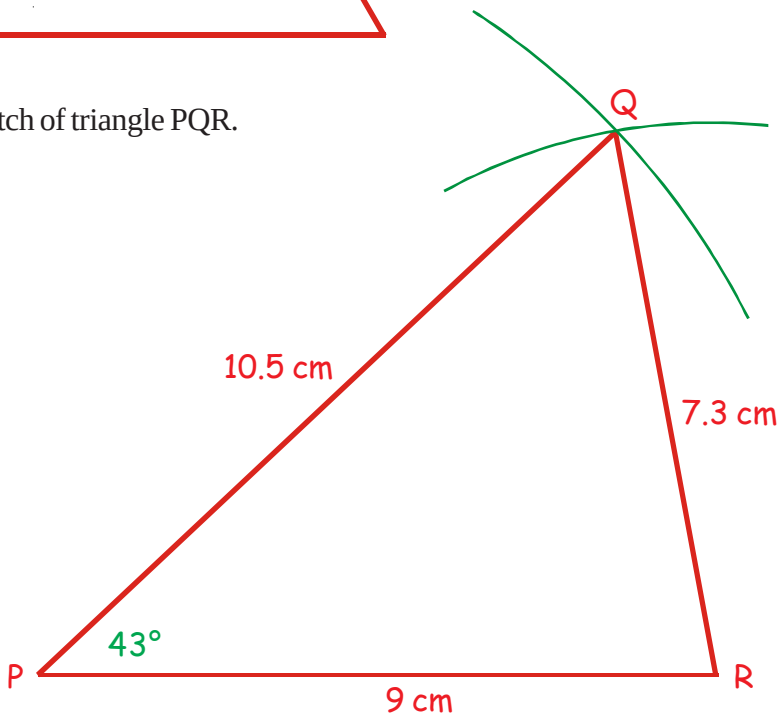
b) Measure the size of angle A on your diagram. Angle A = 59°

2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.



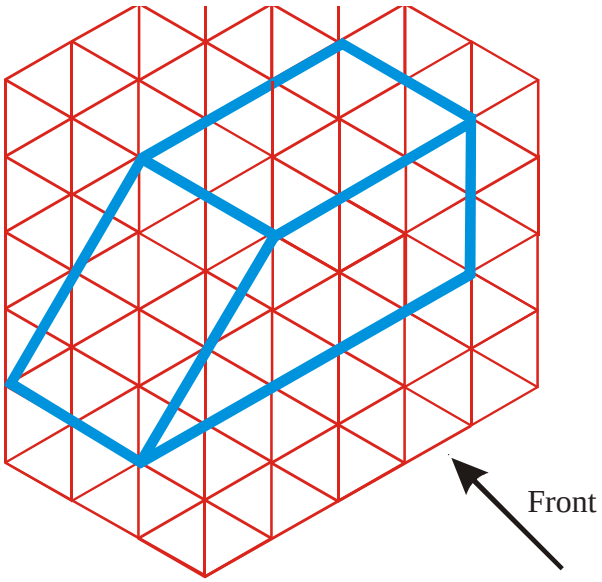
3) The diagram shows a sketch of triangle PQR.

Angle P = 43°



Plans and Elevations

1) The diagram shows a prism drawn on an isometric grid.

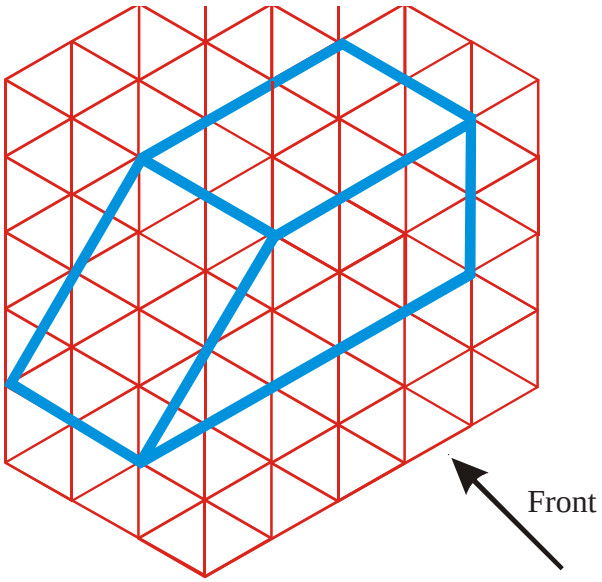


a) On the grid below, draw the front elevation of the prism from the direction marked by the arrow.

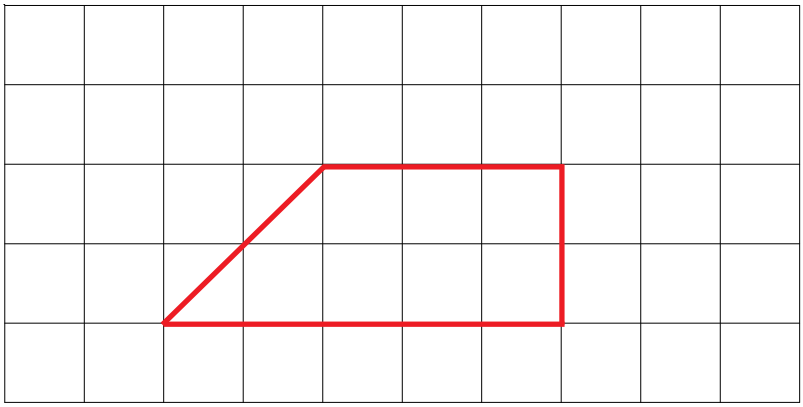
b) On the grid below draw a plan of the prism.

Plans and Elevations

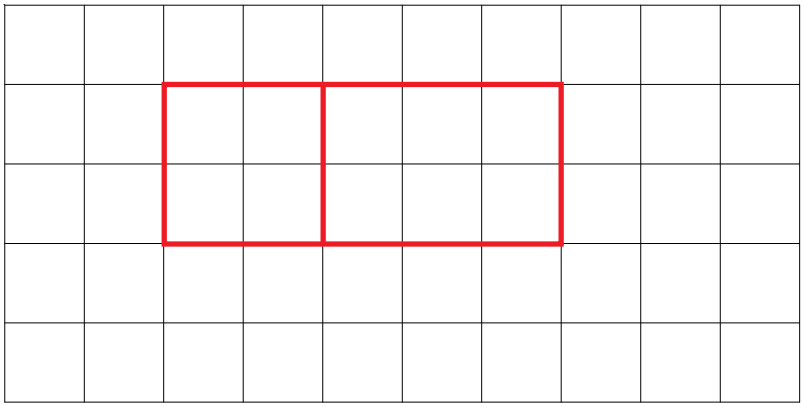
1) The diagram shows a prism drawn on an isometric grid.



a) On the grid below, draw the front elevation of the prism from the direction marked by the arrow.

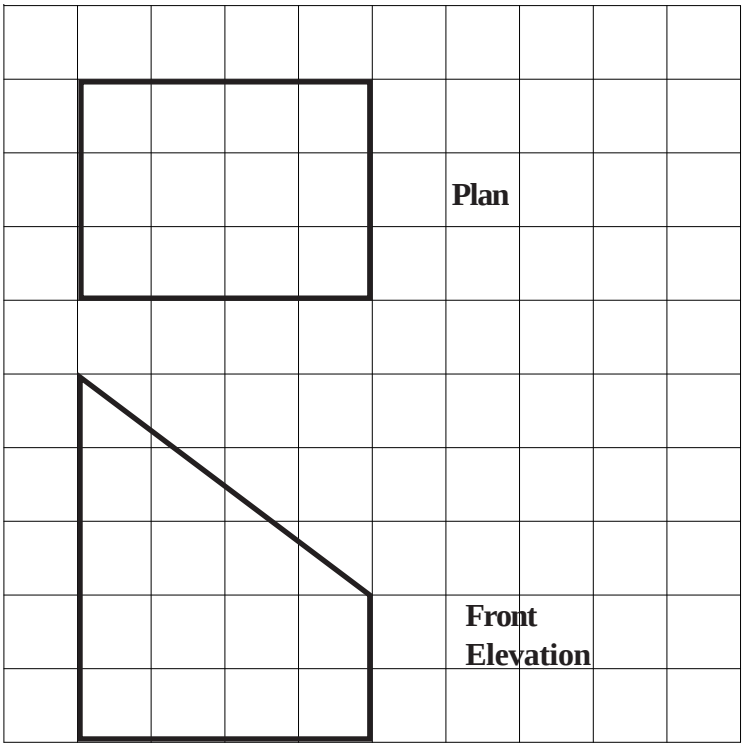


b) On the grid below draw a plan of the prism.

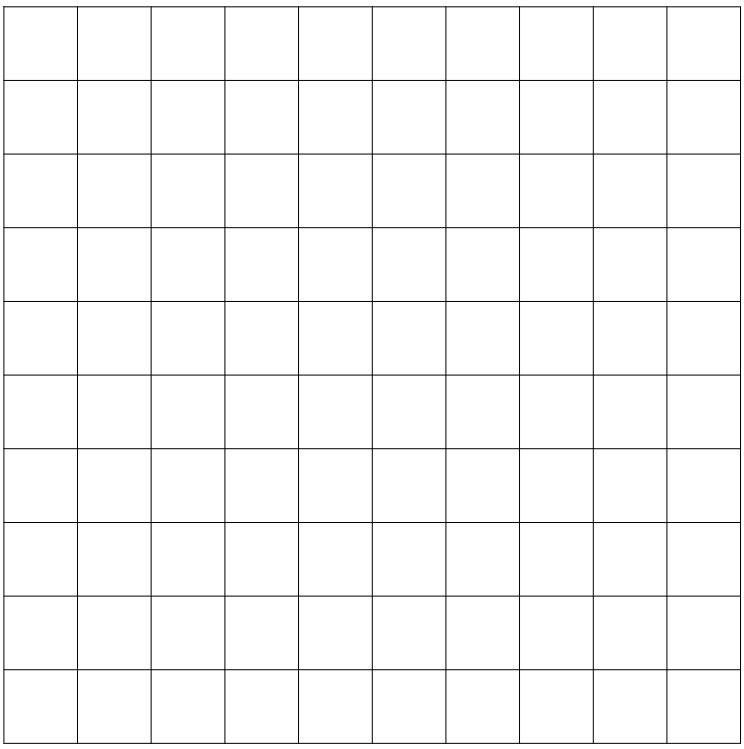


Plans and Elevations

1) Here is the plan and front elevation of a prism.
The front elevation shows the cross section of the prism.

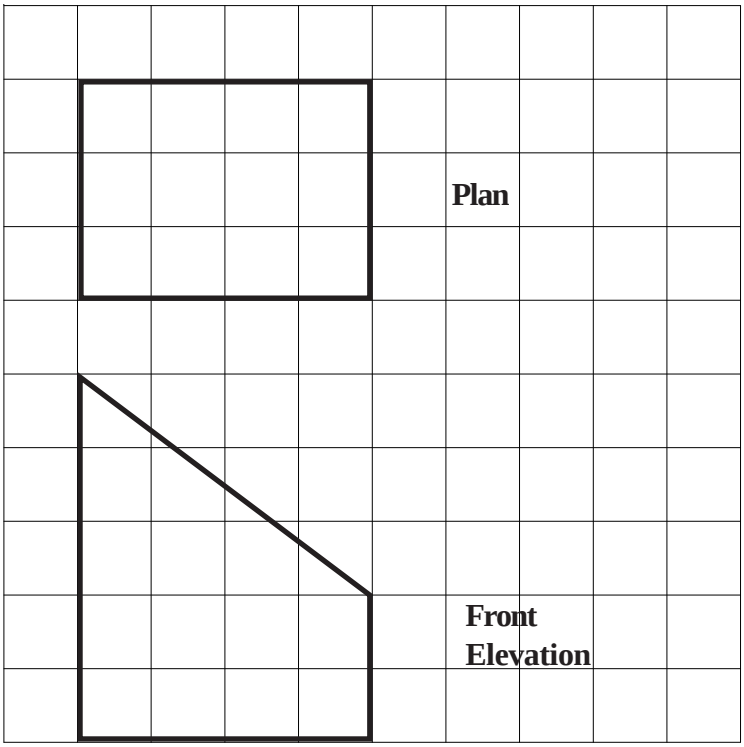


On the grid below, draw the side elevation of the prism.

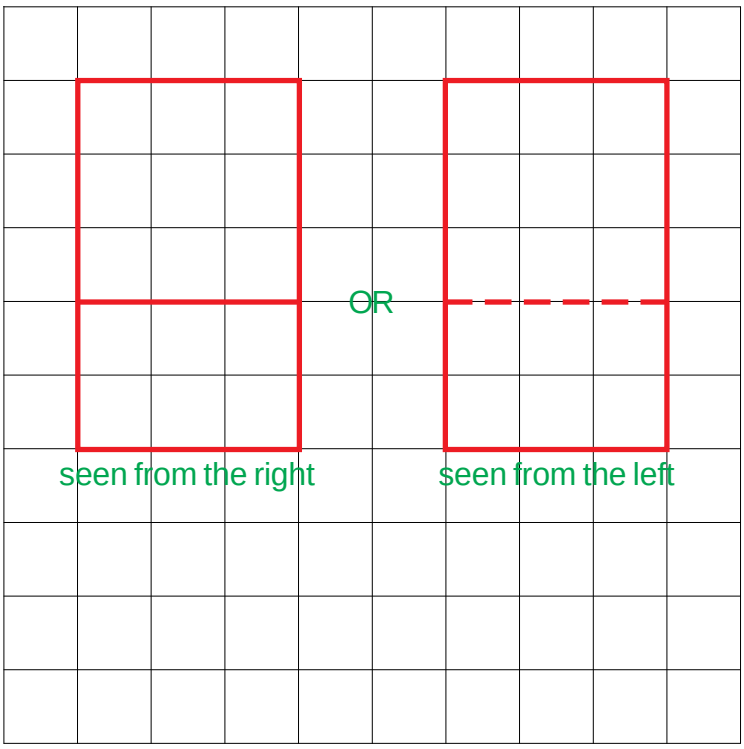


Plans and Elevations

1) Here is the plan and front elevation of a prism.
The front elevation shows the cross section of the prism.

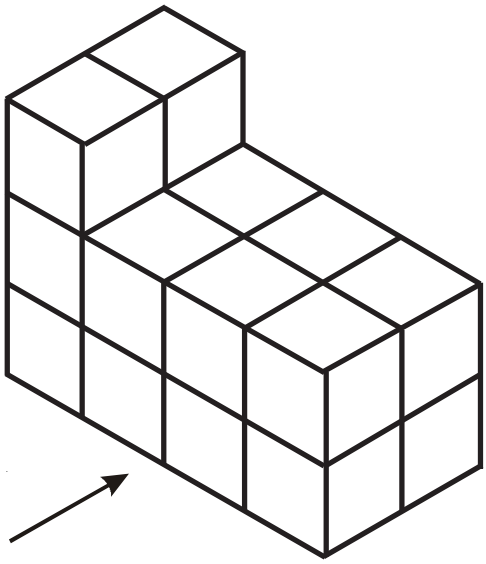


On the grid below, draw the side elevation of the prism.



Plans and Elevations

1) The diagram shows a solid prism made from centimetre cubes.

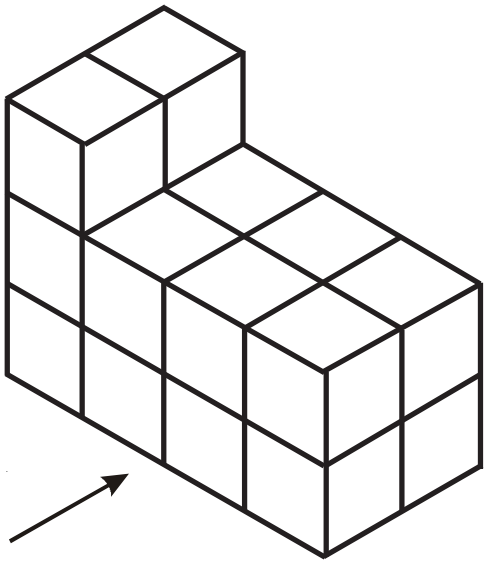


a) On the centimetre square grid, draw the front elevation of the solid prism from the direction shown by the arrow.

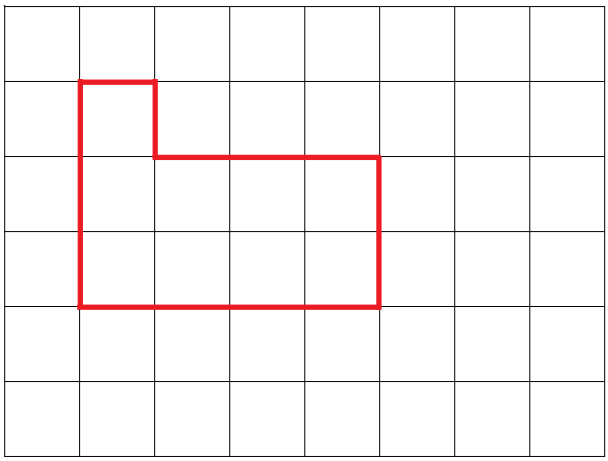
b) On the centimetre square grid below, draw the plan of the solid prism.

Plans and Elevations

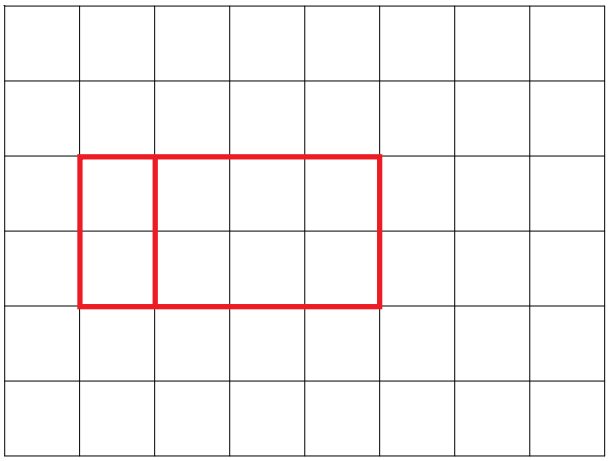
1) The diagram shows a solid prism made from centimetre cubes.



a) On the centimetre square grid, draw the front elevation of the solid prism from the direction shown by the arrow.

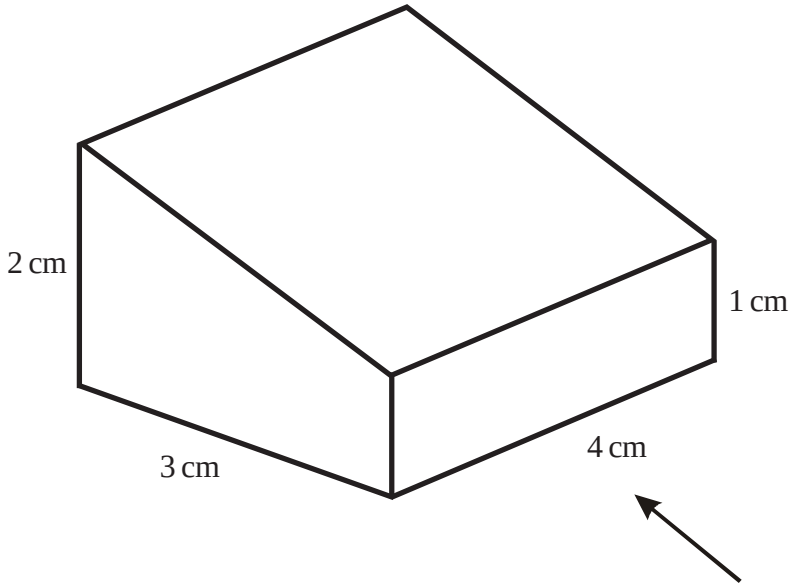


b) On the centimetre square grid below, draw the plan of the solid prism.

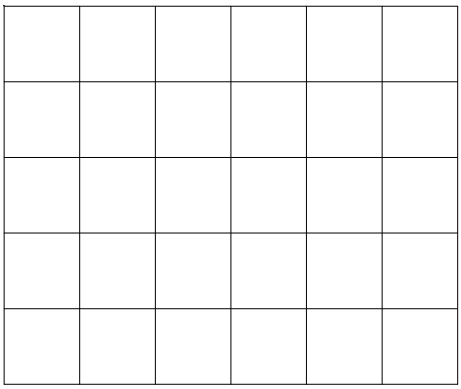


Plans and Elevations

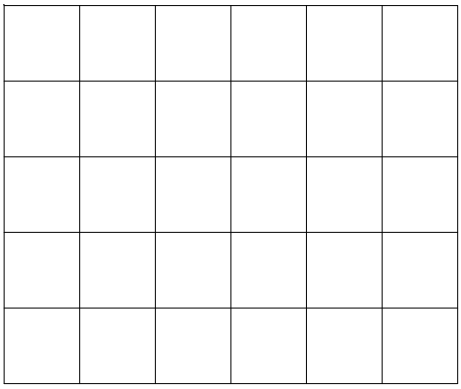
1) The diagram shows a solid prism.



a) On the grid below, draw the front elevation of the prism from the direction of the arrow.

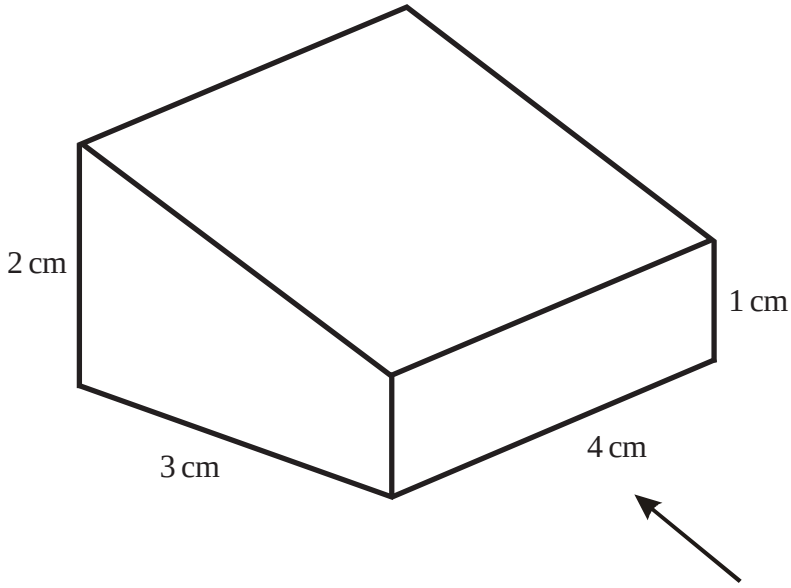


b) On the grid below, draw the plan of the prism.

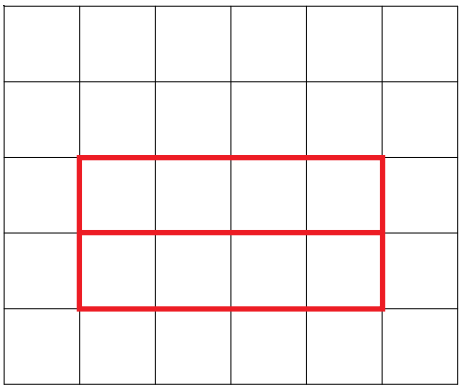


Plans and Elevations

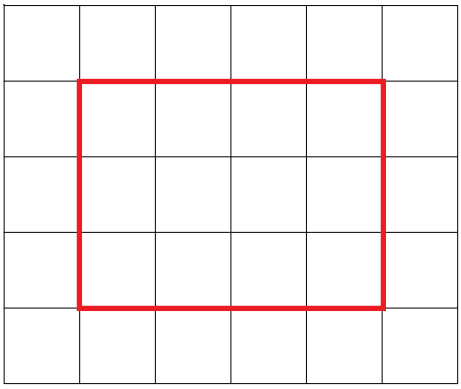
1) The diagram shows a solid prism.



a) On the grid below, draw the front elevation of the prism from the direction of the arrow.



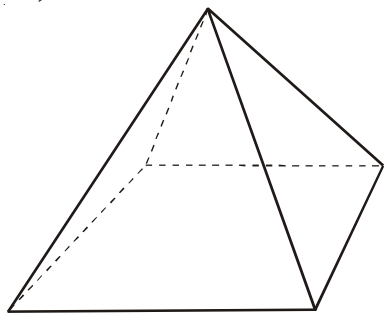
b) On the grid below, draw the plan of the prism.



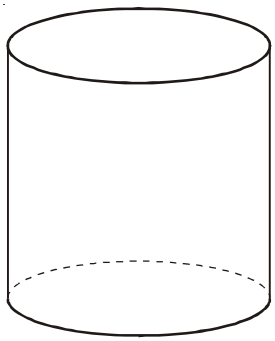
Nets

1) Sketch nets of these solids.

a)

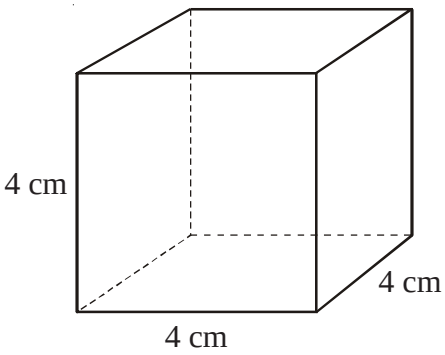


b)

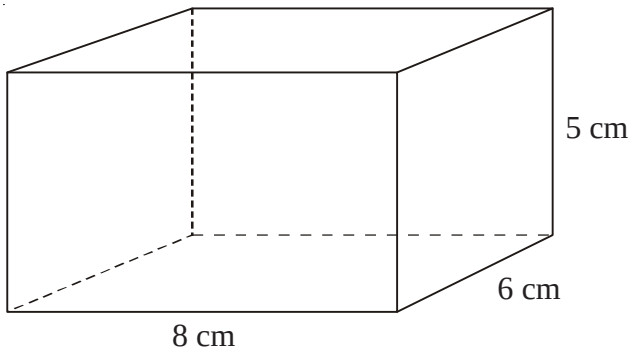


2) On squared paper draw accurate nets of these solids.

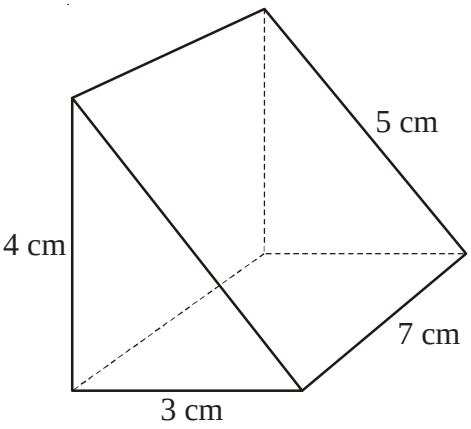
a) **Cube**



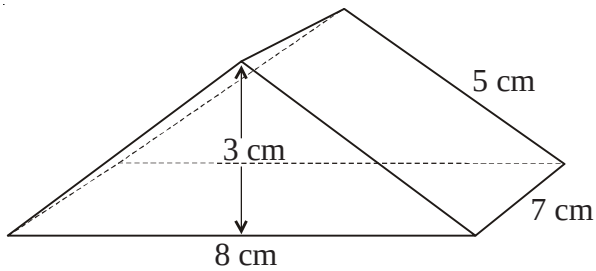
b) **Cuboid**



c) **Right-angled triangular prism**

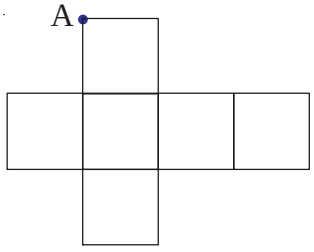


d) **Triangular prism**

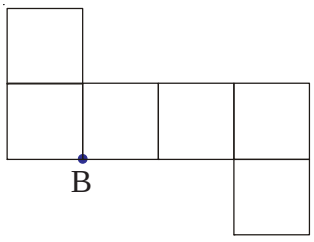


3) The two nets, below, are folded to make cubes.
Two other vertices will meet at the the dot, A. Mark them with As.
One other vertex will meet the dot B. Mark it with B.

a)



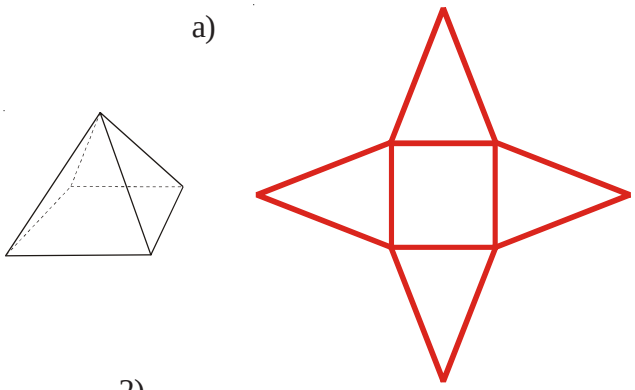
b)



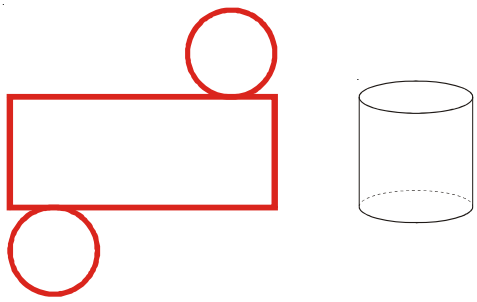
Nets

1) Sketch nets of these solids.

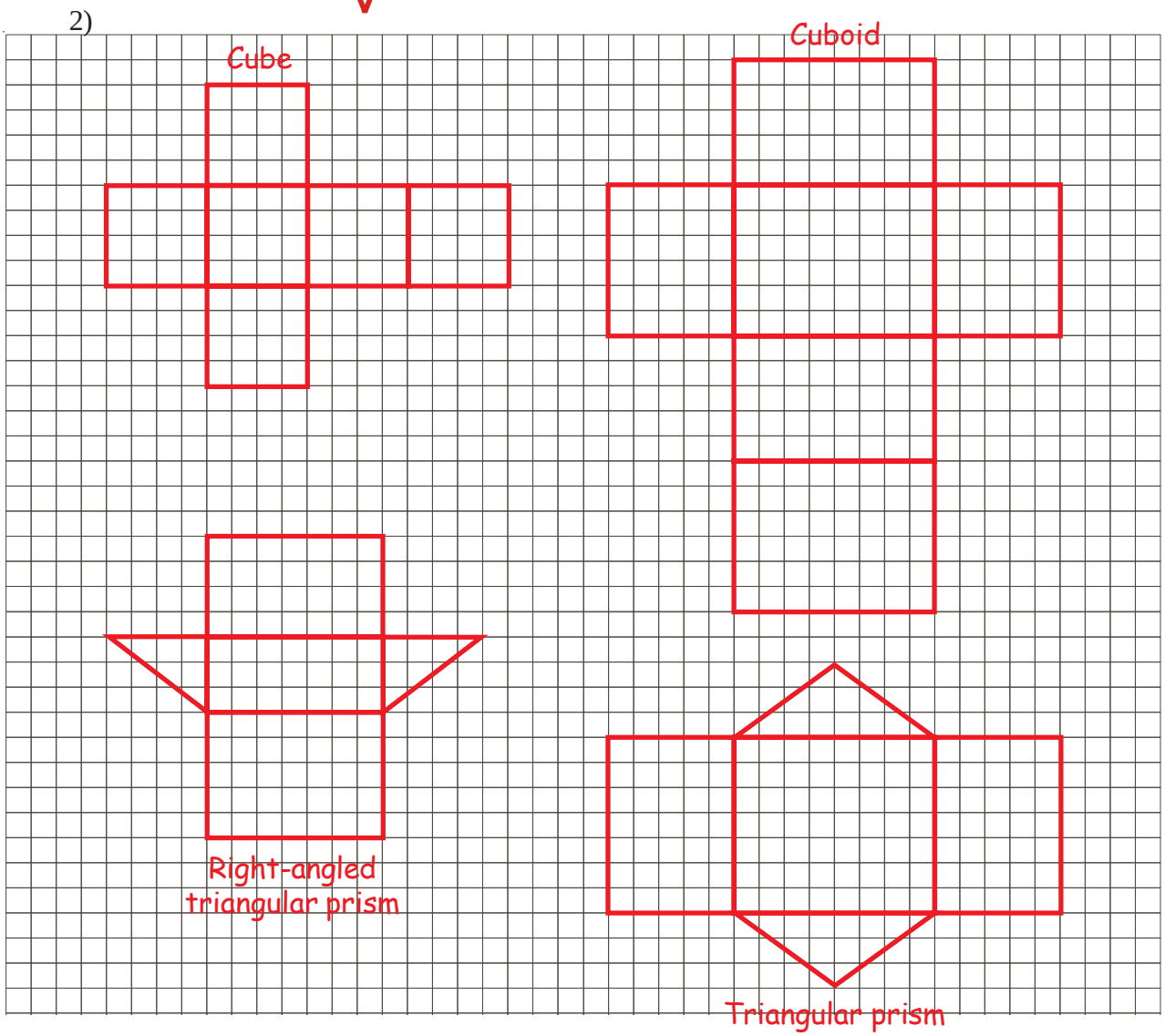
a)



b)

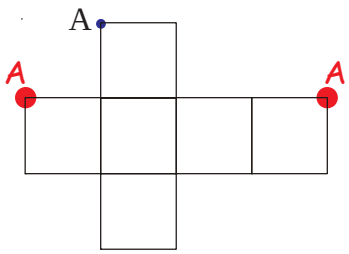


2)

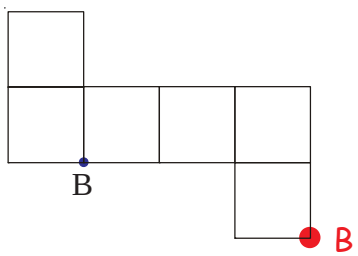


3) The two nets, below, are folded to make cubes.
Two other vertices will meet at the the dot, A. Mark them with As.
One other vertex will meet at the dot B. Mark it with B.

a)

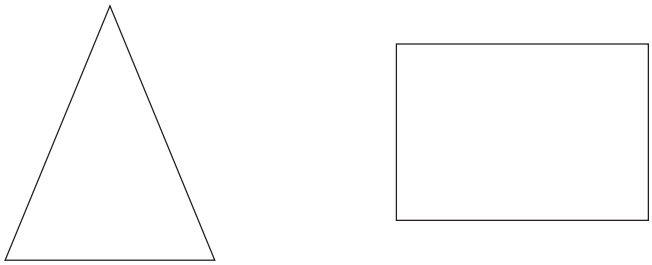


b)

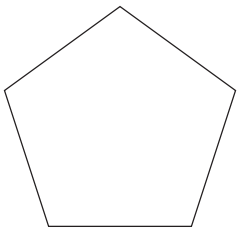


Symmetries

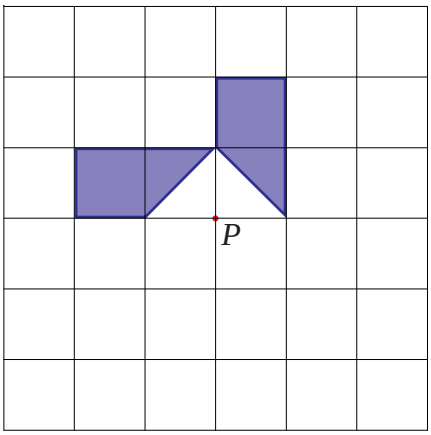
1) Draw all the lines of symmetry on the triangle and the rectangle.



2) What is the order of rotational symmetry of the two shapes below?



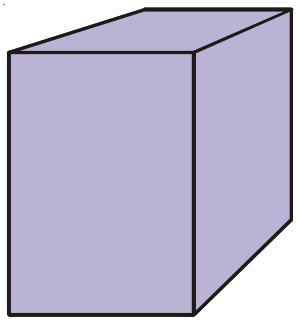
3) The diagram below, shows part of a shape.

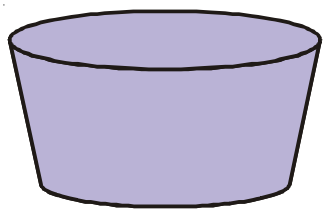


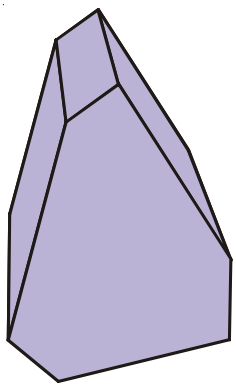
The shape has rotational symmetry of order 4 about point *P*.

Complete the shape.

4) On each of the shapes below, draw one plane of symmetry.

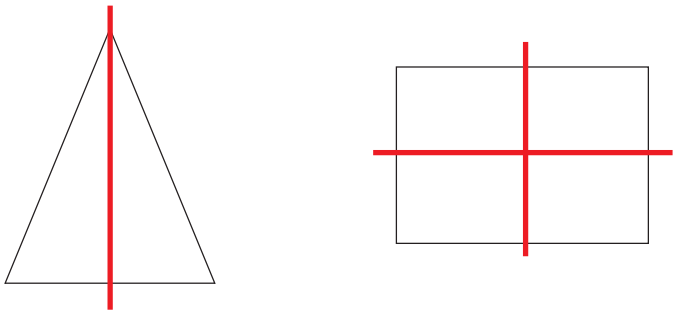




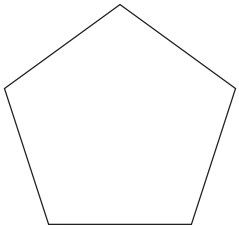


Symmetries

1) Draw all the lines of symmetry on the triangle and the rectangle.



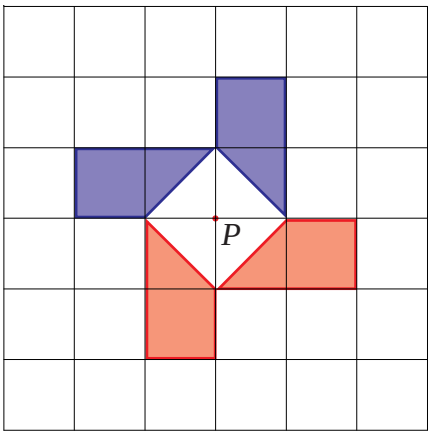
2) What is the order of rotational symmetry of the two shapes below?



Rotational symmetry order 5

Rotational symmetry order 2

3) The diagram below, shows part of a shape.

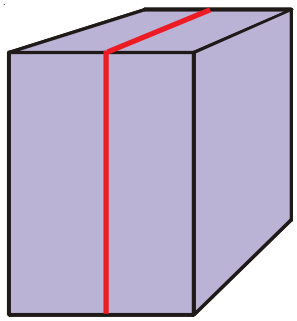


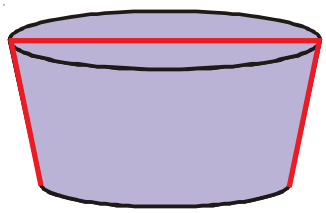
The shape has rotational symmetry of order 4 about point *P*.

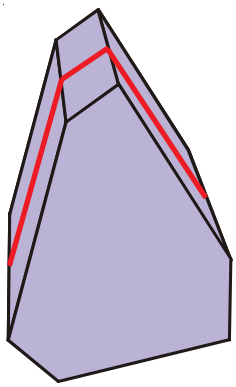
Complete the shape.

4) On each of the shapes below, draw one plane of symmetry.

There are other answers for these two questions.







Data Collection Sheets

1) Tony wants to know which type of programme pupils in his class like watching on TV.
Design a suitable data collection sheet he could use to gather the information.

2) Emma asked 20 people what was their favourite pet.
Here are their answers.

cat	cat	hamster	cat
mouse	hamster	cat	dog
dog	dog	snake	hamster
cat	cat	hamster	dog
cat	hamster	snake	cat

Design and complete a suitable data collection sheet that Emma could have used to collect and show this information.

Data Collection Sheets

1) Tony wants to know which type of programme pupils in his class like watching on TV.
Design a suitable data collection sheet he could use to gather the information.

Type of programme	Tally	Frequency
Soap opera		
Reality TV		
Films		
Situation comedy		
Documentary		

2) Emma asked 20 people what was their favourite pet.
Here are their answers.

cat	cat	hamster	cat
mouse	hamster	cat	dog
dog	dog	snake	hamster
cat	cat	hamster	dog
cat	hamster	snake	cat

Design and complete a suitable data collection sheet that Emma could have used to collect and show this information.

Favourite pet	Tally	Frequency
Cat	~~IIII~~ III	8
Hamster	~~IIII~~	5
Mouse	I	1
Dog	IIII	4
Snake	II	2

Two-Way Tables

1) Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	**Sparkling**	**Both**	**Total**
Male	26			53
Female		20	10	
Total			16	100

a) Complete the two-way table.

b) How many males were in the survey?

c) How many females drink only still water?

d) How many people drink only sparkling water?

2) 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	**German**	**Spanish**	**Total**
Female				
Male		7		
Total	20	18		90

50 of the 90 students are male.

29 of the 50 male students study Spanish.

a) Complete the two-way table.

b) How many females study French?

c) How many people study Spanish?

3) Karen asks 100 students if they like milk, plain or white chocolates best.

36 of the students are girls.

19 of these girls like milk chocolates best.

16 boys like white chocolates best.

8 out of the 24 students who like plain chocolates best are girls.

Work out the number of students who like milk chocolates the best.

Two-Way Tables

1) Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	Sparkling	Both	Total
Male	26	21	6	53
Female	17	20	10	47
Total	43	41	16	100

a) Complete the two-way table.

b) How many males were in the survey? 53

c) How many females drink only still water? 17

d) How many people drink only sparkling water? 41

2) 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	German	Spanish	Total
Female	6	11	23	40
Male	14	7	29	50
Total	20	18	52	90

50 of the 90 students are male.

29 of the 50 male students study Spanish.

a) Complete the two-way table.

b) How many females study French? 6

c) How many people study Spanish? 52

3) Karen asks 100 students if they like milk, plain or white chocolates best.

36 of the students are girls.

19 of these girls like milk chocolates best.

16 boys like white chocolates best.

8 out of the 24 students who like plain chocolates best are girls.

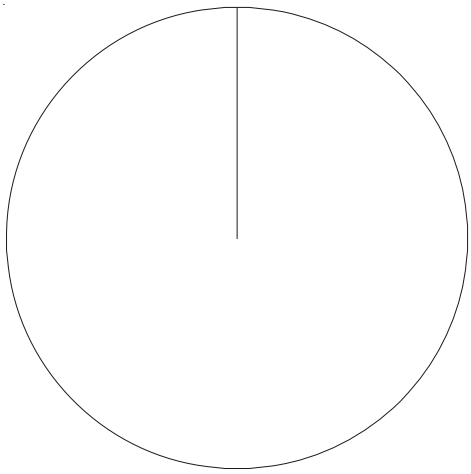
Work out the number of students who like milk chocolates the best. 51

Pie Charts

1) Patrick asked some of his colleagues which was their favourite holiday destination.
The table shows the results.

City	Frequency
Alicante	8
Paris	7
Ibiza	15
St Lucia	1
Biarritz	9

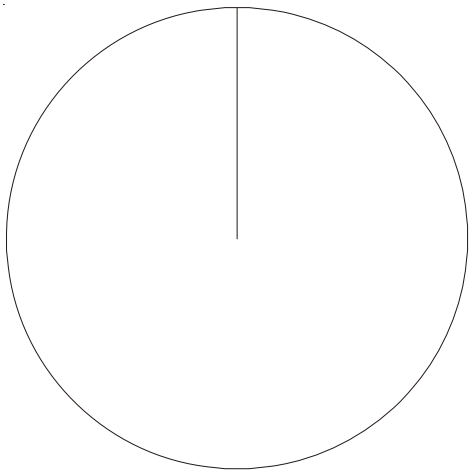
Draw a pie chart to illustrate the information.



2) Brian asked 60 people which region their favourite rugby team came from.
The table shows the results.

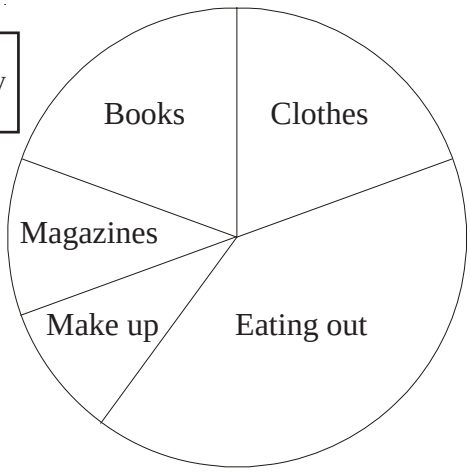
Region	Frequency
Southern England	9
London	23
Midlands	16
Northern England	12
Total	60

Draw a pie chart to illustrate the information.



3) Sophie represents her monthly expenses using a pie chart.

Diagram accurately drawn



Numbers from her table have been rubbed out by mistake.
Use the pie chart to complete the table.

		Angle
Clothes	£35	
Eating out		
Make up	£17	34°
Magazines		
Books		
Total	£180	

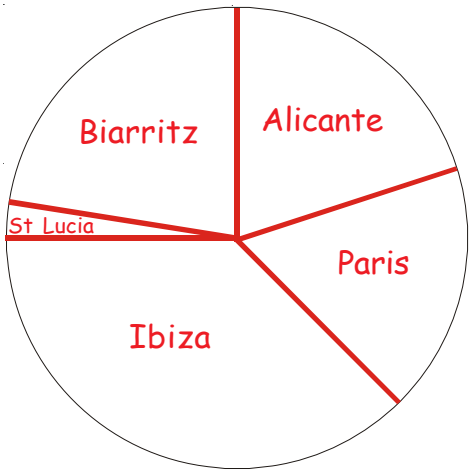
Pie Charts

1) Patrick asked some of his colleagues which was their favourite holiday destination.
The table shows the results.

City	Frequency	Angle
Alicante	8 × 9	72°
Paris	7 × 9	63°
Ibiza	15 × 9	135°
St Lucia	1 × 9	9°
Biarritz	9 × 9	81°
	40	360°

360 ÷ ?
360 ÷ 40 = 9

Draw a pie chart to illustrate the information.

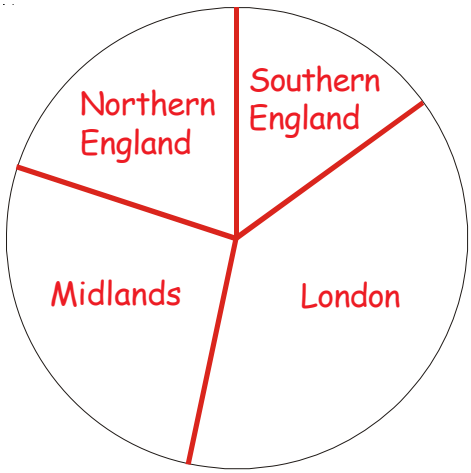


2) Brian asked 60 people which region their favourite rugby team came from.
The table shows the results.

Region	Frequency	Angle
Southern England	9 × 6	54°
London	23 × 6	138°
Midlands	16 × 6	96°
Northern England	12 × 6	72°
Total	60	360°

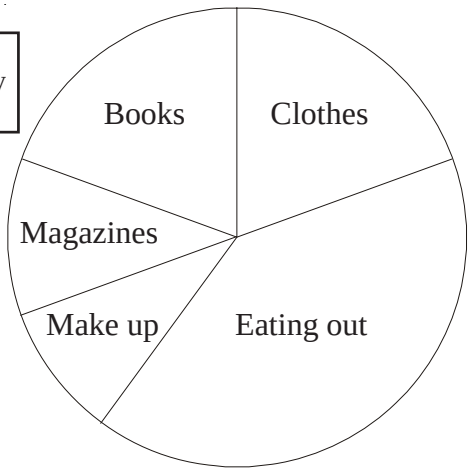
360 ÷ ?
360 ÷ 60 = 6

Draw a pie chart to illustrate the information.



3) Sophie represents her monthly expenses using a pie chart.

Diagram accurately drawn



Numbers from her table have been rubbed out by mistake.
Use the pie chart to complete the table.

		Angle
Clothes	£35	70°
Eating out	£73	146°
Make up	£17	34°
Magazines	£20	40°
Books	£35	70°
Total	£180	360°

Scatter Graphs

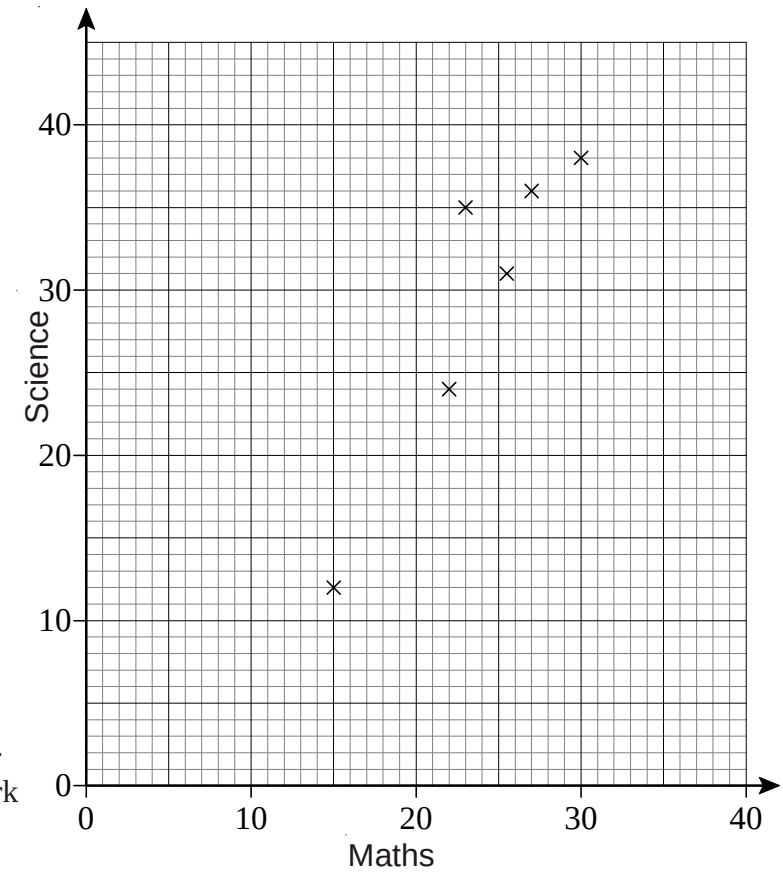
1) The scatter graph shows some information about the marks of six students.
It shows each student's marks in Maths and Science.

The table below shows the marks for four more students.

Maths	22	8	17	26
Science	30	12	24	24

a) On the scatter graph, plot the information from the table.
b) Draw a line of best fit.
c) Describe the correlation between the marks in Maths and the marks in Science.

Another student has a mark of 18 in Science.
d) Use the line of best fit to estimate the mark in Maths of this student.



---

2) The table below shows the average daily number of hours sleep of 10 children.

Age (years)	4	2	5	1	9	6	8	7	10	1.5
Number of hours sleep	14	13	12.5	15	10	12.5	10.8	12	11	14

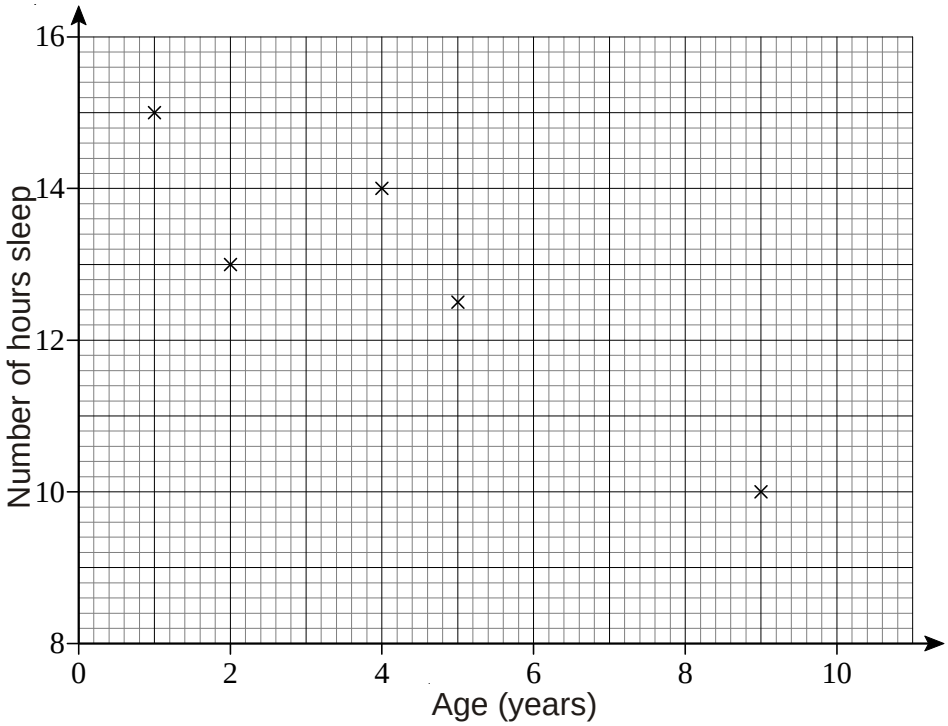
The first five results have been plotted on the scatter diagram.

a) Plot the next five points.

b) Draw a line of best fit.

c) Describe the relationship between the age of the children and their number of hours sleep per day.

d) Use your scatter graph to estimate the number of hours sleep for a 3 year old child.



Scatter Graphs

1) The scatter graph shows some information about the marks of six students.

It shows each student's marks in Maths and Science.

The table below shows the marks for four more students.

Maths	22	8	17	26
Science	30	12	24	24

a) On the scatter graph, plot the information from the table.

b) Draw a line of best fit.

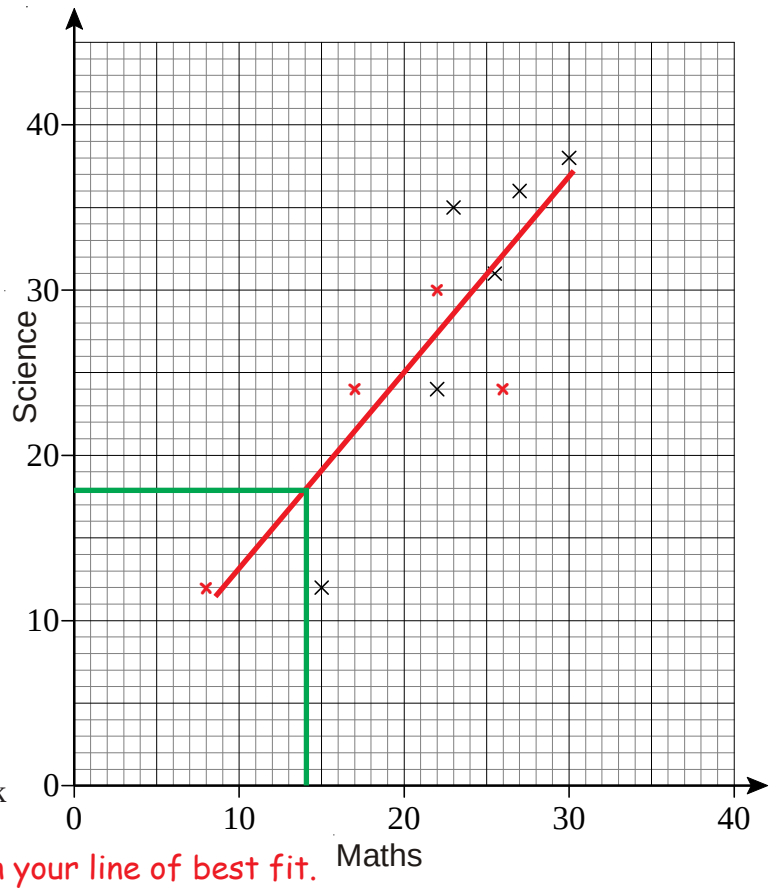
c) Describe the correlation between the marks in Maths and the marks in Science.

There is a positive correlation

Another student has a mark of 18 in Science.

d) Use the line of best fit to estimate the mark in Maths of this student.

My answer is 14. Yours will depend on your line of best fit.



---

2) The table below shows the average daily number of hours sleep of 10 children.

Age (years)	4	2	5	1	9	6	8	7	10	1.5
Number of hours sleep	14	13	12.5	15	10	12.5	10.8	12	11	14

The first five results have been plotted on the scatter diagram.

a) Plot the next five points.

b) Draw a line of best fit.

c) Describe the relationship between the age of the children and their number of hours sleep per day.

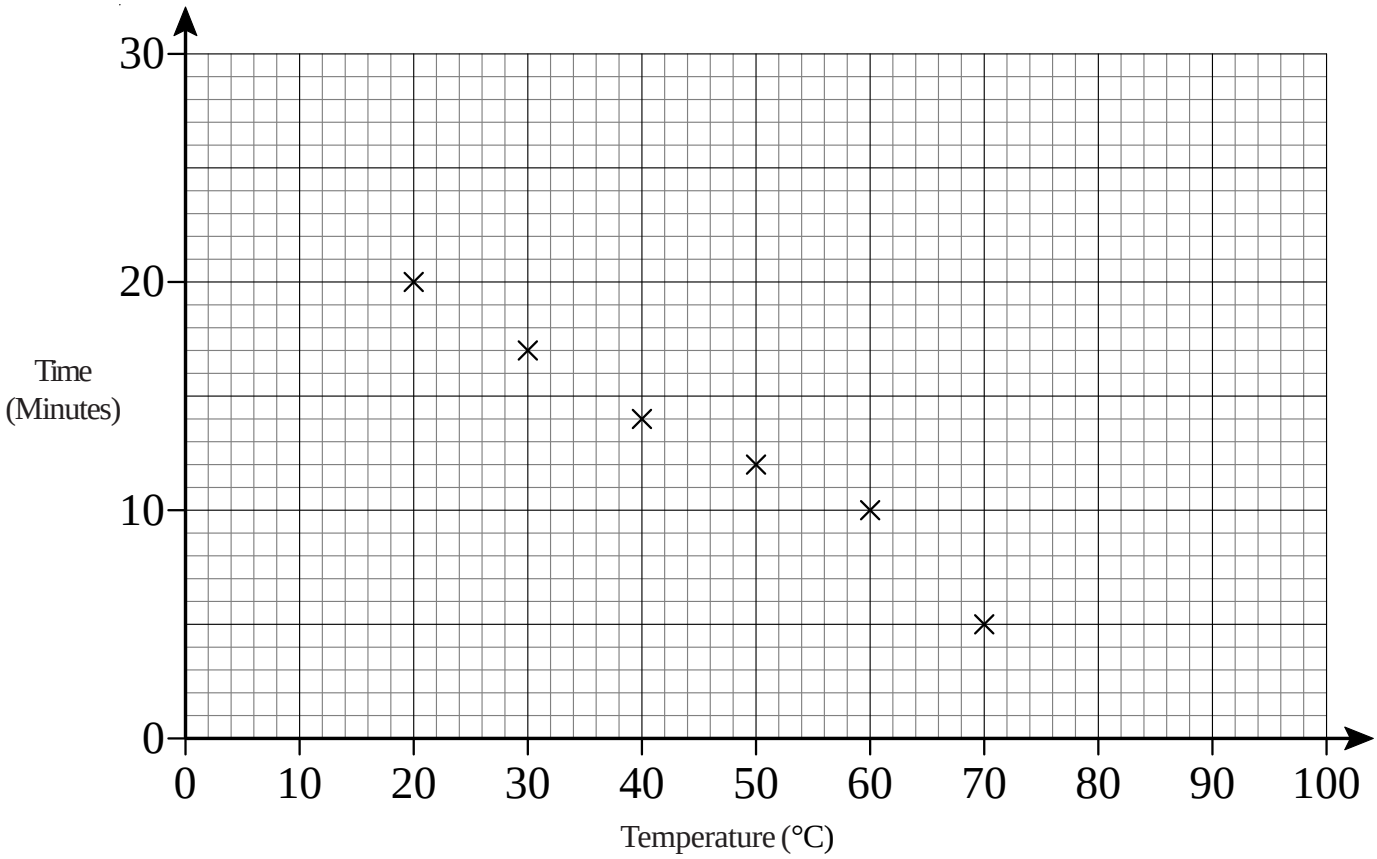
A negative correlation.

d) Use your scatter graph to estimate the number of hours sleep for a 3 year old child.

My answer is 13.6
Yours will depend on your line of best fit.

Scatter Graphs

1) Sue did an experiment to study the times, in minutes, it took 1 cm ice cubes to melt at different temperatures.
Some information about her results is given in the scatter graph.



The table shows the results from two more experiments.

Temperature (°C)	15	55
Time (Minutes)	21	15

a) On the scatter graph, plot the results from the table.

b) Describe the relationship between the temperature and the time it takes a 1 cm ice cube to melt.

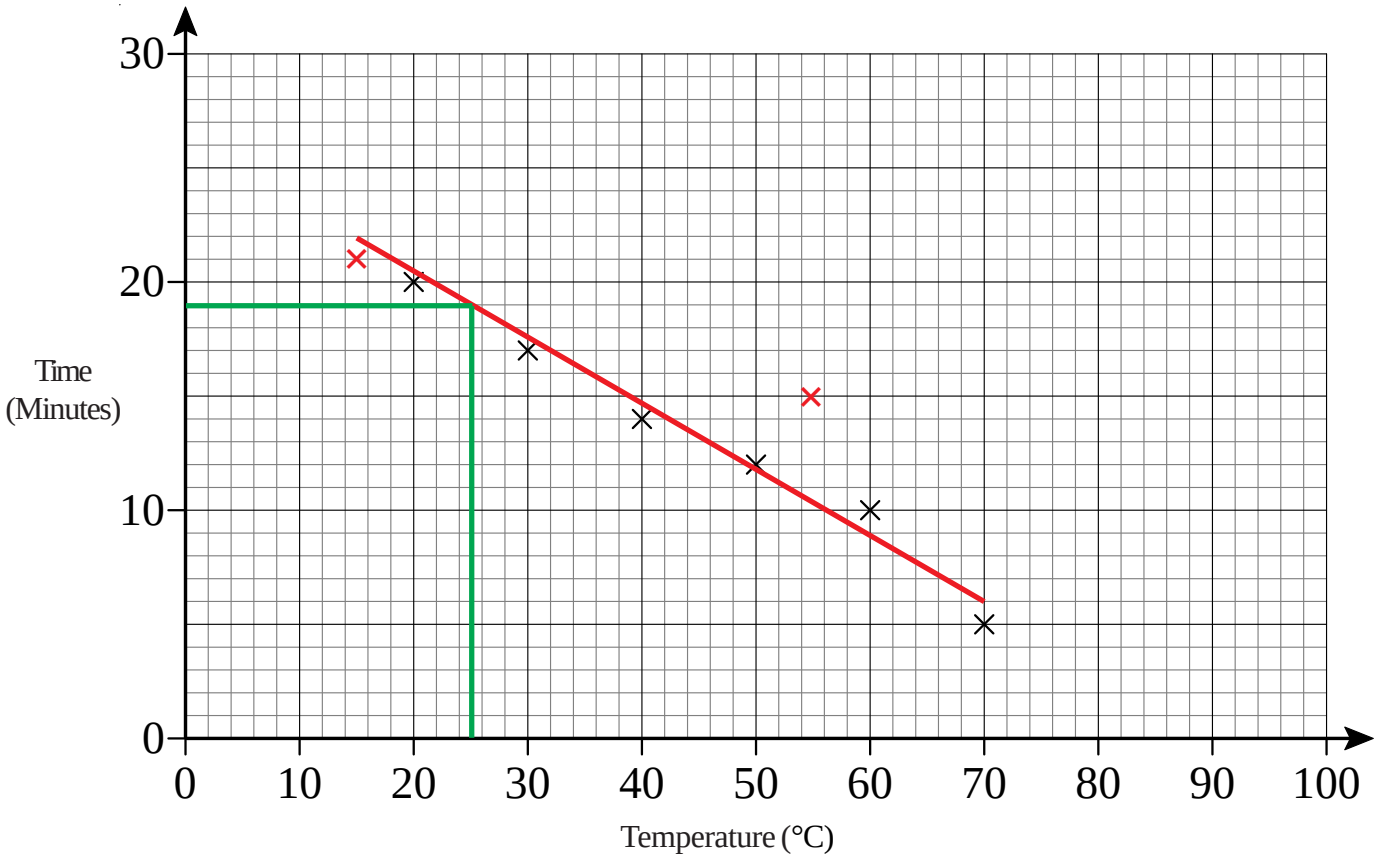
c) Find an estimate for the time it takes a 1 cm ice cube to melt when the temperature is 25 °C.

Sue's data cannot be used to predict how long it will take a 1 cm ice cube to melt when the temperature is 100 °C.

d) Explain why.

Scatter Graphs

1) Sue did an experiment to study the times, in minutes, it took 1 cm ice cubes to melt at different temperatures.
Some information about her results is given in the scatter graph.



The table shows the results from two more experiments.

Temperature (°C)	15	55
Time (Minutes)	21	15

a) On the scatter graph, plot the results from the table.

b) Describe the relationship between the temperature and the time it takes a 1 cm ice cube to melt. Negative correlation

c) Find an estimate for the time it takes a 1 cm ice cube to melt when the temperature is 25 °C. 19 minutes (your answer will depend on your line of best fit)

Sue's data cannot be used to predict how long it will take a 1 cm ice cube to melt when the temperature is 100 °C.

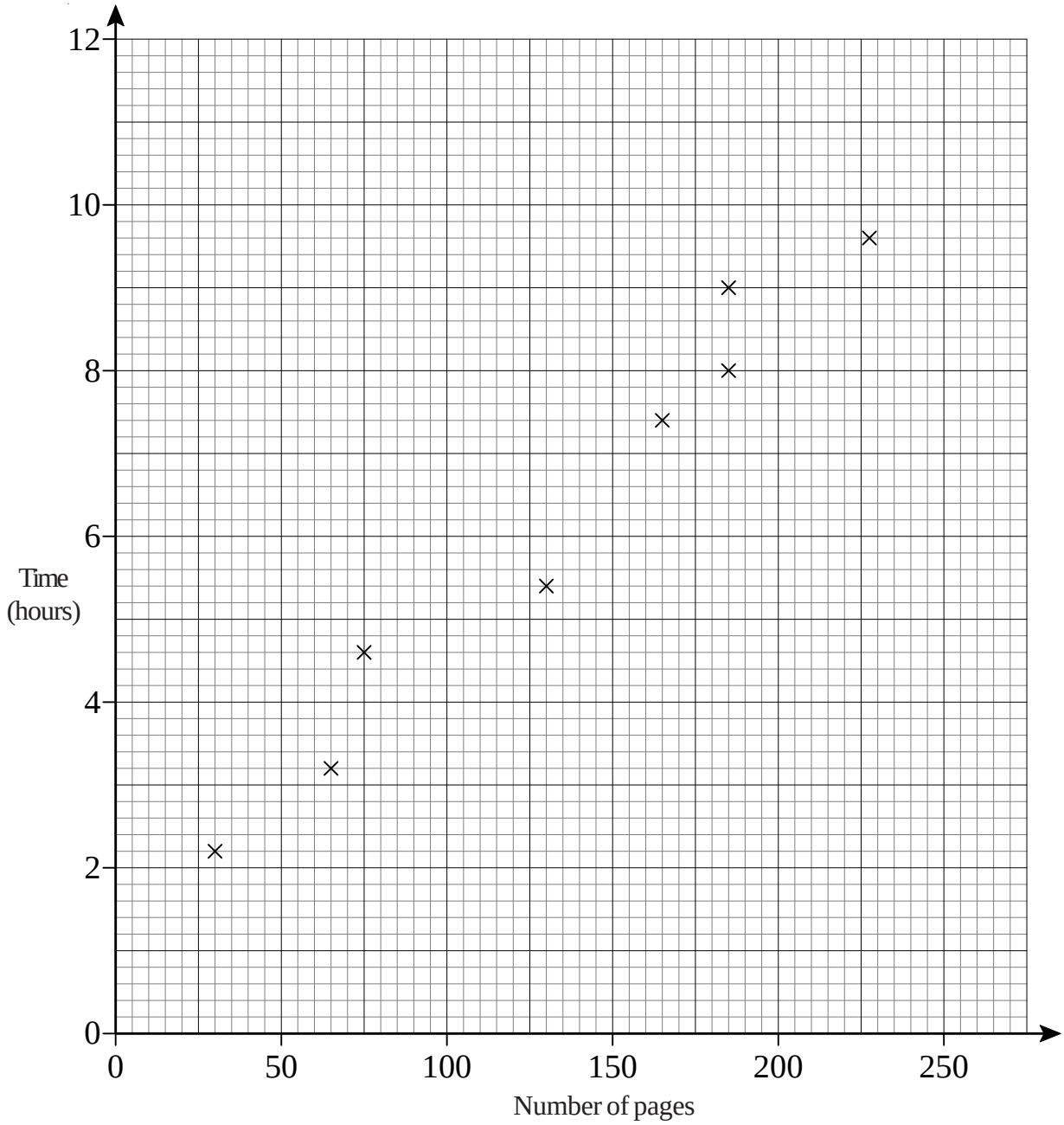
d) Explain why. Line of best fit would give a negative time
or
You cannot draw and use a line of best fit which goes beyond the values.

Scatter Graphs

1) Henry reads eight books.

For each book he recorded the number of pages and the time he took to read it.

The scatter graph shows information about his results.



a) Describe the relationship between the number of pages in a book and the time Henry takes to read it.

Henry reads another book.

The book has 150 pages.

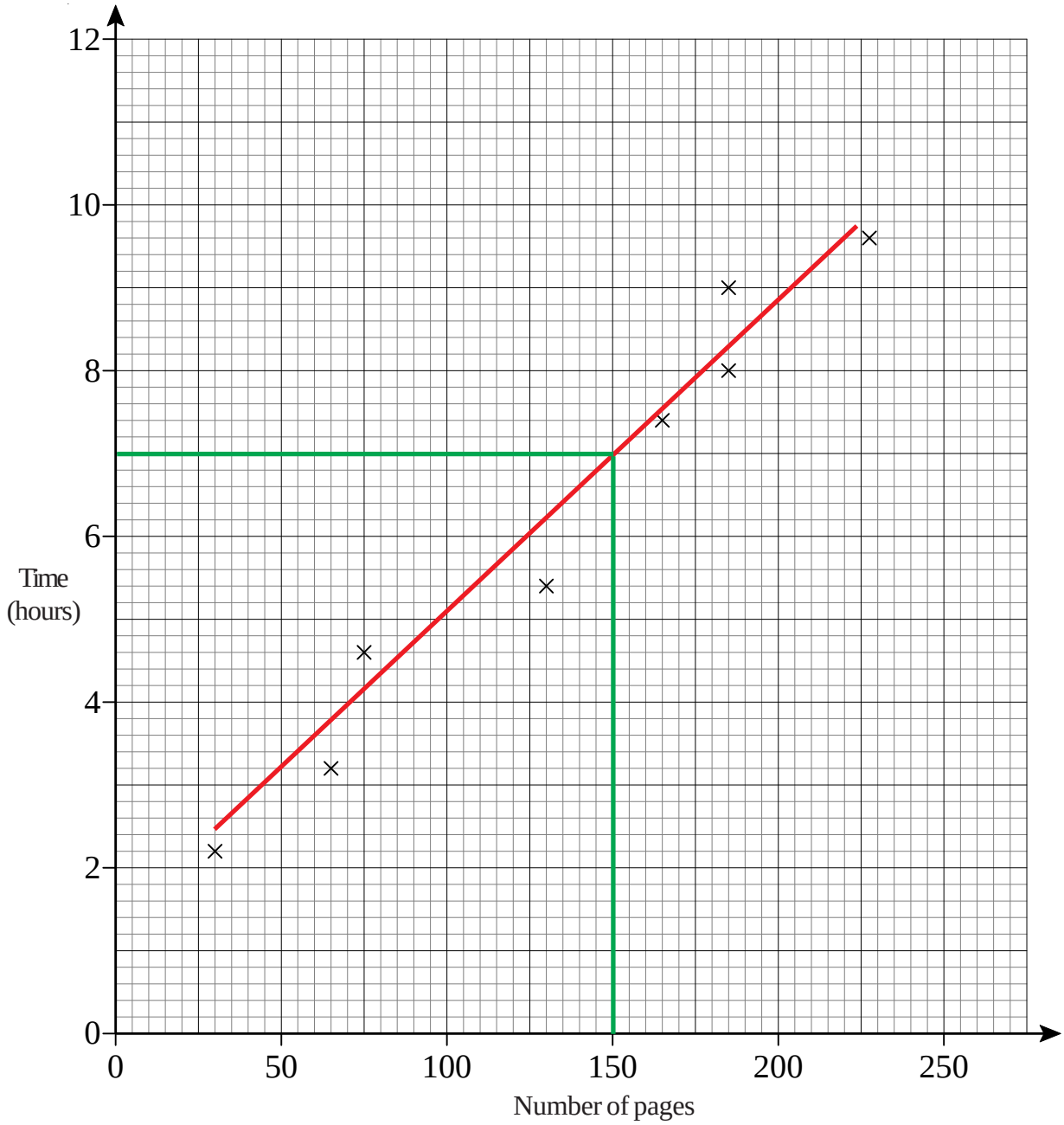
b) Estimate the time it takes Henry to read it.

Scatter Graphs

1) Henry reads eight books.

For each book he recorded the number of pages and the time he took to read it.

The scatter graph shows information about his results.



a) Describe the relationship between the number of pages in a book and the time Henry takes to read it. Positive correlation

Henry reads another book.

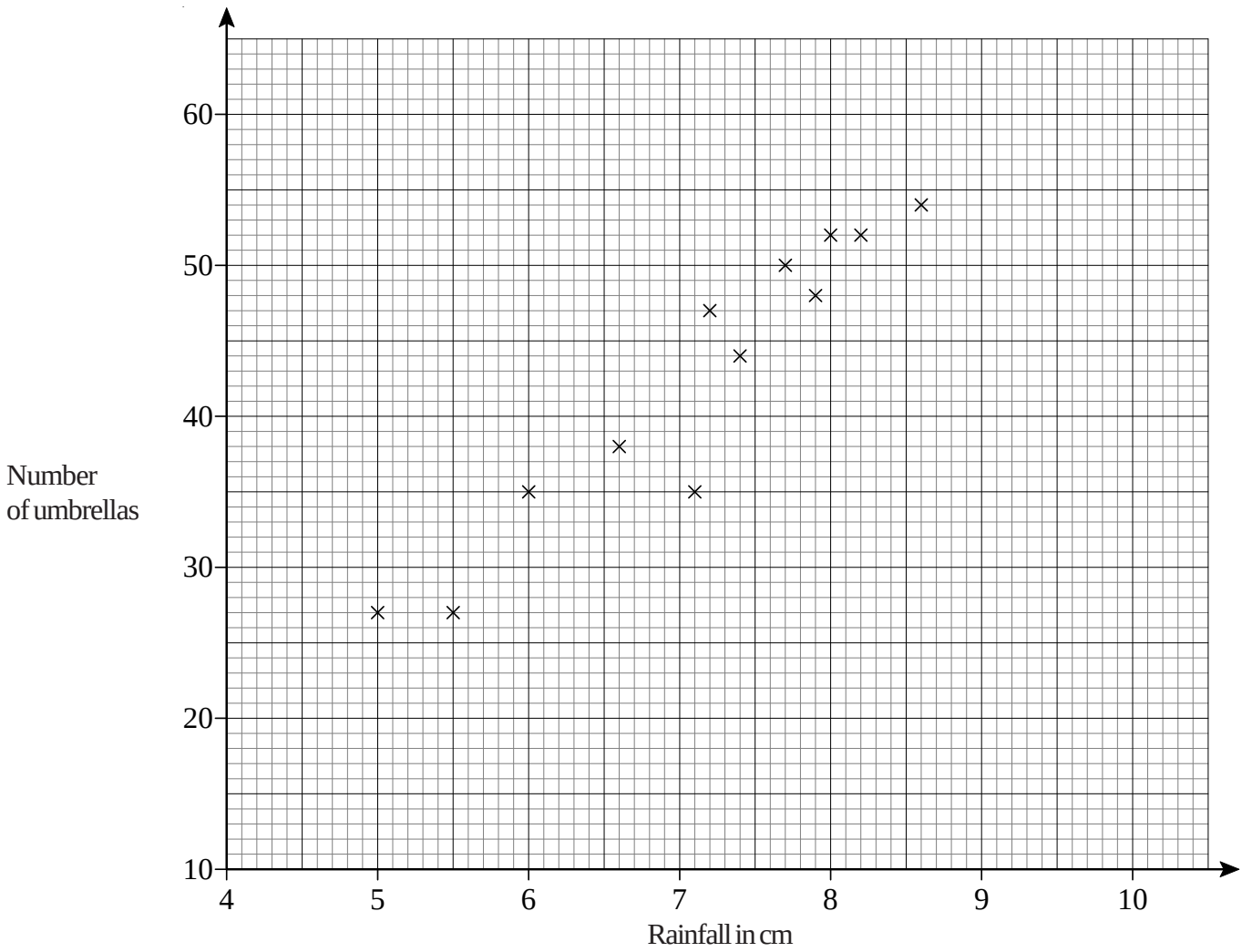
The book has 150 pages.

b) Estimate the time it takes Henry to read it. 7 hours (your answer will depend on your line of best fit)

Scatter Graphs

1) Mr Jones sells umbrellas.

The scatter graph shows some information about the number of umbrellas he sold and the rainfall, in cm, each month last year.



In January of this year, the rainfall was 6.2 cm.

During January, Mr Jones sold 32 umbrellas.

a) Show this information on the scatter graph.

b) What type of correlation does this scatter graph show?

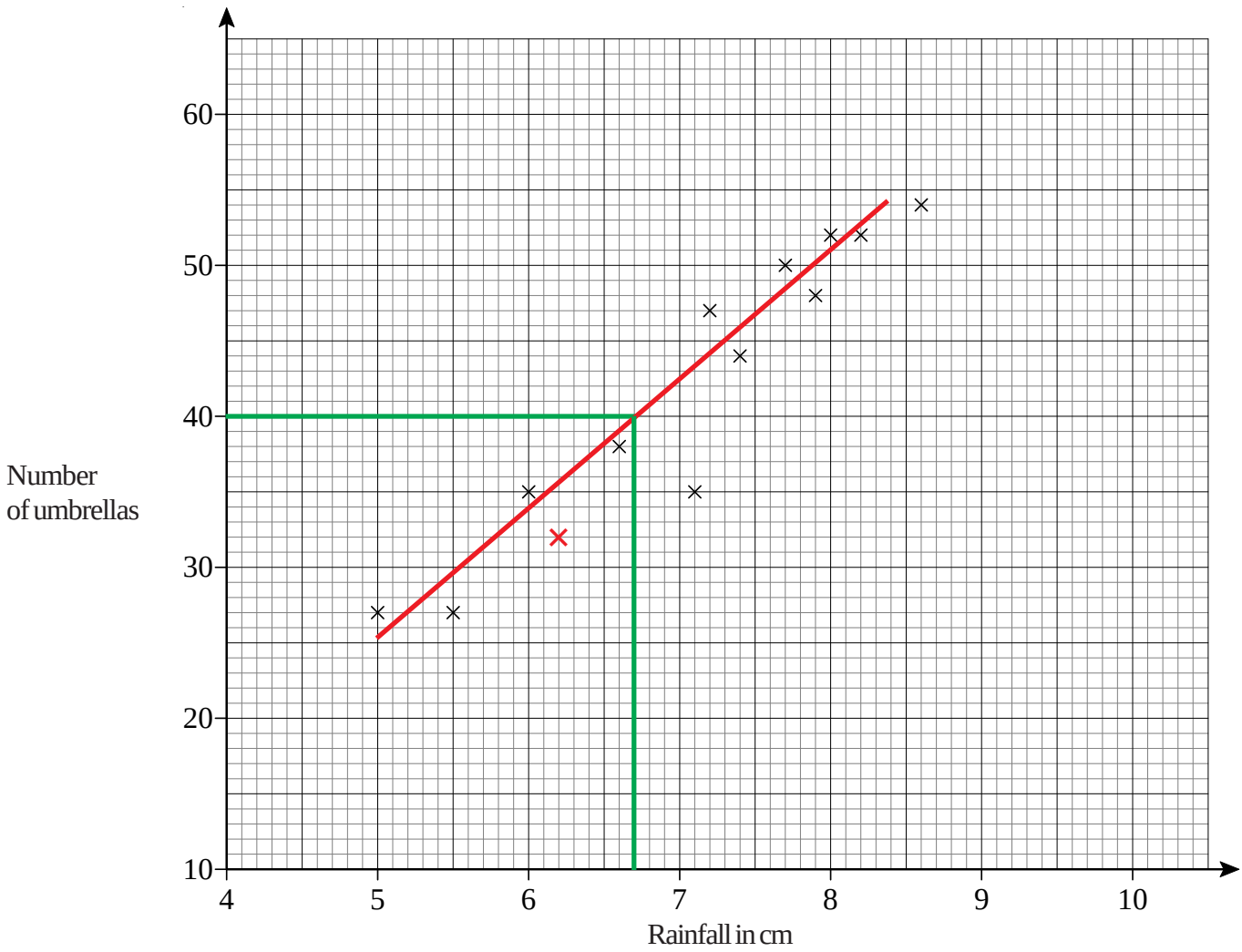
In February of this year, Mr Jones sold 40 umbrellas.

c) Estimate the rainfall for February.

Scatter Graphs

1) Mr Jones sells umbrellas.

The scatter graph shows some information about the number of umbrellas he sold and the rainfall, in cm, each month last year.



In January of this year, the rainfall was 6.2 cm.

During January, Mr Jones sold 32 umbrellas.

a) Show this information on the scatter graph.

b) What type of correlation does this scatter graph show? Positive correlation

In February of this year, Mr Jones sold 40 umbrellas.

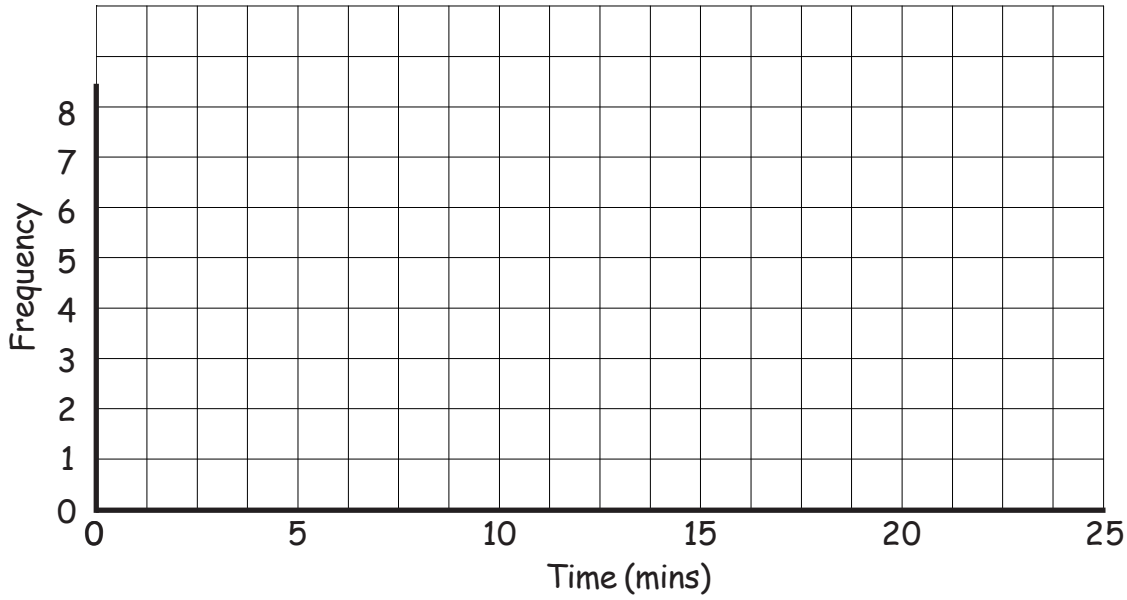
c) Estimate the rainfall for February. 6.7 cm (your answer will depend on your line of best fit)

Frequency Diagrams

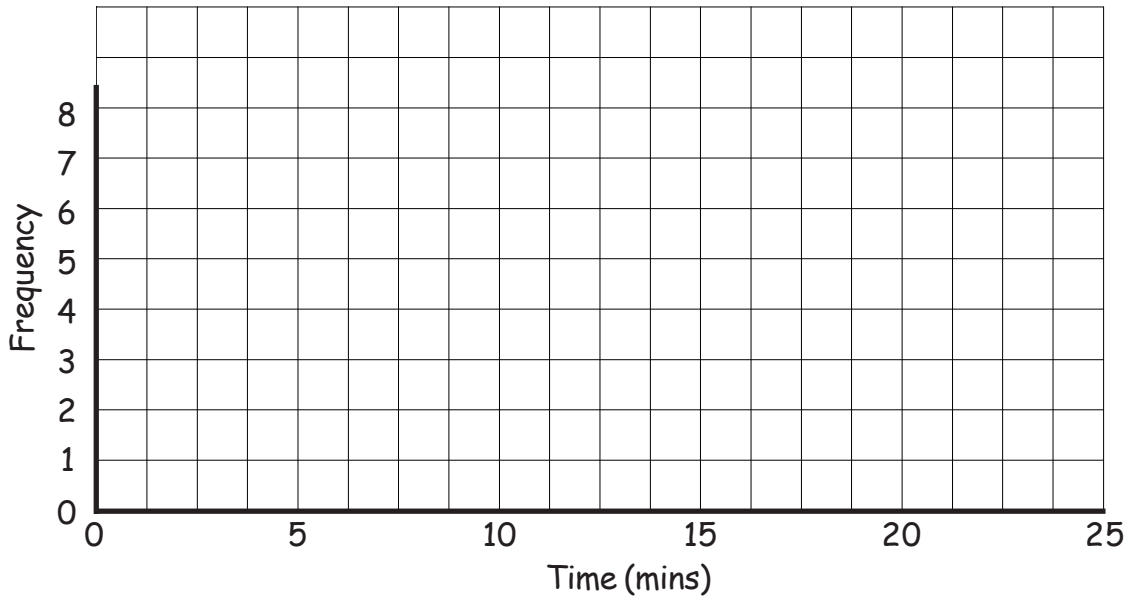
1) A class of pupils is asked to solve a puzzle.
The frequency table below shows the times taken by the pupils to solve the puzzle.

Time (t) in min	Frequency
$0 < t \leqslant 5$	3
$5 < t \leqslant 10$	4
$10 < t \leqslant 15$	5
$15 < t \leqslant 20$	7
$20 < t \leqslant 25$	5

a) Draw a frequency diagram to show this information.



b) Draw a frequency polygon to show this information.

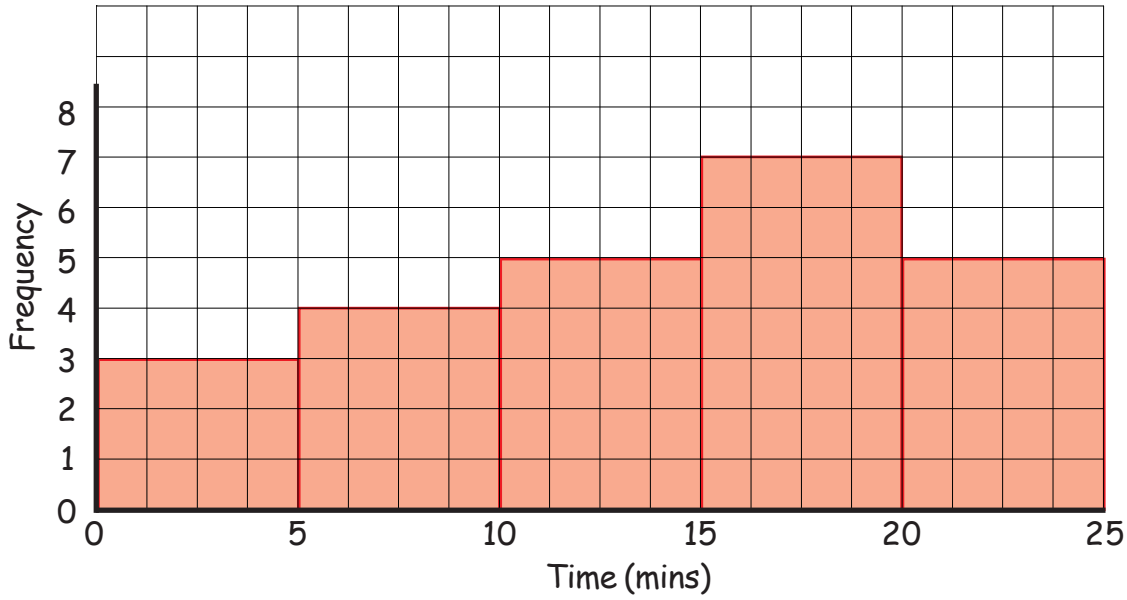


Frequency Diagrams

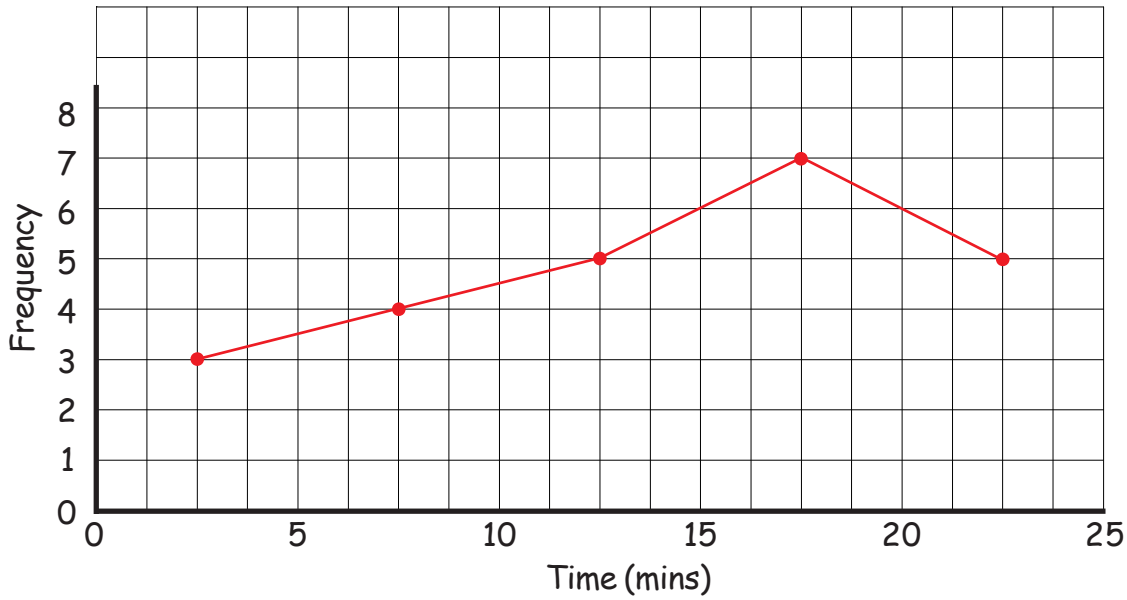
1) A class of pupils is asked to solve a puzzle.
The frequency table below shows the times taken by the pupils to solve the puzzle.

Time (t) in min	Frequency
$0 < t \leqslant 5$	3
$5 < t \leqslant 10$	4
$10 < t \leqslant 15$	5
$15 < t \leqslant 20$	7
$20 < t \leqslant 25$	5

a) Draw a frequency diagram to show this information.



b) Draw a frequency polygon to show this information.



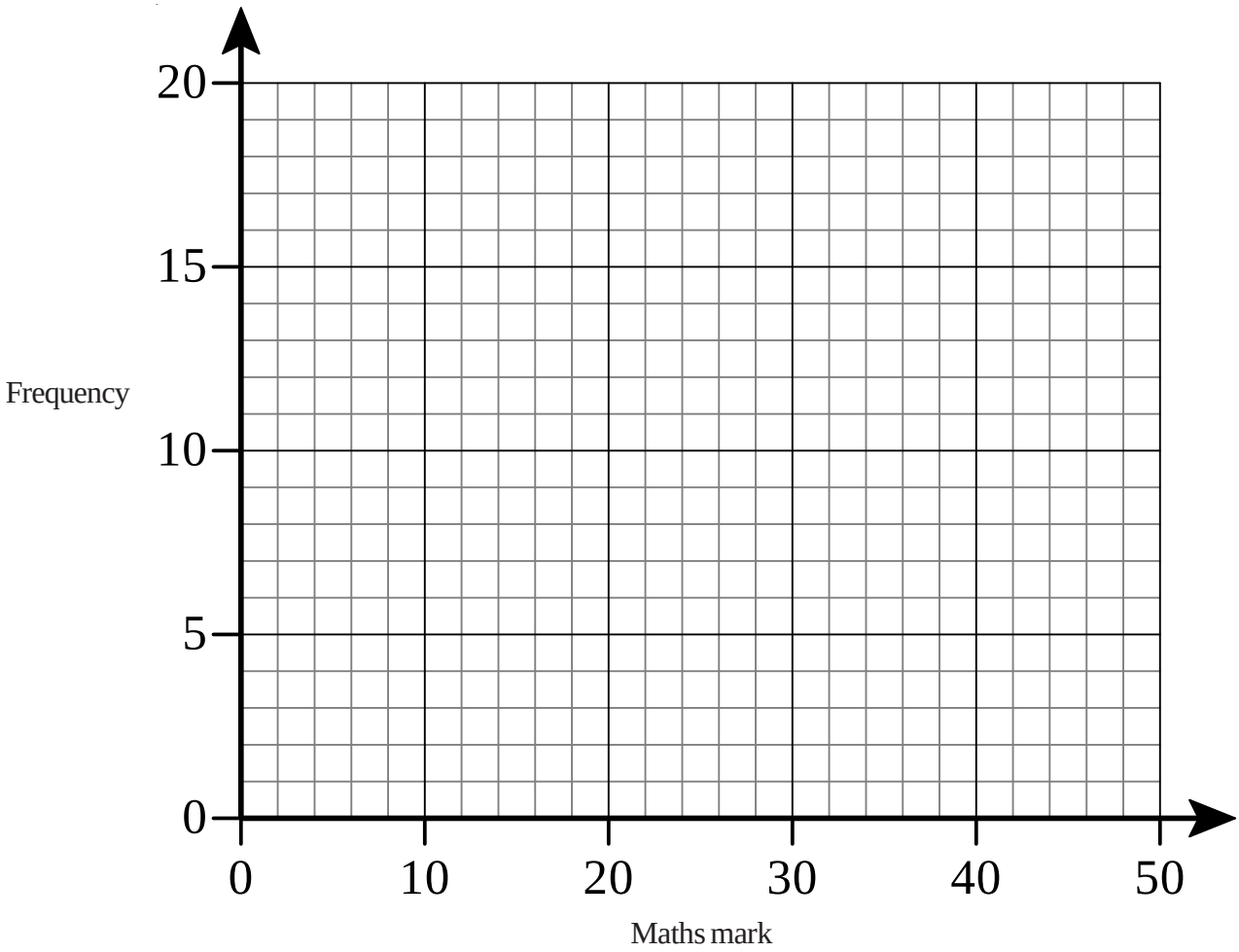
Frequency Diagrams

1) 60 students take a Maths test.
The test is marked out of 50.

This table shows information about students' marks.

Maths mark	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Frequency	3	13	18	19	7

On the grid, draw a frequency polygon to show this information.



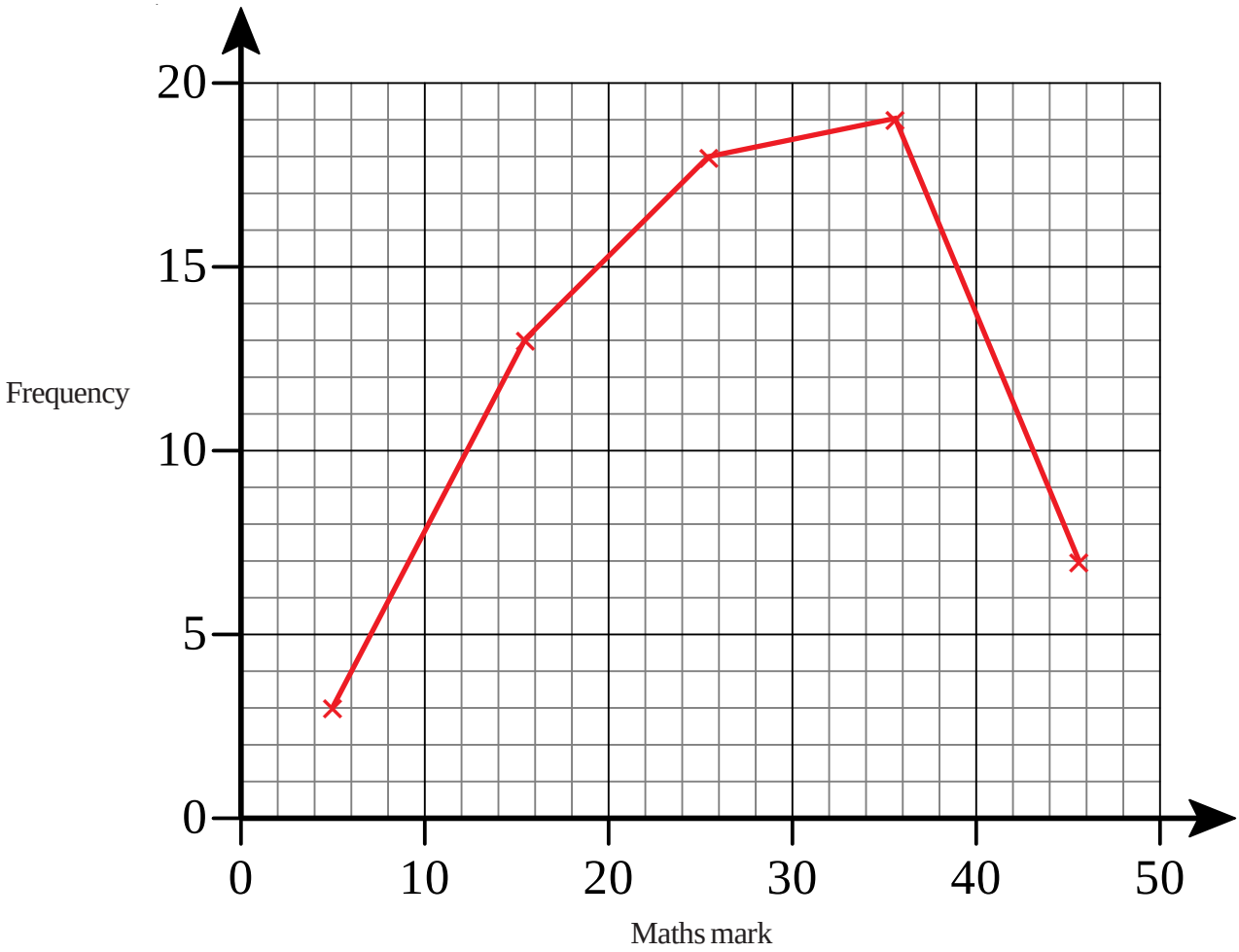
Frequency Diagrams

1) 60 students take a Maths test.
The test is marked out of 50.

This table shows information about students' marks.

	5	15.5	25.5	35.5	45.5
Maths mark	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Frequency	3	13	18	19	7

On the grid, draw a frequency polygon to show this information.

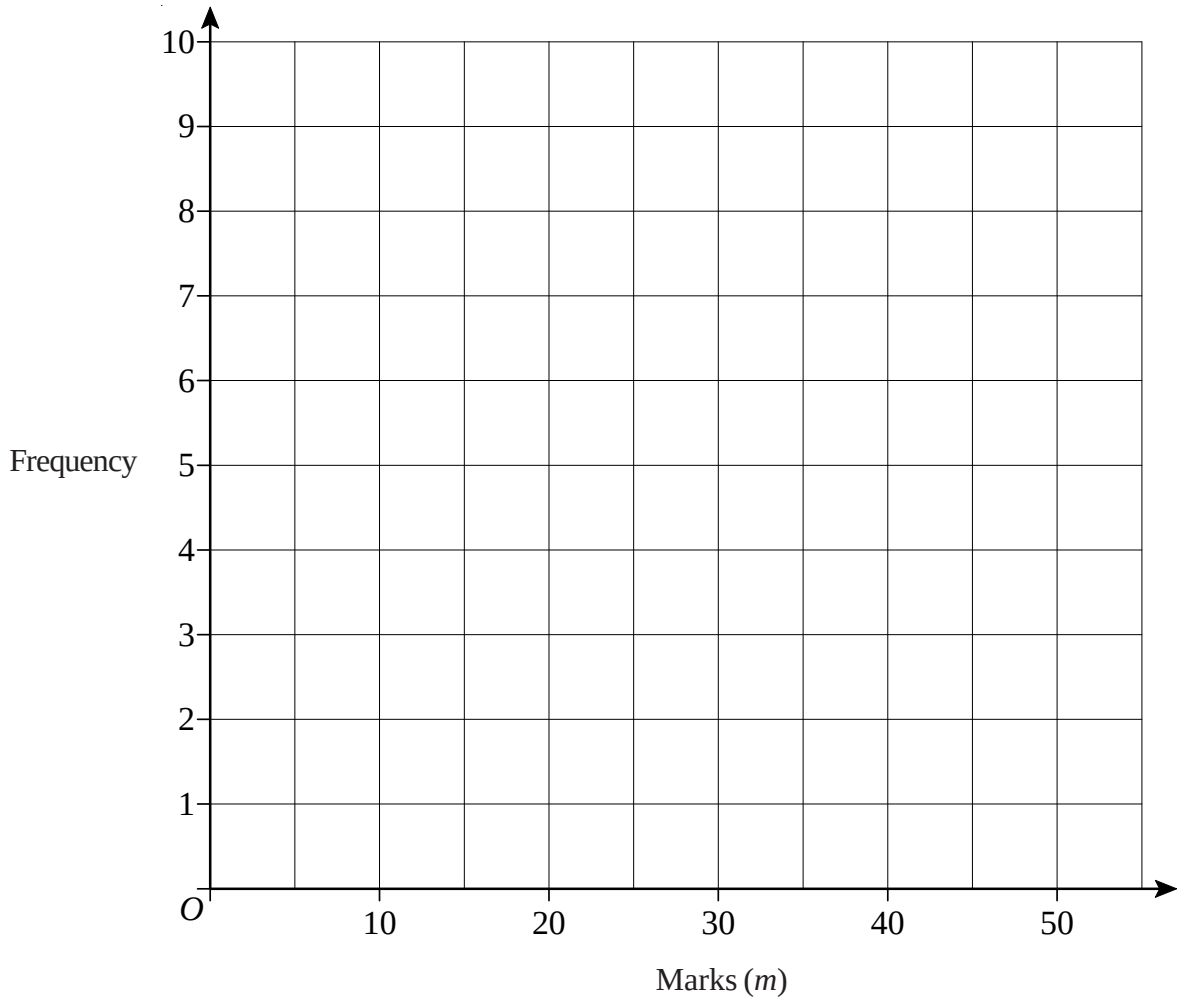


Frequency Diagrams

1) 30 students took a test.
The table shows information about how many marks they gained in the test.

Marks (*m*)	**Frequency**
$0 < m \leqslant 10$	4
$10 < m \leqslant 20$	8
$20 < m \leqslant 30$	9
$30 < m \leqslant 40$	6
$40 < m \leqslant 50$	3

On the grid, draw a frequency polygon for this information.

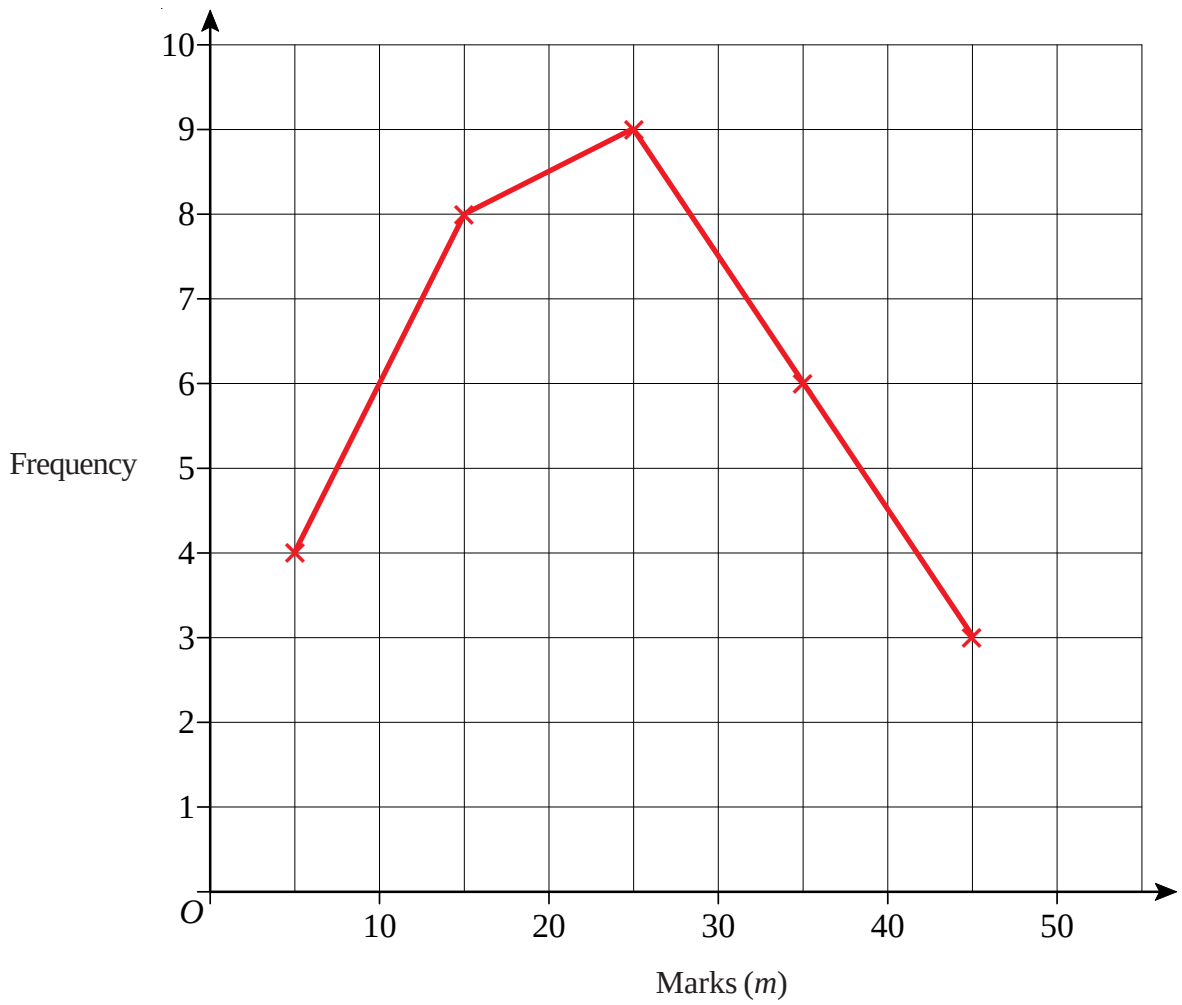


Frequency Diagrams

1) 30 students took a test.
The table shows information about how many marks they gained in the test.

Marks (m)		Frequency
$0 < m \leqslant 10$	5	4
$10 < m \leqslant 20$	15	8
$20 < m \leqslant 30$	25	9
$30 < m \leqslant 40$	35	6
$40 < m \leqslant 50$	45	3

On the grid, draw a frequency polygon for this information.



Frequency Diagrams

1) The table shows some information about the ages, in years, of 60 people.

Age (in years)	Frequency
0 to 9	5
10 to 19	14
20 to 29	12
30 to 39	9
40 to 49	7
50 to 59	3
60 to 69	10

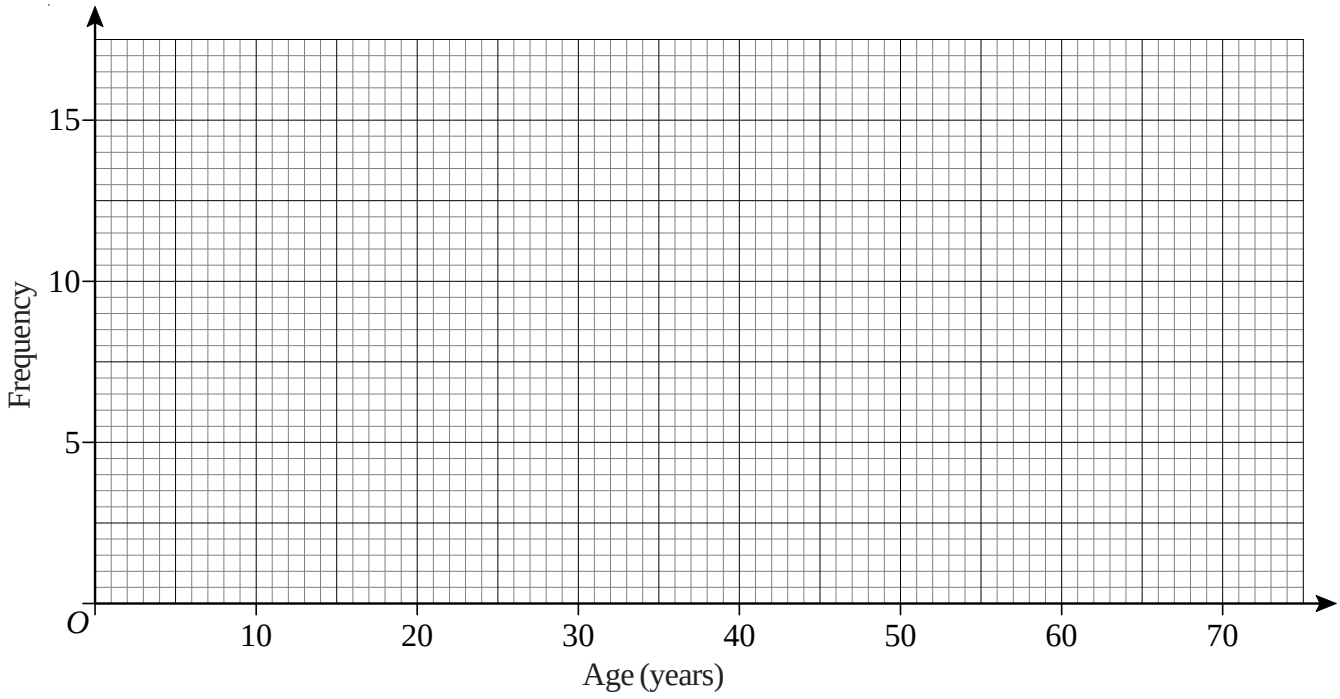
a) Write down the modal class.

Colin says

'The median lies in the class 30 to 39'

Colin is wrong.

b) Explain why.



c) On the grid, draw a frequency polygon for the information in the table.

Frequency Diagrams

1) The table shows some information about the ages, in years, of 60 people.

Age (in years)		Frequency
0 to 9	4.5	5
10 to 19	14.5	14
20 to 29	24.5	12
30 to 39	34.5	9
40 to 49	44.5	7
50 to 59	54.5	3
60 to 69	64.5	10

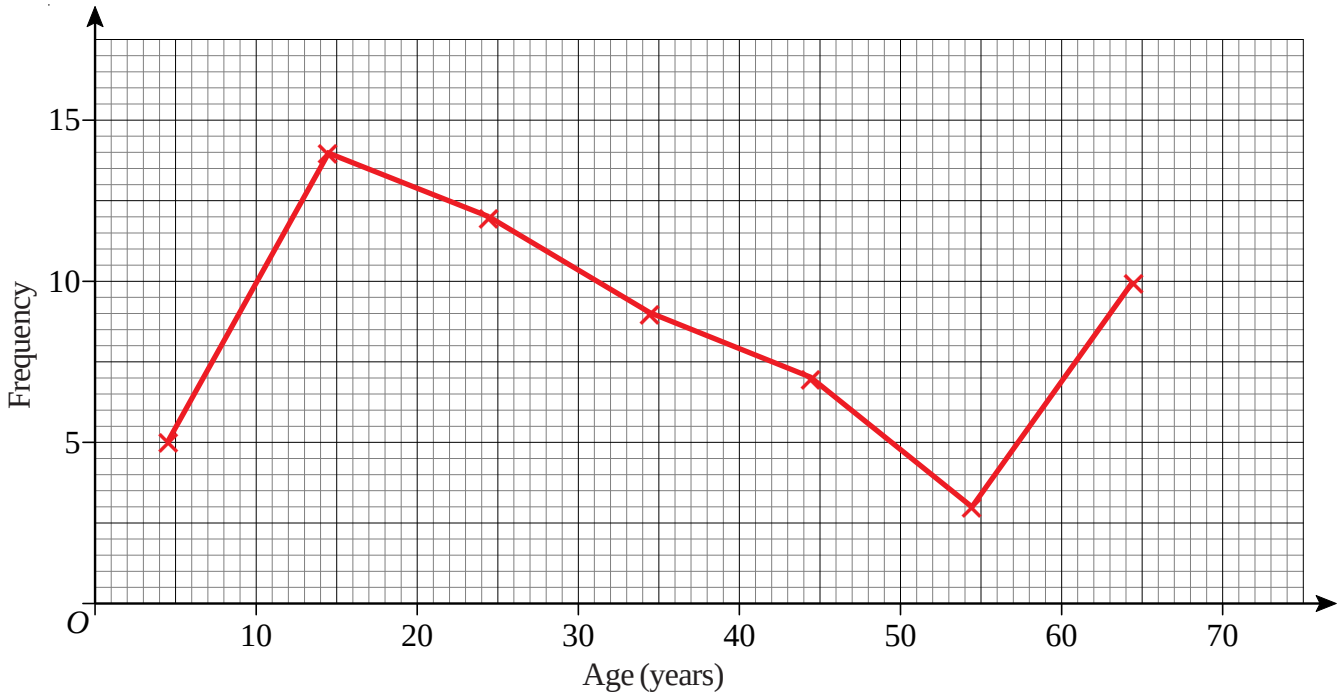
a) Write down the modal class. 10 to 19

Colin says

'The median lies in the class 30 to 39'

Colin is wrong.

b) Explain why. The median lies in the 20 to 29 class.



c) On the grid, draw a frequency polygon for the information in the table.

Stem and Leaf Diagrams

1) 16 students sat a Maths test.
Here are their marks:

64	72	39	45	49	67	73	50
73	44	55	77	51	62	64	79

Draw a stem and leaf diagram to show this information.

2) Pat is carrying out a survey on how tall pupils in her class are.
Here are their heights in cm:

173	162	170	169	163	173	156
159	161	168	177	182	170	169

Draw a stem and leaf diagram to show this information.

3) The stem and leaf diagram, below, shows information about the times, in minutes, it takes a group of people to eat their breakfast.

0	5	7	9		
1	0	0	5	8	8
2	0	2	3	5	7
3	2	5			

Key: 1|0 represents 10 minutes.

a) How many people are in the group?

b) How many people spend 15 minutes or more eating their breakfast?

c) Find the median time that it took to eat breakfast.

Stem and Leaf Diagrams

1) 16 students sat a Maths test.
Here are their marks:

64	72	39	45	49	67	73	50
73	44	55	77	51	62	64	79

39, 44, 45, 49, 50, 51, 55, 62, 64, 64, 67, 72, 73, 73, 77, 79

Draw a stem and leaf diagram to show this information.

3	9
4	4 5 9
5	0 1 5
6	2 4 4 7
7	2 3 3 7 9

Key: 3|9 means 39 marks

2) Pat is carrying out a survey on how tall pupils in her class are.
Here are their heights in cm:

173	162	170	169	163	173	156
159	161	168	177	182	170	169

156, 159, 161, 162, 163, 168, 169, 169, 170, 170, 173, 173, 177, 182

Draw a stem and leaf diagram to show this information.

15	6 9
16	1 2 3 8 9 9
17	0 0 3 3 7
18	2

Key: 15|6 means 156 cm

3) The stem and leaf diagram, below, shows information about the times, in minutes, it takes a group of people to eat their breakfast.

0	5 7 9
1	0 0 5 8 8
2	0 2 3 5 7
3	2 5

Key: 1|0 represents 10 minutes.

a) How many people are in the group? 15 people

b) How many people spend 15 minutes or more eating their breakfast? 10 people

c) Find the median time that it took to eat breakfast. 18 minutes

Stem and Leaf Diagrams

1) Here are the ages, in years, of 15 office workers.

34	54	42	27	36
23	31	41	50	35
44	29	45	45	53

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

Key:

2) Tony collected some information about the heights of 21 plants.
This information is shown in the stem and leaf diagram.

1	1	1	3	5			
2	3	4	5	9	9		
3	0	2	3	3	5	7	8
4	1	2	4	8	9		

Key 3|6 means 36 mm

Find the median.

3) Here are the ages, in years, of 16 people.

36	47	18	22	36	28	45	30
38	27	41	16	36	48	28	21

a) Draw an ordered stem and leaf diagram to show this information.
You must include a key.

Key:

b) Find the median age.

Stem and Leaf Diagrams

1) Here are the ages, in years, of 15 office workers.

34	54	42	27	36
23	31	41	50	35
44	29	45	45	53

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

2	3	7	9		
3	1	4	5	6	
4	1	2	4	5	5
5	0	3	4		

Key: 2|3 means 23 years old

2) Tony collected some information about the heights of 21 plants.
This information is shown in the stem and leaf diagram.

1	1	1	3	5			
2	3	4	5	9	9		
3	0	2	3	3	5	7	8
4	1	2	4	8	9		

Key 3|6 means 36 mm

Find the median. 32 mm

3) Here are the ages, in years, of 16 people.

36	47	18	22	36	28	45	30
38	27	41	16	36	48	28	21

a) Draw an ordered stem and leaf diagram to show this information.
You must include a key.

1	6	8			
2	1	2	7	8	8
3	0	6	6	6	8
4	1	5	7	8	

Key: 1|6 means 16 yrs old

b) Find the median age. 33 years old

Stem and Leaf Diagrams

1) Here are the weights in grams, to the nearest gram, of 15 eggs.

34	45	42	54	50
37	61	44	56	52
63	57	51	37	64

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

Key:

2) Here are the weights, in grams, of 16 eggs.

46	44	50	52	45	60	54	61
59	55	56	47	53	61	57	58

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

Key:

3) Sue plays golf.
Here are 15 of her scores.

68	75	81	85	79
81	90	76	92	83
72	82	81	77	72

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

Key:

Stem and Leaf Diagrams

1) Here are the weights in grams, to the nearest gram, of 15 eggs.

34	45	42	54	50
37	61	44	56	52
63	57	51	37	64

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

3	4	7	7			
4	2	4	5			
5	0	1	2	4	6	7
6	1	3	4			

Key: 3|4 means 34 g

2) Here are the weights, in grams, of 16 eggs.

46	44	50	52	45	60	54	61
59	55	56	47	53	61	57	58

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

4	4	5	6	7				
5	0	2	3	4	5	6	7	8	9
6	0	1	1					

Key: 4|4 means 44 g

3) Sue plays golf.
Here are 15 of her scores.

68	75	81	85	79
81	90	76	92	83
72	82	81	77	72

6	8					
7	2	2	5	6	7	9
8	1	1	1	2	3	5
9	0	2				

Draw an ordered stem and leaf diagram to show this information.
You must include a key.

Key: 6|8 means a score of 68

Simple Probability

1) A blue dice and a red dice are rolled.

a) How many different outcomes are possible?

b) List the possible outcomes.

2) Three coins are flipped.

One possible outcome is H, H, H

List all the outcomes.

3) If five coins are flipped, how many possible outcomes are there?

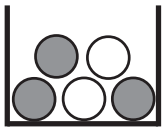
4) A dice is rolled and a coin is flipped.

List all the possible outcomes.

5) A box contains 3 grey counters and 2 white counters.

A counter is taken from the box at random.

What is the probability of choosing a white counter?



6) There are 3 blue counters, 5 red counters and 7 green counters in a bag.

A counter is taken from the bag at random.

a) What is the probability that a green counter will be chosen?

b) What is the probability that a blue or red counter will be chosen?

7) In a class there are 10 boys and 15 girls.

A teacher chooses a student at random from the class.

Eric says that the probability a boy will be chosen is 0.5 because a student can be either a boy or a girl.

Jenny says that Eric is wrong.

Decide who is correct - Eric or Jenny - giving reasons for your answer.

8) Spinner A has numbers 1 to 4 on it.

Spinner B has numbers 1 to 3 on it.

Both spinners are spun and the numbers on each are added together to give a score.

What is the probability that the score will be

a) 7?

b) 3 or 4?

Simple Probability

1) A blue dice and a red dice are rolled.

a) How many different outcomes are possible? 36

b) List the possible outcomes.

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

2) Three coins are flipped.

One possible outcome is H, H, H

List all the outcomes. HHH, HHT, HTH, THH
TTH, THT, HTT, TTT

3) If five coins are flipped, how many possible outcomes are there? 32

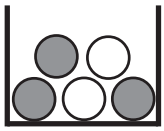
4) A dice is rolled and a coin is flipped.

List all the possible outcomes. 1H, 2H, 3H, 4H, 5H, 6H
1T, 2T, 3T, 4T, 5T, 6T

5) A box contains 3 grey counters and 2 white counters.

A counter is taken from the box at random.

What is the probability of choosing a white counter? $\frac{2}{5}$



6) There are 3 blue counters, 5 red counters and 7 green counters in a bag.

A counter is taken from the bag at random.

a) What is the probability that a green counter will be chosen? $\frac{7}{15}$

b) What is the probability that a blue or red counter will be chosen? $\frac{8}{15}$

7) In a class there are 10 boys and 15 girls.

A teacher chooses a student at random from the class.

Eric says that the probability a boy will be chosen is 0.5 because a student can be either a boy or a girl.

Jenny says that Eric is wrong.

Decide who is correct - Eric or Jenny - giving reasons for your answer.

Jenny is correct.
The probability of choosing a boy is $\frac{10}{25}$

8) Spinner A has numbers 1 to 4 on it.

Spinner B has numbers 1 to 3 on it.

Both spinners are spun and the numbers on each are added together to give a score.

What is the probability that the score will be

a) 7? $\frac{1}{12}$

b) 3 or 4? $\frac{5}{12}$

1,1	1,2	1,3
2,1	2,2	2,3
3,1	3,2	3,3
4,1	4,2	4,3

Mutually Exclusive Events

1) If the probability of passing a driving test is 0.54,
what is the probability of failing it?

2) The probability that a football team will win their next game is $\frac{2}{11}$.
The probability they will lose is $\frac{3}{11}$.
What is the probability the game will be a draw?

3) On the school dinner menu there is only ever one of four options.
Some of the options are more likely to be on the menu than others.
The table shows the options available on any day, together with three of the probabilities.

Food	Curry	Sausages	Fish	Casserole
Probability	0.36	0.41		0.09

a) Work out the probability of the dinner option being Fish.

b) Which option is most likely?

c) Work out the probability that it is a Curry or Sausages on any particular day.

d) Work out the probability that it is **not** Casserole.

4) Julie buys a book every week.
Her favourite types are Novel, Drama, Biography and Romance.
The table shows the probability that Julie chooses a particular type of book.

Type of book	Novel	Drama	Biography	Romance
Probability	0.24	0.16	x	x

a) Work out the probability that she will choose a Novel or a Drama.

b) Work out the probability that she will choose a Biography or a Romance.

The probability that she will choose a Biography is the same as the probability
she will choose a Romance.

c) Work out the probability that she will choose a Biography.

Mutually Exclusive Events

1) If the probability of passing a driving test is 0.54,
what is the probability of failing it? 0.46

2) The probability that a football team will win their next game is $\frac{2}{11}$.
The probability they will lose is $\frac{3}{11}$.
What is the probability the game will be a draw? $\frac{6}{11}$

3) On the school dinner menu there is only ever one of four options.
Some of the options are more likely to be on the menu than others.
The table shows the options available on any day, together with three of the probabilities.

Food	Curry	Sausages	Fish	Casserole
Probability	0.36	0.41	0.14	0.09

a) Work out the probability of the dinner option being Fish. 0.14

b) Which option is most likely? Sausages

c) Work out the probability that it is a Curry or Sausages on any particular day. 0.77

d) Work out the probability that it is **not** Casserole. 0.91

4) Julie buys a book every week.
Her favourite types are Novel, Drama, Biography and Romance.
The table shows the probability that Julie chooses a particular type of book.

Type of book	Novel	Drama	Biography	Romance
Probability	0.24	0.16	x	x

a) Work out the probability that she will choose a Novel or a Drama. 0.4

b) Work out the probability that she will choose a Biography or a Romance. 0.6

The probability that she will choose a Biography is the same as the probability she will choose a Romance.

c) Work out the probability that she will choose a Biography. 0.3

Overview of Percentages

1) Find the following to the nearest penny:

a) 23% of £670
b) 12% of £580
c) 48% of £64
d) 13% of £7.50
e) 87% of £44
f) 15.7% of £7000
g) 23.8% of £980
h) 34% of £16.34
i) 48.6% of £971.26
j) 78.24% of £12.82
k) 42.15% of £7876.42
l) 0.57% of £60000

2) Find the following:

a) 10% of £700
b) 10% of £400
c) 10% of £350
d) 10% of £530
e) 10% of £68
f) 10% of £46
g) 10% of £6.50
h) 10% of £12.20
i) 20% of £600
j) 30% of £900
k) 60% of £800
l) 20% of £650
m) 40% of £320
n) 15% of £300
o) 15% of £360
p) 65% of £12000
q) 45% of £64
r) 85% of £96
s) 17.5% of £800
t) 17.5% of £40
u) 17.5% of £8.80

3) Change the following to percentages, giving all answers to 1 decimal place:

a) 6 out of 28
b) 18 out of 37
c) 42 out of 83
d) 24 out of 96
e) 73 out of 403
f) 234 out of 659
g) 871 out of 903
h) 4.7 out of 23
i) 6.9 out of 79
j) 14.8 out of 23.6
k) 65.8 out of 203.7

4) Change the following to percentages:

a) 46 out of 100
b) 18 out of 50
c) 7 out of 25
d) 23 out of 25
e) 9 out of 20
f) 16 out of 20
g) 7 out of 10
h) 9.5 out of 10
i) 10 out of 40
j) 16 out of 40
k) 30 out of 40
l) 12 out of 40
m) 28 out of 80
n) 32 out of 80
o) 60 out of 80
p) 3 out of 5
q) 4 out of 5
r) 15 out of 75
s) 24 out of 75
t) 30 out of 75

5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence.

6) A television costs £596 plus VAT at 17.5%.

Work out the cost of the television including VAT.

7) Peter has 128 trees in his garden.

16 of the trees are pear trees.

What percentage of the trees in his garden are pear trees?

8) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test.

What were her percentages in both subjects to 1 decimal place?

9) In class 9A there are 7 girls and 18 boys.

What percentage of the class are girls?

10) A shop decides to reduce all the prices by 15%.

The original price of a pair of trainers was £70. How much are they after the reduction?

11) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000.

How much does it cost with the VAT?

Overview of Percentages

1) Find the following to the nearest penny:

a) 23% of £670 £154.10
b) 12% of £580 £69.60
c) 48% of £64 £30.72
d) 13% of £7.50 £0.98
e) 87% of £44 £38.28
f) 15.7% of £7000 £1099
g) 23.8% of £980 £233.24
h) 34% of £16.34 £5.56
i) 48.6% of £971.26 £472.03
j) 78.24% of £12.82 £10.03
k) 42.15% of £7876.42 £3319.91
l) 0.57% of £60000 £342

2) Find the following:

a) 10% of £700 £70
b) 10% of £400 £40
c) 10% of £350 £35
d) 10% of £530 £53
e) 10% of £68 £6.80
f) 10% of £46 £4.60
g) 10% of £6.50 £0.65
h) 10% of £12.20 £1.22
i) 20% of £600 £120
j) 30% of £900 £270
k) 60% of £800 £480
l) 20% of £650 £130
m) 40% of £320 £128
n) 15% of £300 £45
o) 15% of £360 £54
p) 65% of £12000 £7800
q) 45% of £64 £28.80
r) 85% of £96 £81.60
s) 17.5% of £800 £140
t) 17.5% of £40 £7
u) 17.5% of £8.80 £1.54

3) Change the following to percentages, giving all answers to 1 decimal place:

a) 6 out of 28 21.4%
b) 18 out of 37 48.6%
c) 42 out of 83 50.6%
d) 24 out of 96 25%
e) 73 out of 403 18.1%
f) 234 out of 659 35.5%
g) 871 out of 903 96.5%
h) 4.7 out of 23 20.4%
i) 6.9 out of 79 8.7%
j) 14.8 out of 23.6 62.7%
k) 65.8 out of 203.7 32.3%

4) Change the following to percentages:

a) 46 out of 100 46%
b) 18 out of 50 36%
c) 7 out of 25 28%
d) 23 out of 25 92%
e) 9 out of 20 45%
f) 16 out of 20 80%
g) 7 out of 10 70%
h) 9.5 out of 10 95%
i) 10 out of 40 25%
j) 16 out of 40 40%
k) 30 out of 40 75%
l) 12 out of 40 30%
m) 28 out of 80 35%
n) 32 out of 80 40%
o) 60 out of 80 75%
p) 3 out of 5 60%
q) 4 out of 5 80%
r) 15 out of 75 20%
s) 24 out of 75 32%
t) 30 out of 75 40%

5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence. 56p

6) A television costs £596 plus VAT at 17.5%.

Work out the cost of the television including VAT. £700.30

7) Peter has 128 trees in his garden.

16 of the trees are pear trees.

What percentage of the trees in his garden are pear trees? 12.5%

8) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test.

What were her percentages in both subjects to 1 decimal place? Maths 64.3%
Sci 63.9%

9) In class 9A there are 7 girls and 18 boys.

What percentage of the class are girls?
28%

10) A shop decides to reduce all the prices by 15%.

The original price of a pair of trainers was £70. How much are they after the reduction? £59.50

11) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000.

How much does it cost with the VAT?
£21150

Overview of Percentages

1) The normal price of a dog basket is £20.
In a sale the price of the dog basket is reduced by 15%.
Work out the sale price of the dog basket.

2) Tony bought a car.
The total cost of the car was £6000 plus VAT at 17½%.
Tony paid £3000 when he got the car.
He paid the rest of the total cost of the car in 10 equal monthly payments.
Work out the cost of each monthly payment.

3) Jill bought a car.
The total cost of the car was £8000 plus VAT at 17½%.
Jill paid £3400 when she got the car.
She paid the rest of the total cost of the car in 12 equal monthly payments.
Work out the cost of each monthly payment.

4) The cost of a radio is the list price plus VAT at 17.5%.
The list price of the radio is £320.
Work out the cost of the radio.

5) A computer costs £460 plus 17.5% VAT.
Calculate the total cost of the computer.

6) Work out £168 as a percentage of £700.

7) A car tyre costs £90 plus VAT at 17.5%.
Work out the total cost of the tyre.

8) Kate got 9 out of 40 in a test.
Write 9 out of 40 as a percentage.

Overview of Percentages

1) The normal price of a dog basket is £20.
In a sale the price of the dog basket is reduced by 15%.
Work out the sale price of the dog basket. £17

2) Tony bought a car.
The total cost of the car was £6000 plus VAT at 17½%.
Tony paid £3000 when he got the car.
He paid the rest of the total cost of the car in 10 equal monthly payments.
Work out the cost of each monthly payment. £405

3) Jill bought a car.
The total cost of the car was £8000 plus VAT at 17½%.
Jill paid £3400 when she got the car.
She paid the rest of the total cost of the car in 12 equal monthly payments.
Work out the cost of each monthly payment. £500

4) The cost of a radio is the list price plus VAT at 17.5%.
The list price of the radio is £320.
Work out the cost of the radio. £376

5) A computer costs £460 plus 17.5% VAT.
Calculate the total cost of the computer. £540.50

6) Work out £168 as a percentage of £700. 24%

7) A car tyre costs £90 plus VAT at 17.5%.
Work out the total cost of the tyre. £105.75

8) Kate got 9 out of 40 in a test.
Write 9 out of 40 as a percentage. 22.5%

Increase/Decrease by a Percentage

1) Increase:
a) 500 by 10%
b) 320 by 10%
c) 80 by 15%
d) 75 by 20%

2) Decrease:
a) 400 by 10%
b) 380 by 10%
c) 140 by 15%
d) 35 by 20%

3) The price of a laptop is increased by 15%.
The old price of the laptop was £300.
Work out the new price.

4) The price of a £6800 car is reduced by 10%.
What is the new price?

5) Increase:
a) 65 by 12%
b) 120 by 23%
c) 600 by 17.5%
d) 370 by 17.5%

6) Decrease:
a) 42 by 15%
b) 79 by 12%
c) 52 by 8.5%
d) 8900 by 18%

7) The price of a mobile phone is £78.40 plus VAT.
VAT is charged at a rate of 17.5%.
What is the total price of the mobile phone?

8) In a sale, normal prices are reduced by 7%.
The normal price of a camera is £89.
Work out the sale price of the camera.

9) A car dealer offers a discount of 20% off the normal price of a car, for cash.
Peter intends to buy a car which usually costs £6800.
He intends to pay by cash.
Work out how much he will pay.

10) A month ago, John weighed 97.5 kg.
He now weighs 4.5% more.
Work out how much John now weighs.
Give your answer to 1 decimal place.

Increase/Decrease by a Percentage

1) Increase:

a) 500 by 10%
550
10% = 50
500 + 50

b) 320 by 10%
352
10% = 32
320 + 32

c) 80 by 15%
92
10% = 8, 5% = 4
80 + 8 + 4

d) 75 by 20%
90
10% = 7.5, 20% = 15
75 + 15

2) Decrease:

a) 400 by 10%
360
10% = 40
400 - 40

b) 380 by 10%
342
10% = 38
380 – 38

c) 140 by 15%
119
10% = 14, 5% = 7
140 – 14 – 7

d) 35 by 20%
28
10% = 3.5, 20% = 7
35 – 7

3) The price of a laptop is increased by 15%.
The old price of the laptop was £300.
Work out the new price. £345

10% = 30, 5% = 15
300 + 30 + 15 = 345

4) The price of a £6800 car is reduced by 10%.
What is the new price? £6 120

10% = 680
6800 – 680 = 6120

5) Increase:

a) 65 by 12% 72.8 $\frac{112}{100} \times 65$

b) 120 by 23% 147.6 $\frac{123}{100} \times 120$

c) 600 by 17.5% 705 $\frac{117.5}{100} \times 600$

d) 370 by 17.5% 434.75 $\frac{117.5}{100} \times 370$

6) Decrease:

a) 42 by 15% 35.7 $\frac{85}{100} \times 42$

b) 79 by 12% 69.52 $\frac{88}{100} \times 79$

c) 52 by 8.5% 47.58 $\frac{91.5}{100} \times 52$

d) 8900 by 18% 7 298 $\frac{82}{100} \times 8900$

7) The price of a mobile phone is £78.40 plus VAT.
VAT is charged at a rate of 17.5%.
What is the total price of the mobile phone? £92.12 $\frac{117.5}{100} \times 78.40$

8) In a sale, normal prices are reduced by 7%.
The normal price of a camera is £89.
Work out the sale price of the camera. £82.77 $\frac{93}{100} \times 89$

9) A car dealer offers a discount of 20% off the normal price of a car, for cash.
Peter intends to buy a car which usually costs £6800.
He intends to pay by cash.
Work out how much he will pay. £5 440 $\frac{80}{100} \times 6800$

10) A month ago, John weighed 97.5 kg.
He now weighs 4.5% more.
Work out how much John now weighs. 101.9 kg $\frac{104.5}{100} \times 97.5$
Give your answer to 1 decimal place.

Ratio

1) Tom and Julie share £48 in the ratio 5 : 3
Work out how much more money Tom gets than Julie gets.

2) Ben and Sue share £60 in the ratio 2 : 3
Work out how much each person gets.

3) A box contains milk chocolates and plain chocolates only.
The number of milk chocolates to the number of plain chocolates is in the ratio 2 : 1
There are 24 milk chocolates.
Work out the total number of chocolates.

4) Andy, Ben and Claire share £54
Ben gets three times as much money as Andy.
Claire gets twice as much money as Ben.

How much money does Claire get?

5) There are some marbles in a bag.
18 of the marbles are blue.
12 of the marbles are red.
a) Write down the ratio of the number of blue marbles to the number of red marbles.
Give your ratio in its simplest form.

There are some apples and pears in a box.
The total number of apples and pears is 54.
The ratio of the number of apples to the number of pears is 1 : 5
b) Work out the number of pears in the box.

6) A piece of string is 180 cm long.
Jim cuts it into three pieces in the ratio 2 : 3 : 4
Work out the length of the longest piece.

7) Sally is 13 years old.
Tammy is 12 years old.
Danny is 10 years old.

Sally, Tammy and Danny share £28 in the ratio of their ages.
Tammy gives a third of her share to her mother.
How much should Tammy now have?

Ratio

1) Tom and Julie share £48 in the ratio 5 : 3
Work out how much more money Tom gets than Julie gets. £12

2) Ben and Sue share £60 in the ratio 2 : 3
Work out how much each person gets. Ben gets £24 and Sue gets £36

3) A box contains milk chocolates and plain chocolates only.
The number of milk chocolates to the number of plain chocolates is in the ratio 2 : 1
There are 24 milk chocolates.
Work out the total number of chocolates. 36 chocolates altogether

4) Andy, Ben and Claire share £54
Ben gets three times as much money as Andy.
Claire gets twice as much money as Ben.

How much money does Claire get? £32.40

5) There are some marbles in a bag.
18 of the marbles are blue.
12 of the marbles are red.
a) Write down the ratio of the number of blue marbles to the number of red marbles.
Give your ratio in its simplest form. 3 : 2

There are some apples and pears in a box.
The total number of apples and pears is 54.
The ratio of the number of apples to the number of pears is 1 : 5
b) Work out the number of pears in the box. 45 pears

6) A piece of string is 180 cm long.
Jim cuts it into three pieces in the ratio 2 : 3 : 4
Work out the length of the longest piece. 80 cm

7) Sally is 13 years old.
Tammy is 12 years old.
Danny is 10 years old.

Sally, Tammy and Danny share £28 in the ratio of their ages.
Tammy gives a third of her share to her mother.
How much should Tammy now have? £6.40

35 shares

Sa	Ta	Da
13	12	10

£28 ÷ 35 = £0.80

Tammy: 12 × £0.80 = £9.60

Product of Prime Factors

1) List the first seven prime numbers.

2) Express the following numbers as the product of their prime factors:

a) 12

b) 20

c) 30

d) 24

3) Express the following numbers as the product of their prime factors:

a) 64

b) 100

c) 150

4) Express the following numbers as the product of their prime factors:

a) 175

b) 192

c) 315

5) The number 96 can be written as $2^m \times n$, where m and n are prime numbers.
Find the value of m and the value of n.

6) The number 75 can be written as $5^x \times y$, where x and y are prime numbers.
Find the value of x and the value of y.

Product of Prime Factors

1) List the first seven prime numbers. 2, 3, 5, 7, 11, 13, 17

2) Express the following numbers as the product of their prime factors:

a) 12 $2 \times 2 \times 3$

b) 20 $2 \times 2 \times 5$

c) 30 $2 \times 3 \times 5$

d) 24 $2 \times 2 \times 2 \times 3$

3) Express the following numbers as the product of their prime factors:

a) 64 $2 \times 2 \times 2 \times 2 \times 2 \times 2$

b) 100 $2 \times 2 \times 5 \times 5$

c) 150 $2 \times 3 \times 5 \times 5$

4) Express the following numbers as the product of their prime factors:

a) 175 $5 \times 5 \times 7$

b) 192 $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$

c) 315 $3 \times 3 \times 5 \times 7$

5) The number 96 can be written as $2^m \times n$, where m and n are prime numbers.

Find the value of m and the value of n. $m = 5$ and $n = 3$

$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$

$96 = 2^5 \times 3$

6) The number 75 can be written as $5^x \times y$, where x and y are prime numbers.

Find the value of x and the value of y. $x = 2$ and $y = 3$

$75 = 3 \times 5 \times 5$

$75 = 3 \times 5^2$

HCF and LCM

1) Find the Highest Common Factor of 16 and 24.

2) Find the Highest Common Factor of 21 and 28.

3) Find the Highest Common Factor of 60 and 150.

4) Find the Highest Common Factor of 96 and 108.

5) Find the Lowest Common Multiple of 20 and 60.

6) Find the Lowest Common Multiple of 28 and 72.

7) Find the Lowest Common Multiple of 70 and 240.

8) Find the Lowest Common Multiple of 35 and 55.

9) (i) Write 42 and 63 as products of their prime factors.

(ii) Work out the Highest Common Factor of 42 and 63.

(iii) Work out the Lowest Common Multiple of 42 and 63.

HCF and LCM

1) Find the Highest Common Factor of 16 and 24. 8

2) Find the Highest Common Factor of 21 and 28. 7

3) Find the Highest Common Factor of 60 and 150. 30

4) Find the Highest Common Factor of 96 and 108. 12

5) Find the Lowest Common Multiple of 20 and 60. 60

6) Find the Lowest Common Multiple of 28 and 72. 504

7) Find the Lowest Common Multiple of 70 and 240. 1680

8) Find the Lowest Common Multiple of 35 and 55. 385

9) (i) Write 42 and 63 as products of their prime factors. $42 = 2 \times 3 \times 7$ $63 = 3 \times 3 \times 7$

(ii) Work out the Highest Common Factor of 42 and 63. 21

(iii) Work out the Lowest Common Multiple of 42 and 63. 126

Product of Prime Factors, HCF & LCM

1) a) Express 84 as a product of its prime factors.

   b) Find the Highest Common Factor (HCF) of 84 and 35.

2) Express 72 as the product of its prime factors.

3) Express 180 as the product of its prime factors.

4) a) Express 66 as a product of its prime factors.

   b) Express 132^2 as a product of its prime factors.

5) Express 252 as a product of its prime factors.

6) Find the Lowest Common Multiple (LCM) of 24 and 36.

7) a) Write 56 as a product of its prime factors.

   b) Find the Highest Common Factor (HCF) of 56 and 42.

8) a) Express 45 as a product of its prime factors.

   b) Find the Highest Common Factor (HCF) of 45 and 30.

9) a) Find the Highest Common Factor (HCF) of 24 and 30.

   b) Find the Lowest Common Multiple (LCM) of 4, 5 and 6.

Product of Prime Factors, HCF & LCM

1) a) Express 84 as a product of its prime factors. $2 \times 2 \times 3 \times 7$

b) Find the Highest Common Factor (HCF) of 84 and 35. 7

2) Express 72 as the product of its prime factors. $2 \times 2 \times 2 \times 3 \times 3$

3) Express 180 as the product of its prime factors. $2 \times 2 \times 3 \times 3 \times 5$

4) a) Express 66 as a product of its prime factors. $2 \times 3 \times 11$

b) Express 132^2 as a product of its prime factors.
$2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 11 \times 11$

5) Express 252 as a product of its prime factors. $2 \times 2 \times 3 \times 3 \times 7$

6) Find the Lowest Common Multiple (LCM) of 24 and 36. 72

7) a) Write 56 as a product of its prime factors. $2 \times 2 \times 2 \times 7$

b) Find the Highest Common Factor (HCF) of 56 and 42. 14

8) a) Express 45 as a product of its prime factors. $3 \times 3 \times 5$

b) Find the Highest Common Factor (HCF) of 45 and 30. 15

9) a) Find the Highest Common Factor (HCF) of 24 and 30. 6

b) Find the Lowest Common Multiple (LCM) of 4, 5 and 6. 60

Using Place Value

1) Using the information that

$$4.7 \times 34 = 159.8$$

write down the value of

a) 47×34

b) 4.7×3.4

c) $159.8 \div 47$

2) Using the information that

$$324 \times 48 = 15552$$

write down the value of

a) 3.24×4.8

b) 0.324×0.48

c) $15552 \div 4.8$

3) Using the information that

$$73 \times 234 = 17082$$

write down the value of

a) 730×234

b) 73×2.34

4) Using the information that

$$27 \times 5.6 = 151.2$$

write down the value of

a) 27×56

b) 2.7×0.56

c) $151.2 \div 56$

5) Using the information that

$$719 \times 35 = 25165$$

write down the value of

a) 71.9×3.5

b) 0.719×0.35

c) $25165 \div 7.19$

Using Place Value

1) Using the information that

$4.7 \times 34 = 159.8$

write down the value of

a) 47×34 1598

b) 4.7×3.4 15.98

c) $159.8 \div 47$ 3.4

2) Using the information that

$324 \times 48 = 15552$

write down the value of

a) 3.24×4.8 15.552

b) 0.324×0.48 0.15552

c) $15552 \div 4.8$ 3240

3) Using the information that

$73 \times 234 = 17082$

write down the value of

a) 730×234 170820

b) 73×2.34 170.82

4) Using the information that

$27 \times 5.6 = 151.2$

write down the value of

a) 27×56 1512

b) 2.7×0.56 1.512

c) $151.2 \div 56$ 2.7

5) Using the information that

$719 \times 35 = 25165$

write down the value of

a) 71.9×3.5 251.65

b) 0.719×0.35 0.25165

c) $25165 \div 7.19$ 3500

Using Place Value

1) Use the information that

$$13 \times 17 = 221$$

to write down the value of

(i) 1.3×1.7

(ii) $221 \div 1.7$

2) Use the information that

$$253 \times 48 = 12144$$

to write down the value of

(i) 2.53×4.8

(ii) 2530×480

(iii) 0.253×4800

(iv) $12144 \div 25.3$

(v) $12144 \div 0.48$

3) Use the information that

$$27.3 \times 2.8 = 76.44$$

to write down the value of

(i) 273×28

(ii) 2.73×280

(iii) 0.273×28

(iv) $76.44 \div 28$

(v) $7.644 \div 2.73$

4) Use the information that

$$97.6 \times 370 = 36112$$

to write down the value of

(i) 9.76×37

(ii) 9760×3700

(iii) 0.0976×3.7

(iv) $36.112 \div 3.7$

(v) $361120 \div 9.76$

Using Place Value

1) Use the information that

$$13 \times 17 = 221$$

to write down the value of

(i) 1.3×1.7 2.21

(ii) $221 \div 1.7$ 130

2) Use the information that

$$253 \times 48 = 12144$$

to write down the value of

(i) 2.53×4.8 12.144

(ii) 2530×480 1214400

(iii) 0.253×4800 1214.4

(iv) $12144 \div 25.3$ 480

(v) $12144 \div 0.48$ 25300

3) Use the information that

$$27.3 \times 2.8 = 76.44$$

to write down the value of

(i) 273×28 7644

(ii) 2.73×280 764.4

(iii) 0.273×28 7.644

(iv) $76.44 \div 28$ 2.73

(v) $7.644 \div 2.73$ 2.8

4) Use the information that

$$97.6 \times 370 = 36112$$

to write down the value of

(i) 9.76×37 361.12

(ii) 9760×3700 36112000

(iii) 0.0976×3.7 0.36112

(iv) $36.112 \div 3.7$ 9.76

(v) $361120 \div 9.76$ 37000

Recurring Decimals into Fractions

1) Write each recurring decimal as an exact fraction, in its lowest terms.

a) $0.\dot{5}$

b) $0.\dot{7}$

c) $0.\dot{4}$

d) $0.\dot{2}\dot{4}$

e) $0.\dot{7}\dot{5}$

f) $0.\dot{8}\dot{2}$

g) $0.\dot{6}1\dot{7}$

h) $0.\dot{2}1\dot{6}$

i) $0.\dot{7}1\dot{4}$

j) $0.\dot{3}2\dot{4}$

k) $0.\dot{7}2357\dot{}$

l) $0.\dot{6}5214\dot{}$

Recurring Decimals into Fractions

1) Write each recurring decimal as an exact fraction, in its lowest terms.

a) $0.\dot{5}$ $\quad \frac{5}{9}$

b) $0.\dot{7}$ $\quad \frac{7}{9}$

c) $0.\dot{4}$ $\quad \frac{4}{9}$

d) $0.\dot{2}\dot{4}$ $\quad \frac{24}{99}$ $\quad \frac{8}{33}$

e) $0.\dot{7}\dot{5}$ $\quad \frac{75}{99}$ $\quad \frac{25}{33}$

f) $0.\dot{8}\dot{2}$ $\quad \frac{82}{99}$

g) $0.\dot{6}1\dot{7}$ $\quad \frac{617}{999}$

h) $0.\dot{2}1\dot{6}$ $\quad \frac{216}{999}$ $\quad \frac{8}{37}$

i) $0.\dot{7}1\dot{4}$ $\quad \frac{714}{999}$ $\quad \frac{238}{333}$

j) $0.\dot{3}2\dot{4}$ $\quad \frac{324}{999}$ $\quad \frac{12}{37}$

k) $0.\dot{7}2357\dot{}$ $\quad \frac{72357}{99999}$ $\quad \frac{89}{123}$

l) $0.\dot{6}5214\dot{}$ $\quad \frac{65214}{99999}$ $\quad \frac{7246}{11111}$

Four Rules of Negatives

1) Work out the following:

a) 2 – 7

b) 4 – 6

c) 1 – 8

d) 0 – 4

2) Work out the following:

a) -3 + 2

b) -7 + 5

c) -3 + 8

d) -9 + 11

3) Work out the following:

a) -1 – 3

b) -4 – 5

c) -7 – 8

d) -2 – 12

4) Work out the following:

a) 6 – -3

b) -3 – -5

c) -9 – -2

d) 1 – -13

5) Work out the following:

a) -3 × 4

b) 5 × -2

c) -4 × -5

d) -6 × -3

6) Work out the following:

a) 12 ÷ -4

b) -20 ÷ -2

c) -15 ÷ 3

d) -100 ÷ -5

Four Rules of Negatives

1) Work out the following:

a) 2 – 7 -5

b) 4 – 6 -2

c) 1 – 8 -7

d) 0 – 4 -4

2) Work out the following:

a) -3 + 2 -1

b) -7 + 5 -2

c) -3 + 8 5

d) -9 + 11 2

3) Work out the following:

a) -1 – 3 -4

b) -4 – 5 -9

c) -7 – 8 -15

d) -2 – 12 -14

4) Work out the following:

a) 6 – -3 9

b) -3 – -5 2

c) -9 – -2 -7

d) 1 – -13 14

5) Work out the following:

a) -3 × 4 -12

b) 5 × -2 -10

c) -4 × -5 20

d) -6 × -3 18

6) Work out the following:

a) 12 ÷ -4 -3

b) -20 ÷ -2 10

c) -15 ÷ 3 -5

d) -100 ÷ -5 20

Division by Decimals

1) Work out the following:

a) $1 \div 0.1$

b) $1 \div 0.2$

c) $1 \div 0.5$

2) Work out the following:

a) $2 \div 0.2$

b) $5 \div 0.1$

c) $8 \div 0.5$

3) Work out the following:

a) $6 \div 0.3$

b) $24 \div 0.8$

c) $7.2 \div 0.9$

4) Work out the following:

a) $5 \div 0.25$

b) $8 \div 0.25$

c) $20 \div 0.25$

5) Work out the following:

a) $4.08 \div 0.12$

b) $7.13 \div 0.23$

c) $44.94 \div 0.14$

6) Work out the following:

a) $61.6 \div 0.55$

b) $5.166 \div 0.42$

c) $2.6202 \div 0.11$

Division by Decimals

1) Work out the following:

a) 1 ÷ 0.1 10

b) 1 ÷ 0.2 5

c) 1 ÷ 0.5 2

2) Work out the following:

a) 2 ÷ 0.2 10

b) 5 ÷ 0.1 50

c) 8 ÷ 0.5 16

3) Work out the following:

a) 6 ÷ 0.3 20

b) 24 ÷ 0.8 30

c) 7.2 ÷ 0.9 8

4) Work out the following:

a) 5 ÷ 0.25 20

b) 8 ÷ 0.25 32

c) 20 ÷ 0.25 80

5) Work out the following:

a) 4.08 ÷ 0.12 34

b) 7.13 ÷ 0.23 31

c) 44.94 ÷ 0.14 321

6) Work out the following:

a) 61.6 ÷ 0.55 112

b) 5.166 ÷ 0.42 12.3

c) 2.6202 ÷ 0.11 23.82

Significant Figures

1) Round the following numbers to 1 significant figure:

a) 428

b) 783

c) 5608

d) 3 521

e) 21 999

f) 793 041

2) Round the following numbers to 2 significant figures:

a) 846

b) 2 647

c) 3 552

d) 46 817

e) 89 711

f) 195 084

3) Round the following numbers to 3 significant figures:

a) 91 249

b) 64 182

c) 223 058

d) 389 512

e) 7 761 223

f) 4 997 124

4) Work out the following and give your answer to 3 significant figures:

a) 216 × 348

b) 7721 × 609

c) 8714 × 2198

5) Round the following numbers to 1 significant figure:

a) 0.00618

b) 0.00482

c) 0.00006492

d) 0.004981

6) Round the following numbers to 2 significant figures:

a) 0.035812

b) 0.00082477

c) 0.0038611

d) 0.000037211

7) Round the following numbers to 3 significant figures:

a) 0.00143229

b) 0.000721981

c) 0.0000044251

d) 0.000668821

8) Round the following numbers to 3 significant figures:

a) 47.84122

b) 9.778112

c) 12.35913

9) Work out the following and give your answer to 3 significant figures:

a) 15 ÷ 0.38

b) 0.31 ÷ 0.16

c) 208 × 366

Significant Figures

1) Round the following numbers to 1 significant figure:

a) 428 400
b) 783 800
c) 5608 6 000
d) 3 521 4 000
e) 21 999 20 000
f) 793 041 800 000

2) Round the following numbers to 2 significant figures:

a) 846 850
b) 2 647 2600
c) 3 552 3600
d) 46 817 47000
e) 89 711 90 000
f) 195 084 200 000

3) Round the following numbers to 3 significant figures:

a) 91 249 91 200
b) 64 182 64 200
c) 223 058 223 000
d) 389 512 390 000
e) 7 761 223 7 760 000
f) 4 997 124 5 000 000

4) Work out the following and give your answer to 3 significant figures:

a) 216 × 348 75 200
b) 7721 × 609 4 700 000
c) 8714 × 2198 192 000 000

5) Round the following numbers to 1 significant figure:

a) 0.00618 0.006
b) 0.00482 0.005
c) 0.00006492 0.00006
d) 0.004981 0.005

6) Round the following numbers to 2 significant figures:

a) 0.035812 0.036
b) 0.00082477 0.00082
c) 0.0038611 0.0039
d) 0.000037211 0.000037

7) Round the following numbers to 3 significant figures:

a) 0.00143229 0.00143
b) 0.000721981 0.000722
c) 0.0000044251 0.00000443
d) 0.000668821 0.000669

8) Round the following numbers to 3 significant figures:

a) 47.84122 47.8
b) 9.778112 9.78
c) 12.35913 12.4

9) Work out the following and give your answer to 3 significant figures:

a) 15 ÷ 0.38 39.5
b) 0.31 ÷ 0.16 1.94
c) 208 × 366 76100

Estimating Answers

1) Work out an estimate for $\dfrac{304 \times 9.96}{0.51}$

2) Work out an estimate for $\dfrac{6.7 \times 192}{0.051}$

3) Work out an estimate for $\dfrac{32 \times 4.92}{0.21}$

4) Work out an estimate for $\dfrac{3880}{236 \times 4.85}$

5) Work out an estimate for $\dfrac{7.18 \times 19.7}{0.47}$

Estimating Answers

1) Work out an estimate for $\dfrac{304 \times 9.96}{0.51}$ 6000

$\dfrac{300 \times 10}{0.5}$

2) Work out an estimate for $\dfrac{6.7 \times 192}{0.051}$ 28000

$\dfrac{7 \times 200}{0.05}$

3) Work out an estimate for $\dfrac{32 \times 4.92}{0.21}$ 750

$\dfrac{30 \times 5}{0.2}$

4) Work out an estimate for $\dfrac{3880}{236 \times 4.85}$ 4

$\dfrac{4000}{200 \times 5}$

5) Work out an estimate for $\dfrac{7.18 \times 19.7}{0.47}$ 280

$\dfrac{7 \times 20}{0.5}$

Estimating Answers

1) Work out an estimate for the value of

a) $\dfrac{547}{4.8 \times 9.7}$

b) $\dfrac{69 \times 398}{207}$

c) $\dfrac{7.5 \times 2.79}{2.71 + 3.19}$

d) $\dfrac{409 \times 5.814}{0.19}$

2) a) Work out an estimate for

$$\frac{19.6 \times 31.7}{7.9 \times 5.2}$$

b) Use your answer to part (a) to find an estimate for

$$\frac{196 \times 317}{79 \times 52}$$

3) a) Work out an estimate for

$$\frac{6.13 \times 9.68}{3.79 \times 2.56}$$

b) Use your answer to part (a) to find an estimate for

$$\frac{613 \times 968}{379 \times 256}$$

Estimating Answers

1) Work out an estimate for the value of

a) $\dfrac{547}{4.8 \times 9.7}$ 10 $\dfrac{500}{5 \times 10}$ $\dfrac{500}{50}$

b) $\dfrac{69 \times 398}{207}$ 140 $\dfrac{70 \times 400}{200}$ $\dfrac{28\,000}{200}$

c) $\dfrac{7.5 \times 2.79}{2.71 + 3.19}$ 4 $\dfrac{8 \times 3}{3 + 3}$ $\dfrac{24}{6}$

d) $\dfrac{409 \times 5.814}{0.19}$ 12 000 $\dfrac{400 \times 6}{0.2}$ $\dfrac{2\,400}{0.2}$

2) a) Work out an estimate for

$\dfrac{19.6 \times 31.7}{7.9 \times 5.2}$ 15 $\dfrac{20 \times 30}{8 \times 5}$ $\dfrac{600}{40}$

b) Use your answer to part (a) to find an estimate for

$\dfrac{196 \times 317}{79 \times 52}$ 15

3) a) Work out an estimate for

$\dfrac{6.13 \times 9.68}{3.79 \times 2.56}$ 5 $\dfrac{6 \times 10}{4 \times 3}$ $\dfrac{60}{12}$

b) Use your answer to part (a) to find an estimate for

$\dfrac{613 \times 968}{379 \times 256}$ 5

Simplification of Algebraic Expressions

1) Simplify the following

a) $x + x$

b) $2x + 3x$

c) $5t - 3t$

d) $7y - 6y$

e) $x + 2x + 3x$

f) $3g - g + 6g$

g) $2x - 7x + 8x$

h) $y - 2y - 3y + 6y$

2) Simplify the following

a) $xy + 3xy$

b) $5xy - 2xy$

c) $4x^2y + x^2y$

d) $3xy^2 - 2xy^2$

e) $2x^2y^3 + 4x^2y^3 - 3x^2y^3$

f) $6a^2bc^4 + 5a^2bc^4 - 2a^2bc^4$

3) Simplify the following

a) $x + y + x + y$

b) $2x + 3y + x + 4y$

c) $2a + 4b - a + 2b$

d) $3x + 4y - x - 2y$

e) $6x - 2y + 2x + 5y$

f) $4x - 3y - 2x - 5y$

g) $3t + 4u + 2t - 7u$

h) $2xy + 3t - xy - 4t$

4) Simplify the following

a) $x \times x$

b) $x \times x \times x \times x \times x$

c) $y \times y \times y$

5) Simplify the following

a) $x^2 \times x^4$

b) $x^3 \times x^5$

c) $y \times y^3$

d) $x^2 \times x \times x^4$

6) Simplify the following

a) $2x \times x$

b) $4x \times 3x$

c) $3t^2 \times 2t$

d) $4y^2 \times 3y^3$

e) $x \times 2x^2 \times 3x^3$

7) Simplify the following

a) $3x \times y$

b) $4x^2y \times 2x$

c) $3xy^2 \times 2xy^3$

d) $2x^2y^3 \times 5x^4y^2$

e) $tu^2 \times t^2u \times 4tu$

8) Simplify the following

a) $x^5 \div x$

b) $y^4 \div y^3$

c) $g^8 \div g^5$

9) Simplify the following

a) $\dfrac{x^6 \times x^3}{x^4}$

b) $\dfrac{x^3 \times x^4}{x^2 \times x}$

c) $\dfrac{(x + 5)^5}{(x + 5)^2}$

10) Simplify the following

a) $20x^6 \div 5x^2$

b) $\dfrac{14x^7}{2x^2}$

c) $\dfrac{8x \times 2x^3}{4x^2}$

Simplification of Algebraic Expressions

1) Simplify the following

a) $x + x$ $2x$

b) $2x + 3x$ $5x$

c) $5t - 3t$ $2t$

d) $7y - 6y$ y

e) $x + 2x + 3x$ $6x$

f) $3g - g + 6g$ $8g$

g) $2x - 7x + 8x$ $3x$

h) $y - 2y - 3y + 6y$ $2y$

2) Simplify the following

a) $xy + 3xy$ $4xy$

b) $5xy - 2xy$ $3xy$

c) $4x^2y + x^2y$ $5x^2y$

d) $3xy^2 - 2xy^2$ xy^2

e) $2x^2y^3 + 4x^2y^3 - 3x^2y^3$ $3x^2y^3$

f) $6a^2bc^4 + 5a^2bc^4 - 2a^2bc^4$ $9a^2bc^4$

3) Simplify the following

a) $x + y + x + y$ $2x + 2y$

b) $2x + 3y + x + 4y$ $3x + 7y$

c) $2a + 4b - a + 2b$ $a + 6b$

d) $3x + 4y - x - 2y$ $2x + 2y$

e) $6x - 2y + 2x + 5y$ $8x + 3y$

f) $4x - 3y - 2x - 5y$ $2x - 8y$

g) $3t + 4u + 2t - 7u$ $5t - 3u$

h) $2xy + 3t - xy - 4t$ $xy - t$

4) Simplify the following

a) $x \times x$ x^2

b) $x \times x \times x \times x \times x$ x^5

c) $y \times y \times y$ y^3

5) Simplify the following

a) $x^2 \times x^4$ x^6

b) $x^3 \times x^5$ x^8

c) $y \times y^3$ y^4

d) $x^2 \times x \times x^4$ x^7

6) Simplify the following

a) $2x \times x$ $2x^2$

b) $4x \times 3x$ $12x^2$

c) $3t^2 \times 2t$ $6t^3$

d) $4y^2 \times 3y^3$ $12y^5$

e) $x \times 2x^2 \times 3x^3$ $6x^6$

7) Simplify the following

a) $3x \times y$ $3xy$

b) $4x^2y \times 2x$ $8x^3y$

c) $3xy^2 \times 2xy^3$ $6x^2y^5$

d) $2x^2y^3 \times 5x^4y^2$ $10x^6y^5$

e) $tu^2 \times t^2u \times 4tu$ $4t^4u^4$

8) Simplify the following

a) $x^5 \div x$ x^4

b) $y^4 \div y^3$ y

c) $g^8 \div g^5$ g^3

9) Simplify the following

a) $\dfrac{x^6 \times x^3}{x^4}$ x^5

b) $\dfrac{x^3 \times x^4}{x^2 \times x}$ x^4

c) $\dfrac{(x+5)^5}{(x+5)^2}$ $(x+5)^3$

10) Simplify the following

a) $20x^6 \div 5x^2$ $4x^4$

b) $\dfrac{14x^7}{2x^2}$ $7x^5$

c) $\dfrac{8x \times 2x^3}{4x^2}$ $4x^2$

Simplification of Algebraic Expressions

1) a) Simplify $4p \times 6q$

b) Simplify $d \times d \times d \times d$

c) Simplify $t^9 \div t^4$

2) a) Simplify $4a + 3c - 2a + c$

b) Simplify $2x - 6c - x + 2c$

3) a) Simplify $5xt + 2xt - 4xt$

b) Simplify $4x + 3y - 2x + 4y$

c) Simplify $m \times m \times m$

d) Simplify $3n \times 2t$

4) Simplify $3x^2 \times 4x^5y^4$

5) Simplify $4x + 3y - 2x + 6y$

6) a) Simplify $t^4 \times t^5$

b) Simplify $a \times a \times a$

7) a) Simplify $x^6 \times x^2$

b) Simplify $10x^2y^4 \div 2xy^2$

8) a) Simplify $3a + 5c - a + 3c$

b) Simplify $x^3 \times x^4$

c) Simplify $4x^2y^4 \times 5xy^2$

9) Simplify $6x + 8y + 2x - 10y$

10) a) Simplify $x \times x \times x \times x$

b) Simplify $2x \times 3y$

11) a) Simplify $pq + 2pq$

b) Simplify $5x + 3y - x - 4y$

12) a) Simplify $6a + 5b - 3b + a$

b) Simplify $x^4 + x^4$

13) a) Simplify $x + y + x + y + x$

b) Simplify $t^2 + t^2 + t^2$

14) a) Simplify $a^3 \times a^3$

b) Simplify $\dfrac{3x^2y \times 4xy^3}{2xy^2}$

15) a) Simplify $3d + e - d + 4e$

b) Simplify $3x^2 - x^2$

c) Simplify $5t + 8d - 2t - 3d$

d) Simplify $\dfrac{(3x + 1)^3}{(3x + 1)}$

Simplification of Algebraic Expressions

1) a) Simplify $4p \times 6q$ $24pq$

b) Simplify $d \times d \times d \times d$ d^4

c) Simplify $t^9 \div t^4$ t^5

2) a) Simplify $4a + 3c - 2a + c$ $2a + 4c$

b) Simplify $2x - 6c - x + 2c$ $x - 4c$

3) a) Simplify $5xt + 2xt - 4xt$ $3xt$

b) Simplify $4x + 3y - 2x + 4y$ $2x + 7y$

c) Simplify $m \times m \times m$ m^3

d) Simplify $3n \times 2t$ $6nt$

4) Simplify $3x^2 \times 4x^5y^4$ $12x^7y^4$

5) Simplify $4x + 3y - 2x + 6y$ $2x + 9y$

6) a) Simplify $t^4 \times t^5$ t^9

b) Simplify $a \times a \times a$ a^3

7) a) Simplify $x^6 \times x^2$ x^8

b) Simplify $10x^2y^4 \div 2xy^2$ $5xy^2$

8) a) Simplify $3a + 5c - a + 3c$ $2a + 8c$

b) Simplify $x^3 \times x^4$ x^7

c) Simplify $4x^2y^4 \times 5xy^2$ $20x^3y^6$

9) Simplify $6x + 8y + 2x - 10y$ $8x - 2y$

10) a) Simplify $x \times x \times x \times x$ x^4

b) Simplify $2x \times 3y$ $6xy$

11) a) Simplify $pq + 2pq$ $3pq$

b) Simplify $5x + 3y - x - 4y$ $4x - y$

12) a) Simplify $6a + 5b - 3b + a$ $7a + 2b$

b) Simplify $x^4 + x^4$ $2x^4$

13) a) Simplify $x + y + x + y + x$ $3x + 2y$

b) Simplify $t^2 + t^2 + t^2$ $3t^2$

14) a) Simplify $a^3 \times a^3$ a^6

b) Simplify $\dfrac{3x^2y \times 4xy^3}{2xy^2}$ $6x^2y^2$

15) a) Simplify $3d + e - d + 4e$ $2d + 5e$

b) Simplify $3x^2 - x^2$ $2x^2$

c) Simplify $5t + 8d - 2t - 3d$ $3t + 5d$

d) Simplify $\dfrac{(3x + 1)^3}{(3x + 1)}$ $(3x + 1)^2$

Expanding and Simplifying Brackets

1) Expand these brackets

a) $2(x + 3)$

b) $3(2x + 4)$

c) $5(3p - 2q)$

d) $4(x^2 + 2y^2)$

e) $6(r - r^2)$

2) Expand these brackets

a) $x(x - 2)$

b) $x(3x + 5)$

c) $p(3p - 7q)$

d) $y(y + 6y^2)$

e) $x(r + r^2)$

3) Expand these brackets

a) $2x(x - 5)$

b) $4x(2x + 3)$

c) $5p(4p - 2q)$

d) $2y(3y + 4x^2)$

e) $x(x + r^2)$

4) Expand these brackets

a) $x(x^2 - 2)$

b) $3x(2x^3 + 1)$

c) $5p^2(4p - 2)$

d) $2y^2(3y^3 + 4y)$

e) $2xy(x + y^2)$

5) Expand and simplify

a) $2(x + y) + 3(x + y)$

b) $3(2x + y) + 2(5x + 3y)$

c) $5(x + y) + 3(2x + y)$

d) $3(2c + d) + 2(c + d)$

e) $4(2p + q) + 3(2p + q)$

6) Expand and simplify

a) $2(x + y) + 3(x - y)$

b) $5(2x + y) + 2(3x - 2y)$

c) $4(x - y) + 3(2x + y)$

d) $6(2c - d) + 2(c - d)$

e) $2(5p - q) + 3(p - 2q)$

7) Expand and simplify

a) $3(x + 2y) - 3(x - y)$

b) $5(2x - y) - 2(3x - 2y)$

c) $7(x - 2y) - 3(2x + y)$

d) $6(2x - y) - 2(x + 2y)$

e) $2(5p - q) - (p - 3q)$

Expanding and Simplifying Brackets

1) Expand these brackets

a) $2(x + 3)$ $2x + 6$

b) $3(2x + 4)$ $6x + 12$

c) $5(3p - 2q)$ $15p - 10q$

d) $4(x^2 + 2y^2)$ $4x^2 + 8y^2$

e) $6(r - r^2)$ $6r - 6r^2$

2) Expand these brackets

a) $x(x - 2)$ $x^2 - 2x$

b) $x(3x + 5)$ $3x^2 + 5x$

c) $p(3p - 7q)$ $3p^2 - 7pq$

d) $y(y + 6y^2)$ $y^2 + 6y^3$

e) $x(r + r^2)$ $xr + xr^2$

3) Expand these brackets

a) $2x(x - 5)$ $2x^2 - 10x$

b) $4x(2x + 3)$ $8x^2 + 12x$

c) $5p(4p - 2q)$ $20p^2 - 10pq$

d) $2y(3y + 4x^2)$ $6y^2 + 8x^2y$

e) $x(x + r^2)$ $x^2 + r^2x$

4) Expand these brackets

a) $x(x^2 - 2)$ $x^3 - 2x$

b) $3x(2x^3 + 1)$ $6x^4 + 3x$

c) $5p^2(4p - 2)$ $20p^3 - 10p^2$

d) $2y^2(3y^3 + 4y)$ $6y^5 + 8y^3$

e) $2xy(x + y^2)$ $2x^2y + 2xy^3$

5) Expand and simplify

a) $2(x + y) + 3(x + y)$ $5x + 5y$

b) $3(2x + y) + 2(5x + 3y)$ $16x + 9y$

c) $5(x + y) + 3(2x + y)$ $11x + 8y$

d) $3(2c + d) + 2(c + d)$ $8c + 5d$

e) $4(2p + q) + 3(2p + q)$ $14p + 7q$

6) Expand and simplify

a) $2(x + y) + 3(x - y)$ $5x - y$

b) $5(2x + y) + 2(3x - 2y)$ $16x + y$

c) $4(x - y) + 3(2x + y)$ $10x - y$

d) $6(2c - d) + 2(c - d)$ $14c - 8d$

e) $2(5p - q) + 3(p - 2q)$ $13p - 8q$

7) Expand and simplify

a) $3(x + 2y) - 3(x - y)$ $9y$

b) $5(2x - y) - 2(3x - 2y)$ $4x - y$

c) $7(x - 2y) - 3(2x + y)$ $x - 17y$

d) $6(2x - y) - 2(x + 2y)$ $10x - 10y$

e) $2(5p - q) - (p - 3q)$ $9p + q$

Expanding and Simplifying Brackets

1) Expand and simplify

a) $(x + 3)(x + 2)$

b) $(x + 5)(x + 3)$

c) $(x + 1)(x + 4)$

d) $(x + 6)(x + 4)$

e) $(x + 5)(x + 7)$

2) Expand and simplify

a) $(x + 5)(x - 2)$

b) $(x - 7)(x + 2)$

c) $(x - 1)(x + 3)$

d) $(x + 4)(x - 3)$

e) $(x - 5)(x + 5)$

3) Expand and simplify

a) $(x - 3)(x - 4)$

b) $(x - 2)(x - 6)$

c) $(x - 1)(x - 1)$

d) $(x - 7)(x - 2)$

e) $(x - 4)(x - 5)$

4) Expand and simplify

a) $(x - 7)(x + 1)$

b) $(p - 6)(p + 4)$

c) $(e - 3)(e - 7)$

d) $(x + 8)(x + 1)$

e) $(x - 5)(x - 5)$

5) Expand and simplify

a) $(2x + 3)(2x + 1)$

b) $(3p - 4)(2p + 5)$

c) $(e - 3)(3e - 4)$

d) $(4x - 6)(2x + 1)$

e) $(2x - 3)(2x + 3)$

6) Expand and simplify

a) $(2x + y)(3x + 2y)$

b) $(3p - 2q)(4p + 5q)$

c) $(4e - 3f)(2e - 2f)$

d) $(6x - y)(6x + y)$

e) $(3x - 2y)(x - 5y)$

Expanding and Simplifying Brackets

1) Expand and simplify

a) $(x + 3)(x + 2)$ $x^2 + 5x + 6$

b) $(x + 5)(x + 3)$ $x^2 + 8x + 15$

c) $(x + 1)(x + 4)$ $x^2 + 5x + 4$

d) $(x + 6)(x + 4)$ $x^2 + 10x + 24$

e) $(x + 5)(x + 7)$ $x^2 + 12x + 35$

2) Expand and simplify

a) $(x + 5)(x - 2)$ $x^2 + 3x - 10$

b) $(x - 7)(x + 2)$ $x^2 - 5x - 14$

c) $(x - 1)(x + 3)$ $x^2 + 2x - 3$

d) $(x + 4)(x - 3)$ $x^2 + x - 12$

e) $(x - 5)(x + 5)$ $x^2 - 25$

3) Expand and simplify

a) $(x - 3)(x - 4)$ $x^2 - 7x + 12$

b) $(x - 2)(x - 6)$ $x^2 - 8x + 12$

c) $(x - 1)(x - 1)$ $x^2 - 2x + 1$

d) $(x - 7)(x - 2)$ $x^2 - 9x + 14$

e) $(x - 4)(x - 5)$ $x^2 - 9x + 20$

4) Expand and simplify

a) $(x - 7)(x + 1)$ $x^2 - 6x - 7$

b) $(p - 6)(p + 4)$ $p^2 - 2p - 24$

c) $(e - 3)(e - 7)$ $e^2 - 10e + 21$

d) $(x + 8)(x + 1)$ $x^2 + 9x + 8$

e) $(x - 5)(x - 5)$ $x^2 - 10x + 25$

5) Expand and simplify

a) $(2x + 3)(2x + 1)$ $4x^2 + 8x + 3$

b) $(3p - 4)(2p + 5)$ $6p^2 + 7p - 20$

c) $(e - 3)(3e - 4)$ $3e^2 - 13e + 12$

d) $(4x - 6)(2x + 1)$ $8x^2 - 8x - 6$

e) $(2x - 3)(2x + 3)$ $4x^2 - 9$

6) Expand and simplify

a) $(2x + y)(3x + 2y)$ $6x^2 + 7xy + 2y^2$

b) $(3p - 2q)(4p + 5q)$ $12p^2 + 7pq - 10q^2$

c) $(4e - 3f)(2e - 2f)$ $8e^2 - 14ef + 6f^2$

d) $(6x - y)(6x + y)$ $36x^2 - y^2$

e) $(3x - 2y)(x - 5y)$ $3x^2 - 17xy + 10y^2$

Factorisation

1) Factorise

a) $2x + 4$

b) $2y + 10$

c) $3x + 12$

d) $3x - 6$

e) $5x - 15$

2) Factorise

a) $p^2 + 7p$

b) $x^2 + 4x$

c) $y^2 - 2y$

d) $p^2 - 5p$

e) $x^2 + x$

3) Factorise

a) $2x^2 + 6x$

b) $2y^2 - 8y$

c) $5p^2 + 10p$

d) $7c^2 - 21c$

e) $6x^2 + 9x$

4) Factorise

a) $2x^2 - 4xy$

b) $2t^2 + 10tu$

c) $6x^2 - 8xy$

d) $3x^2y^2 + 9xy$

Factorisation

1) Factorise

a) $2x + 4$ $2(x + 2)$

b) $2y + 10$ $2(y + 5)$

c) $3x + 12$ $3(x + 4)$

d) $3x - 6$ $3(x - 2)$

e) $5x - 15$ $5(x - 3)$

2) Factorise

a) $p^2 + 7p$ $p(p + 7)$

b) $x^2 + 4x$ $x(x + 4)$

c) $y^2 - 2y$ $y(y - 2)$

d) $p^2 - 5p$ $p(p - 5)$

e) $x^2 + x$ $x(x + 1)$

3) Factorise

a) $2x^2 + 6x$ $2x(x + 3)$

b) $2y^2 - 8y$ $2y(y - 4)$

c) $5p^2 + 10p$ $5p(p + 2)$

d) $7c^2 - 21c$ $7c(c - 3)$

e) $6x^2 + 9x$ $3x(2x + 3)$

4) Factorise

a) $2x^2 - 4xy$ $2x(x - 2y)$

b) $2t^2 + 10tu$ $2t(t + 5u)$

c) $6x^2 - 8xy$ $2x(3x - 4y)$

d) $3x^2y^2 + 9xy$ $3xy(xy + 3)$

 Clip 105

Grade C questions

Solving Equations

1) Solve $2x - 3 = 17$

2) Solve $3x + 2 = 14$

3) Solve $5x - 7 = 33$

4) Solve $4x + 7 = 19$

5) Solve $x + x + x + x = 20$

6) Solve $x + 3x = 24$

7) Solve $2(x + 3) = 8$

8) Solve $2(3x - 4) = 22$

9) Solve $5(t - 1) = 20$

10) Solve $3(2x + 5) = 36$

11) Solve $2x + 7 = x + 11$

12) Solve $5y - 2 = 3y + 10$

13) Solve $2x + 1 = 5x - 20$

14) Solve $p - 3 = 3p - 11$

15) Solve $2d + 5 = 20 - 3d$

16) Solve $4 - e = 2e - 8$

17) Solve $2(x + 3) = x + 9$

18) Solve $x - 7 = 3(2x - 4)$

19) Solve $5(x + 3) = 2(x + 6)$

20) Solve $4(2y + 1) = 2(12 - y)$

21) Solve $7 - 3x = 2(x + 1)$

22) Solve $\frac{x}{2} = 5$

23) Solve $\frac{x}{5} = 6$

24) Solve $\frac{2x}{3} = 4$

25) Solve $\frac{5x}{2} = 15$

26) Solve $\frac{x - 2}{3} = 1$

27) Solve $\frac{x + 5}{2} = 7$

28) Solve $\frac{2x + 1}{4} = 2$

29) Solve $\frac{5x - 3}{3} = 4$

30) Solve $\frac{x + 2}{3} = x + 4$

31) Solve $\frac{3x - 1}{4} = 2x - 3$

32) Solve $\frac{4x + 3}{5} = \frac{2x - 1}{2}$

Solving Equations

1) Solve $2x - 3 = 17$
$x = 10$

2) Solve $3x + 2 = 14$
$x = 4$

3) Solve $5x - 7 = 33$
$x = 8$

4) Solve $4x + 7 = 19$
$x = 3$

5) Solve $x + x + x + x = 20$
$x = 5$

6) Solve $x + 3x = 24$
$x = 6$

7) Solve $2(x + 3) = 8$
$x = 1$

8) Solve $2(3x - 4) = 22$
$x = 5$

9) Solve $5(t - 1) = 20$
$t = 5$

10) Solve $3(2x + 5) = 36$
$x = 3.5$

11) Solve $2x + 7 = x + 11$
$x = 4$

12) Solve $5y - 2 = 3y + 10$
$y = 6$

13) Solve $2x + 1 = 5x - 20$
$x = 7$

14) Solve $p - 3 = 3p - 11$
$p = 4$

15) Solve $2d + 5 = 20 - 3d$
$d = 3$

16) Solve $4 - e = 2e - 8$
$e = 4$

17) Solve $2(x + 3) = x + 9$
$x = 3$

18) Solve $x - 7 = 3(2x - 4)$
$x = 1$

19) Solve $5(x + 3) = 2(x + 6)$
$x = -1$

20) Solve $4(2y + 1) = 2(12 - y)$
$y = 2$

21) Solve $7 - 3x = 2(x + 1)$
$x = 1$

22) Solve $\frac{x}{2} = 5$
$x = 10$

23) Solve $\frac{x}{5} = 6$
$x = 30$

24) Solve $\frac{2x}{3} = 4$
$x = 6$

25) Solve $\frac{5x}{2} = 15$
$x = 6$

26) Solve $\frac{x - 2}{3} = 1$
$x = 5$

27) Solve $\frac{x + 5}{2} = 7$
$x = 9$

28) Solve $\frac{2x + 1}{4} = 2$
$x = 3.5$

29) Solve $\frac{5x - 3}{3} = 4$
$x = 3$

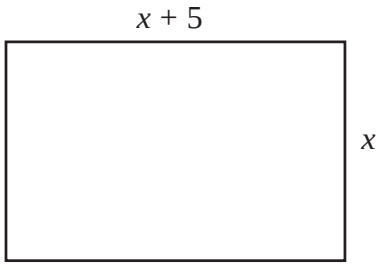
30) Solve $\frac{x + 2}{3} = x + 4$
$x = -5$

31) Solve $\frac{3x - 1}{4} = 2x - 3$
$x = 2.2$

32) Solve $\frac{4x + 3}{5} = \frac{2x - 1}{2}$
$x = 5.5$

Forming Equations

1) The width of a rectangle is x centimetres.
The length of the rectangle is $(x + 5)$ centimetres.



a) Find an expression, in terms of x, for the perimeter of the rectangle.
Give your answer in its simplest form.

The perimeter of the rectangle is 38 centimetres.

b) Work out the length of the rectangle.

2)

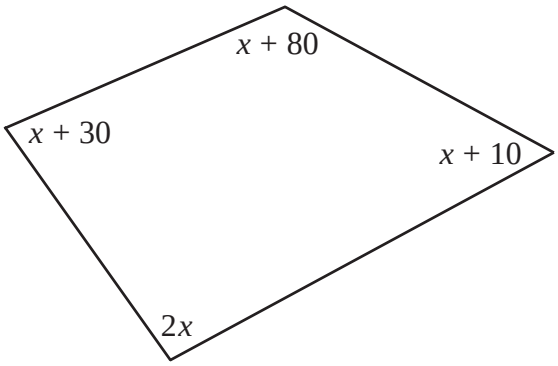


*Diagram **NOT** accurately drawn*

The sizes of the angles, in degrees, of the quadrilateral are

$x + 10$
$2x$
$x + 80$
$x + 30$

a) Use this information to write down an equation in terms of x.

b) Use your answer to part (a) to work out the size of the smallest angle of the quadrilateral.

3) Sarah buys 6 cups and 6 mugs
A cup costs £x
A mug costs £$(x + 3)$

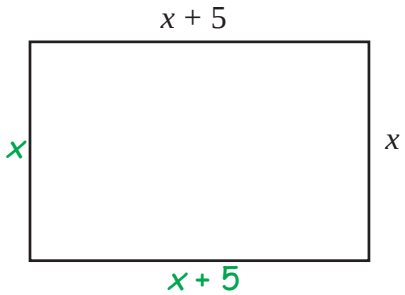
a) Write down an expression, in terms of x, for the total cost, in pounds, of 6 cups and 6 mugs.

b) If the total cost of 6 cups and 6 mugs is £48, write an equation in terms of x.

c) Solve your equation to find the cost of a cup and the cost of a mug.

Forming Equations

1) The width of a rectangle is x centimetres.
The length of the rectangle is $(x + 5)$ centimetres.



$P = x + 5 + x + x + 5 + x$
$P = 4x + 10$

a) Find an expression, in terms of x, for the perimeter of the rectangle.
Give your answer in its simplest form. $4x + 10$

The perimeter of the rectangle is 38 centimetres.

b) Work out the length of the rectangle. Length is 12 cm

2)

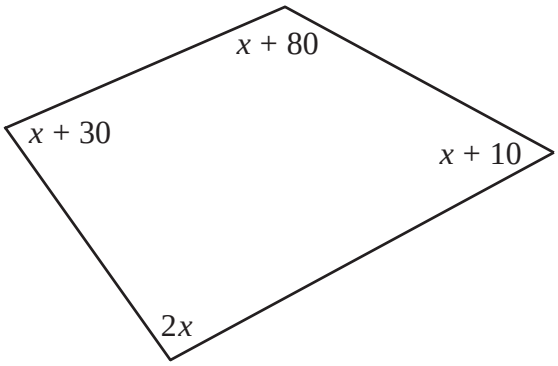


*Diagram **NOT** accurately drawn*

The sizes of the angles, in degrees, of the quadrilateral are

$x + 10$
$2x$
$x + 80$
$x + 30$

Angles of a quadrilateral add up to 360°
$x + 80 + x + 10 + 2x + x + 30 = 360$
$5x + 120 = 360$

a) Use this information to write down an equation in terms of x. $5x + 120 = 360$

b) Use your answer to part (a) to work out the size of the smallest angle of the quadrilateral. Smallest angle is 58°

$5x + 120 = 360$
$5x = 240$
$x = 48$

3) Sarah buys 6 cups and 6 mugs
A cup costs £x
A mug costs £$(x + 3)$

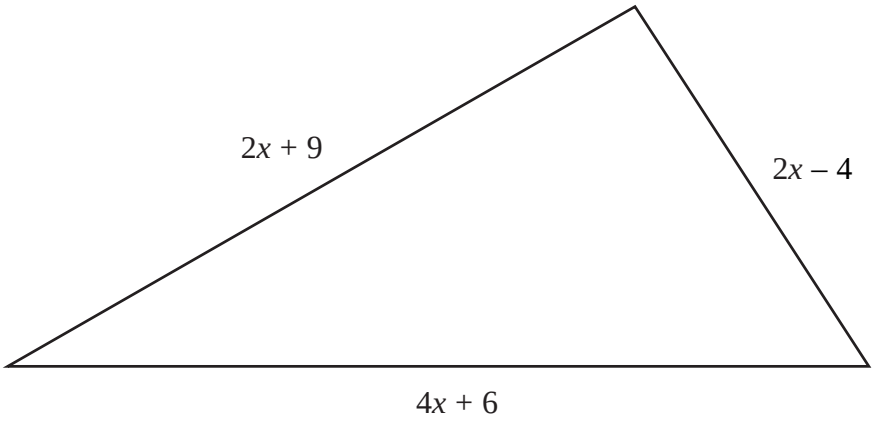
a) Write down an expression, in terms of x, for the total cost, in pounds, of 6 cups and 6 mugs. $12x + 18$

b) If the total cost of 6 cups and 6 mugs is £48, write an equation in terms of x. $12x + 18 = 48$

c) Solve your equation to find the cost of a cup and the cost of a mug.
A cup costs £2.50 and a mug costs £5.50

Forming Equations

1)



In the diagram, all measurements are in centimetres.

The lengths of the sides are

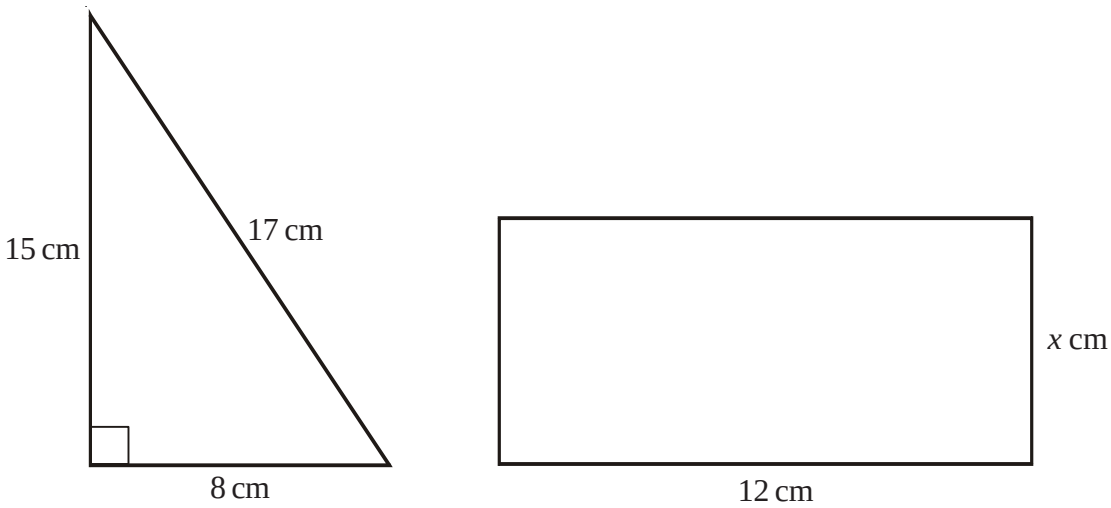
$2x + 9$
$2x - 4$
$4x + 6$

a) Find an expression, in terms of x, for the perimeter of the triangle.
Give your expression in its simplest form.

The perimeter of the triangle is 39 cm.

b) Find the value of x.

2) The diagram shows a right-angled triangle and a rectangle.

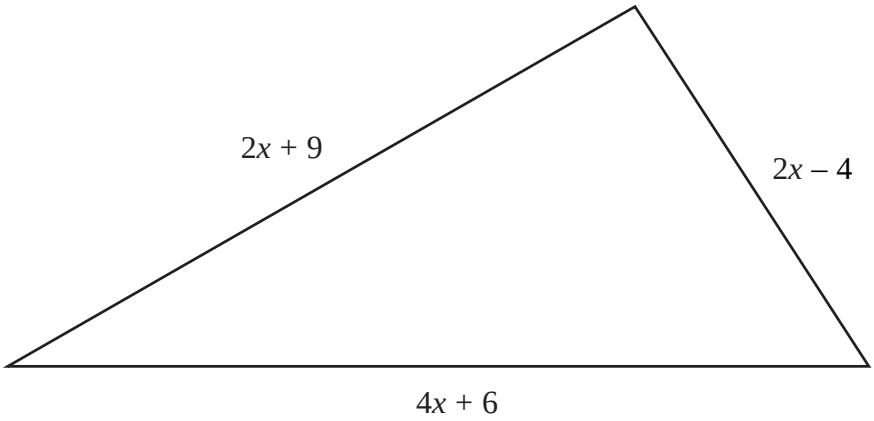


The area of the right-angled triangle is equal to the area of the rectangle.

Find the value of x.

Forming Equations

1)



In the diagram, all measurements are in centimetres.

The lengths of the sides are

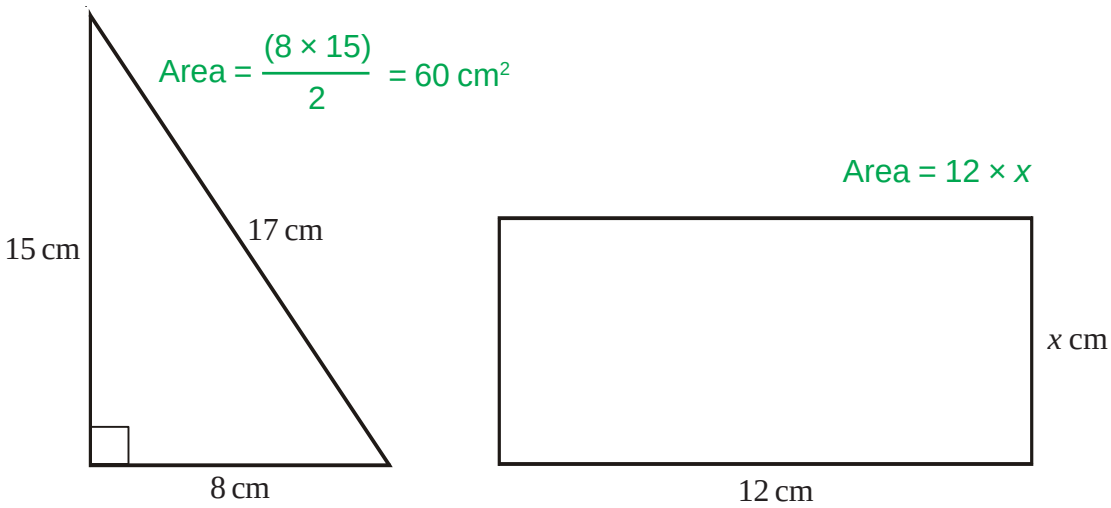
$2x + 9$
$2x - 4$
$4x + 6$

a) Find an expression, in terms of x, for the perimeter of the triangle. $8x + 11$
Give your expression in its simplest form.

The perimeter of the triangle is 39 cm.

b) Find the value of x. $x = 3.5$ cm

2) The diagram shows a right-angled triangle and a rectangle.



The area of the right-angled triangle is equal to the area of the rectangle.

Find the value of x. $x = 5$ cm

Forming Equations

1) A shop sells small boxes and large boxes for storing CDs.

A small box stores x CDs.
A large box stores y CDs.

Emma buys 8 small boxes and 5 large boxes.

Emma can store a total of T CDs in these boxes.

Write down a formula for T in terms of x and y.

2) Batteries are sold in packets and boxes.

Each packet contains 4 batteries.
Each box contains 20 batteries.

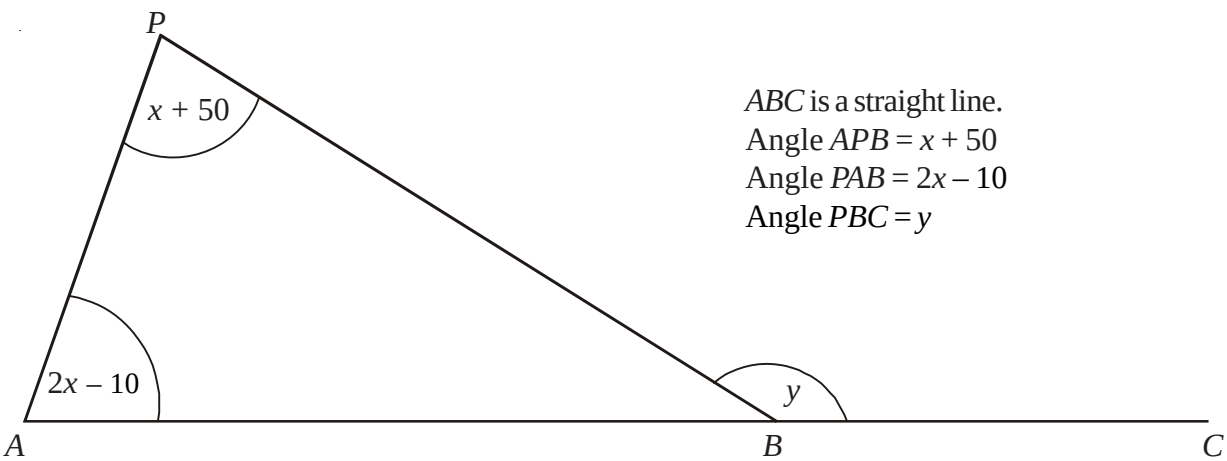
Tony buys p packets of batteries and b boxes of batteries.
Tony buys a total of N batteries.

Write down a formula for N in terms of p and b.

3) Compasses cost c pence each.
Rulers cost r pence each.

Write down an expression for the total cost, in pence, of 2 compasses and 4 rulers.

4)



ABC is a straight line.
Angle $APB = x + 50$
Angle $PAB = 2x - 10$
Angle $PBC = y$

a) Show that $y = 3x + 40$
Give reasons for each stage of your working.

b) Given that y equals 145 degrees

(i) Work out the value of x.

(ii) Work out the size of the largest angle in triangle *APB*.

Forming Equations

1) A shop sells small boxes and large boxes for storing CDs.

A small box stores x CDs.
A large box stores y CDs.

Emma buys 8 small boxes and 5 large boxes.

Emma can store a total of T CDs in these boxes.

Write down a formula for T in terms of x and y. $T = 8x + 5y$

2) Batteries are sold in packets and boxes.

Each packet contains 4 batteries.
Each box contains 20 batteries.

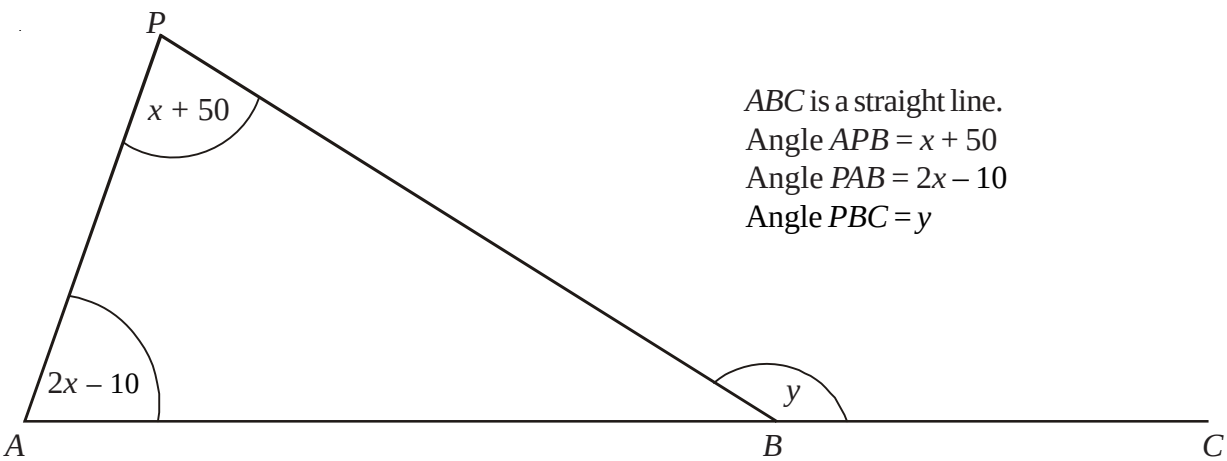
Tony buys p packets of batteries and b boxes of batteries.
Tony buys a total of N batteries.

Write down a formula for N in terms of p and b. $N = 4p + 20b$

3) Compasses cost c pence each.
Rulers cost r pence each.

Write down an expression for the total cost, in pence, of 2 compasses and 4 rulers. $2c + 4r$

4)



ABC is a straight line.
Angle $APB = x + 50$
Angle $PAB = 2x - 10$
Angle $PBC = y$

a) Show that $y = 3x + 40$
Give reasons for each stage of your working.

Angle PAB + Angle $APB = 3x + 40$
Angle $PBA = 180 - (3x + 40)$
$= 140 - 3x$
Angle y = 180 – angle PBA
$= 180 - (140 - 3x)$
$= 40 + 3x$
$= 3x + 40$

b) Given that y equals 145 degrees

(i) Work out the value of x. 35°

(ii) Work out the size of the largest angle in triangle APB. 85°

Changing the Subject of a Formula

1) Make c the subject of the formula.

$a = b + cd$

2) Make t the subject of the formula.

$u = v + 2t$

3) Make n the subject of the formula.

$M = 3n + 5$

4) Make z the subject of the formula.

$x = 3y + z$

5) $r = 5s + 3t$

a) Make t the subject of the formula.

b) Make s the subject of the formula.

6) Rearrange $y = 3x + 1$ to make x the subject.

7) Rearrange $y = \frac{1}{2}x + 2$ to make x the subject.

8) Rearrange $y = \frac{1}{3}x + 1$ to make x the subject.

Changing the Subject of a Formula

1) Make c the subject of the formula.

$a = b + cd$ $\quad c = \dfrac{a - b}{d}$

2) Make t the subject of the formula.

$u = v + 2t$ $\quad t = \dfrac{u - v}{2}$

3) Make n the subject of the formula.

$M = 3n + 5$ $\quad n = \dfrac{M - 5}{3}$

4) Make z the subject of the formula.

$x = 3y + z$ $\quad z = x - 3y$

5) $r = 5s + 3t$

a) Make t the subject of the formula. $\quad t = \dfrac{r - 5s}{3}$

b) Make s the subject of the formula. $\quad s = \dfrac{r - 3t}{5}$

6) Rearrange $y = 3x + 1$ to make x the subject. $\quad x = \dfrac{y - 1}{3}$

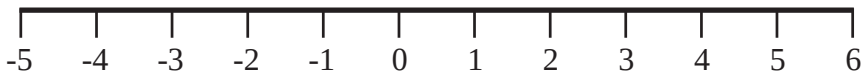
7) Rearrange $y = \dfrac{1}{2}x + 2$ to make x the subject. $\quad x = 2(y - 2)$ or $x = 2y - 4$

8) Rearrange $y = \dfrac{1}{3}x + 1$ to make x the subject. $\quad x = 3(y - 1)$ or $x = 3y - 3$

Inequalities

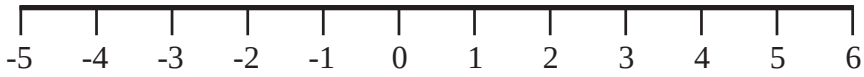
1) Represent this inequality on the number line

$$-3 < x \leqslant 2$$

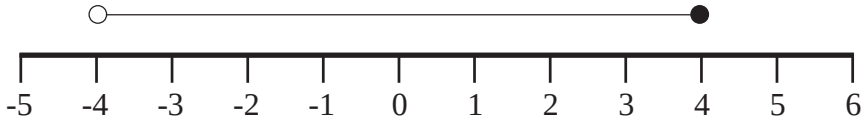


2) Represent this inequality on the number line

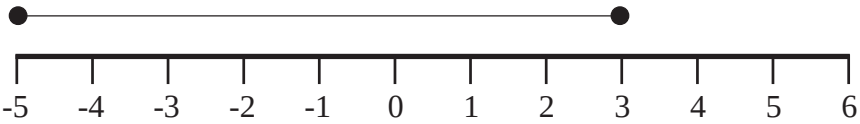
$$-1 \leqslant x < 5$$



3) Write down the inequality shown



4) Write down the inequality shown



5) If y is an integer, write down all the possible values of

$$-2 < y \leqslant 5$$

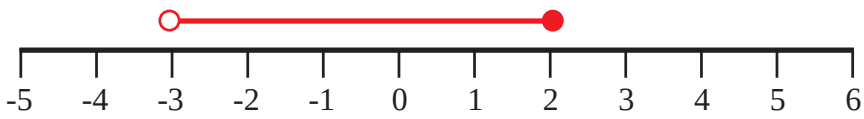
6) If x is an integer, write down all the possible values of

$$-9 < x < -5$$

Inequalities

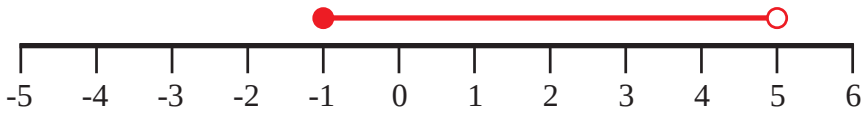
1) Represent this inequality on the number line

$$-3 < x \leqslant 2$$

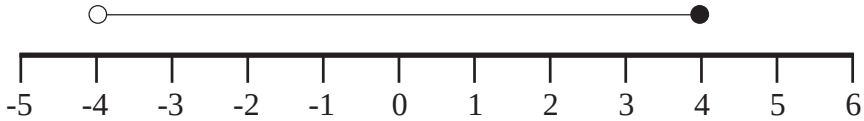


2) Represent this inequality on the number line

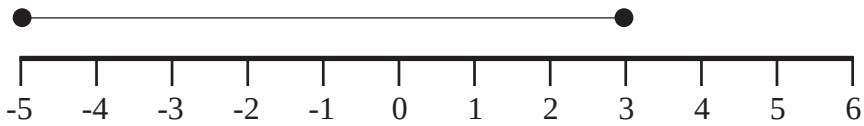
$$-1 \leqslant x < 5$$



3) Write down the inequality shown $-4 < x \leqslant 4$



4) Write down the inequality shown $-5 \leqslant x \leqslant 3$



5) If y is an integer, write down all the possible values of

$$-2 < y \leqslant 5$$

-1, 0, 1, 2, 3, 4, 5

6) If x is an integer, write down all the possible values of

$$-9 < x < -5$$

-8, -7, -6

Solving Inequalities

1) Solve

a) $3x - 1 > 5$

b) $7y + 2 \leq 30$

c) $\frac{x}{2} - 3 \geq 2$

d) $5 + 2x > 7$

e) $8 < 5p - 2$

f) $\frac{y}{3} + 5 \geq 3$

g) $\frac{2x}{3} - 5 \geq -3$

h) $6x - 5 > 2x + 3$

i) $3p - 9 < 6 - 2p$

j) $5 - 3y < 2y - 10$

2) a) Solve the inequality

$2z + 2 \geq 7$

b) Write down the smallest **integer** value of z which satisfies the inequality

$2z + 2 \geq 7$

3) $5x + 2y < 10$

x and y are both integers.

Write down two possible pairs of values that satisfy this inequality.

x = ..., y = ...

and

x = ..., y = ...

Solving Inequalities

1) Solve

a) $3x - 1 > 5$

$x > 2$

b) $7y + 2 \leq 30$

$y \leq 4$

c) $\frac{x}{2} - 3 \geq 2$

$x \geq 10$

d) $5 + 2x > 7$

$x > 1$

e) $8 < 5p - 2$

$2 < p$

f) $\frac{y}{3} + 5 \geq 3$

$y \geq -6$

g) $\frac{2x}{3} - 5 \geq -3$

$x \geq 3$

h) $6x - 5 > 2x + 3$

$x > 2$

i) $3p - 9 < 6 - 2p$

$p < 3$

j) $5 - 3y < 2y - 10$

$3 < y$

2) a) Solve the inequality

$2z + 2 \geq 7$

$z \geq 2.5$

b) Write down the smallest **integer** value of z which satisfies the inequality

$2z + 2 \geq 7$

$z = 3$

3) $5x + 2y < 10$

x and y are both integers.

Write down two possible pairs of values that satisfy this inequality.

x = ...1...., y = ...1....

and

x = ...1...., y = ...2....

other pairs of values are possible.

Solving Equations & Inequalities

1) Solve the inequality $6x - 3 < 9$

2) Solve $4x + 1 = 2x + 12$

3) a) Solve the inequality $3t + 1 < t + 13$

b) If $2t^2 = 72$ find a value of t

4) Solve $3(x + 2) = 8$

5) Solve the inequality $6y \geqslant y + 10$

6) Solve $4(2x - 3) = 5x + 7$

7) $h = 5t^2 + 3$
Work out the value of t when $h = 48$

8) Solve $3(2p - 4) = 2p + 12$

---

9) Solve the equation $4x + 1 = 19$

10) Solve $\dfrac{29 - x}{3} = x + 5$

11) Solve $3x - 10 = x + 30$

12) Solve the inequality $3x - 2 > x + 7$

13) Solve the inequality $\dfrac{2x}{3} < 10$

Solving Equations & Inequalities

1) Solve the inequality $6x - 3 < 9$

$x < 2$

2) Solve $4x + 1 = 2x + 12$

$x = 5.5$

3) a) Solve the inequality $3t + 1 < t + 13$

$t < 6$

b) If $2t^2 = 72$ find a value of t

$t = 6$ (or -6)

4) Solve $3(x + 2) = 8$ $x = \frac{2}{3}$

5) Solve the inequality $6y \geqslant y + 10$

$y \geqslant 2$

6) Solve $4(2x - 3) = 5x + 7$ $x = 6\frac{1}{3}$

7) $h = 5t^2 + 3$

Work out the value of t when $h = 48$ $t = 3$ or -3

8) Solve $3(2p - 4) = 2p + 12$

$p = 6$

---

9) Solve the equation $4x + 1 = 19$

$x = 4.5$

10) Solve $\frac{29 - x}{3} = x + 5$ $x = 3.5$

11) Solve $3x - 10 = x + 30$ $x = 20$

12) Solve the inequality $3x - 2 > x + 7$ $x > 4.5$

13) Solve the inequality $\frac{2x}{3} < 10$ $x < 15$

Trial and Improvement

1) The equation

$$x^3 - x = 29$$

has a solution between 3 and 4
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

2) The equation

$$x^3 - 4x = 25$$

has a solution between 3 and 4
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

3) The equation

$$x^3 - 2x = 68$$

has a solution between 4 and 5
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

4) The equation

$$x^3 + 4x = 101$$

has one solution which is a positive number.

Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

Trial and Improvement

1) The equation

$$x^3 - x = 29$$

has a solution between 3 and 4
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

$x^3 - x = 29$

$x = 3$	$3^3 - 3 = 24$	too low
$x = 4$	$4^3 - 4 = 60$	too high
$x = 3.1$	$3.1^3 - 3.1 = 26.691$	too low
$x = 3.2$	$3.2^3 - 3.2 = 29.568$	too high
$x = 3.15$	$3.15^3 - 3.15 = 28.105875$	too low

Therefore, $x = 3.2$ to 1 decimal place.

3.1 — 3.15 — 3.2
Low — Low — High

2) The equation

$$x^3 - 4x = 25$$

has a solution between 3 and 4
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

$x^3 - 4x = 25$

$x = 3$	$3^3 - 4 \times 3 = 15$	too low
$x = 4$	$4^3 - 4 \times 4 = 48$	too high
$x = 3.4$	$3.4^3 - 4 \times 3.4 = 25.704$	too high
$x = 3.3$	$3.3^3 - 4 \times 3.3 = 22.737$	too low
$x = 3.35$	$3.35^3 - 4 \times 3.35 = 24.195375$	too low

Therefore, $x = 3.4$ to 1 decimal place.

3.3 — 3.35 — 3.4
Low — Low — High

3) The equation

$$x^3 - 2x = 68$$

has a solution between 4 and 5
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

$x^3 - 2x = 68$

$x = 4$	$4^3 - 2 \times 4 = 56$	too low
$x = 5$	$5^3 - 2 \times 5 = 115$	too high
$x = 4.2$	$4.2^3 - 2 \times 4.2 = 65.688$	too low
$x = 4.3$	$4.3^3 - 2 \times 4.3 = 70.907$	too high
$x = 4.25$	$4.25^3 - 2 \times 4.25 = 68.265625$	too high

Therefore, $x = 4.2$ to 1 decimal place.

4.2 — 4.25 — 4.3
Low — High — High

4) The equation

$$x^3 + 4x = 101$$

has one solution which is a positive number.
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place
You must show **all** your working.

$x^3 + 4x = 101$

$x = 3$	$3^3 + 4 \times 3 = 39$	too low
$x = 4$	$4^3 + 4 \times 4 = 80$	too low
$x = 5$	$5^3 + 4 \times 5 = 145$	too high
$x = 4.2$	$4.2^3 + 4 \times 4.2 = 90.888$	too low
$x = 4.3$	$4.3^3 + 4 \times 4.3 = 96.707$	too low
$x = 4.4$	$4.4^3 + 4 \times 4.4 = 102.784$	too high
$x = 4.35$	$4.35^3 + 4 \times 4.35 = 99.712875$	too low

Therefore, $x = 4.4$ to 1 decimal place.

4.3 — 4.35 — 4.4
Low — Low — High

Index Notation

1) Write as a power of 8

a) $8^4 \times 8^3$ b) $8^{12} \div 8^7$

2) Write as a power of 3

a) $3^2 \times 3^9$ b) $3^{10} \div 3^3$

3) Simplify

a) $k^5 \times k^2$

b) $x^4 \div x^2$

c) $\dfrac{k^{11}}{k^6}$

d) $(k^8)^2$

4) Simplify

eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

a) $(2xy^5)^3$

b) $(2x^2y^2)^3$

c) $(4xy^4)^2$

d) $(3xy^2)^4$

5) $2^x \times 2^y = 2^{10}$

and

$2^x \div 2^y = 2^2$

Work out the value of x and the value of y.

6) $5^x \times 5^y = 5^{12}$

and

$5^x \div 5^y = 5^6$

Work out the value of x and the value of y.

7) $a = 2^x$, $b = 2^y$

Express in terms of a and b

a) 2^{x+y}

b) 2^{2x}

c) 2^{3y}

d) 2^{x+2y}

Index Notation

1) Write as a power of 8

a) $8^4 \times 8^3$ 8^7 b) $8^{12} \div 8^7$ 8^5

2) Write as a power of 3

a) $3^2 \times 3^9$ 3^{11} b) $3^{10} \div 3^3$ 3^7

3) Simplify

a) $k^5 \times k^2$ k^7

b) $x^4 \div x^2$ x^2

c) $\dfrac{k^{11}}{k^6}$ k^5

d) $(k^8)^2$ k^{16}

4) Simplify

eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

a) $(2xy^5)^3$ $8x^3y^{15}$

b) $(2x^2y^2)^3$ $8x^6y^6$

c) $(4xy^4)^2$ $16x^2y^8$

d) $(3xy^2)^4$ $81x^4y^8$

5) $2^x \times 2^y = 2^{10}$

and

$2^x \div 2^y = 2^2$

Work out the value of x and the value of y.

$x = 6$ and $y = 4$

6) $5^x \times 5^y = 5^{12}$

and

$5^x \div 5^y = 5^6$

Work out the value of x and the value of y.

$x = 9$ and $y = 3$

7) $a = 2^x$, $b = 2^y$

Express in terms of a and b

a) 2^{x+y} ab

b) 2^{2x} a^2

c) 2^{3y} b^3

d) 2^{x+2y} ab^2

Index Notation

1) a) Simplify $d \times d \times d \times d$
   b) Simplify $t \times t^2$
   c) Simplify $m^5 \div m^3$

2) a) Simplify $(2x^2)^3$
   b) Simplify $3x^2 \times 4x^5y^4$

3) a) Simplify $t^4 \times t^5$
   b) Simplify $x^8 \div x^5$
   c) Simplify $(c^4)^3$

4) a) Simplify $x^6 \times x^2$
   b) Simplify $\frac{x^8}{x^3}$
   c) Simplify $(2t)^3$
   d) Simplify $3x^2y \times 4x^5y^4$

5) a) Simplify $x^3 \times x^4$
   b) Simplify $t^7 \div t^3$
   c) Simplify $4x^2y^4 \times 3xy^2$

6) a) Simplify $x \times x \times x \times x$
   b) Simplify $2x \times 3y$

Index Notation

1) a) Simplify $d \times d \times d \times d$ d^4

b) Simplify $t \times t^2$ t^3

c) Simplify $m^5 \div m^3$ m^2

2) a) Simplify $(2x^2)^3$ $8x^6$

b) Simplify $3x^2 \times 4x^5y^4$ $12x^7y^4$

3) a) Simplify $t^4 \times t^5$ t^9

b) Simplify $x^8 \div x^5$ x^3

c) Simplify $(c^4)^3$ c^{12}

4) a) Simplify $x^6 \times x^2$ x^8

b) Simplify $\frac{x^8}{x^3}$ x^5

c) Simplify $(2t)^3$ $8t^3$

d) Simplify $3x^2y \times 4x^5y^4$ $12x^7y^5$

5) a) Simplify $x^3 \times x^4$ x^7

b) Simplify $t^7 \div t^3$ t^4

c) Simplify $4x^2y^4 \times 3xy^2$ $12x^3y^6$

6) a) Simplify $x \times x \times x \times x$ x^4

b) Simplify $2x \times 3y$ $6xy$

Finding the *N*th Term

1) Here are the first five terms of an arithmetic sequence.

1 3 5 7 9

Find, in terms of *n*, an expression for the *n*th term of this sequence.

2) Here are the first five terms of an arithmetic sequence.

6 10 14 18 22

Find, in terms of *n*, an expression for the *n*th term of this sequence.

3) Here are the first five terms of an arithmetic sequence.

1 4 7 10 13

Find, in terms of *n*, an expression for the *n*th term of this sequence.

4) Here are the first five terms of an arithmetic sequence.

7 12 17 22 27

Find, in terms of *n*, an expression for the *n*th term of this sequence.

5) Here are the first five terms of an arithmetic sequence.

8 6 4 2 0

Find, in terms of *n*, an expression for the *n*th term of this sequence.

Finding the *N*th Term

1) Here are the first five terms of an arithmetic sequence.

1 3 5 7 9

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$2n - 1$

2) Here are the first five terms of an arithmetic sequence.

6 10 14 18 22

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$4n + 2$

3) Here are the first five terms of an arithmetic sequence.

1 4 7 10 13

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$3n - 2$

4) Here are the first five terms of an arithmetic sequence.

7 12 17 22 27

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$5n + 2$

5) Here are the first five terms of an arithmetic sequence.

8 6 4 2 0

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$-2n + 10$

*N*th Term

1) Here are the first four terms of an arithmetic sequence.

4 7 10 13

Find an expression, in terms of n, for the nth term of the sequence.

2) The nth term of a number sequence is $n^2 + 3$
Write down the first three terms of the sequence.

3) Here are the first five terms of an arithmetic sequence.

2 7 12 17 22

a) Find, in terms of n, an expression for the nth term of this sequence.

b) An expression for the nth term of another sequence is $11 - n^2$

(i) Find the third term of this sequence.

(ii) Find the fifth term of this sequence.

4) The nth term of a sequence is $2n^2$

(i) Find the 4th term of the sequence.

(ii) Is the number 400 a term of the sequence?

Give reasons for your answer.

*N*th Term

1) Here are the first four terms of an arithmetic sequence.

4 7 10 13

Find an expression, in terms of n, for the nth term of the sequence. $3n + 1$

2) The nth term of a number sequence is $n^2 + 3$
Write down the first three terms of the sequence. 4, 7, 12

3) Here are the first five terms of an arithmetic sequence.

2 7 12 17 22

a) Find, in terms of n, an expression for the nth term of this sequence. $5n - 3$

b) An expression for the nth term of another sequence is $11 - n^2$

(i) Find the third term of this sequence. 2

(ii) Find the fifth term of this sequence. -14

4) The nth term of a sequence is $2n^2$

(i) Find the 4th term of the sequence. 32

(ii) Is the number 400 a term of the sequence? No

Give reasons for your answer.

$2n^2 = 400$

$n^2 = \frac{400}{2} = 200$

200 isn't a square number

*N*th Term

1) The *n*th term of a number sequence is given by $4n + 1$

a) Work out the first **two** terms of the number sequence.

Here are the first four terms of another number sequence.

1 4 7 10

b) Find, in terms of *n*, an expression for the *n*th term of this number sequence.

2) Here is a number pattern.

Line Number			
1	$1^2 + 3^2$	$2 \times 2^2 + 2$	10
2	$2^2 + 4^2$	$2 \times 3^2 + 2$	20
3	$3^2 + 5^2$	$2 \times 4^2 + 2$	34
4			
. . .			
10			

a) Complete Line Number 4 of the pattern.

b) Complete Line Number 10 of the pattern.

c) Use the number pattern to find the answer to $999^2 + 1001^2$

*N*th Term

1) The *n*th term of a number sequence is given by $4n + 1$

a) Work out the first **two** terms of the number sequence. 5, 9

Here are the first four terms of another number sequence.

1 4 7 10

b) Find, in terms of *n*, an expression for the *n*th term of this number sequence. $3n - 2$

2) Here is a number pattern.

Line Number			
1	$1^2 + 3^2$	$2 \times 2^2 + 2$	10
2	$2^2 + 4^2$	$2 \times 3^2 + 2$	20
3	$3^2 + 5^2$	$2 \times 4^2 + 2$	34
4	$4^2 + 6^2$	$2 \times 5^2 + 2$	52
. . .			
10	$10^2 + 12^2$	$2 \times 11^2 + 2$	244

a) Complete Line Number 4 of the pattern.

b) Complete Line Number 10 of the pattern.

c) Use the number pattern to find the answer to $999^2 + 1001^2$ 2000002

$2 \times 1000^2 + 2$
$2 \times 1000000 + 2$
$2000000 + 2$
2000002

Drawing Straight Line Graphs

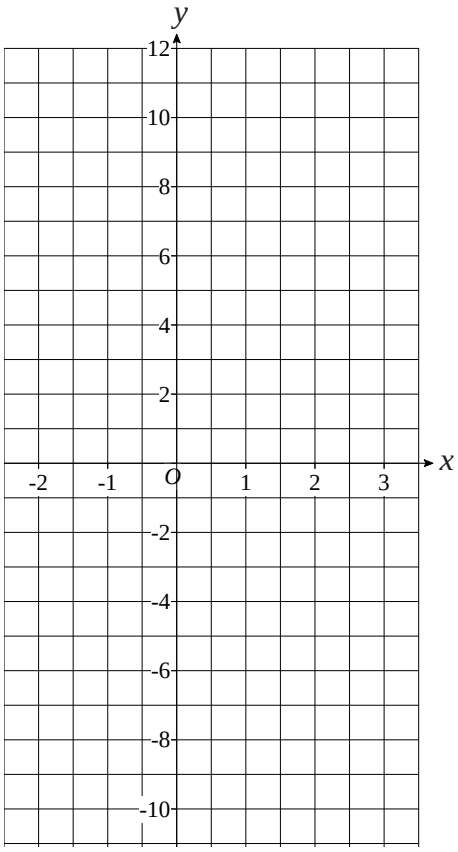
1) a) Complete the table of values for $y = 4x - 2$

x	-2	-1	0	1	2	3
y	-10		-2			10

b) On the grid, draw the graph of $y = 4x - 2$, for values of x from -2 to 3.

c) Use the graph to find the value of y when $x = 2.5$

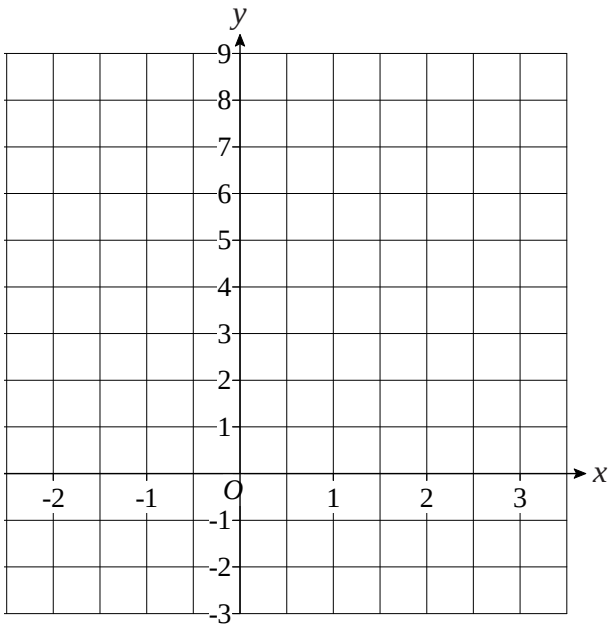
d) Use the graph to find the value of x when $y = -8$



2) a) Complete the table of values for $y = 2x + 2$

x	-2	-1	0	1	2	3
y		0	2			

b) On the grid, draw the graph of $y = 2x + 2$.



Drawing Straight Line Graphs

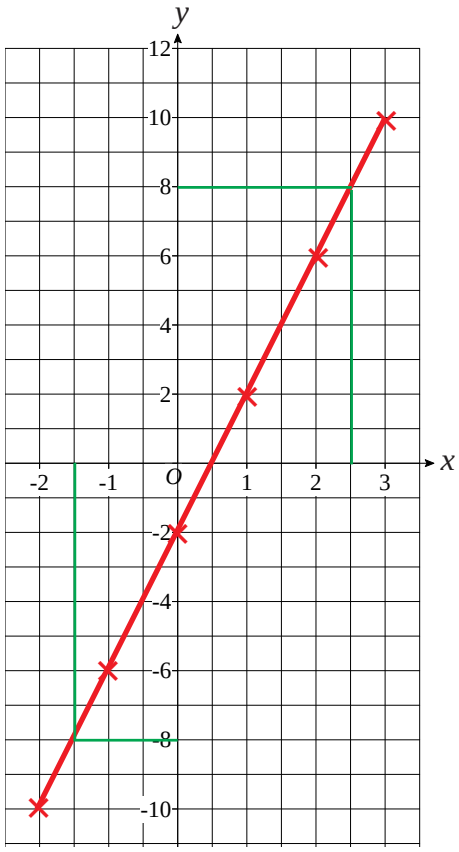
1) a) Complete the table of values for $y = 4x - 2$

x	-2	-1	0	1	2	3
y	-10	-6	-2	2	6	10

b) On the grid, draw the graph of $y = 4x - 2$, for values of x from -2 to 3.

c) Use the graph to find the value of y when $x = 2.5$
$y = 8$

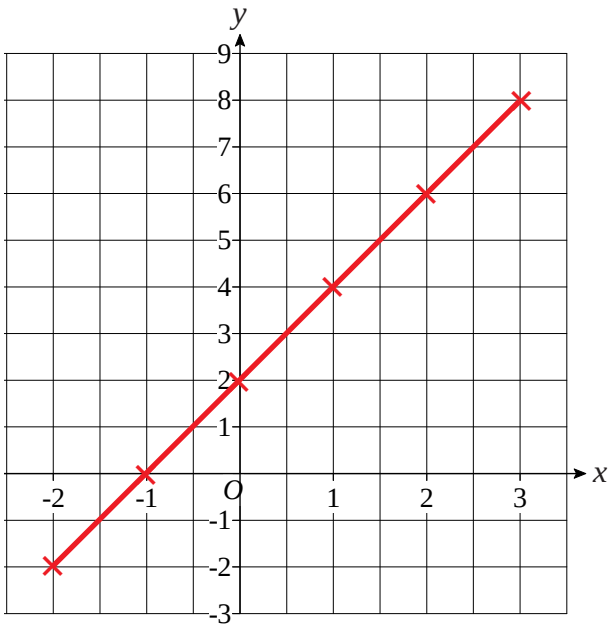
d) Use the graph to find the value of x when $y = -8$
$x = -1.5$



2) a) Complete the table of values for $y = 2x + 2$

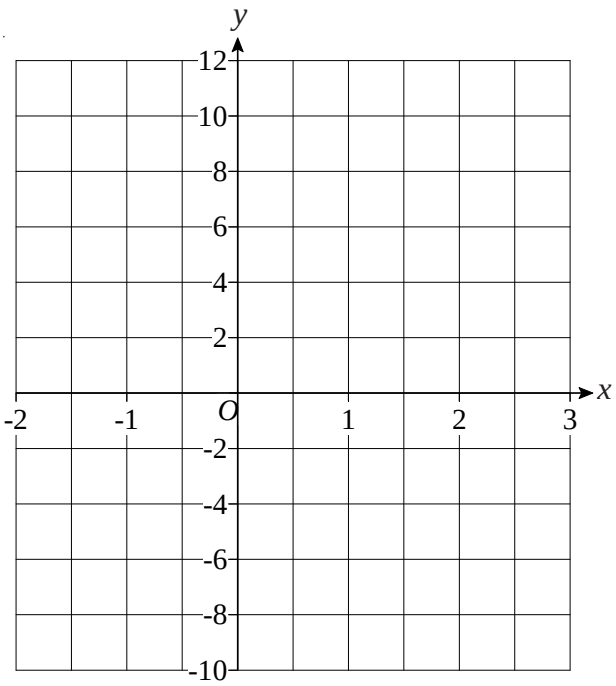
x	-2	-1	0	1	2	3
y	-2	0	2	4	6	8

b) On the grid, draw the graph of $y = 2x + 2$.



Drawing Straight Line Graphs

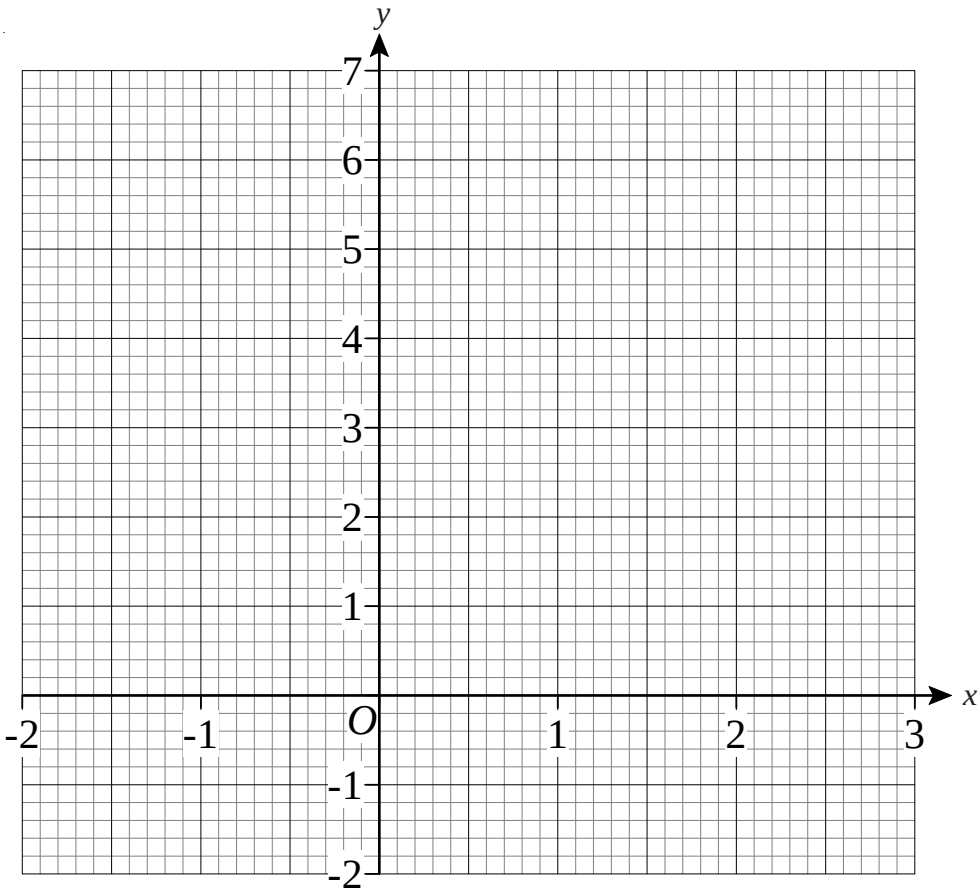
1) On the grid, draw the graph of $y = 2x - 4$



2) a) Complete the table of values for $3x + 2y = 6$

x	-2	-1	0	1	2	3
y		4.5	3			-1.5

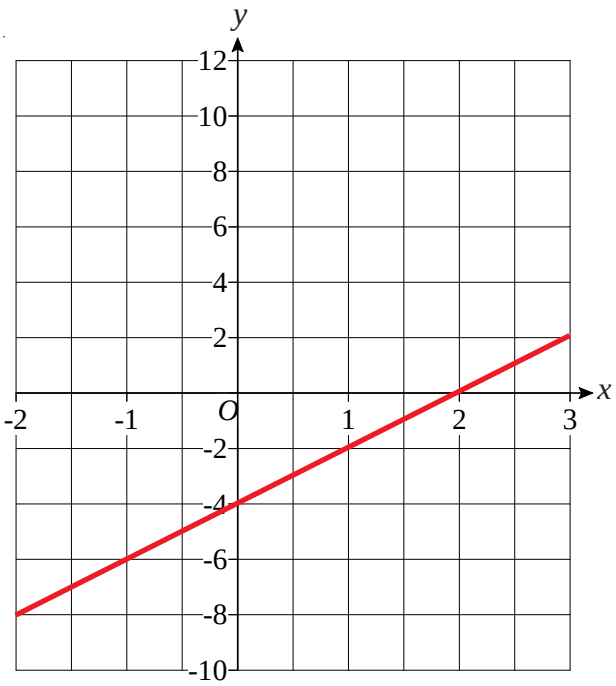
b) On the grid, draw the graph of $3x + 2y = 6$



c) Find the gradient of the graph of $3x + 2y = 6$.

Drawing Straight Line Graphs

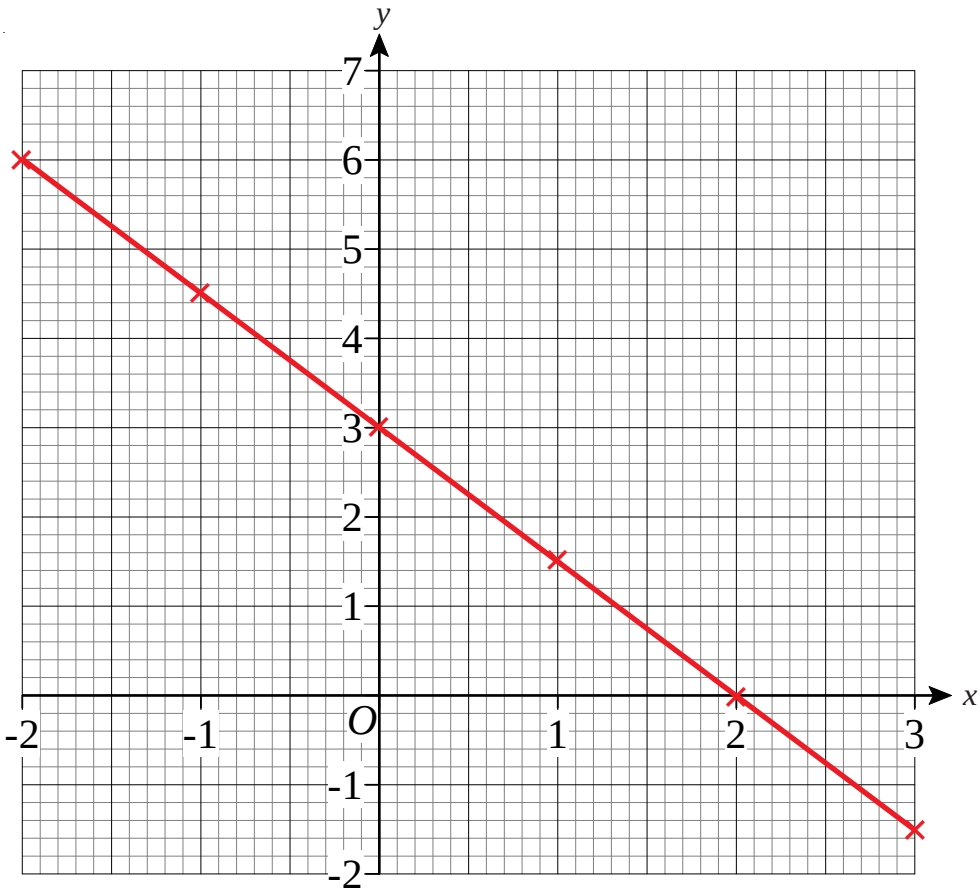
1) On the grid, draw the graph of $y = 2x - 4$



2) a) Complete the table of values for $3x + 2y = 6$

x	-2	-1	0	1	2	3
y	6	4.5	3	1.5	0	-1.5

b) On the grid, draw the graph of $3x + 2y = 6$



c) Find the gradient of the graph of $3x + 2y = 6$. Gradient is -1.5

Drawing Straight Line Graphs

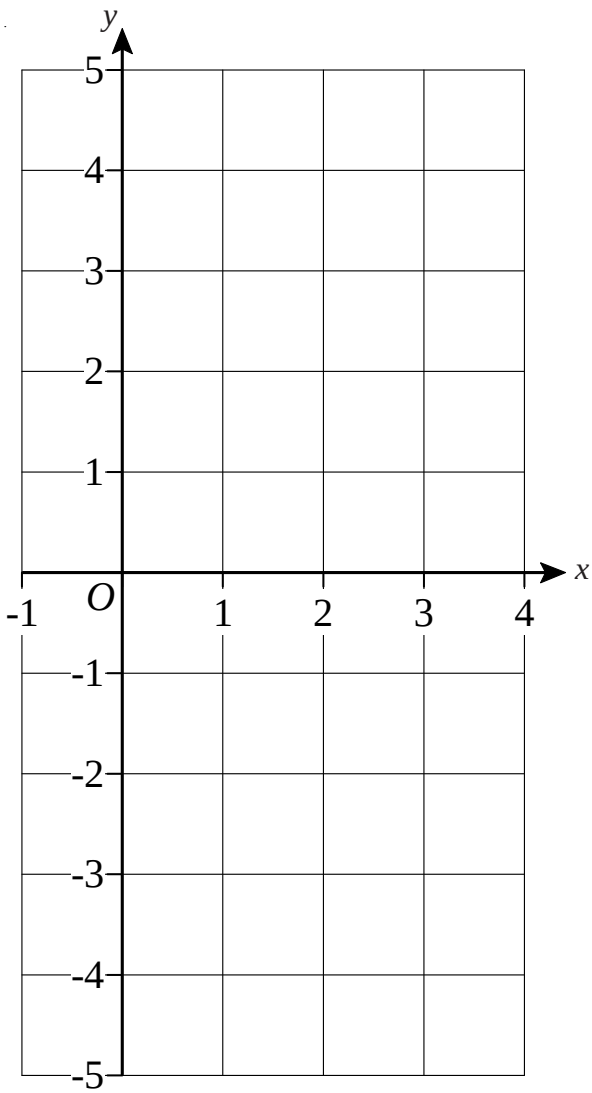
1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y				1		

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$

d) Use your graph to work out the value of x when $y = 4.5$



2) a) Complete the table of values for $y = 2 - x$

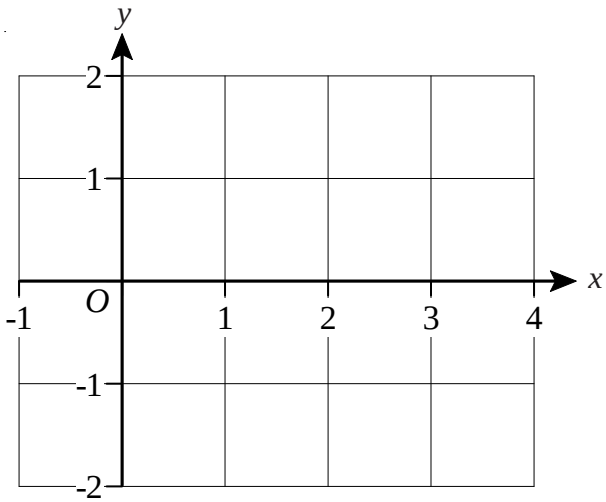
x	-1	0	1	2	3	4
y					-1	

b) Using the axes on the right, again, draw the graph of $y = 2 - x$

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

x	-1	0	1	2	3	4
y				0		

b) Draw the graph of $y = \frac{1}{2}x - 1$



c) Use your graph to find the value of y when $x = 3.5$

Drawing Straight Line Graphs

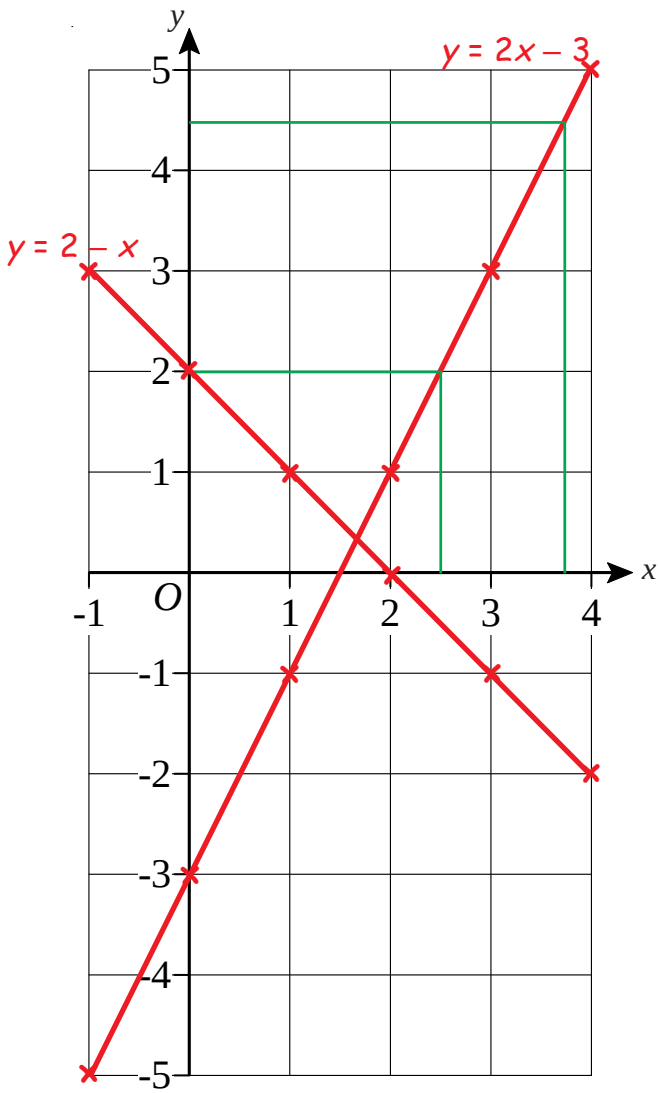
1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y	-5	-3	-1	1	3	5

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$ $y = 2$

d) Use your graph to work out the value of x when $y = 4.5$ $x = 3.75$



2) a) Complete the table of values for $y = 2 - x$

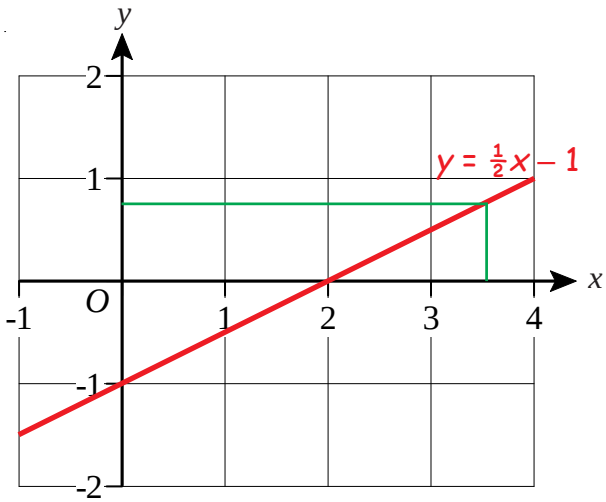
x	-1	0	1	2	3	4
y	3	2	1	0	-1	-2

b) Using the axes on the right, again, draw the graph of $y = 2 - x$

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

x	-1	0	1	2	3	4
y	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1

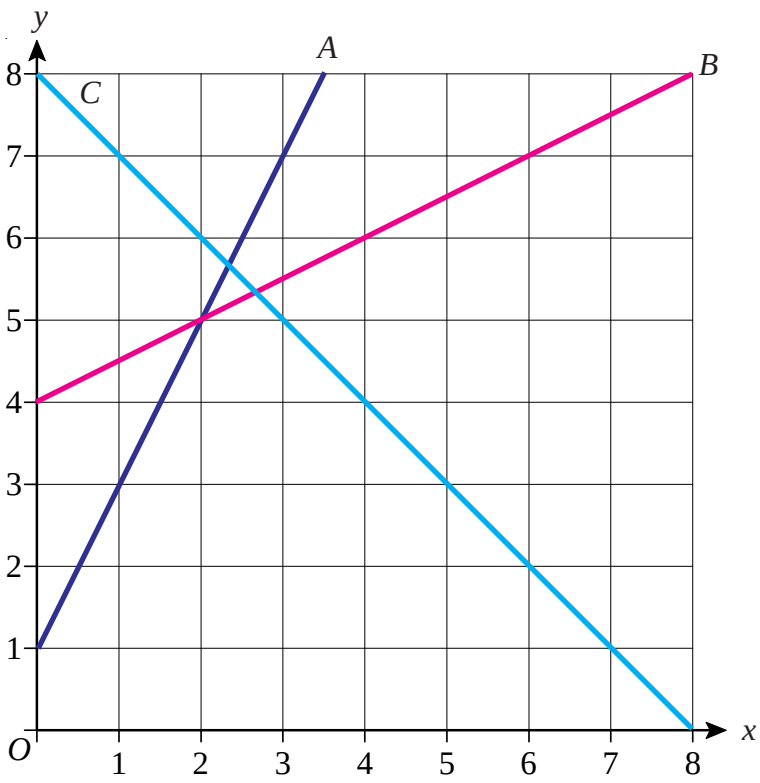
b) Draw the graph of $y = \frac{1}{2}x - 1$



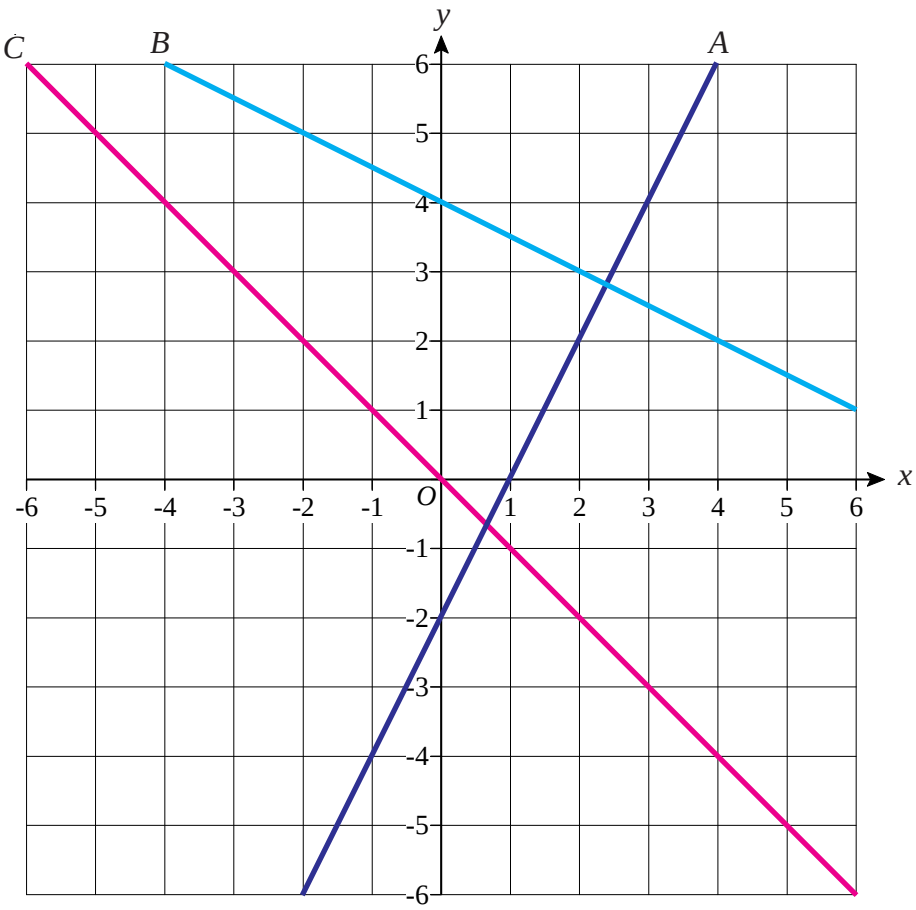
c) Use your graph to find the value of y when $x = 3.5$ $x = 0.75$

Finding the Equation of a Straight Line

1) Find the equations of lines *A*, *B* and *C* on the axes below

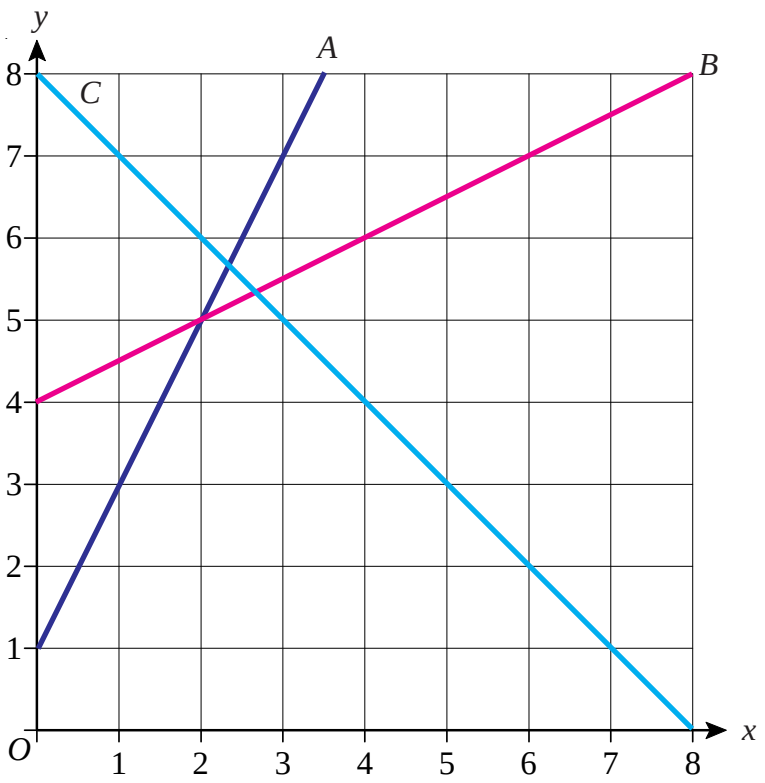


2) Find the equations of lines *A*, *B* and *C* on the axes below



Finding the Equation of a Straight Line

1) Find the equations of lines *A*, *B* and *C* on the axes below



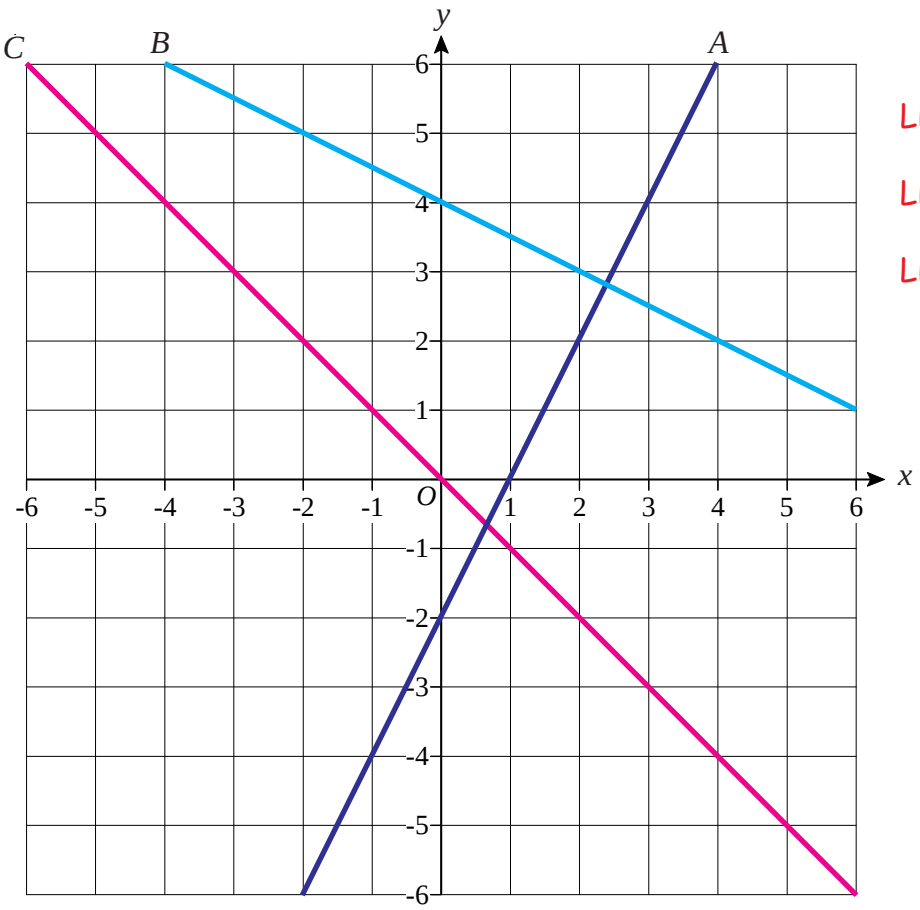
Line *A*: $y = 2x + 1$

Line *B*: $y = \frac{1}{2}x + 4$

Line *C*: $y = -x + 8$

or Line *C*: $y = 8 - x$

2) Find the equations of lines *A*, *B* and *C* on the axes below



Line *A*: $y = 2x - 2$

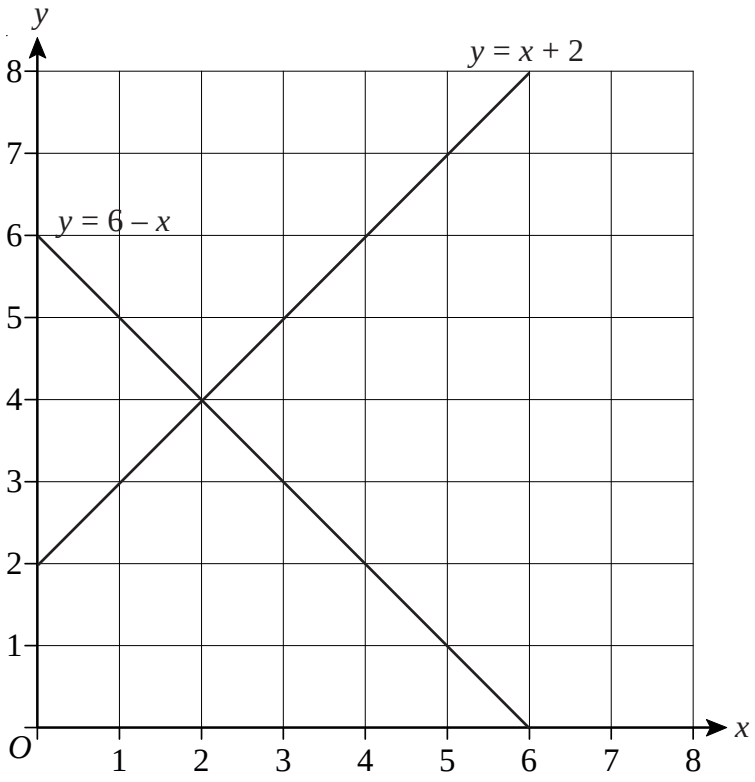
Line *B*: $y = -\frac{1}{2}x + 4$

Line *C*: $y = -x$

Solving Simultaneous Equations Graphically

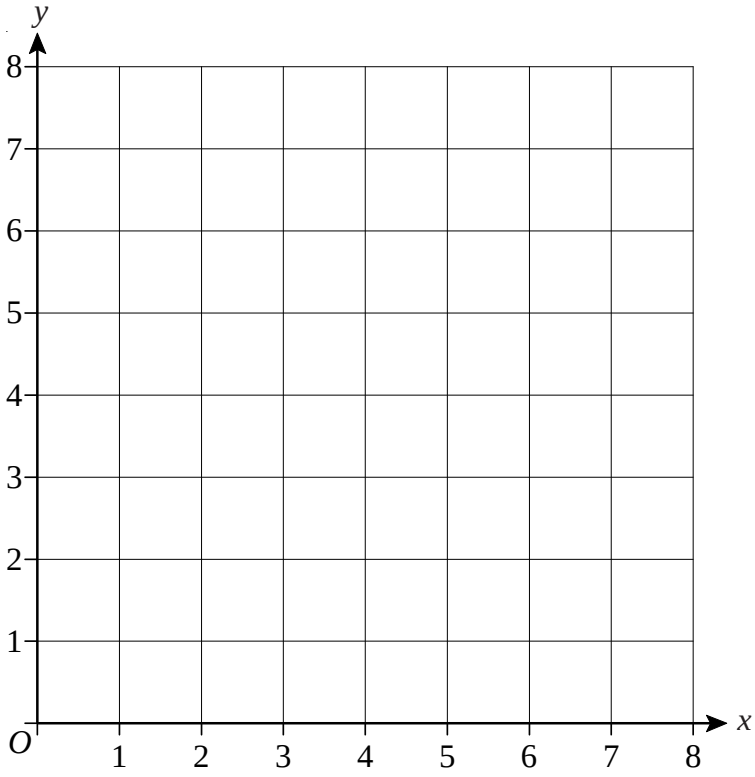
1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.

Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$



2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$

Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$

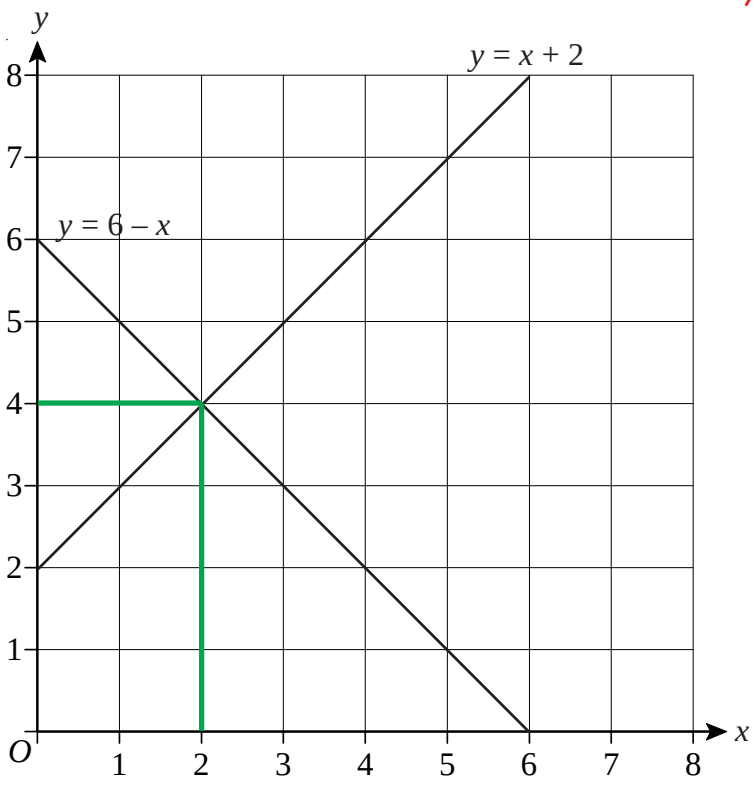


Solving Simultaneous Equations Graphically

1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.

Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$

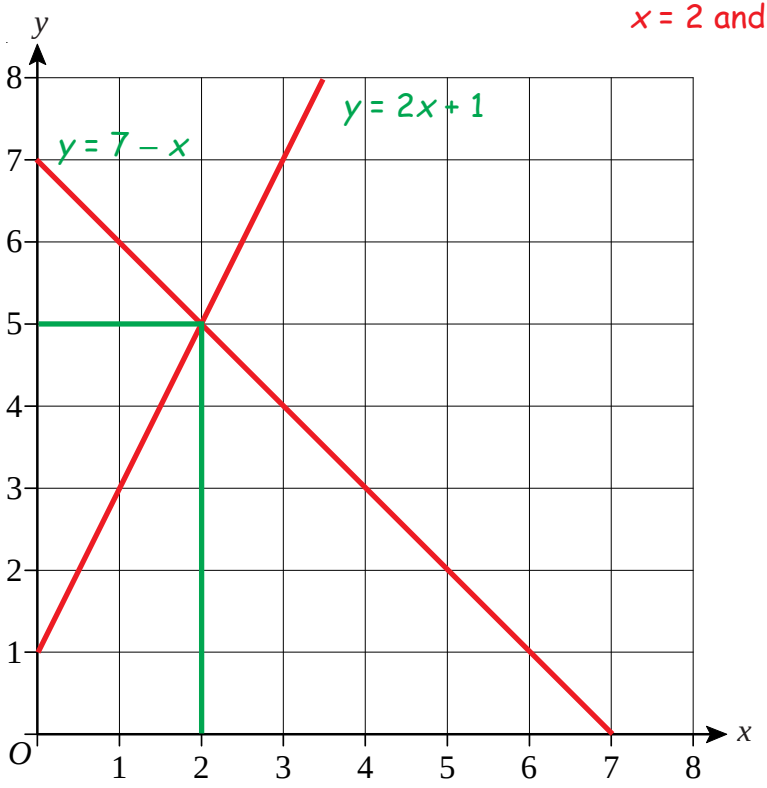
$x = 2$ and $y = 4$



2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$

Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$

$x = 2$ and $y = 5$

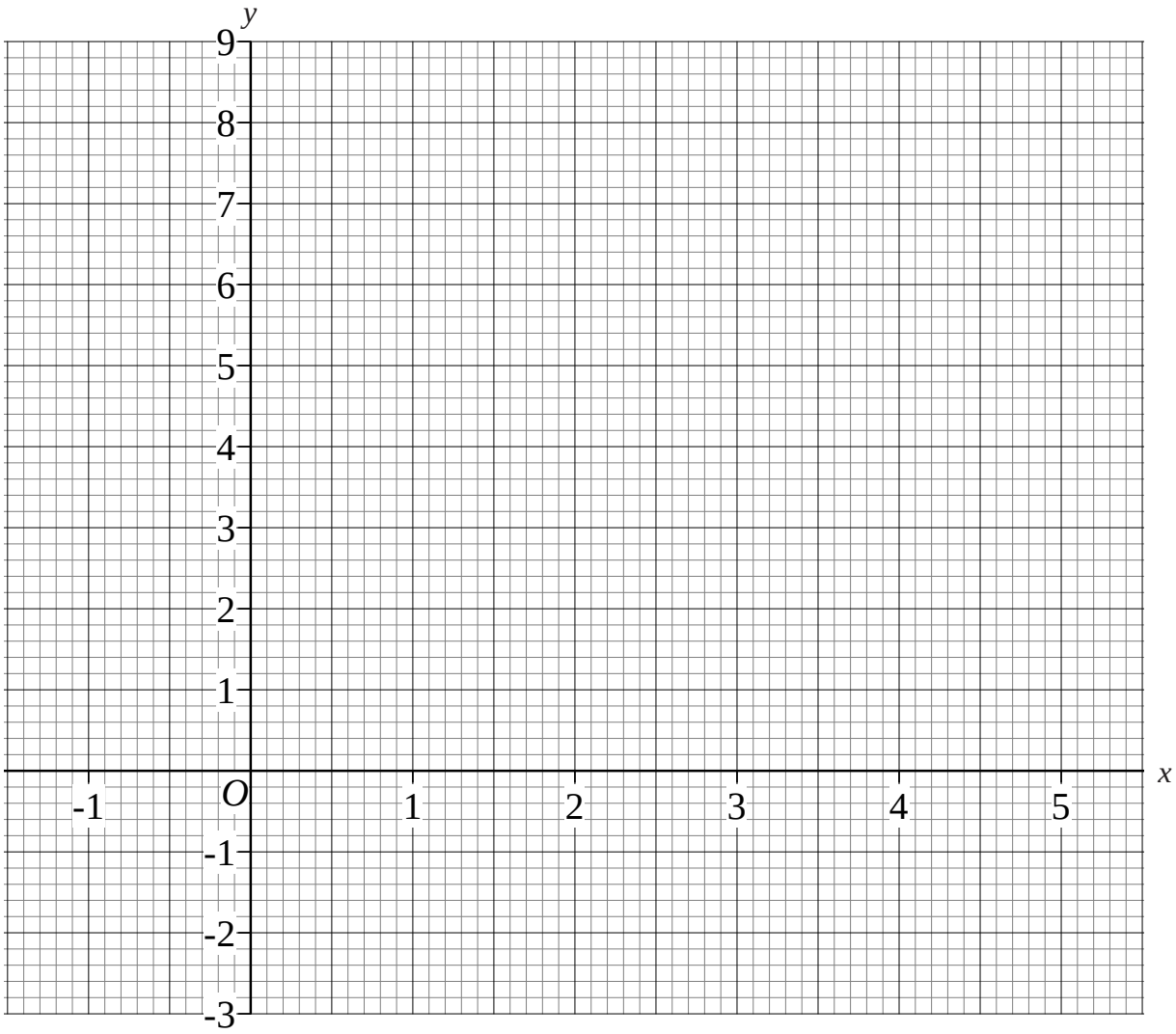


Drawing Quadratic Graphs

1) Complete the table of values for $y = x^2 - 4x + 3$

x	-1	0	1	2	3	4	5
y		3	0		0		8

On the grid, draw the graph of $y = x^2 - 4x + 3$

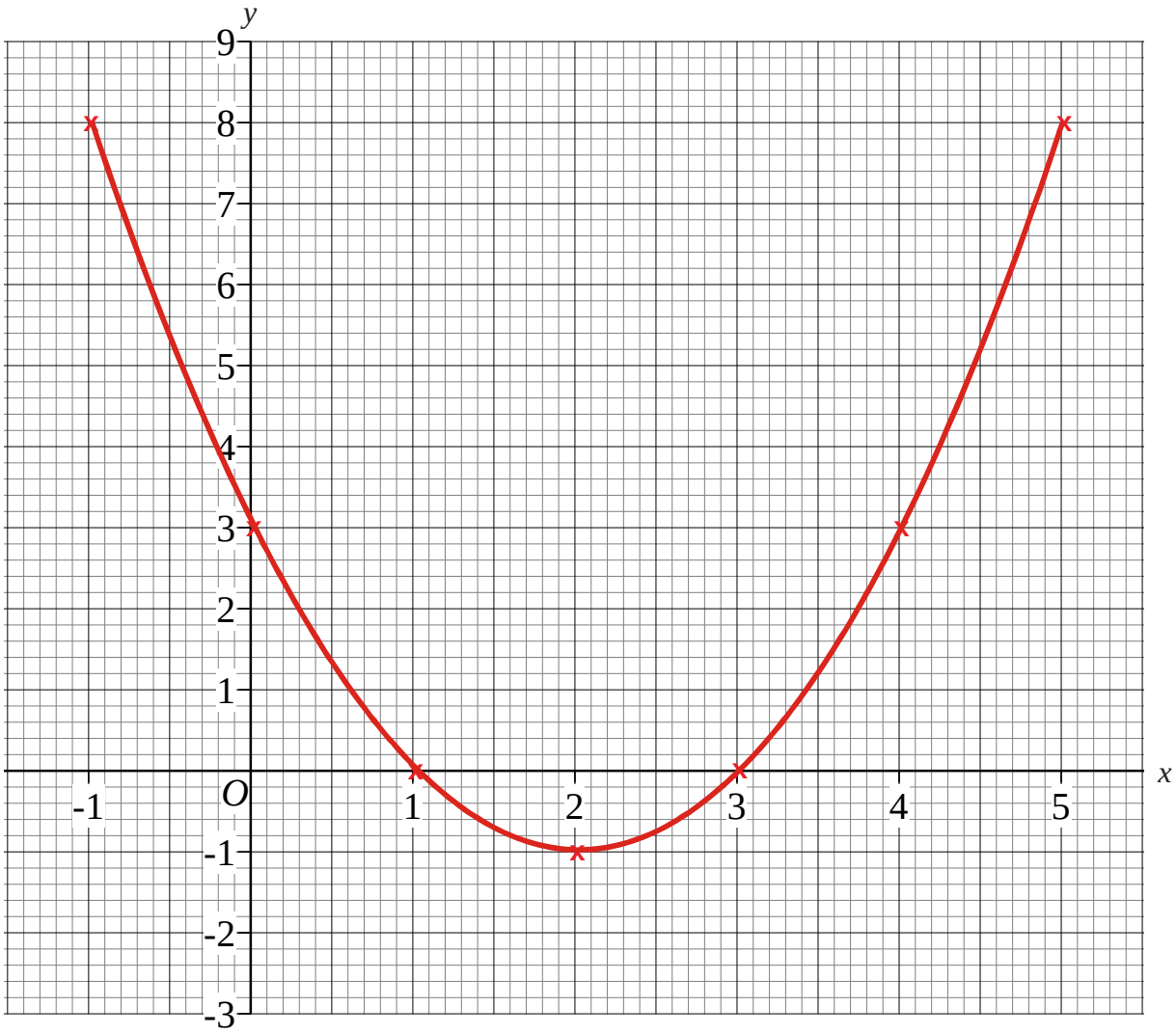


Drawing Quadratic Graphs

1) Complete the table of values for $y = x^2 - 4x + 3$

x	-1	0	1	2	3	4	5
y	8	3	0	-1	0	3	8

On the grid, draw the graph of $y = x^2 - 4x + 3$

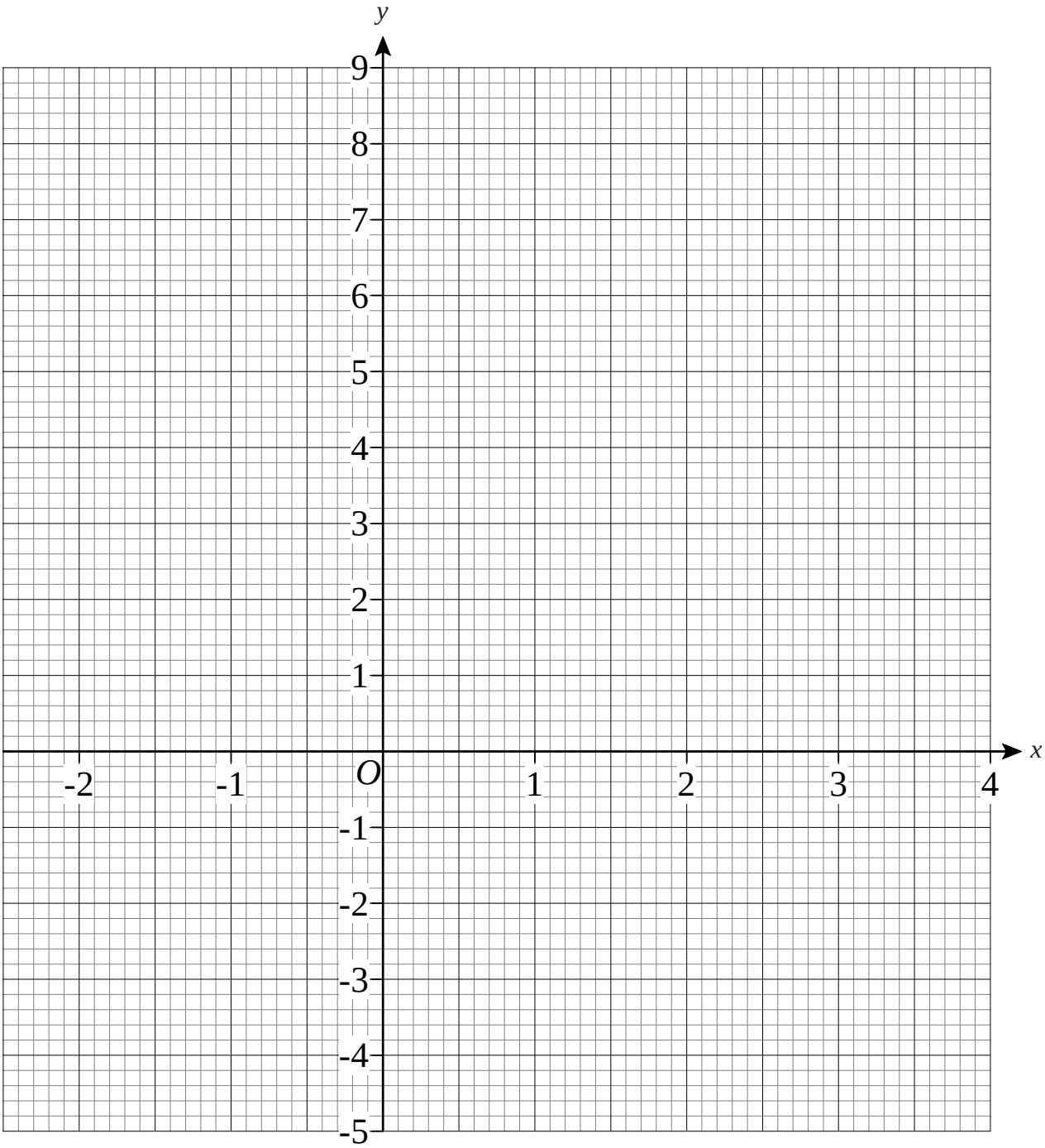


Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 - 3x - 2$

x	-2	-1	0	1	2	3	4
y		2	-2	-4		-2	

b) On the grid, draw the graph of $y = x^2 - 3x - 2$



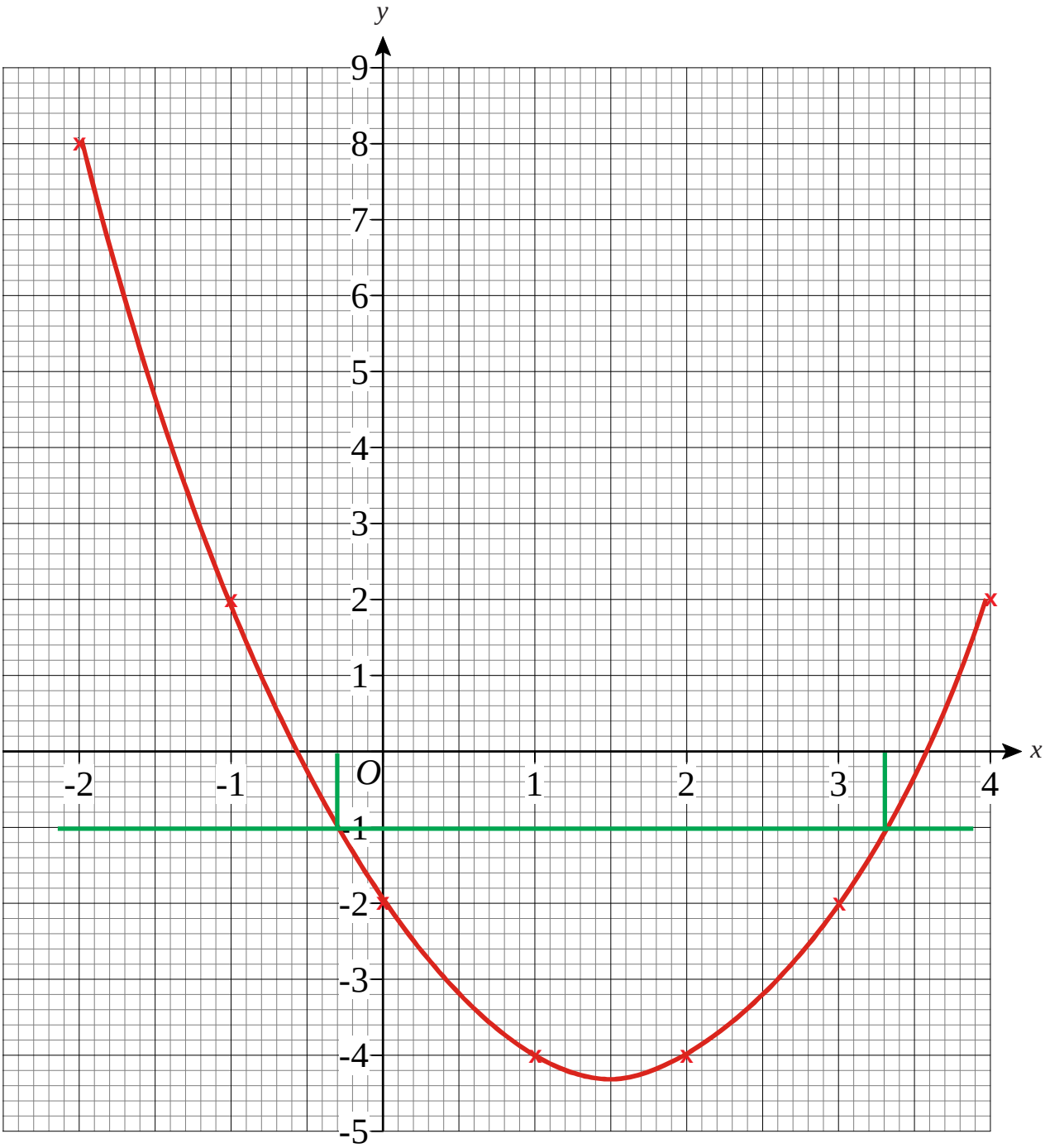
c) Use your graph to estimate the values of x when $y = -1$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 - 3x - 2$

x	-2	-1	0	1	2	3	4
y	8	2	-2	-4	-4	-2	2

b) On the grid, draw the graph of $y = x^2 - 3x - 2$



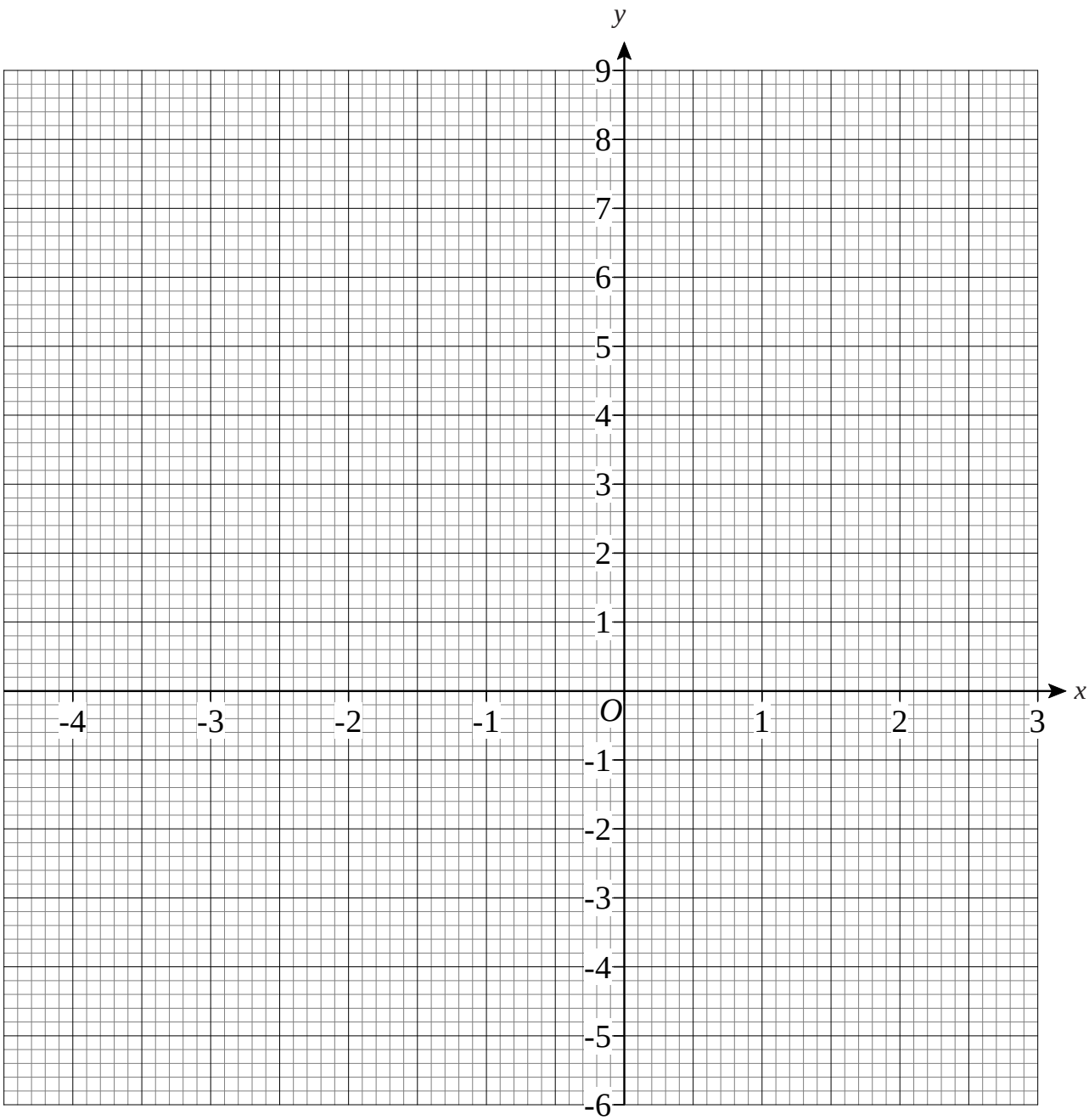
c) Use your graph to estimate the values of x when $y = -1$ $x = -0.3$ and $x = 3.3$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 + x - 4$

x	-4	-3	-2	-1	0	1	2	3
y	8		-2	-4				8

b) On the grid, draw the graph of $y = x^2 + x - 4$

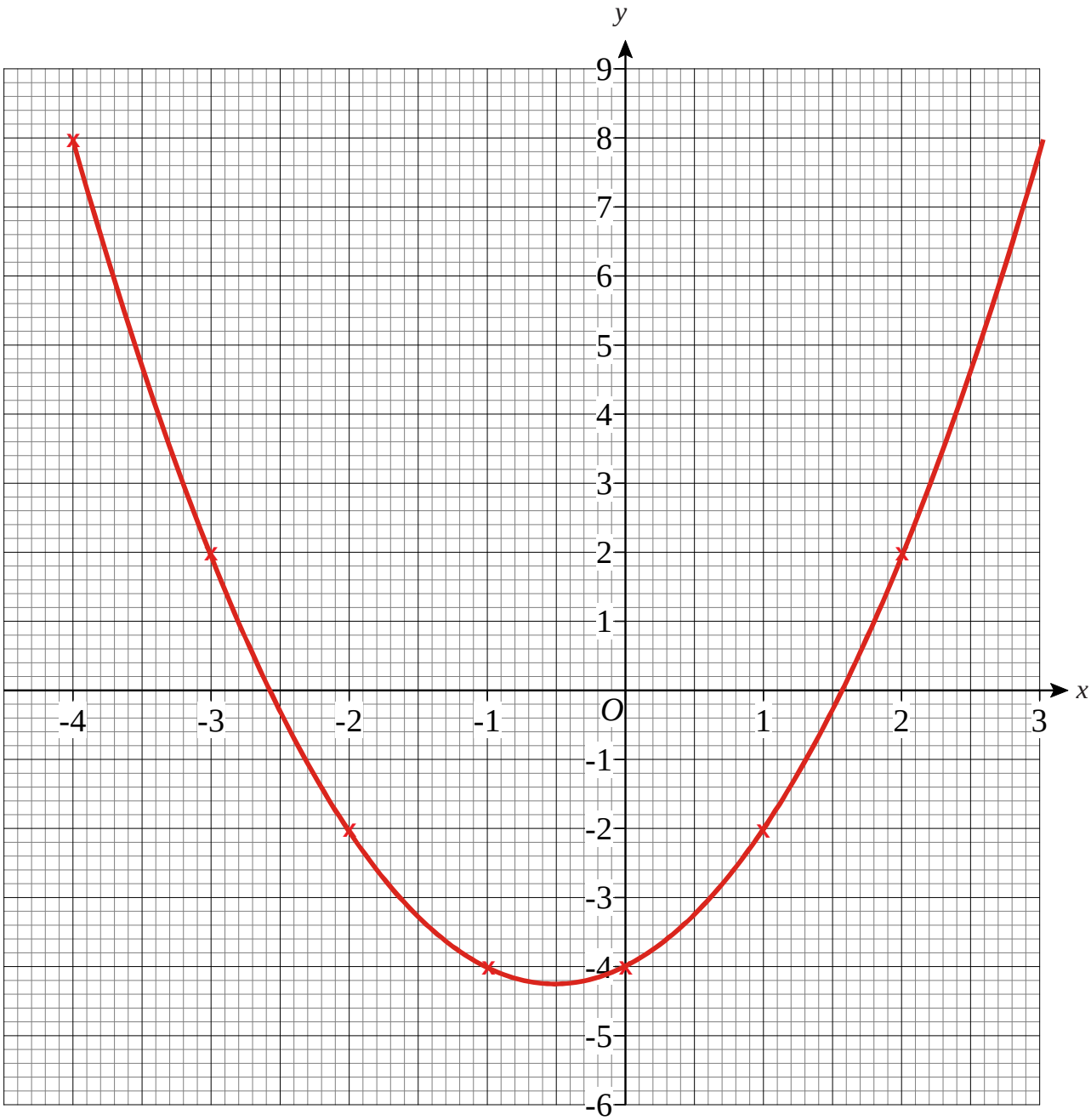


Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 + x - 4$

x	-4	-3	-2	-1	0	1	2	3
y	8	2	-2	-4	-4	-2	2	8

b) On the grid, draw the graph of $y = x^2 + x - 4$

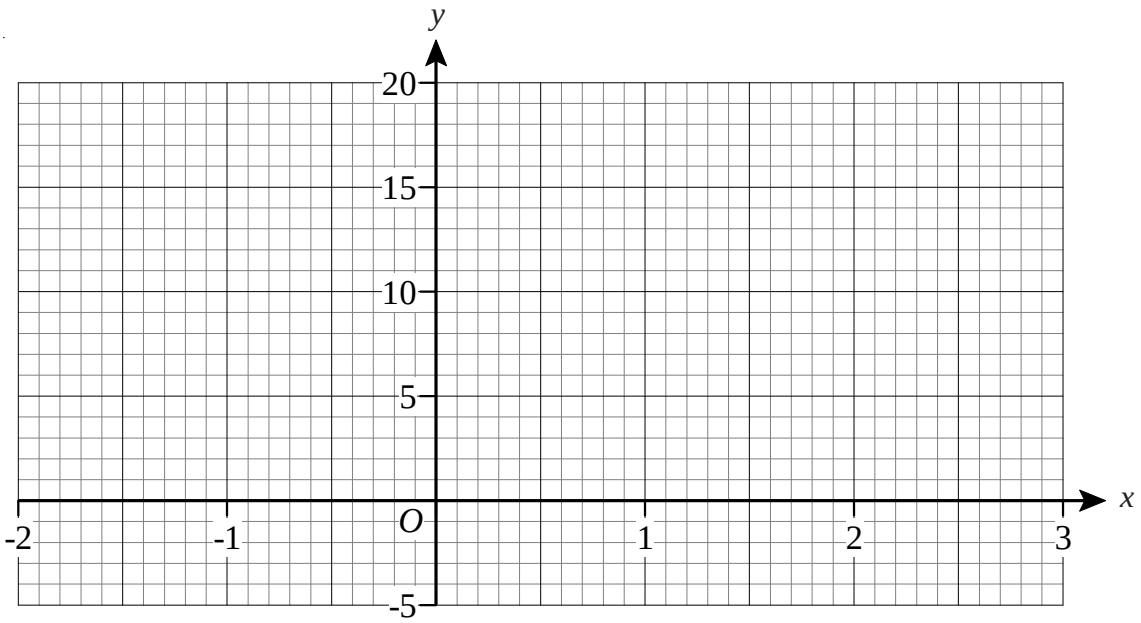


Drawing Quadratic Graphs

1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14		0			9

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3



c) Use the graph to find the value of y when $x = -1.5$

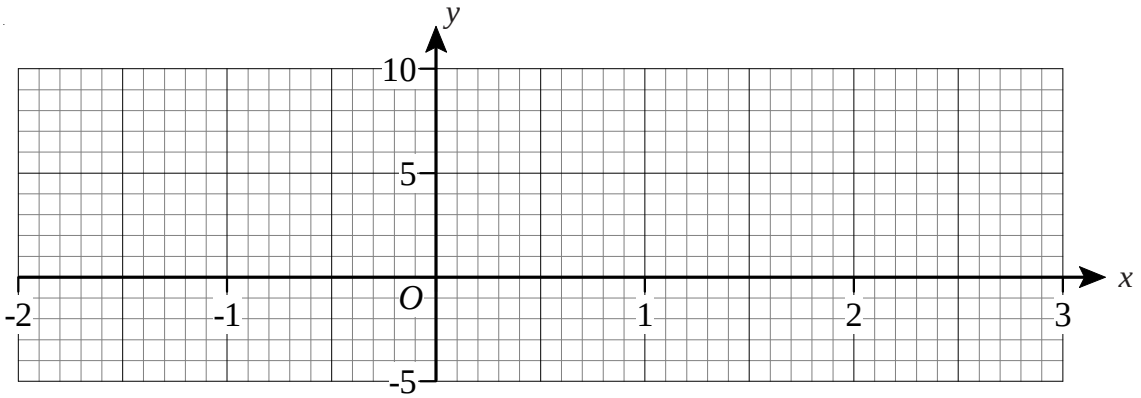
d) Use the graph to find the values of x when $y = 4$

---

2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8		0			

b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3



c) (i) On the same axes draw the straight line $y = 2.5$

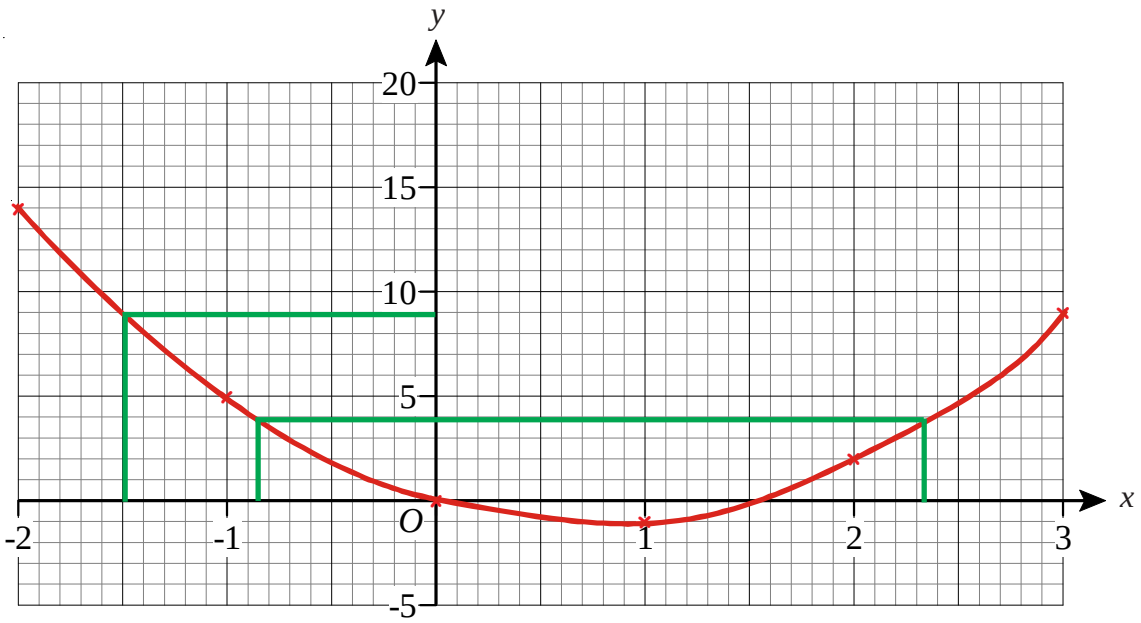
(ii) Write down the values of x for which $x^2 - 2x = 2.5$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14	5	0	-1	2	9

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3



c) Use the graph to find the value of y when $x = -1.5$ $y = 9$

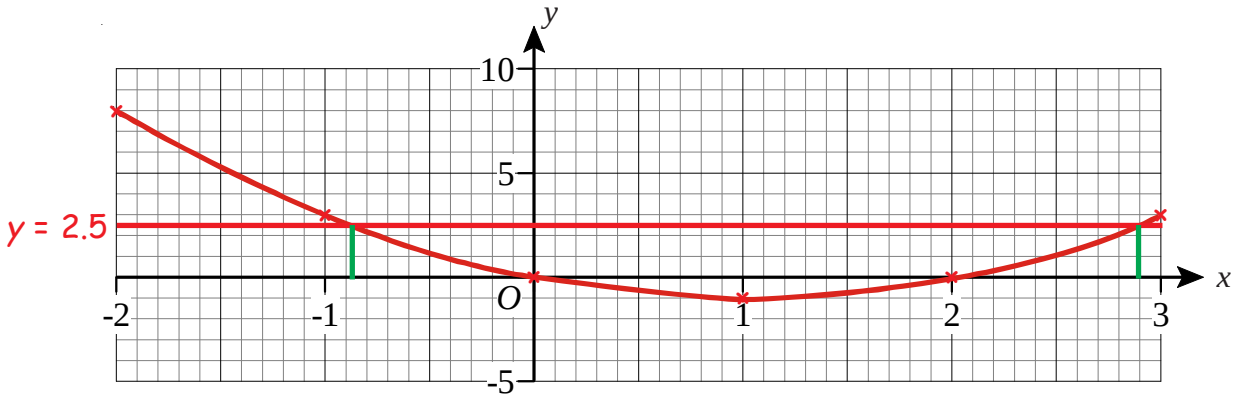
d) Use the graph to find the values of x when $y = 4$ $x = -0.85$ and $x = 2.33$

---

2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8	3	0	-1	0	3

b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3

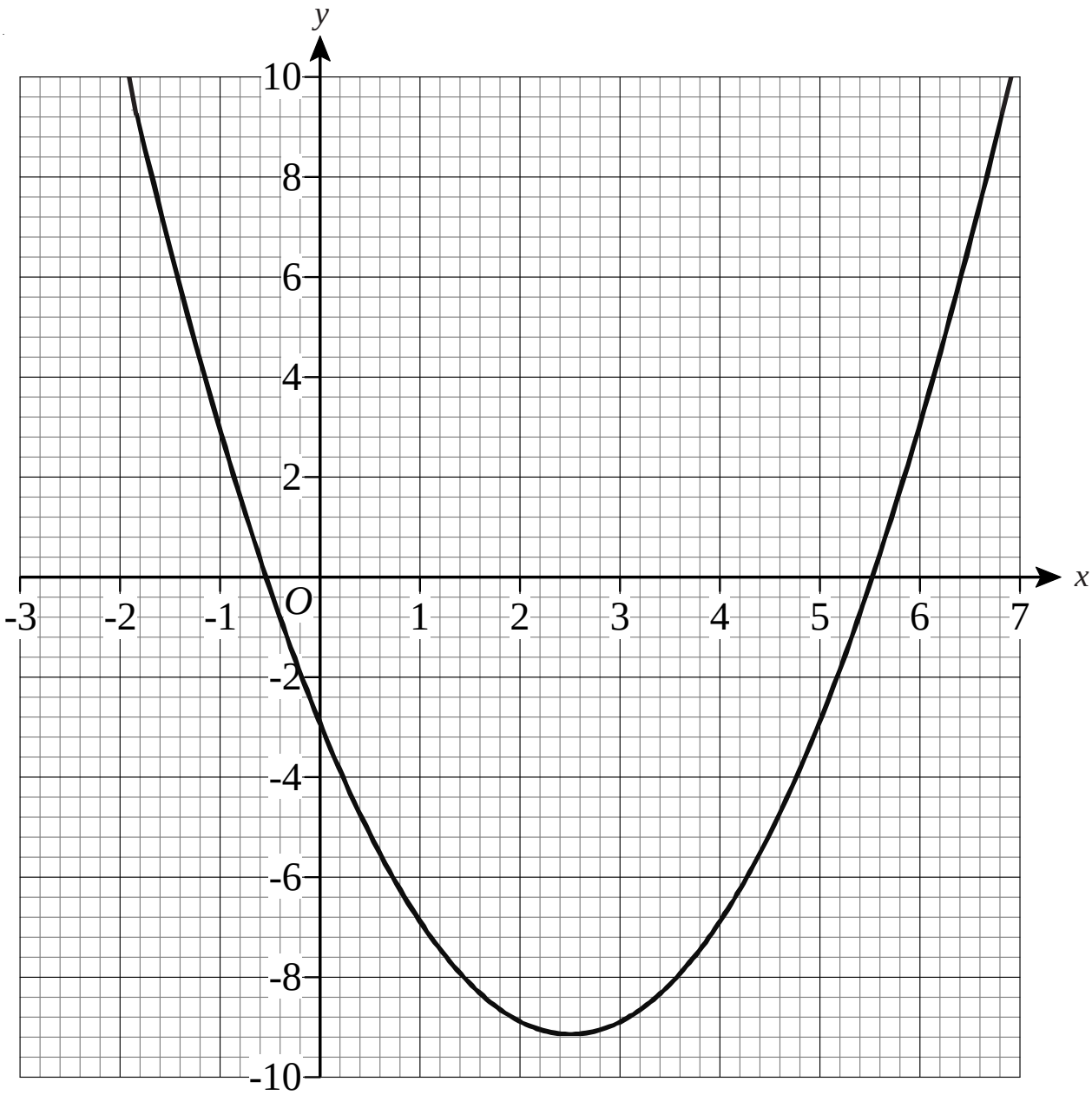


c) (i) On the same axes draw the straight line $y = 2.5$

(ii) Write down the values of x for which $x^2 - 2x = 2.5$ $x = -0.89$ or $x = 2.9$

Drawing Quadratic Graphs

1) The diagram shows the graph of $y = x^2 - 5x - 3$



a) Use the graph to find estimates for the solutions of

(i) $x^2 - 5x - 3 = 0$

(ii) $x^2 - 5x - 3 = 6$

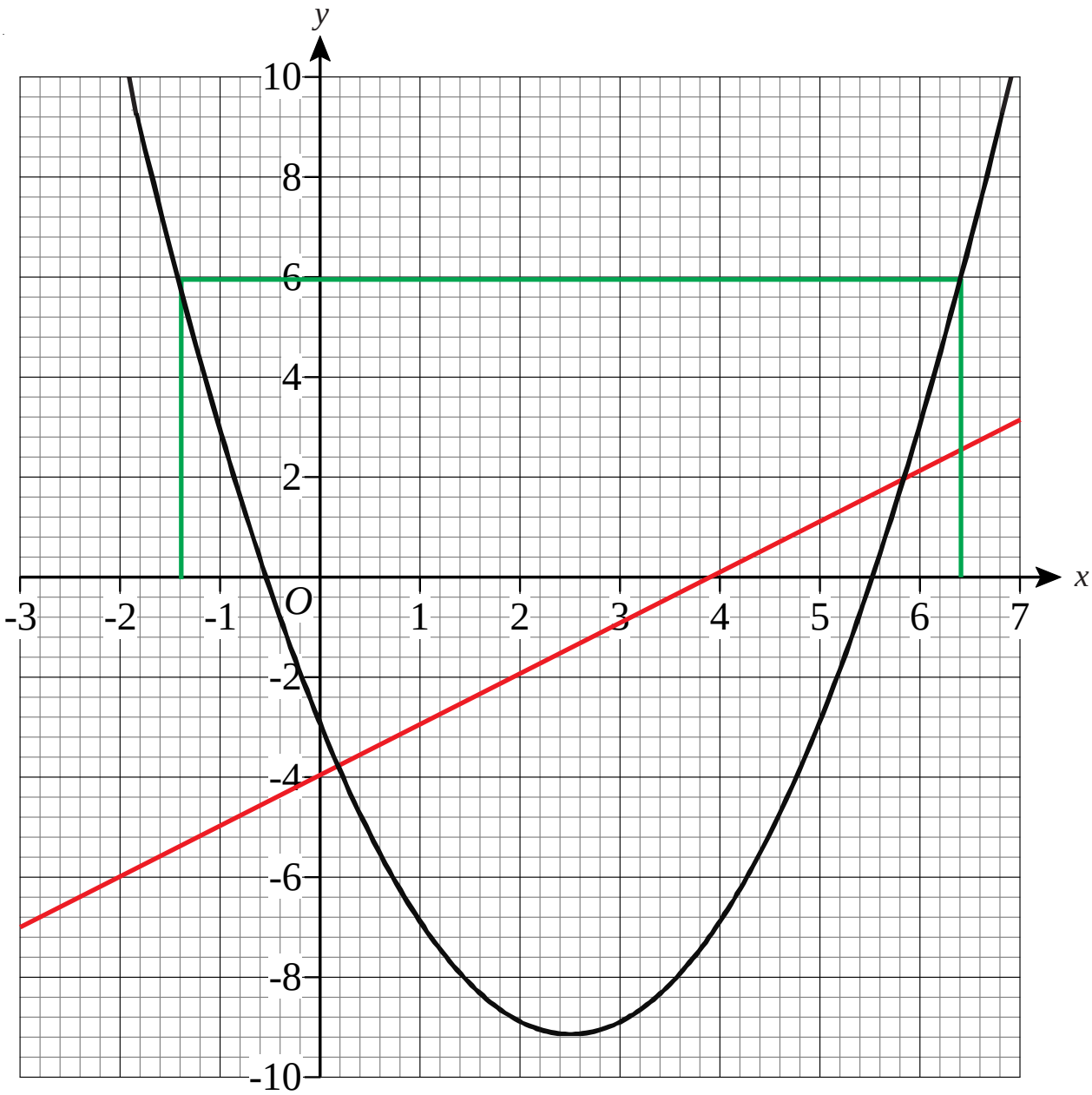
b) Use the graph to find estimates for the solutions of the simultaneous equations

$y = x^2 - 5x - 3$

$y = x - 4$

Drawing Quadratic Graphs

1) The diagram shows the graph of $y = x^2 - 5x - 3$



a) Use the graph to find estimates for the solutions of

(i) $x^2 - 5x - 3 = 0$ $x = -0.5$ and 5.5

(ii) $x^2 - 5x - 3 = 6$ $x = -1.4$ and 6.4

b) Use the graph to find estimates for the solutions of the simultaneous equations

$y = x^2 - 5x - 3$ $x = 0.2$ $x = 5.8$

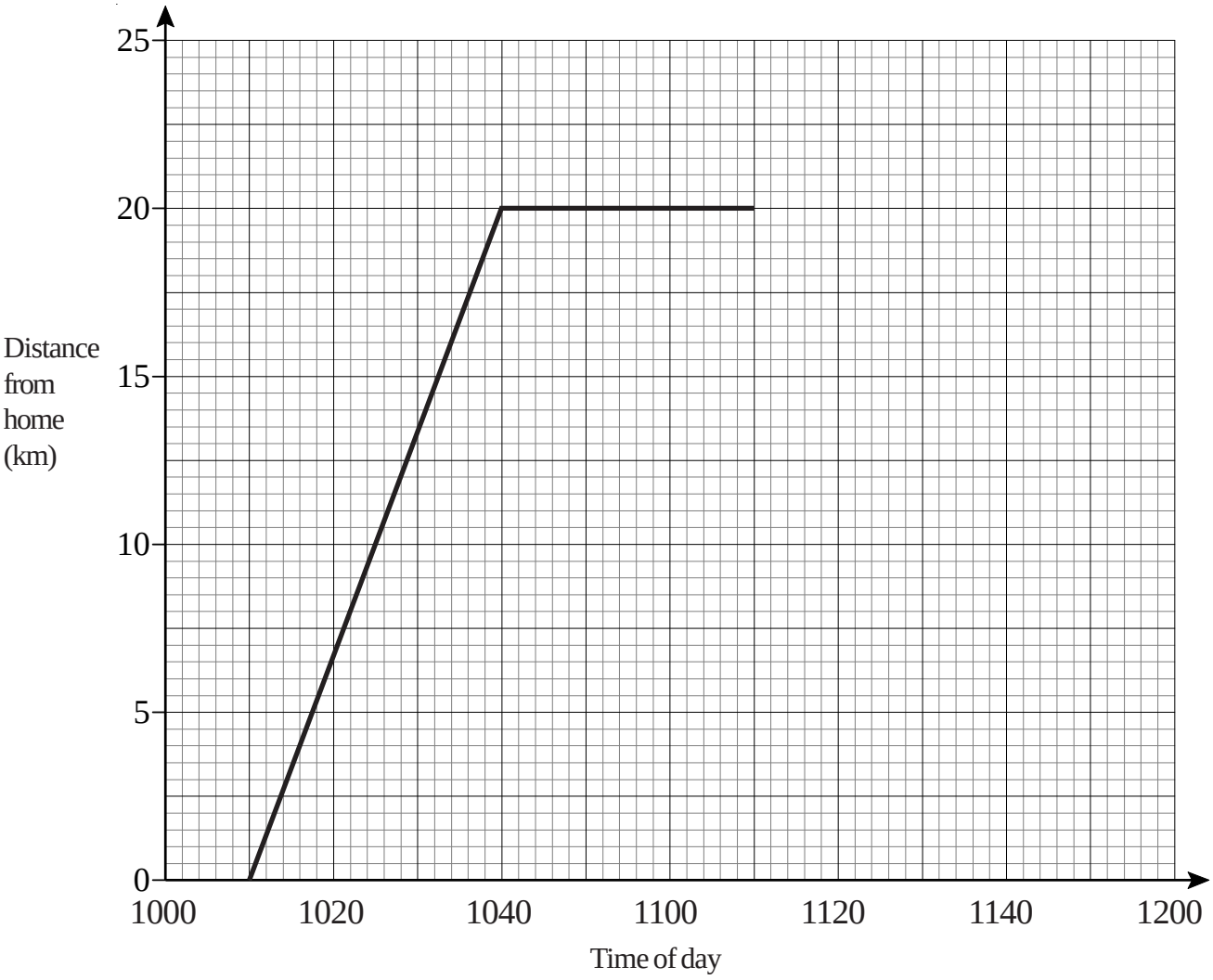
$y = x - 4$ $y = -3.8$ $y = 1.8$

$y = x - 4$

x	y
0	-4
1	-3
2	-2

Distance-Time Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.



a) At what time did Sarah leave home?

b) How far was Sarah from home at 10 30?

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house.

Sarah returned home at a steady speed.
She arrived home at 11 50

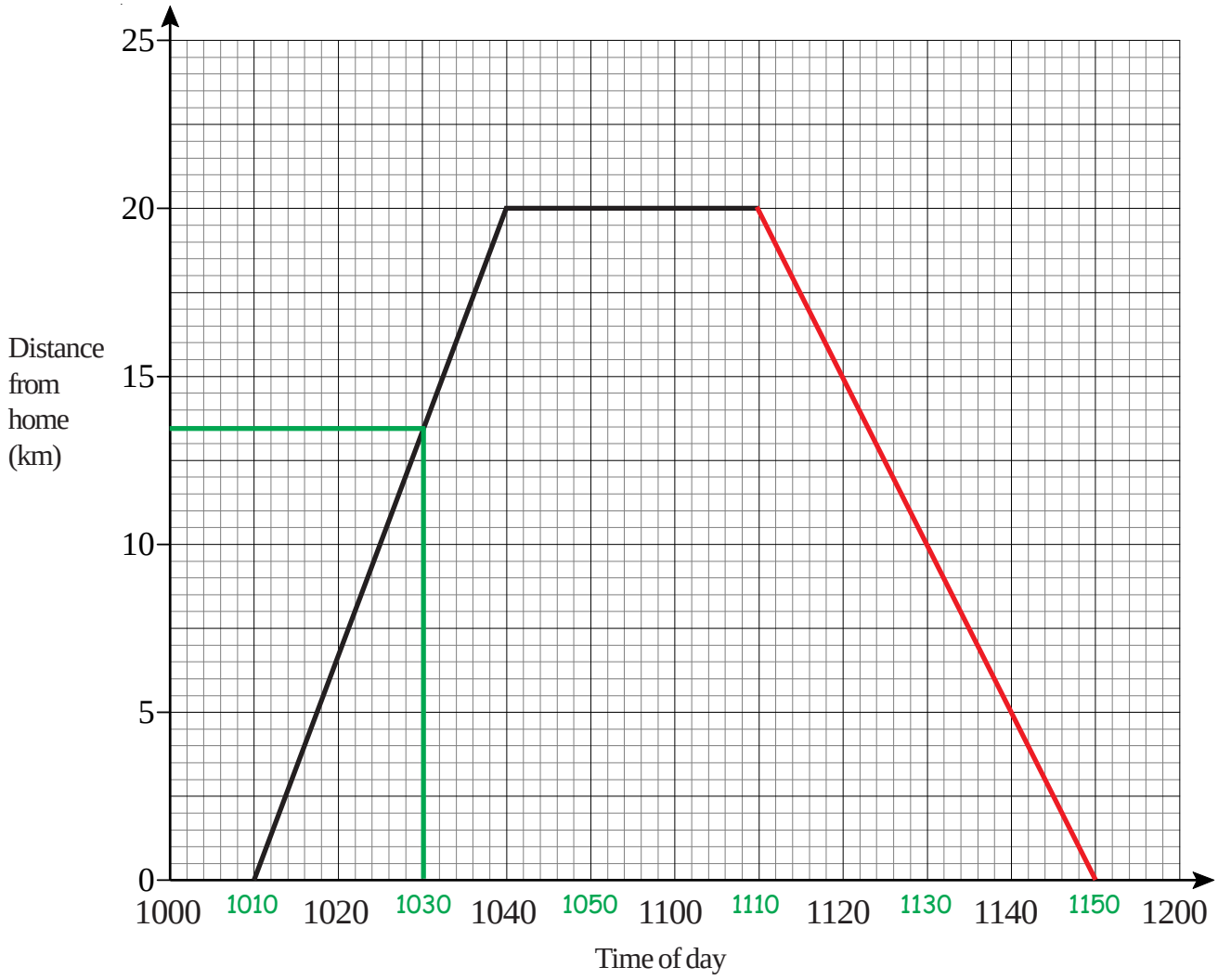
d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour.

f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour.

Distance-Time Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.



a) At what time did Sarah leave home? 10 10

b) How far was Sarah from home at 10 30? 13.5 km

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house. 30 minutes

Sarah returned home at a steady speed.
She arrived home at 11 50

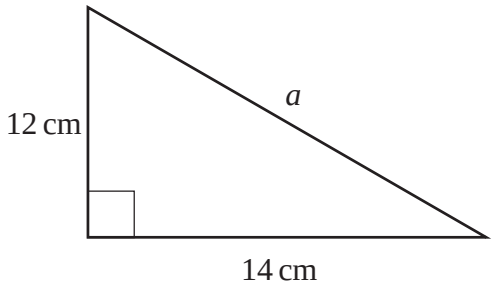
d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour. 40km/h

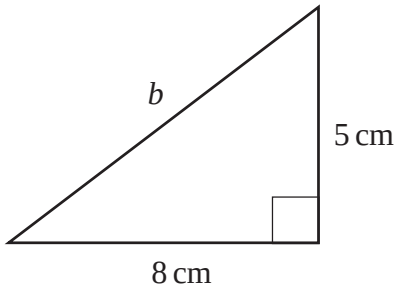
f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour. 30km/h

Pythagoras' Theorem

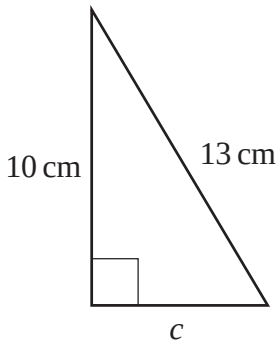
1) Find the length of side *a*.
Give your answer to 1 decimal place.



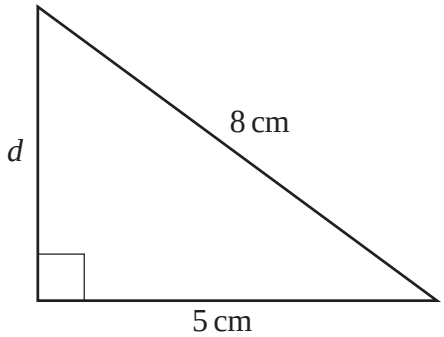
2) Find the length of side *b*.
Give your answer to 1 decimal place.



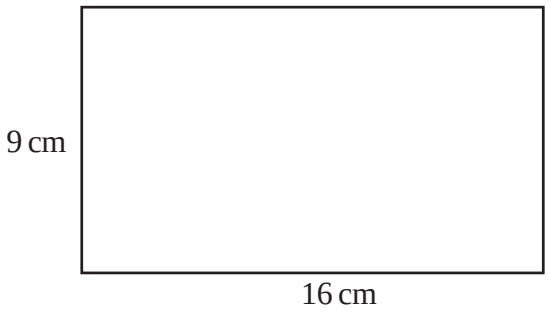
3) Find the length of side *c*.
Give your answer to 1 decimal place.



4) Find the length of side *d*.
Give your answer to 1 decimal place.

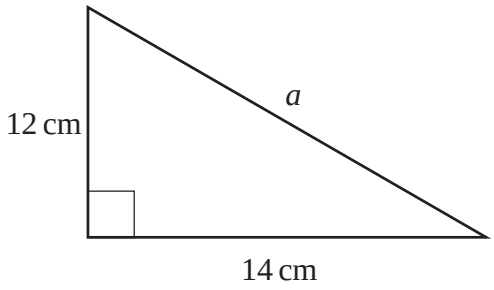


5) Find the length of the diagonal of this rectangle.
Give your answer to 1 decimal place.

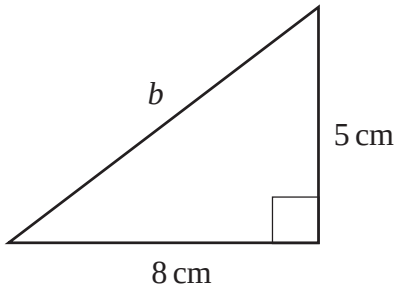


Pythagoras' Theorem

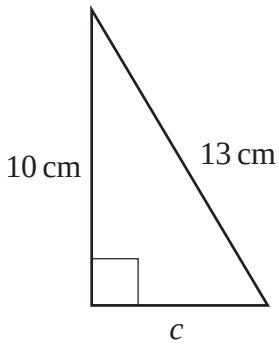
1) Find the length of side *a*. 18.4 cm
Give your answer to 1 decimal place.



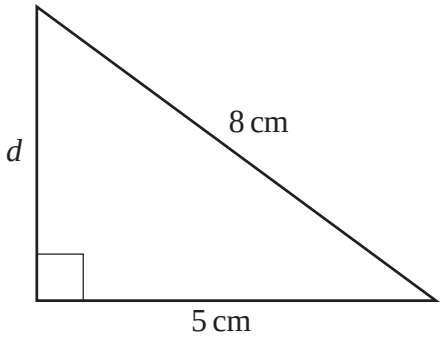
2) Find the length of side *b*. 9.4 cm
Give your answer to 1 decimal place.



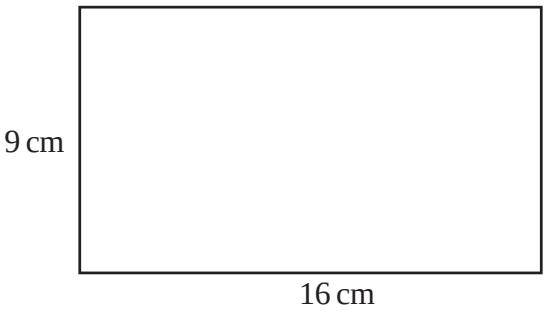
3) Find the length of side *c*. 8.3 cm
Give your answer to 1 decimal place.



4) Find the length of side *d*. 6.2 cm
Give your answer to 1 decimal place.

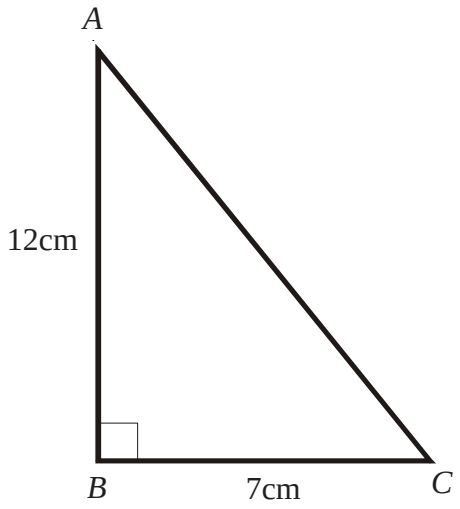


5) Find the length of the diagonal of this rectangle.
Give your answer to 1 decimal place. 18.4 cm

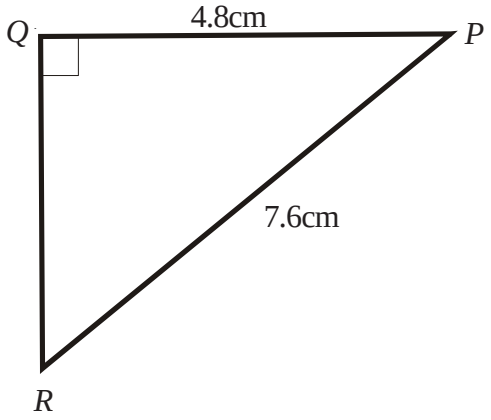


Pythagoras' Theorem

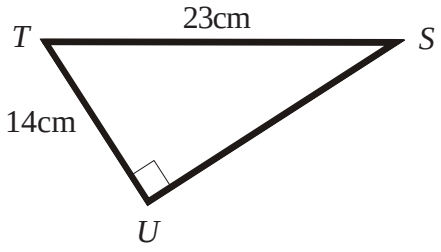
1) Find the length of side *AC*.
Give your answer to 1 decimal place.



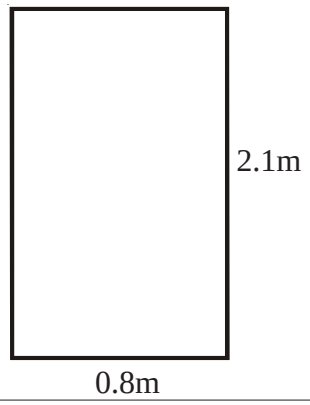
2) Find the length of side *QR*
Give your answer to 1 decimal place.



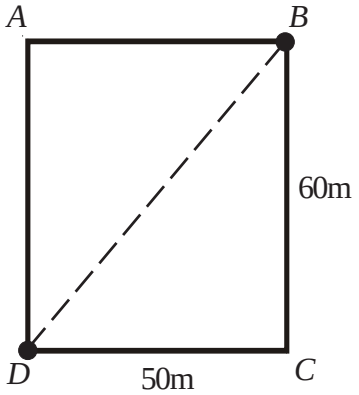
3) Find the length of side *SU*
Give your answer to 1 decimal place.



4) Below is a picture of a doorway.
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

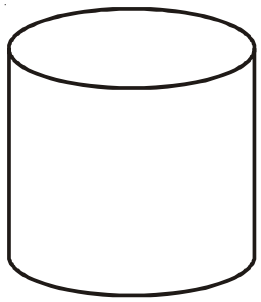


5) In the sketch of the rectangular field, below, James wants to walk from *B* to *D*.



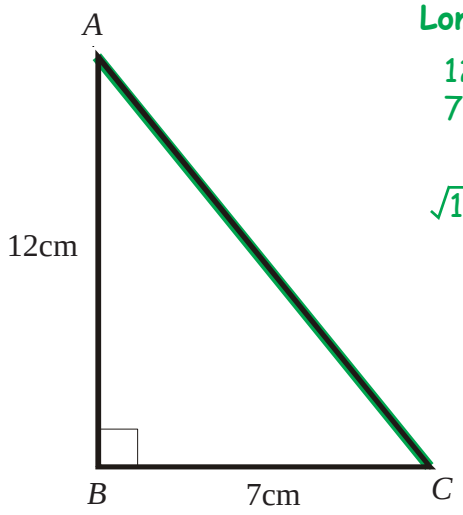
Which of the following routes is shorter and by how much?
From *B* to *C* to *D* or straight across the field from *B* to *D*.
Give your answer to the nearest metre.

6) Fiona keeps her pencils in a cylindrical beaker as shown below.
The beaker has a diameter of 8cm and a height of 17cm.
Will a pencil of length 19cm fit in the beaker without poking out of the top?
All workings must be shown.



Pythagoras' Theorem

1) Find the length of side *AC*. 13.9cm
Give your answer to 1 decimal place.

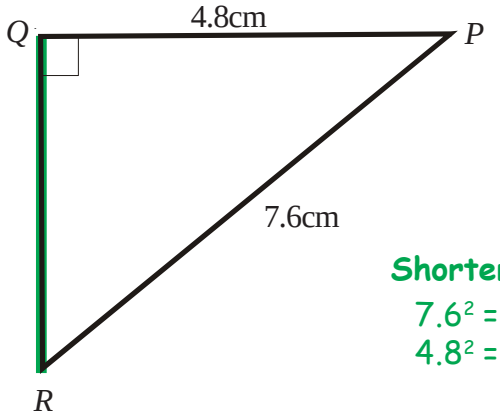


Longest side

$12^2 = 144$
$7^2 = 49$
193

$\sqrt{193} = 13.9$

2) Find the length of side *QR* 5.9cm
Give your answer to 1 decimal place.

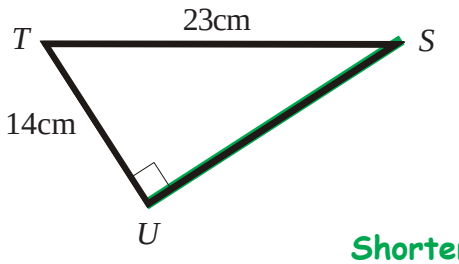


Shorter side

$7.6^2 = 57.76$
$4.8^2 = 23.04$
34.72

$\sqrt{34.72} = 5.9$

3) Find the length of side *SU* 18.2cm
Give your answer to 1 decimal place.

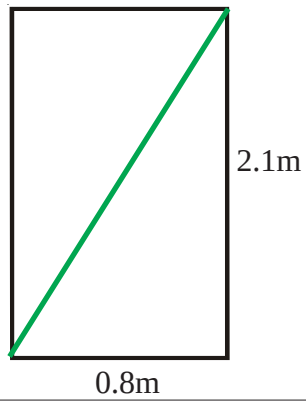


Shorter side

$23^2 = 529$
$14^2 = 196$
333

$\sqrt{333} = 18.2$

4) Below is a picture of a doorway. 2.2m
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

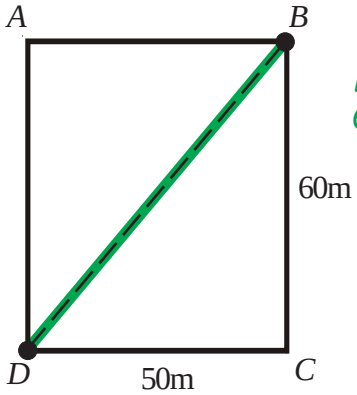


Longest side

$2.1^2 = 4.41$
$0.8^2 = 0.64$
5.05

$\sqrt{5.05} = 2.2$

5) In the sketch of the rectangular field, below, James wants to walk from *B* to *D*.



B to *C* to *D*
60m + 50m = 110m

B to *D*
Longest side

$60^2 = 3600$
$50^2 = 2500$
6100

$\sqrt{6100} = 78$

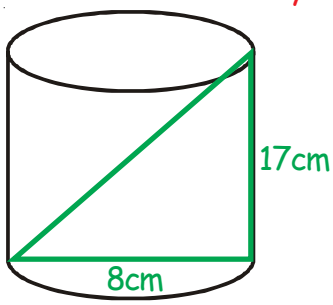
Which of the following routes is shorter and by how much? *B* to *D* by 32m
From *B* to *C* to *D* or straight across the field from *B* to *D*. 110m – 78m = 32m
Give your answer to the nearest metre.

6) Fiona keeps her pencils in a cylindrical beaker as shown below.
The beaker has a diameter of 8cm and a height of 17cm.
Will a pencil of length 19cm fit in the beaker without poking out of the top? No. The diagonal is only 18.8cm.
All workings must be shown.

Longest side

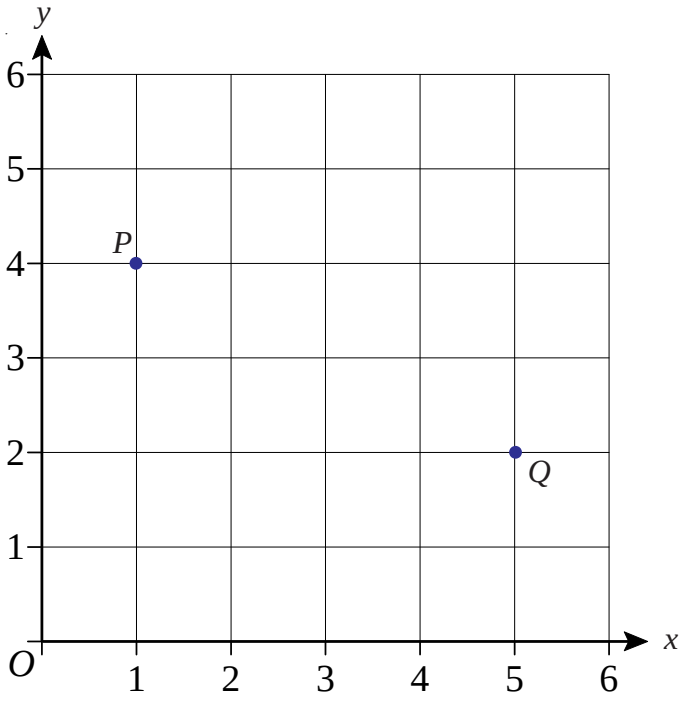
$17^2 = 289$
$8^2 = 64$
353

$\sqrt{353} = 18.79$

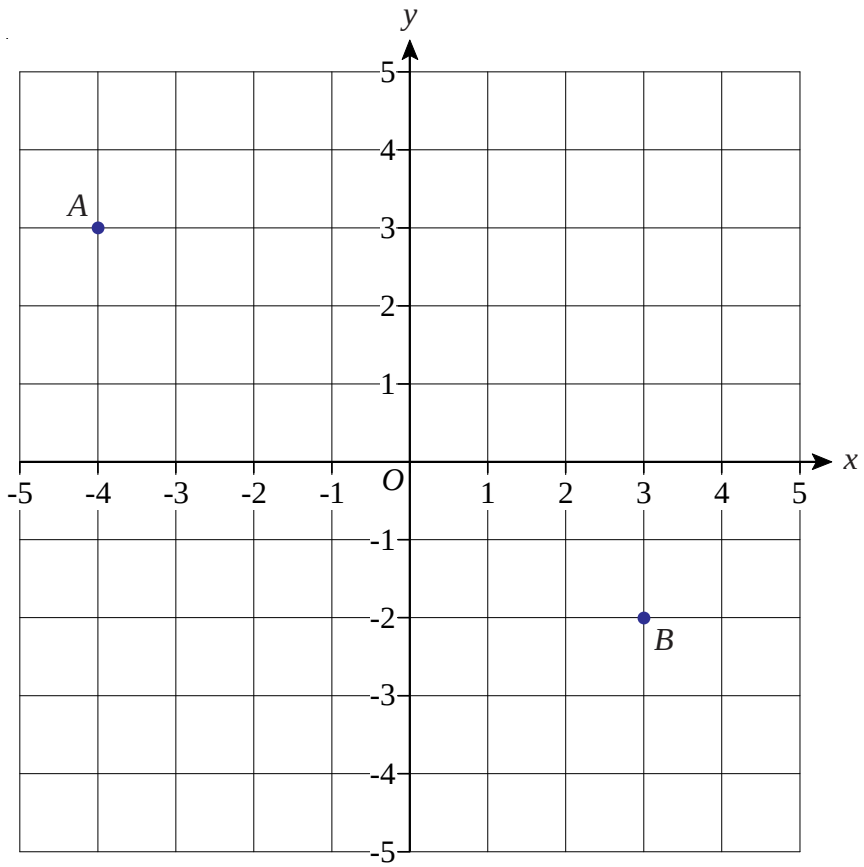


Pythagoras - Line on a Graph

1) Points P and Q have coordinates (1, 4) and (5, 2).
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place.

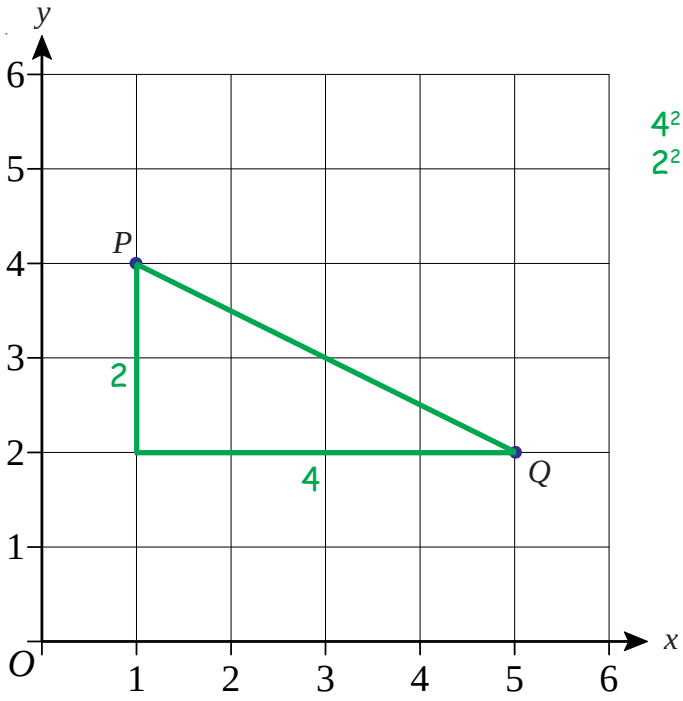


2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place.



Pythagoras - Line on a Graph

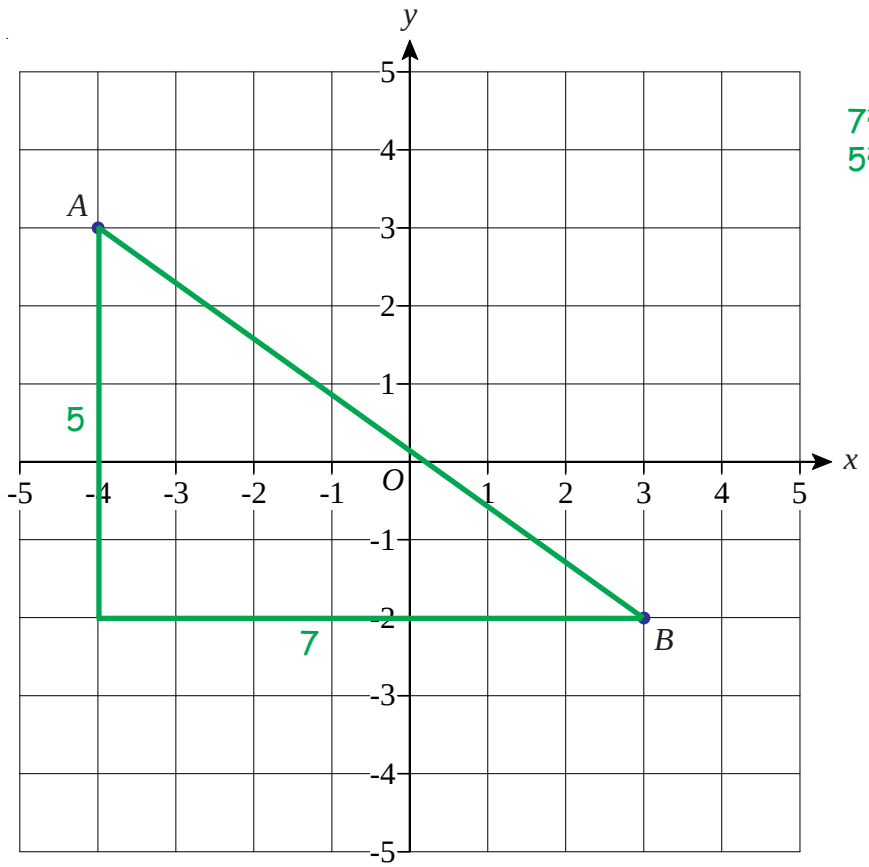
1) Points P and Q have coordinates (1, 4) and (5, 2).
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place. 4.5



$4^2 = 16$
$2^2 = 4$
20

$\sqrt{20} = 4.5$

2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place. 8.6



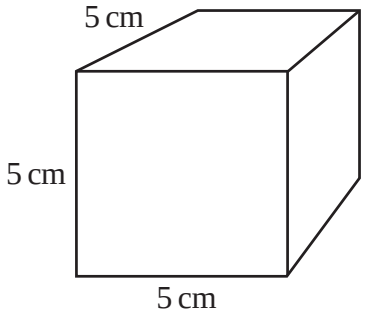
$7^2 = 49$
$5^2 = 25$
74

$\sqrt{74} = 8.6$

Surface Area of Cuboids

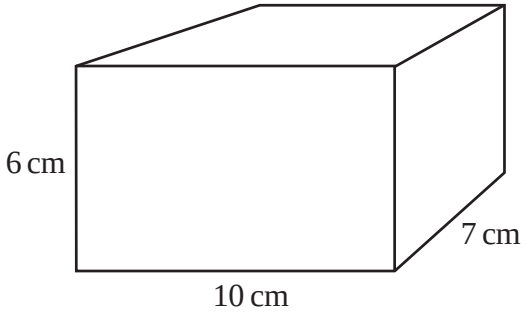
1) A cube has sides of length 5 cm.

Find the total surface area of the cube.



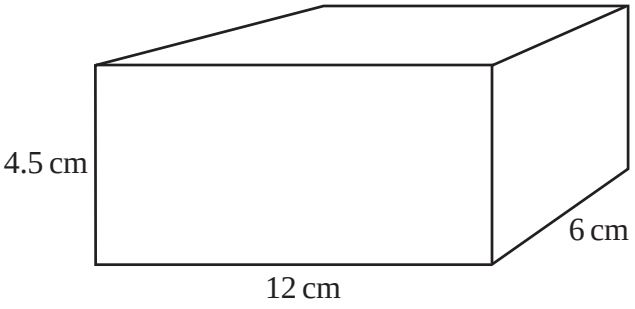
2) A cuboid has sides of length 10 cm, 6cm and 7 cm.

Find the total surface area of the cuboid.



3) A cuboid has sides of length 12 cm, 4.5cm and 6 cm.

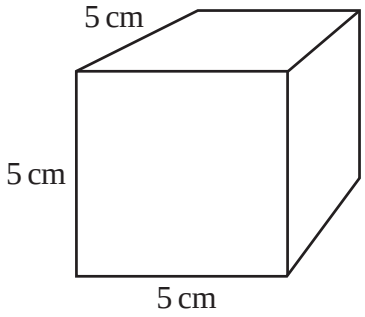
Find the total surface area of the cuboid.



Surface Area of Cuboids

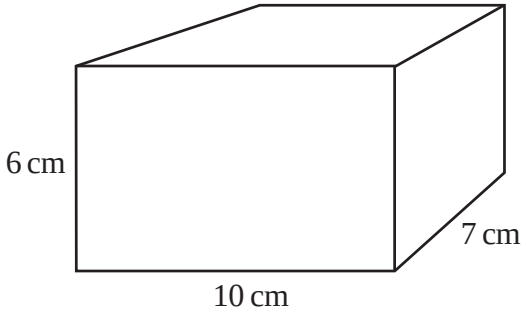
1) A cube has sides of length 5 cm.

Find the total surface area of the cube. 150 cm^2



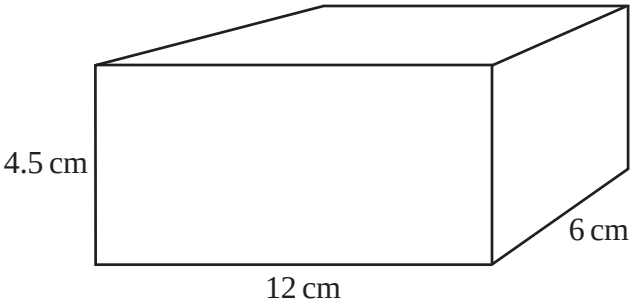
2) A cuboid has sides of length 10 cm, 6cm and 7 cm.

Find the total surface area of the cuboid. 344 cm^2



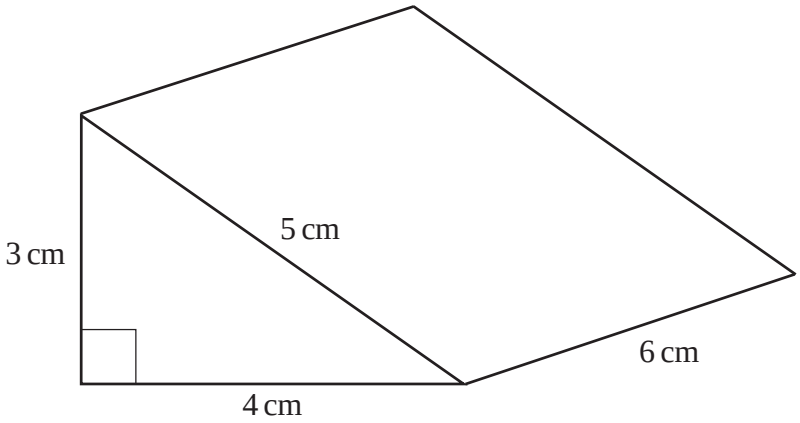
3) A cuboid has sides of length 12 cm, 4.5cm and 6 cm.

Find the total surface area of the cuboid. 306 cm^2

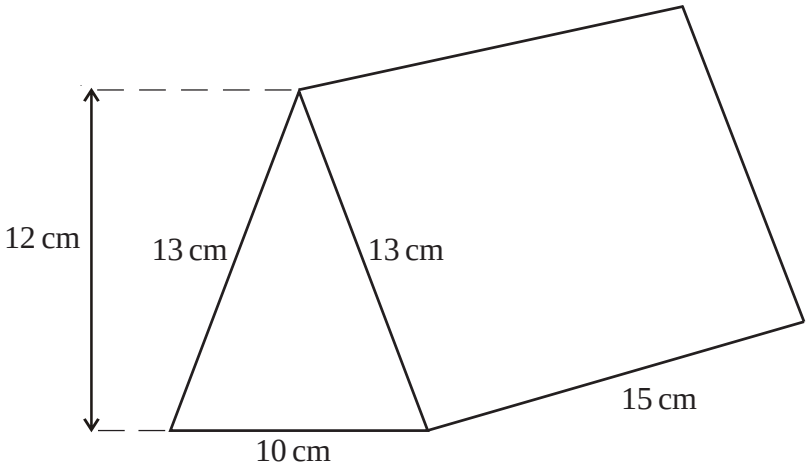


Surface Area of Triangular Prisms

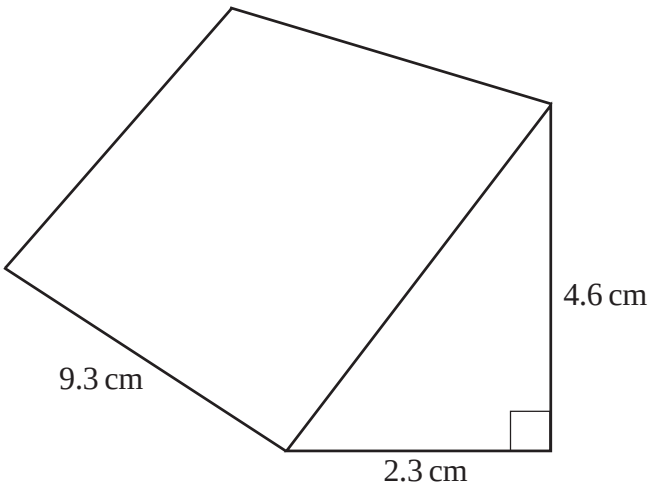
1) Find the surface area of this triangular prism.



2) Find the surface area of this triangular prism.

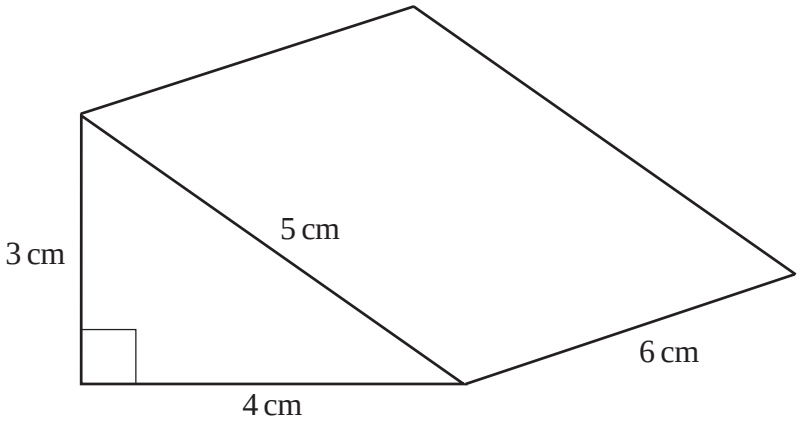


3) With the aid of Pythagoras' Theorem, find the surface area of this triangular prism.
Give your answer correct to 2 significant figures.

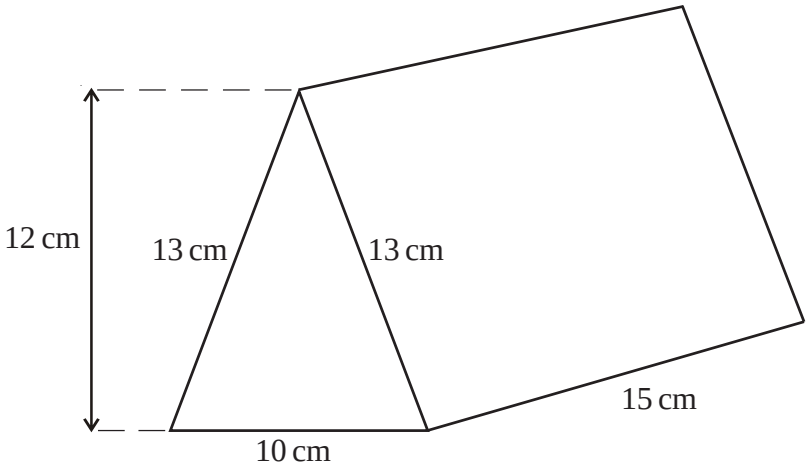


Surface Area of Triangular Prisms

1) Find the surface area of this triangular prism. 84 cm^2 6 + 6 + 30 + 24 + 18

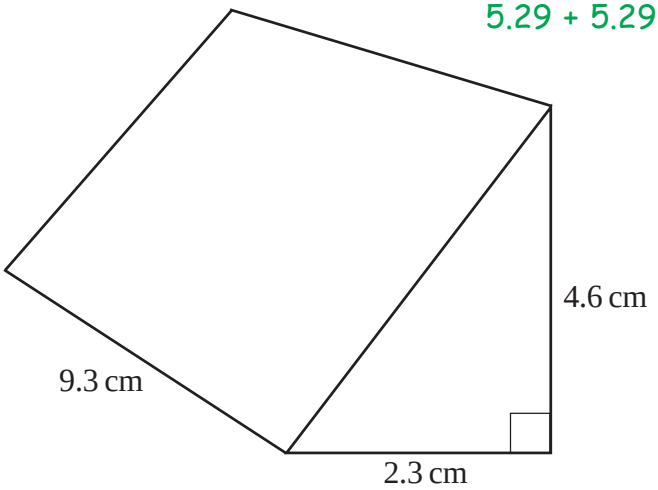


2) Find the surface area of this triangular prism. 660 cm^2 60 + 60 + 195 + 195 + 150



3) With the aid of Pythagoras' Theorem, find the surface area of this triangular prism.
Give your answer correct to 2 significant figures. 120 cm^2

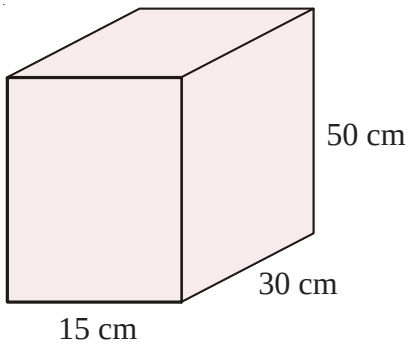
5.29 + 5.29 + 42.78 + 21.39 + 47.43



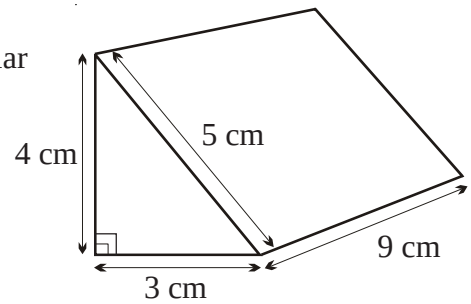
Volume of a Prism

1) The diagram shows a cuboid.

Work out the volume of the cuboid.



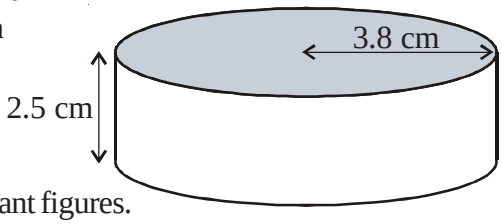
2) Calculate the volume of this triangular prism.



3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

Take π to be 3.142

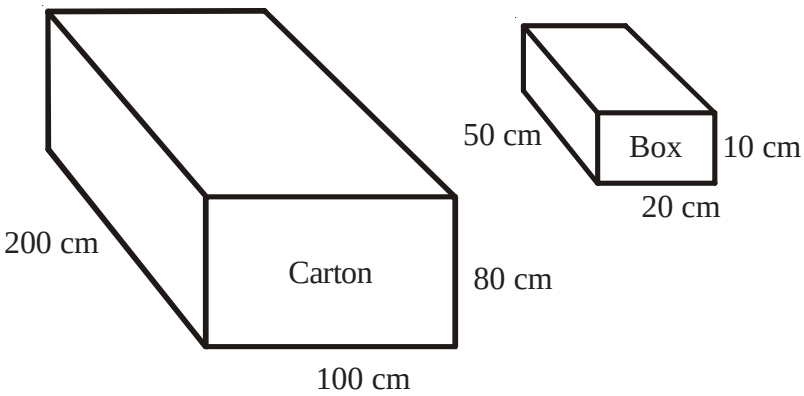
Work out the volume of the puck.
Give your answer correct to 3 significant figures.



4) A cuboid has: a volume of $80cm^3$
a length of 5 cm
a width of 2 cm

Work out the height of the cuboid.

5) Work out the maximum number of boxes which can fit in the carton.

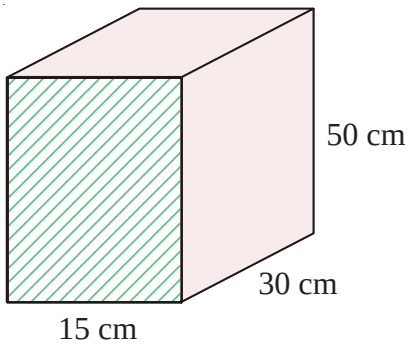


Volume of a Prism

1) The diagram shows a cuboid.

Work out the volume of the cuboid.

$V = 22500\ cm^3$

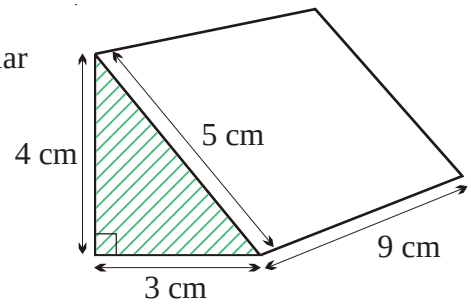


$A = L \times H$
$A = 15 \times 50$
$A = 750\ cm^2$

$V = A \times L$
$V = 750 \times 30$

2) Calculate the volume of this triangular prism.

$V = 54\ cm^3$



$A = \frac{b \times h}{2}$

$A = \frac{3 \times 4}{2}$

$A = 6\ cm^2$

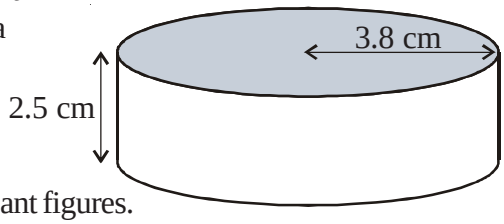
$V = A \times L$
$V = 6 \times 9$

3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

Take π to be 3.142

Work out the volume of the puck.
Give your answer correct to 3 significant figures.

$V = 113\ cm^3$



$A = \pi r^2$
$A = 3.142 \times 3.8^2$
$A = 45.37048\ cm^2$

$V = A \times L$
$V = 45.37048 \times 2.5$

4) A cuboid has:
a volume of $80 cm^3$
a length of 5 cm
a width of 2 cm

$80 \div 5 \div 2$

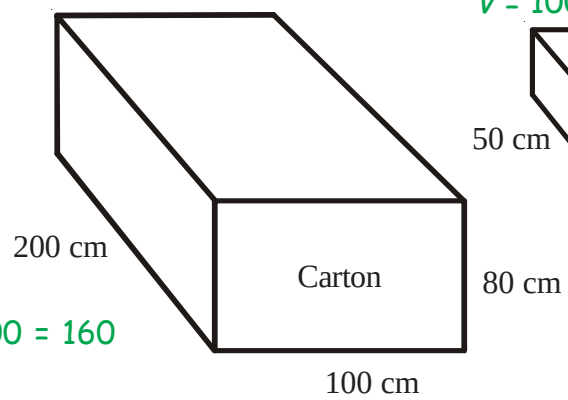
Work out the height of the cuboid.

$H = 8\ cm$

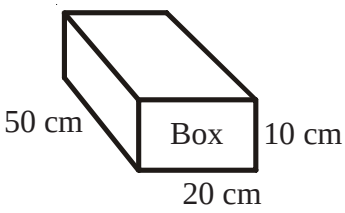
5) Work out the maximum number of boxes which can fit in the carton.

160 boxes will fit.

$V = 1600000\ cm^3$



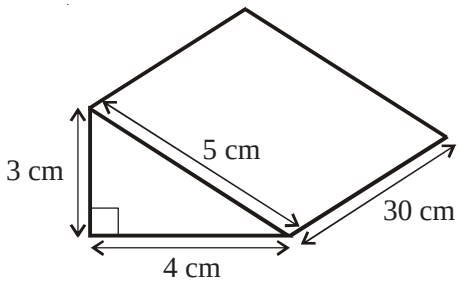
$V = 10000\ cm^3$



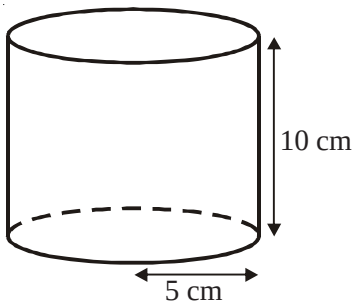
$1600000 \div 10000 = 160$

Volume of a Prism

1) Work out the volume of the prism.



2)

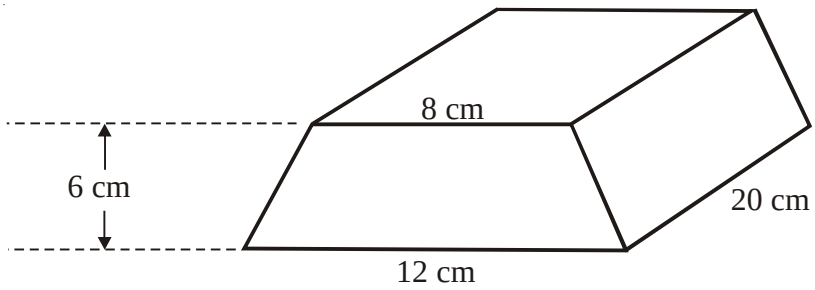


A solid cylinder has a radius of 5 cm and a height of 10 cm.

Work out the volume of the cylinder.

Take π to be 3.142
Give your answer correct to 3 significant figures.

3)

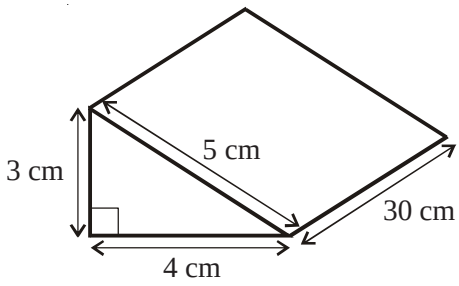


The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

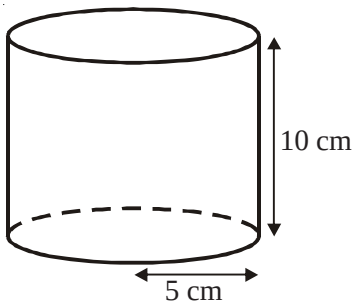
Find the volume of the prism.
You must state your units.

Volume of a Prism

1) Work out the volume of the prism. 180 cm^3



2)

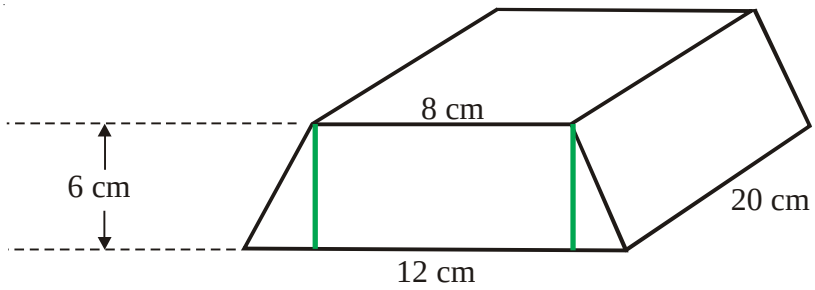


A solid cylinder has a radius of 5 cm and a height of 10 cm.

Work out the volume of the cylinder. 786 cm^3

Take π to be 3.142
Give your answer correct to 3 significant figures.

3)

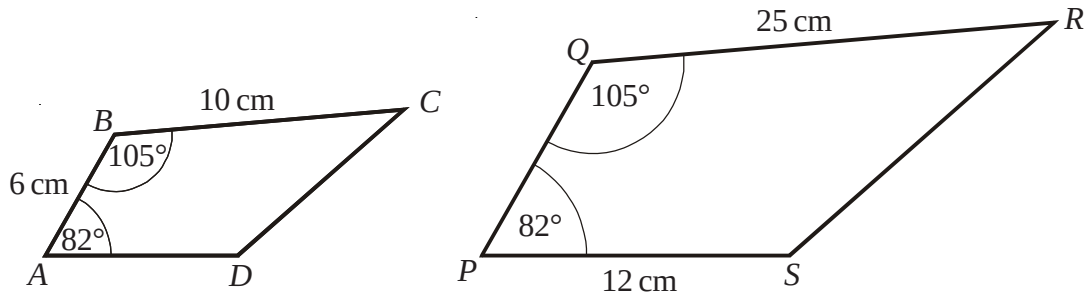


The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

Find the volume of the prism. 1200 cm^3
You must state your units.

Similar Shapes

1)

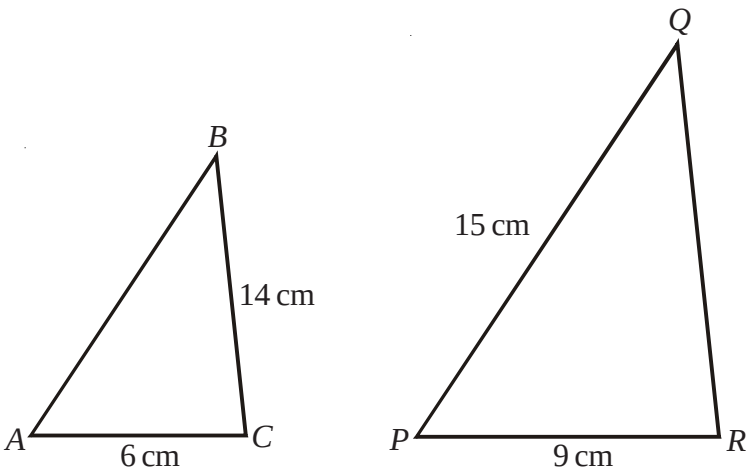


ABCD and *PQRS* are mathematically similar.

a) Find the length of *PQ*.

b) Find the length of *AD*.

2)



Triangles *ABC* and *PQR* are mathematically similar.

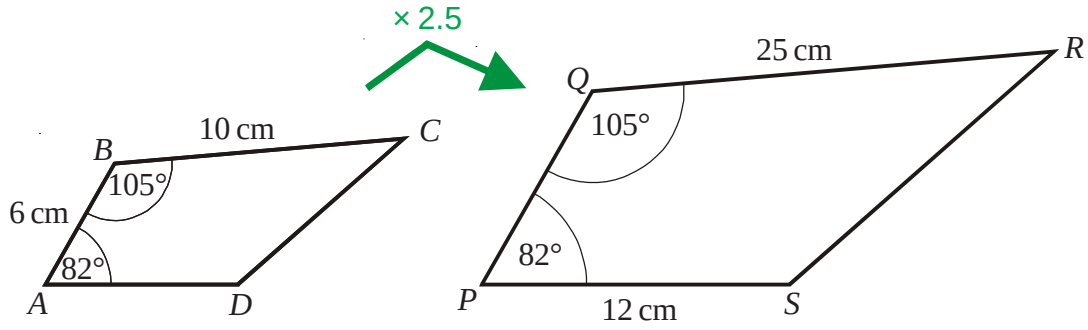
Angle *A* = angle *P*.
Angle *B* = angle *Q*.
Angle *C* = angle *R*.
AC = 6 cm.
BC = 14 cm.
PR = 9 cm.
PQ = 15 cm

a) Work out the length of *QR*.

b) Work out the length of *AB*.

Similar Shapes

1)

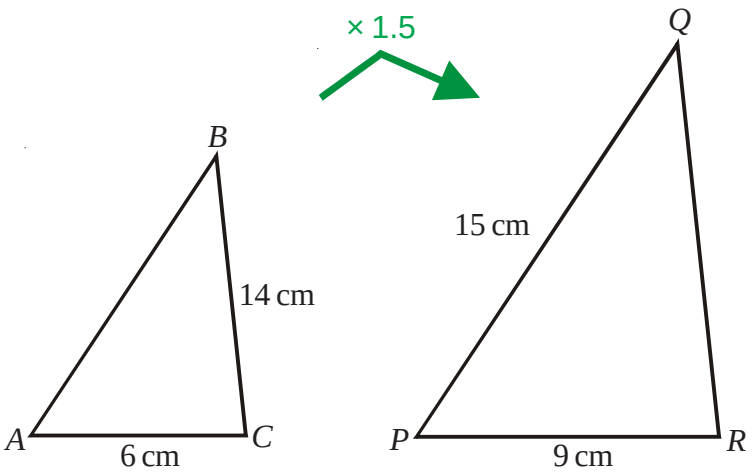


ABCD and *PQRS* are mathematically similar.

a) Find the length of *PQ*. 15 cm

b) Find the length of *AD*. 4.8 cm

2)



Triangles *ABC* and *PQR* are mathematically similar.

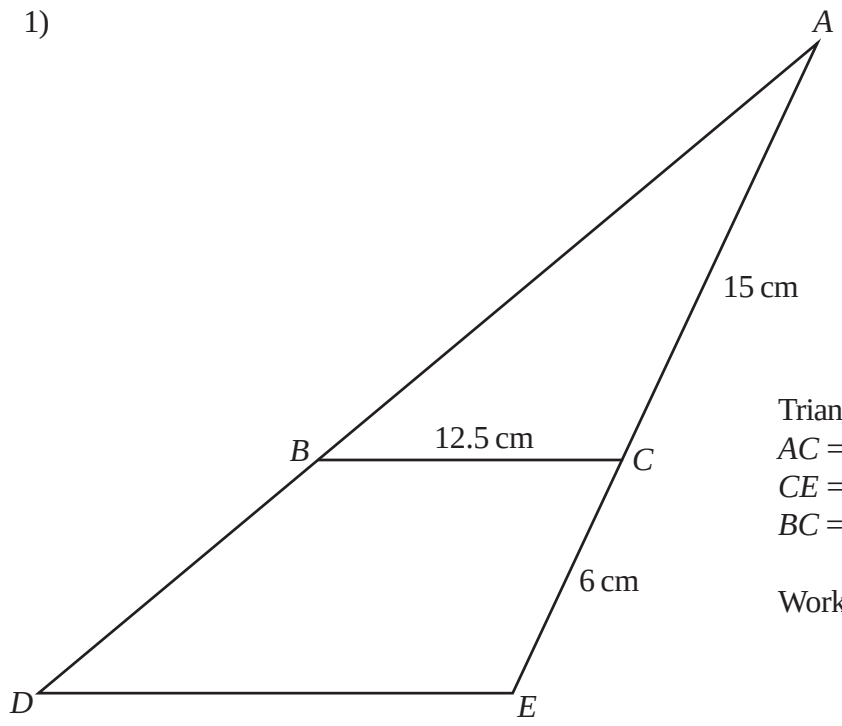
Angle *A* = angle *P*.
Angle *B* = angle *Q*.
Angle *C* = angle *R*.
AC = 6 cm.
BC = 14 cm.
PR = 9 cm.
PQ = 15 cm

a) Work out the length of *QR*. 21 cm

b) Work out the length of *AB*. 10 cm

Similar Shapes

1)



Triangle *ABC* is similar to triangle *ADE*.
AC = 15 cm.
CE = 6 cm.
BC = 12.5 cm.

Work out the length of *DE*.

2) *ABC* and *AED* are straight lines.

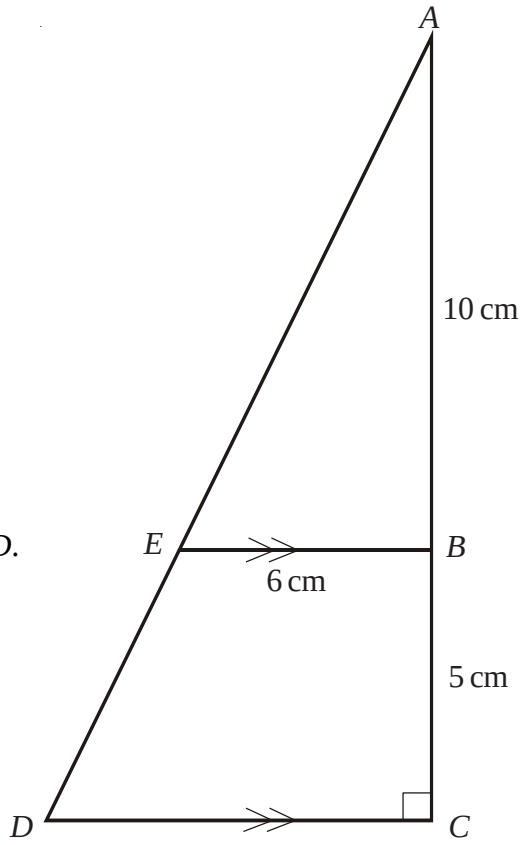
EB is parallel to *DC*.

Angle *ACD* = 90°

AB = 10 cm
BC = 5 cm
EB = 6 cm

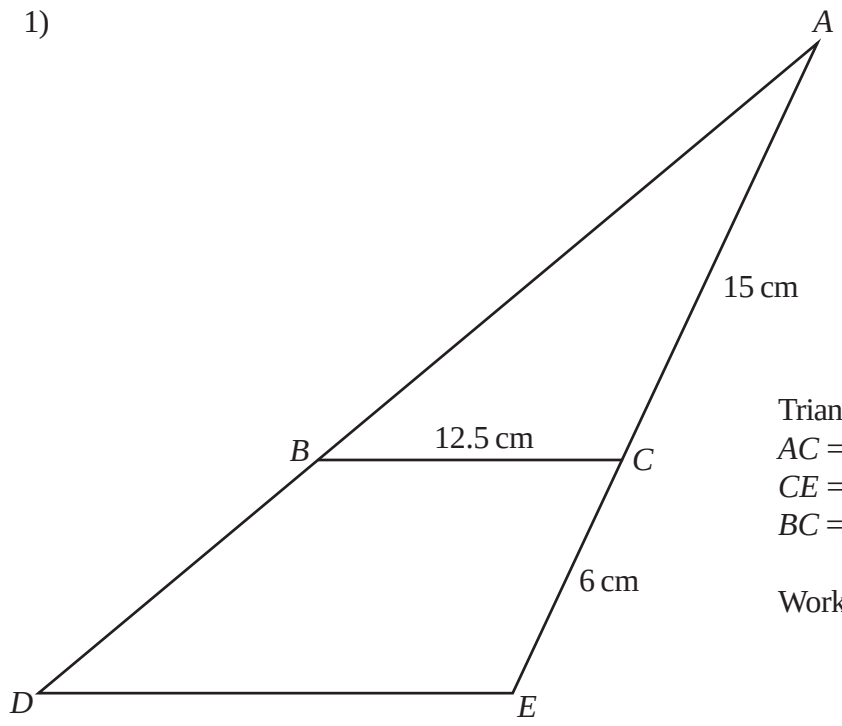
a) Work out the length of *DC*.

b) Work out the area of the trapezium *EBCD*.



Similar Shapes

1)



Triangle *ABC* is similar to triangle *ADE*.
AC = 15 cm.
CE = 6 cm.
BC = 12.5 cm.

Work out the length of *DE*. 17.5 cm

2) *ABC* and *AED* are straight lines.

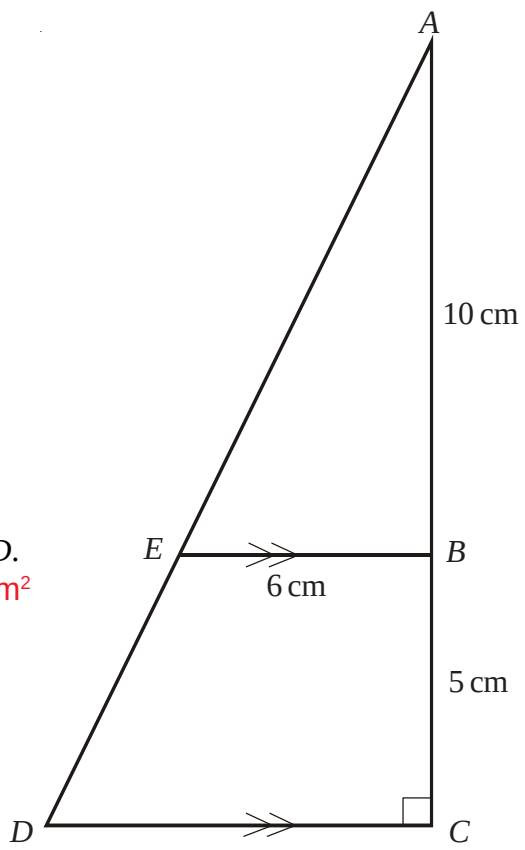
EB is parallel to *DC*.

Angle *ACD* = 90°

AB = 10 cm
BC = 5 cm
EB = 6 cm

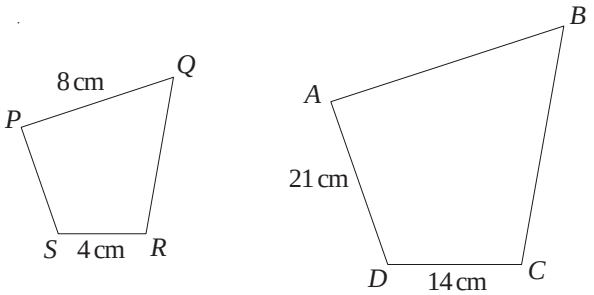
a) Work out the length of *DC*. 9 cm

b) Work out the area of the trapezium *EBCD*. 37.5 cm^2



Similar Shapes

1) The diagram shows two quadrilaterals that are mathematically **similar**.

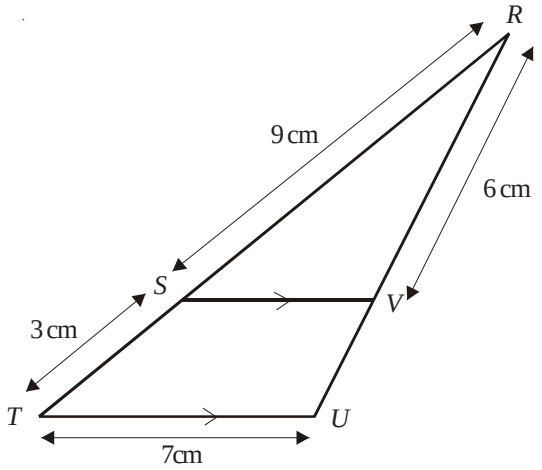


a) Calculate the length of *AB*

b) Calculate the length of *PS*

2) *SV* is parallel to *TU*.
RST and *RVU* are straight lines.
RS = 9 cm, *ST* = 3 cm, *TU* = 7 cm, *RV* = 6 cm

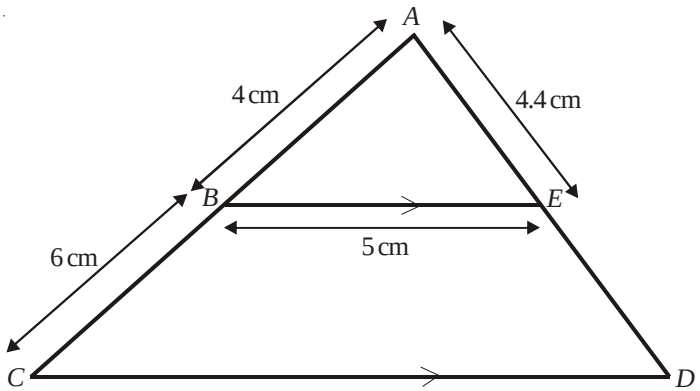
Calculate the length of *VU*.



3) *BE* is parallel to *CD*.
ABC and *AED* are straight lines.
AB = 4 cm, *BC* = 6 cm, *BE* = 5 cm, *AE* = 4.4 cm

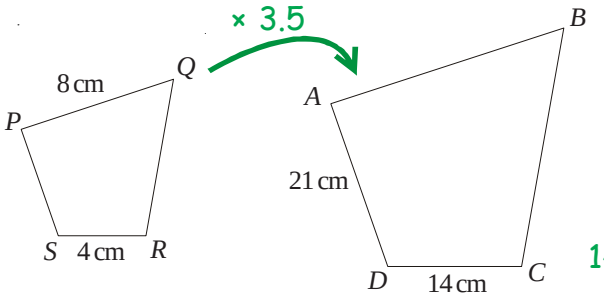
a) Calculate the length of *CD*.

b) Calculate the length of *ED*.



Similar Shapes

1) The diagram shows two quadrilaterals that are mathematically **similar**.



14 ÷ 4 = 3.5

a) Calculate the length of *AB* 28 cm

AB = PQ × 3.5

b) Calculate the length of *PS* 6 cm

PS = AD ÷ 3.5

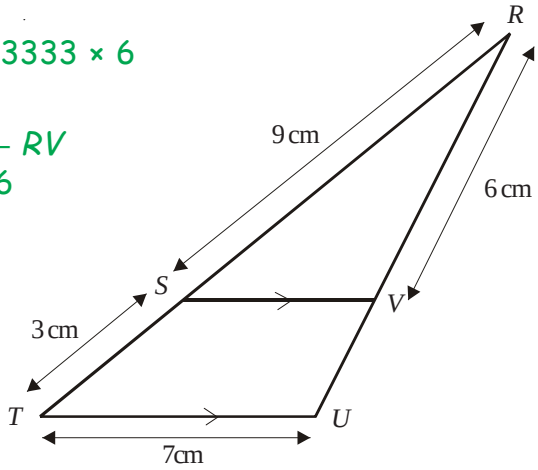
2) *SV* is parallel to *TU*.
RST and *RVU* are straight lines.
RS = 9 cm, *ST* = 3 cm, *TU* = 7 cm, *RV* = 6 cm

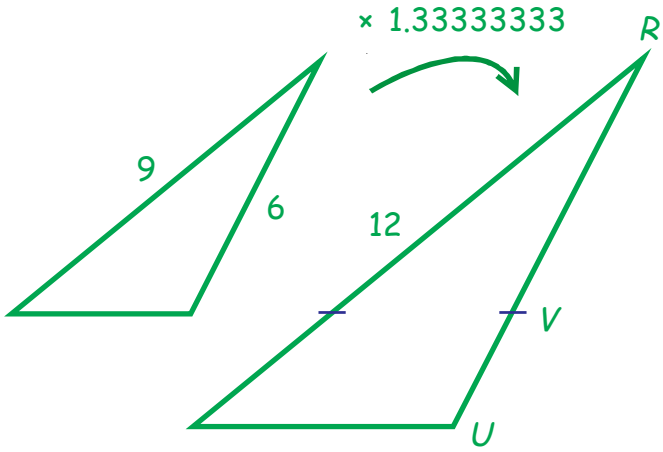
12 ÷ 9 = 1.3333333

Calculate the length of *VU*. 2 cm

RU = 1.333333 × 6
RU = 8

VU = RU – RV
VU = 8 – 6



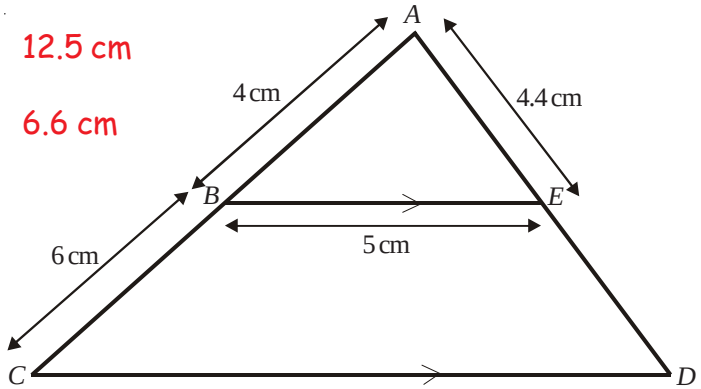


3) *BE* is parallel to *CD*.
ABC and *AED* are straight lines.
AB = 4 cm, *BC* = 6 cm, *BE* = 5 cm, *AE* = 4.4 cm

Scale factor = 2.5 (10 ÷ 4)

a) Calculate the length of *CD*. 12.5 cm

b) Calculate the length of *ED*. 6.6 cm



Converting Metric Units

1) Change 9 m^2 into cm^2

2) How many square metres are there in 5 square kilometres?

3) Change 4 cm^2 into mm^2

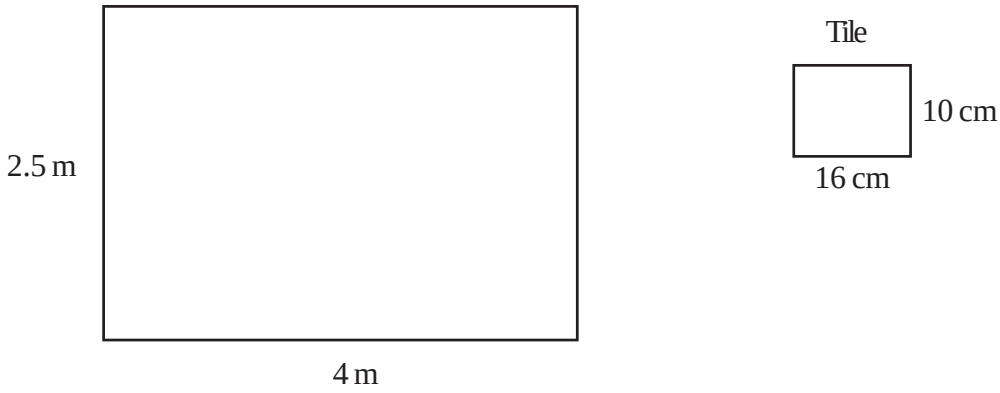
4) Convert 6.5 m^2 into mm^2

5) Change 2 m^3 into cm^3

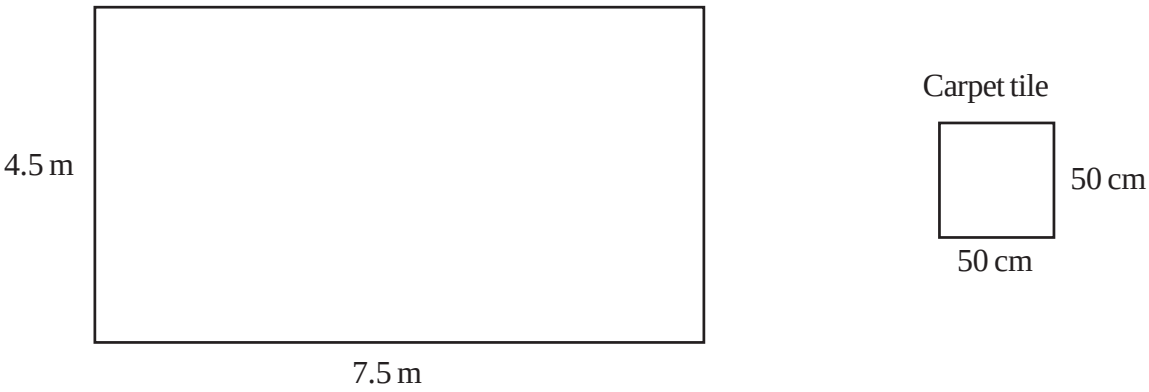
6) How many cubic millimetres are there in 3 cubic centimetres?

7) Change 7 m^3 into mm^3

8) A tiler wants to tile a rectangular wall which measures 4 m by 2.5 m.
Each tile measures 16 cm by 10 cm.
How many tiles will he need for the wall?



9) A carpet-fitter is laying carpet tiles on a rectangular floor which measures 7.5 m by 4.5 m.
Each carpet tile measures 50 cm by 50 cm.
How many carpet tiles will he need for the floor?



Converting Metric Units

1) Change 9 m^2 into cm^2 90000 cm^2

2) How many square metres are there in 5 square kilometres? 5000000 m^2

3) Change 4 cm^2 into mm^2 400 mm^2

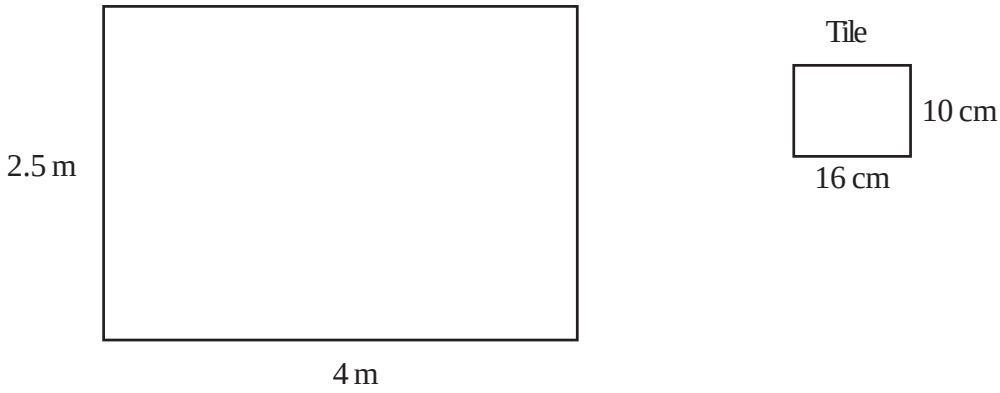
4) Convert 6.5 m^2 into mm^2 6500000 mm^2

5) Change 2 m^3 into cm^3 2000000cm^3

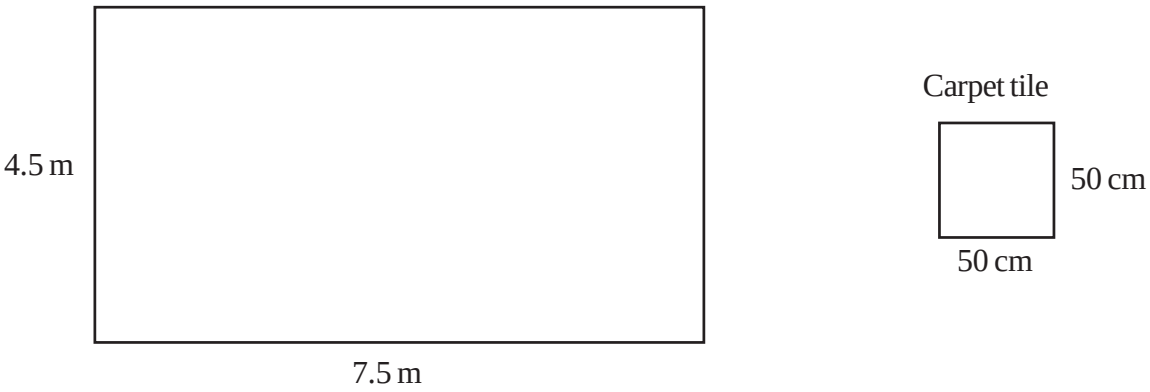
6) How many cubic millimetres are there in 3 cubic centimetres? 3000 mm^3

7) Change 7 m^3 into mm^3 7000000000 mm^3

8) A tiler wants to tile a rectangular wall which measures 4 m by 2.5 m.
Each tile measures 16 cm by 10 cm.
How many tiles will he need for the wall? 625



9) A carpet-fitter is laying carpet tiles on a rectangular floor which measures 7.5 m by 4.5 m.
Each carpet tile measures 50 cm by 50 cm.
How many carpet tiles will he need for the floor? 135



Bounds

1) A silver necklace has a mass of 123 grams, correct to the nearest gram.

   a) Write down the least possible mass of the necklace.

   b) Write down the greatest possible mass of the necklace.

2) Each of these measurements was made correct to one decimal place.
   Write the maximum and minimum possible measurement in each case.

   a) 4.6 cm b) 0.8 kg c) 12.5 litres d) 25.0 km/h

   e) 10.3 s f) 36.1 m g) 136.7 m/s h) 0.1 g

3) Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.

   a) Write down the least possible length of each side.

   b) Write down the greatest possible length of each side.

   c) Write down the greatest possible perimeter of the octagon.

4) A girl has a pen that is of length 12 cm, measured to the nearest centimetre.
   Her pencil case has a diagonal of length 12.5 cm, measured to the nearest millimetre.
   Explain why it might not be possible for her to fit the pen in the pencil case.

5) A square has sides of length 7 cm, correct to the nearest centimetre.

   a) Calculate the lower bound for the perimeter of the square.

   b) Calculate the upper bound for the area of the square.

Bounds

1) A silver necklace has a mass of 123 grams, correct to the nearest gram.

a) Write down the least possible mass of the necklace. 122.5 g

b) Write down the greatest possible mass of the necklace. 123.5 g

2) Each of these measurements was made correct to one decimal place.
Write the maximum and minimum possible measurement in each case.

a) 4.6 cm	b) 0.8 kg	c) 12.5 litres	d) 25.0 km/h
max: 4.65 cm	max: 0.85 kg	max: 12.55 L	max: 25.05 km/h
min: 4.55 cm	min: 0.75 kg	min: 12.45 L	min: 24.95 km/h
e) 10.3 s	f) 36.1 m	g) 136.7 m/s	h) 0.1 g
max: 10.35 s	max: 36.15 m	max: 136.75 m/s	max: 0.15 g
min: 10.25 s	min: 36.05 m	min: 136.65 m/s	min: 0.05 g

3) Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.

a) Write down the least possible length of each side. 20.55 cm

b) Write down the greatest possible length of each side. 20.65 cm

c) Write down the greatest possible perimeter of the octagon. 165.2 cm

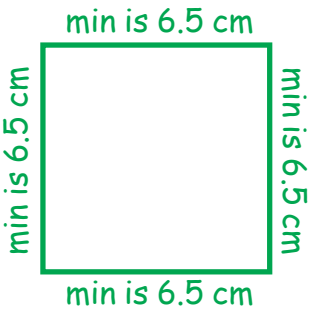
4) A girl has a pen that is of length 12 cm, measured to the nearest centimetre.
Her pencil case has a diagonal of length 12.5 cm, measured to the nearest millimetre.

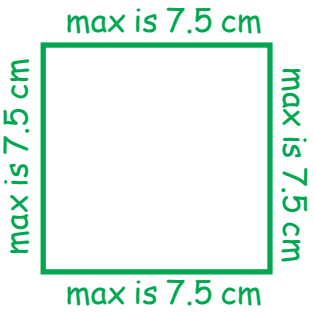
Explain why it might not be possible for her to fit the pen in the pencil case.
12 cm to the nearest cm has a maximum possible length of 12.5 cm.
12.5 cm to the nearest mm has a minimum possible length of 12.45 cm.
A 12.5 cm pencil won't fit into a pencil case with a diagonal length of 12.45 cm.

5) A square has sides of length 7 cm, correct to the nearest centimetre.

a) Calculate the lower bound for the perimeter of the square. 26 cm 6.5 + 6.5 + 6.5 + 6.5

b) Calculate the upper bound for the area of the square. 56.25 cm^2 7.5 × 7.5





Compound Measures

1) Jane runs 200 metres in 21.4 seconds.

Work out Jane's average speed in metres per second.
Give your answer correct to 1 decimal place.

2) A car travels at a steady speed and takes five hours to travel 310 miles.

Work out the average speed of the car in miles per hour.

3) A plane flies 1440 miles at a speed of 240 mph.

How long does it take?

4) A marathon runner runs at 7.6 mph for three and a half hours.

How many miles has he run?

5) A car takes 15 minutes to travel 24 miles.

Find its speed in **mph**.

6) A cyclist takes 10 minutes to travel 2.4 miles.

Calculate the average speed in mph.

---

7) An ice hockey puck has a volume of 113 cm^3.

It is made out of rubber with a density of 1.5 grams per cm^3.

Work out the mass of the ice hockey puck.

8) An apple has a mass of 160 g and a volume of 100 cm^3.

Find its density in g/cm^3.

9) A steel ball has a volume of 1500 cm^3.

The density of the ball is 95 g/cm^3.

Find the mass of the ball **in kg**.

10) The mass of a bar of chocolate is 1800 g.

The density of the chocolate is 9 g/cm^3.

What is the volume of the bar of chocolate?

Compound Measures

1) Jane runs 200 metres in 21.4 seconds.

Work out Jane's average speed in metres per second.
Give your answer correct to 1 decimal place.

$S = 9.3$ m/s

$S = \frac{D}{T}$

$S = \frac{200}{21.4}$

2) A car travels at a steady speed and takes five hours to travel 310 miles.

Work out the average speed of the car in miles per hour.

$S = 62$ mph

$S = \frac{D}{T}$

$S = \frac{310}{5}$

3) A plane flies 1440 miles at a speed of 240 mph.

How long does it take?

$T = 6$ hours

$T = \frac{D}{S}$

$T = \frac{1440}{240}$

4) A marathon runner runs at 7.6 mph for three and a half hours.

How many miles has he run?

$D = 26.6$ miles

$D = S \times T$

$D = 7.6 \times 3.5$

5) A car takes 15 minutes to travel 24 miles.

Find its speed in **mph**.

$S = 96$ mph

$S = \frac{D}{T}$ 15 mins is 0.25 of an hour

$S = \frac{24}{0.25}$

6) A cyclist takes 10 minutes to travel 2.4 miles.

Calculate the average speed in mph.

$S = 14.4$ mph

$S = \frac{D}{T}$ 10 mins is $0.1\dot{6}$ of an hour

$S = \frac{2.4}{0.1\dot{6}}$

---

7) An ice hockey puck has a volume of 113 cm^3.

It is made out of rubber with a density of 1.5 grams per cm^3.

Work out the mass of the ice hockey puck.

$M = 169.5$ g

$M = D \times V$

$M = 1.5 \times 113$

8) An apple has a mass of 160 g and a volume of 100 cm^3.

Find its density in g/cm^3.

$D = 1.6$ g/cm^3

$D = \frac{M}{V}$

$D = \frac{160}{100}$

9) A steel ball has a volume of 1500 cm^3.

The density of the ball is 95 g/cm^3.

Find the mass of the ball **in kg**.

$M = 142.5$ kg

$M = D \times V$

$M = 95 \times 1500$
$M = 142\,500$

10) The mass of a bar of chocolate is 1800 g.

The density of the chocolate is 9 g/cm^3.

What is the volume of the bar of chocolate?

$V = 200$ cm^3

$V = \frac{M}{D}$

$D = \frac{1800}{9}$

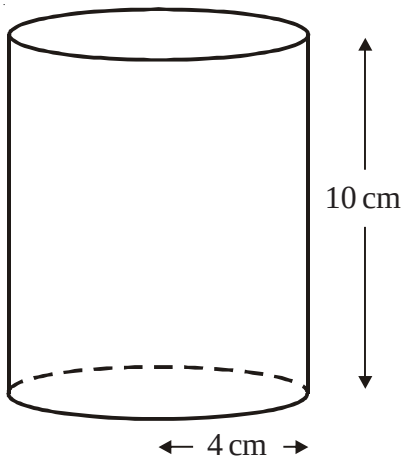
Compound Measures

1) Tony went on holiday to Miami.
He travelled from London by plane.

The distance from London to Miami is 7120 km.
The plane journey took 8 hours.

Calculate the average speed of the plane.

2) A solid cylinder has a radius of 4 cm and a height of 10 cm.

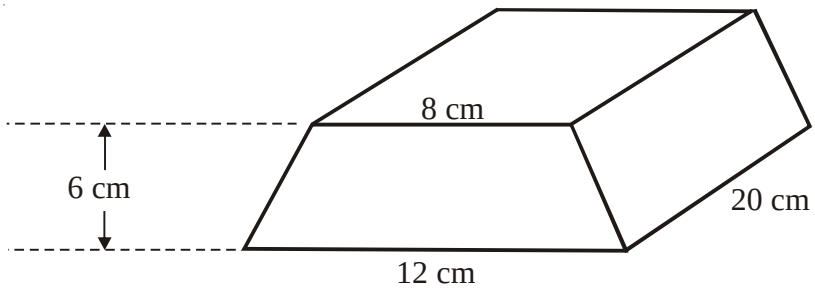


a) Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

The cylinder is made of wood.
The density of the wood is 0.7 grams per cm^3

b) Work out the mass of the cylinder.
Give your answer correct to 3 significant figures.

3)



The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

The parallel sides of the trapezium are 8 cm and 12 cm.
The height of the trapezium is 6 cm.
The length of the prism is 20 cm.

The density of the metal is 4 g/cm^3.

Calculate the mass of the prism.
Give your answer in kilograms.

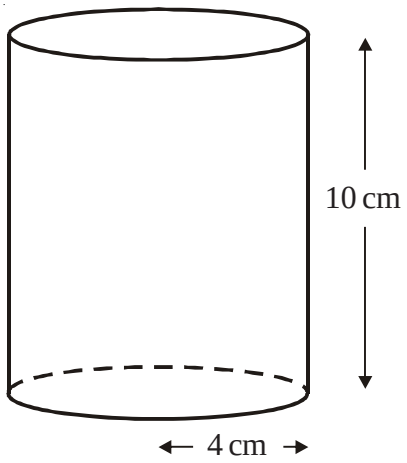
Compound Measures

1) Tony went on holiday to Miami.
He travelled from London by plane.

The distance from London to Miami is 7120 km.
The plane journey took 8 hours.

Calculate the average speed of the plane. 890 km/h

2) A solid cylinder has a radius of 4 cm and a height of 10 cm.

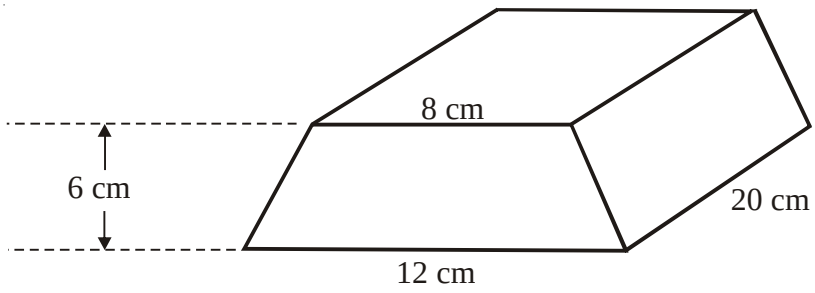


a) Work out the volume of the cylinder.
Give your answer correct to 3 significant figures. 503 cm^3

The cylinder is made of wood.
The density of the wood is 0.7 grams per cm^3

b) Work out the mass of the cylinder.
Give your answer correct to 3 significant figures. 352 g

3)



The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

The parallel sides of the trapezium are 8 cm and 12 cm.
The height of the trapezium is 6 cm.
The length of the prism is 20 cm.

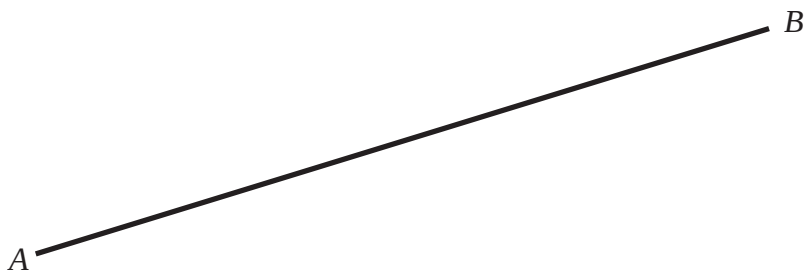
The density of the metal is 4 g/cm^3.

mass = density × volume
mass = 4 × 1200
mass = 4800 g

Calculate the mass of the prism. 4.8 kg
Give your answer in kilograms.

Bisecting a Line

1) Using ruler and compasses, bisect line *AB*.



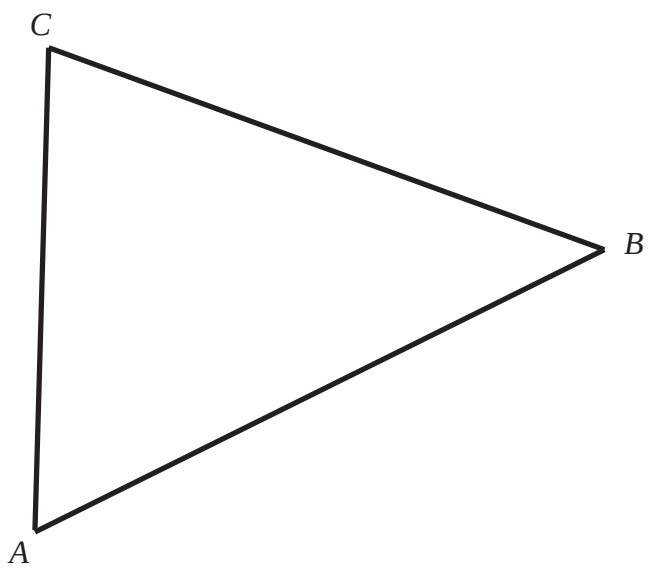
2) Using ruler and compasses

a) Bisect line *AB*

b) Bisect line *BC*

c) Bisect line *AC*

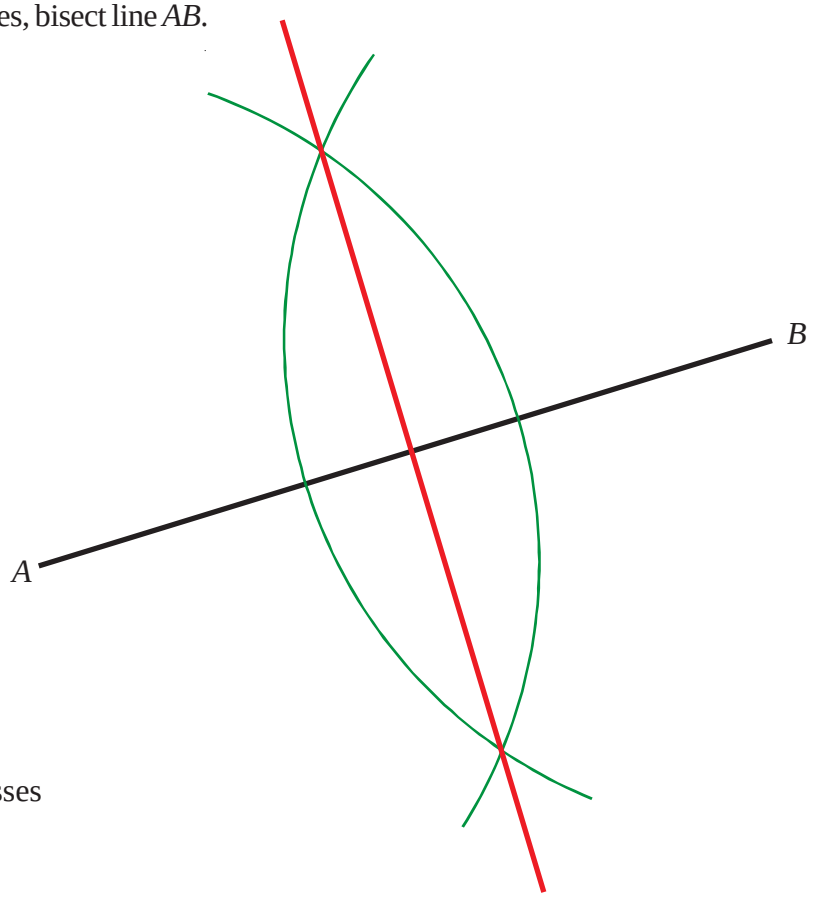
d) Place your compass point where your three lines cross*
Now open them out until your pencil is touching vertex *A*.
Draw a circle using this radius.



* *If your three lines don't cross at a point then you have a mistake somewhere or just haven't been accurate enough.*

Bisecting a Line

1) Using ruler and compasses, bisect line *AB*.



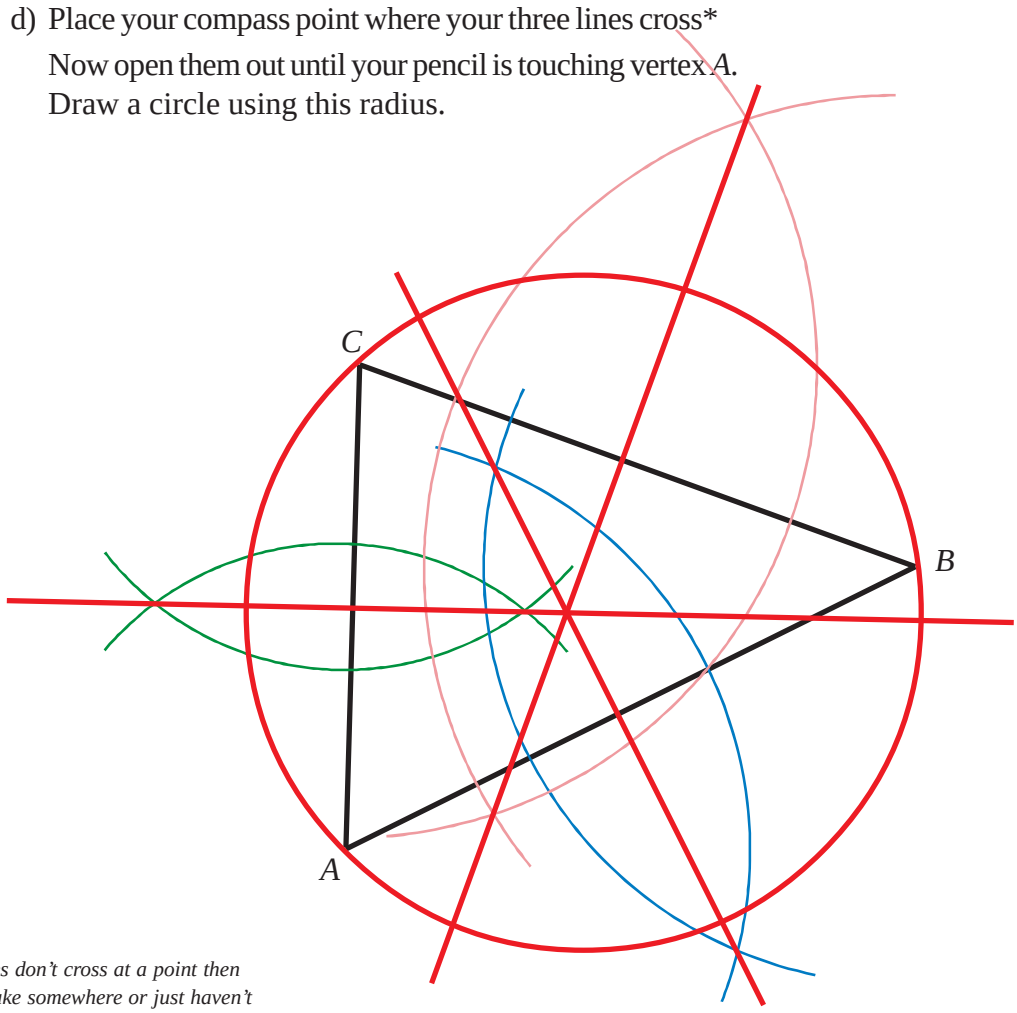
2) Using ruler and compasses

a) Bisect line *AB*

b) Bisect line *BC*

c) Bisect line *AC*

d) Place your compass point where your three lines cross*
Now open them out until your pencil is touching vertex *A*.
Draw a circle using this radius.

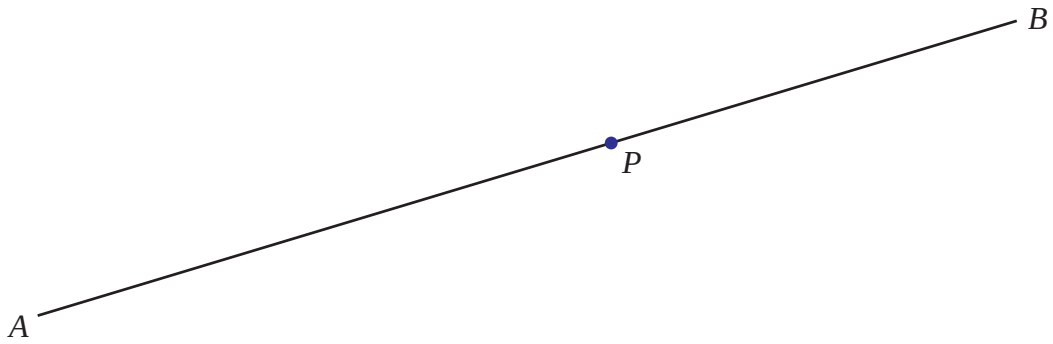


* *If your three lines don't cross at a point then you have a mistake somewhere or just haven't been accurate enough.*

Drawing a Perpendicular to a Line

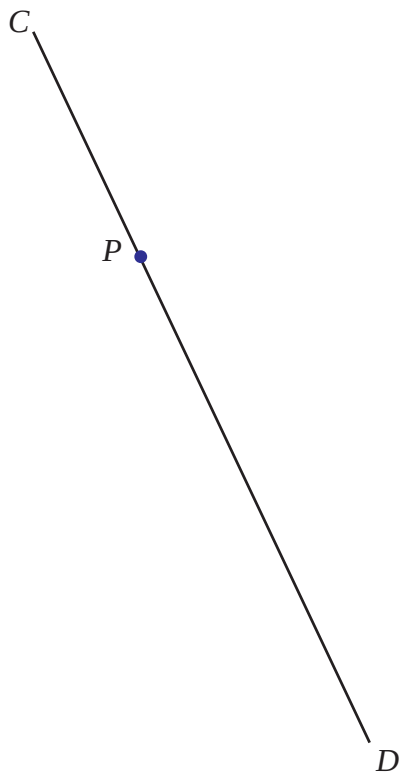
1) Use ruler and compasses to **construct** the perpendicular to the line segment *AB* that passes through the point *P*.

You must show all construction lines.



2) Use ruler and compasses to **construct** the perpendicular to the line segment *CD* that passes through the point *P*.

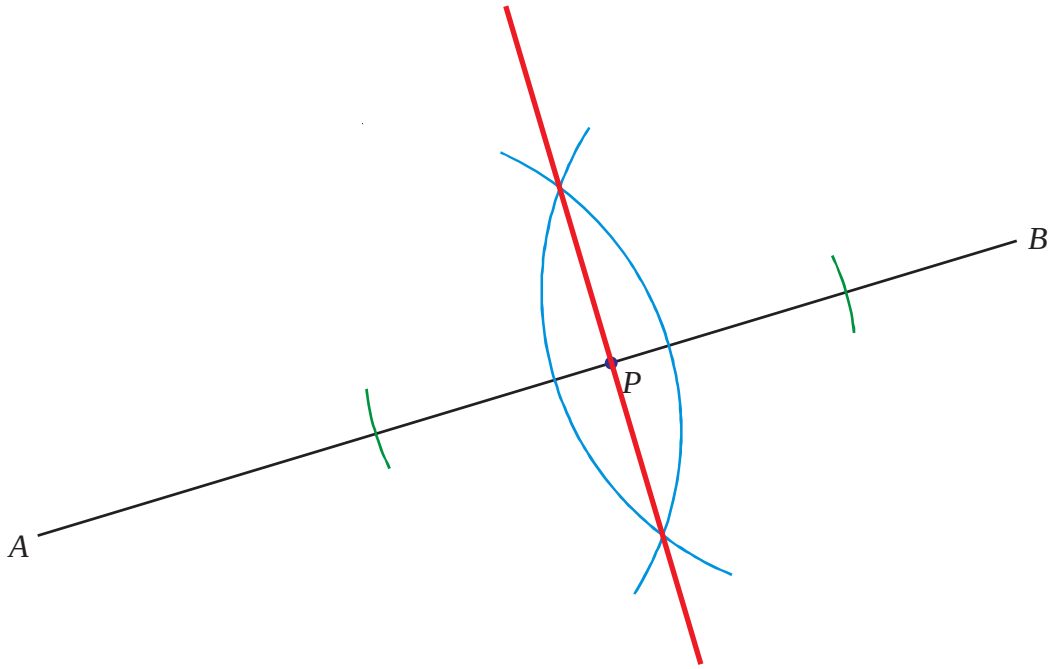
You must show all construction lines.



Drawing a Perpendicular to a Line

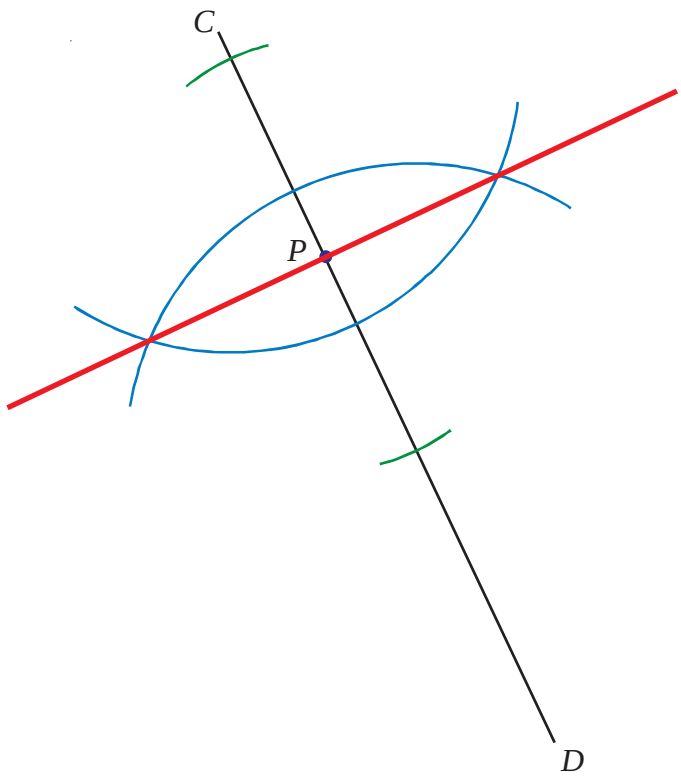
1) Use ruler and compasses to **construct** the perpendicular to the line segment *AB* that passes through the point *P*.

You must show all construction lines.



2) Use ruler and compasses to **construct** the perpendicular to the line segment *CD* that passes through the point *P*.

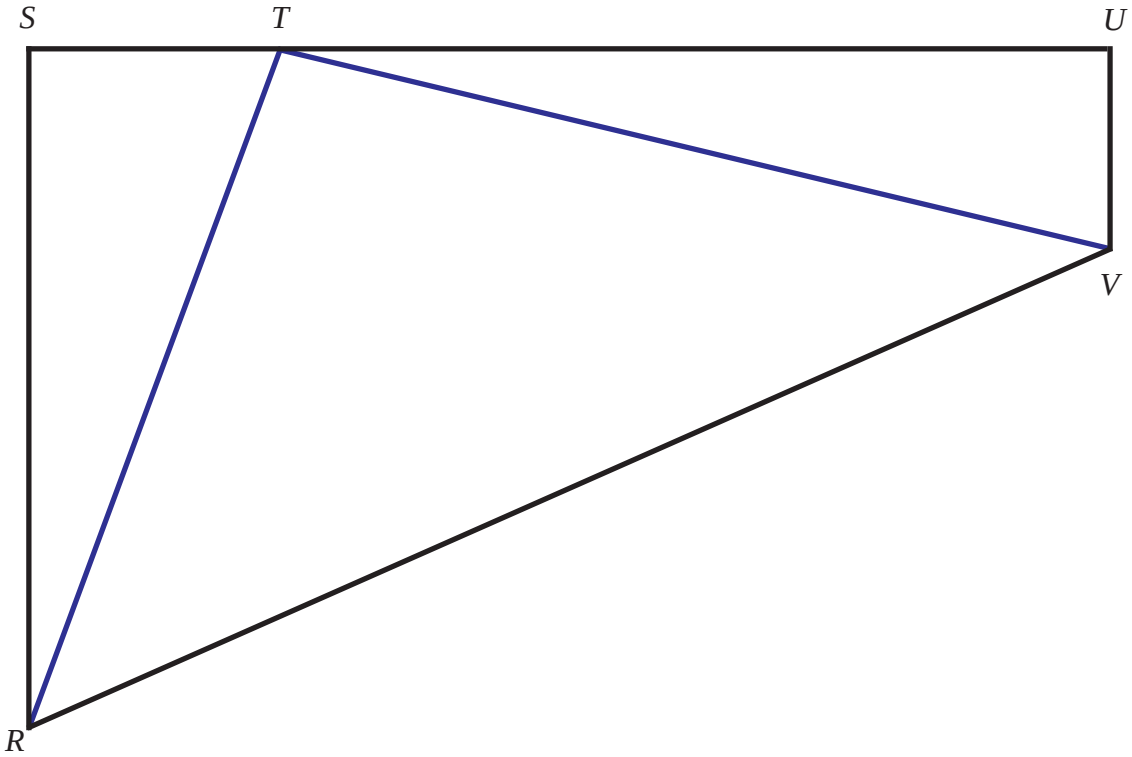
You must show all construction lines.



Bisecting an Angle

1) Using ruler and compasses, bisect angle *ABC*.

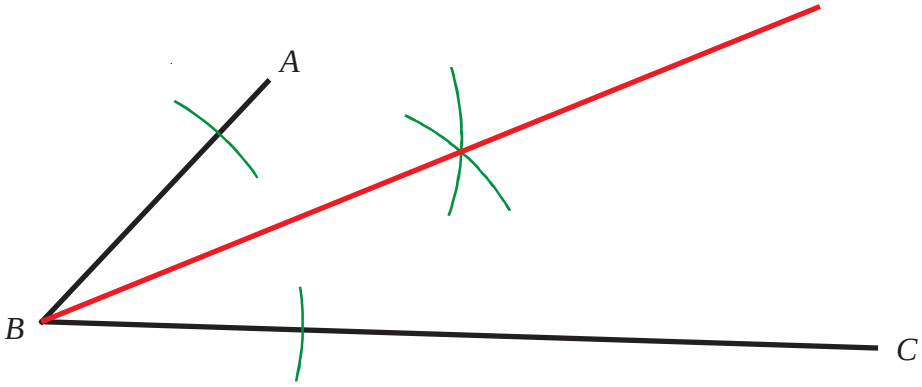
2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral *RSTUV*



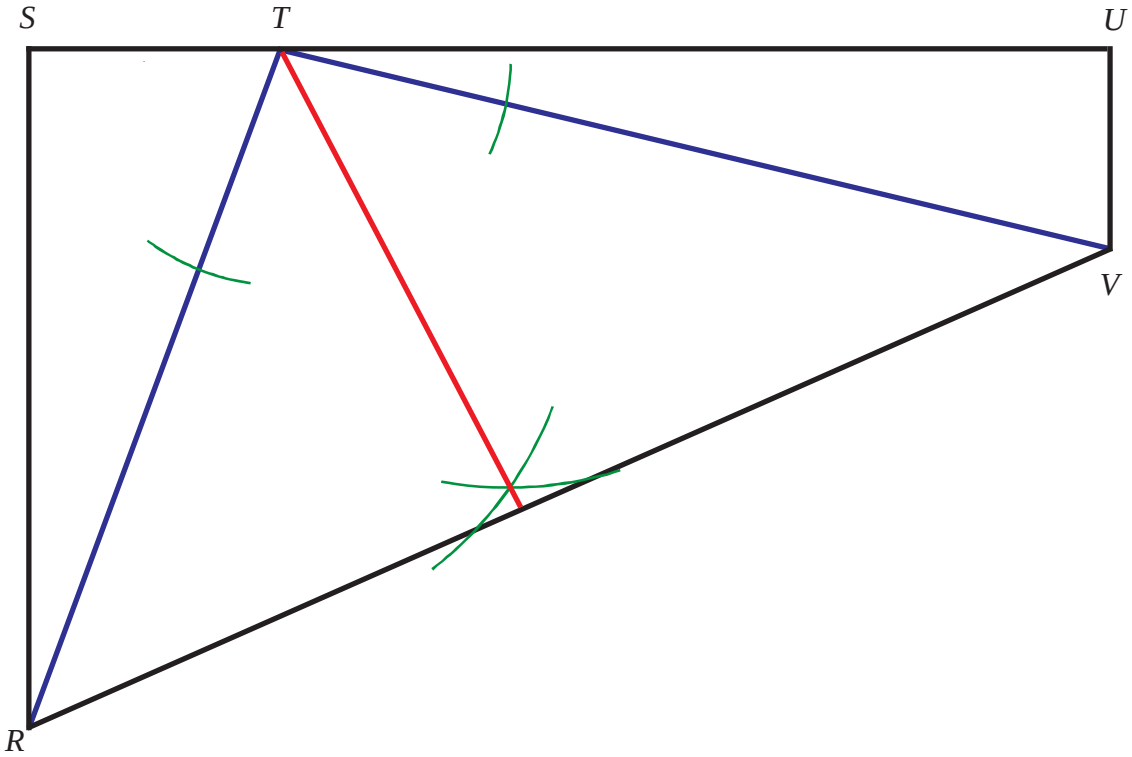
There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

Bisecting an Angle

1) Using ruler and compasses, bisect angle *ABC*.



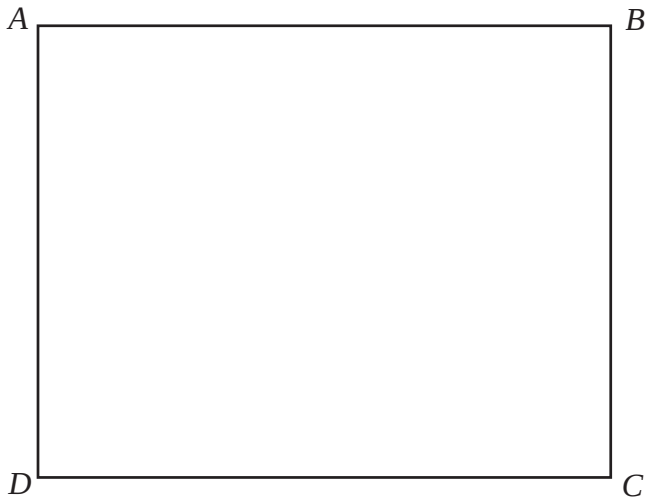
2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral *RSTUV*



There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

Loci

1)



ABCD is a rectangle.

Shade the set of points inside the rectangle which are **both**
more than 4 centimetres from the point *D*
and more than 1 centimetre from the line *AB*.

2) Two radio transmitters, *A* and *B*, are situated as below.

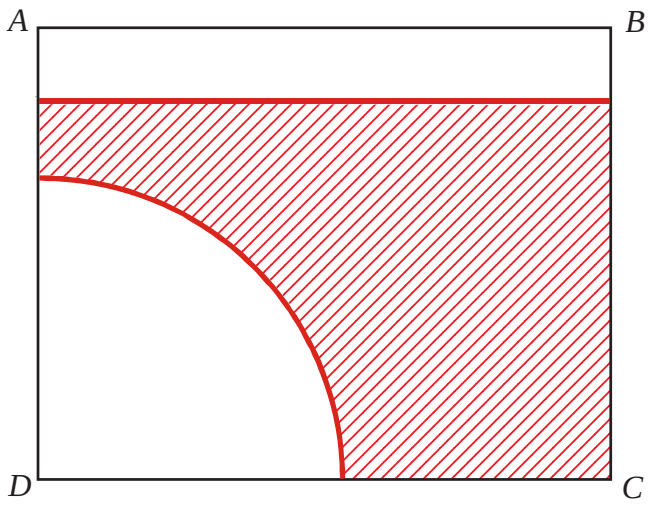
Transmitter *A* broadcasts signals which can be heard up to 3 km from *A*.

Transmitter *B* broadcasts signals which can be heard up to 6 km from *B*.

Shade in the area in which radio signals can be heard from both transmitters.
Use a scale of 1 cm = 1 km.

Loci

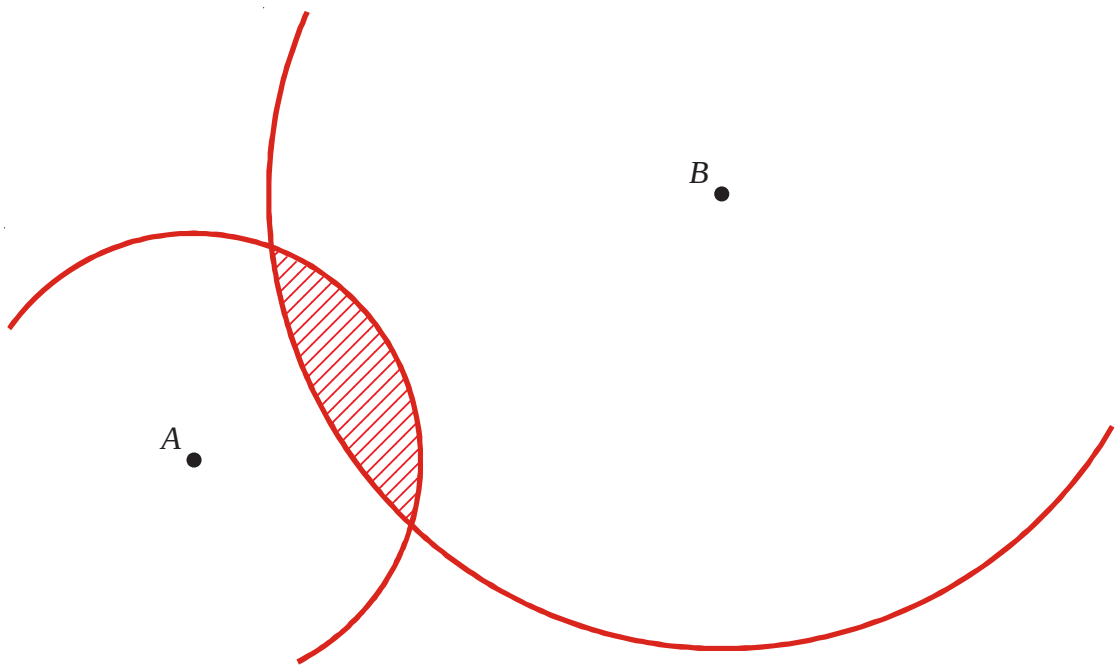
1)



ABCD is a rectangle.

Shade the set of points inside the rectangle which are **both**
more than 4 centimetres from the point *D*
and more than 1 centimetre from the line *AB*.

2) Two radio transmitters, *A* and *B*, are situated as below.



Transmitter *A* broadcasts signals which can be heard up to 3 km from *A*.

Transmitter *B* broadcasts signals which can be heard up to 6 km from *B*.

Shade in the area in which radio signals can be heard from both transmitters.
Use a scale of 1 cm = 1 km.

Loci

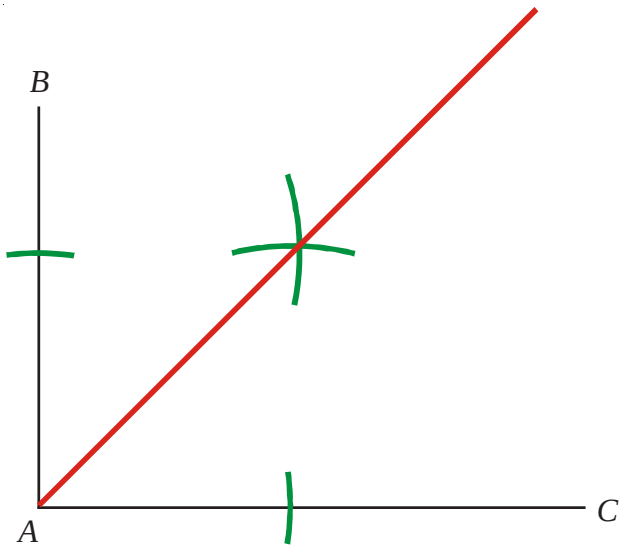
1) Draw the locus of all points which are equidistant from the lines *AB* **and** *AC*.

2) Draw the locus of all points which are equidistant from the points *A* and *B*.

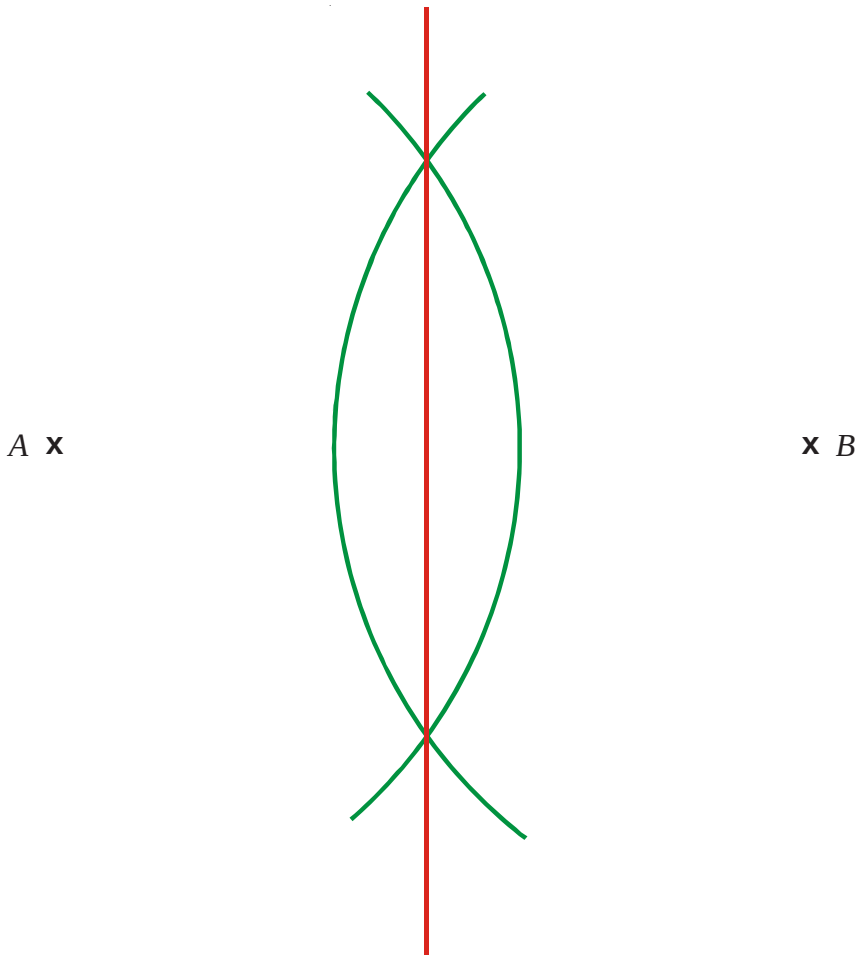
A x x *B*

Loci

1) Draw the locus of all points which are equidistant from the lines *AB* **and** *AC*.



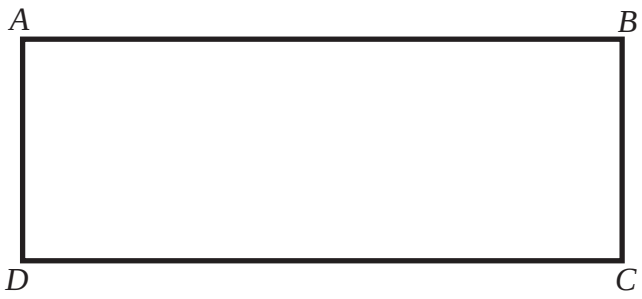
2) Draw the locus of all points which are equidistant from the points *A* and *B*.



Loci

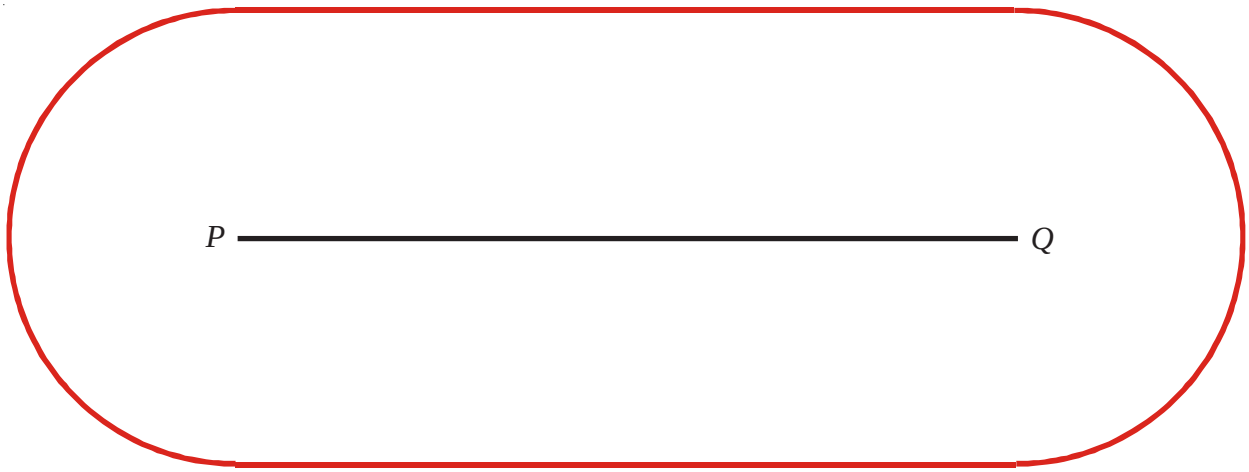
1) Draw the locus of all points that are exactly 3 cm from the line *PQ*.

2) Draw the locus of all points that are exactly 4 cm from the rectangle *ABCD*

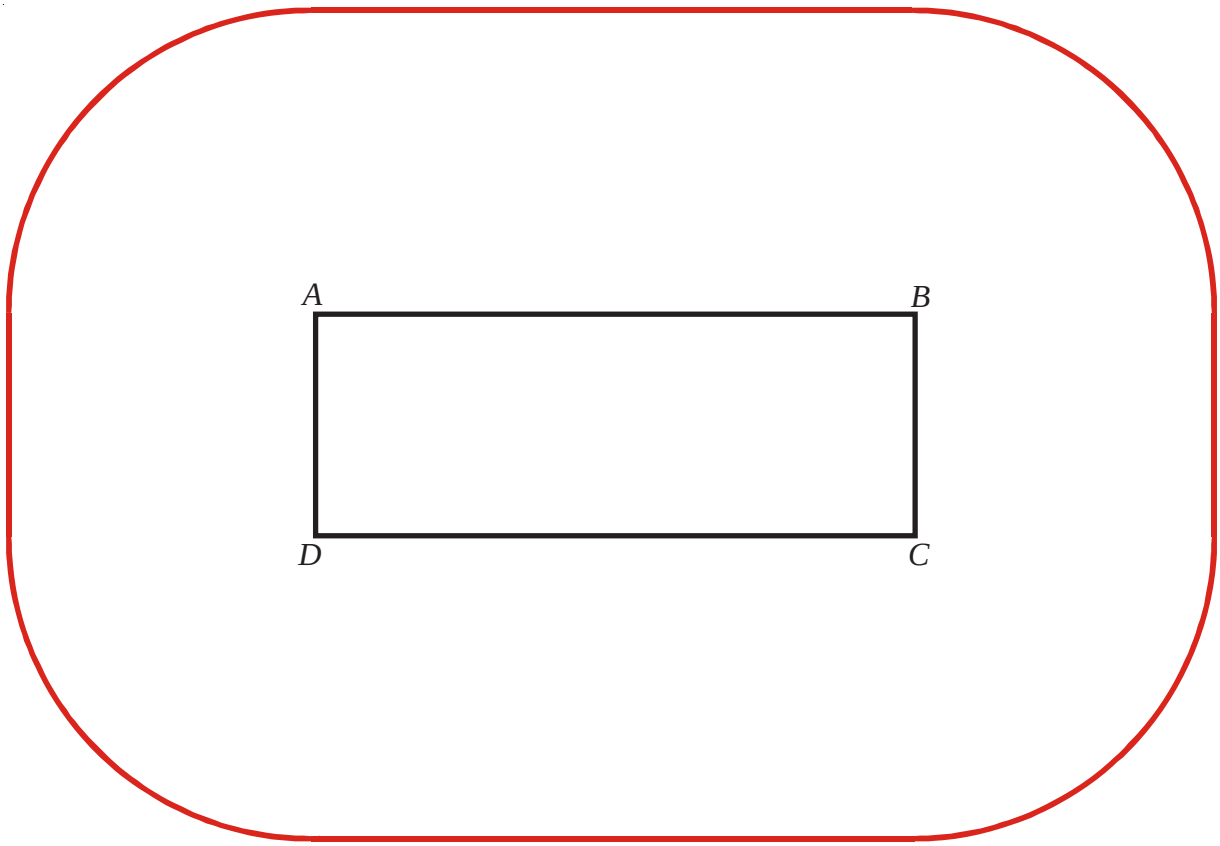


Loci

1) Draw the locus of all points that are exactly 3 cm from the line *PQ*.

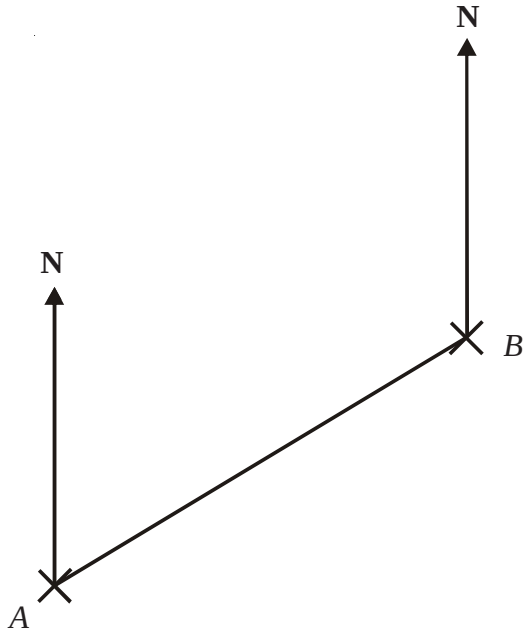


2) Draw the locus of all points that are exactly 4 cm from the rectangle *ABCD*



Bearings

1) The diagram shows the position of two telephone masts, *A* and *B*, on a map.

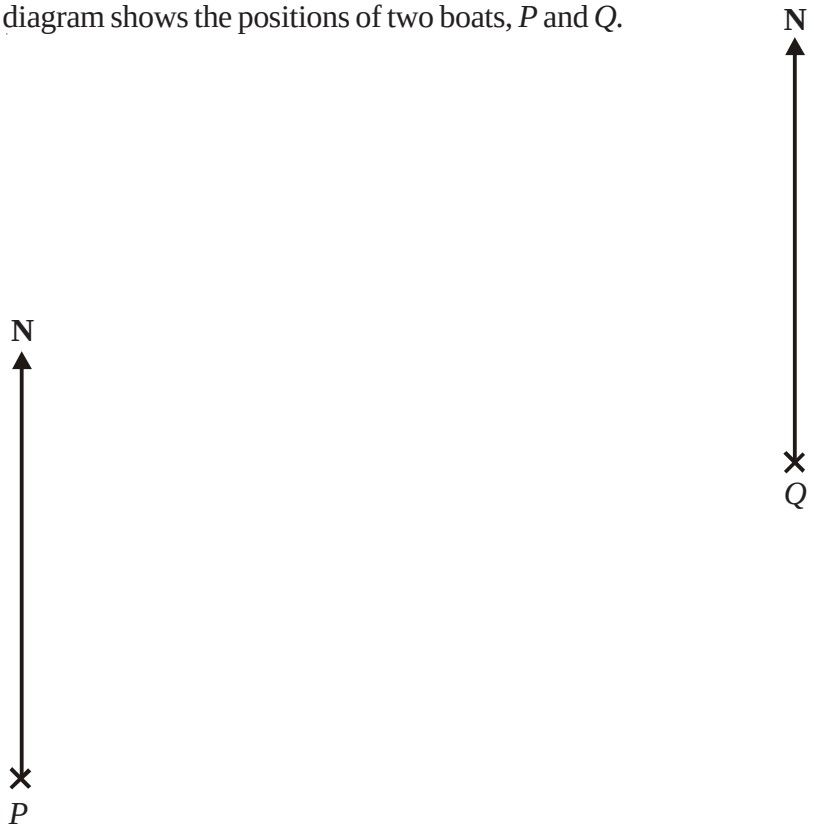


a) Measure the bearing of *B* from *A*.

Another mast *C* is on a bearing of 160° from *B*.
On the map, *C* is 4 cm from *B*.

b) Mark the position of *C* with a cross and label it *C*.

2) The diagram shows the positions of two boats, *P* and *Q*.

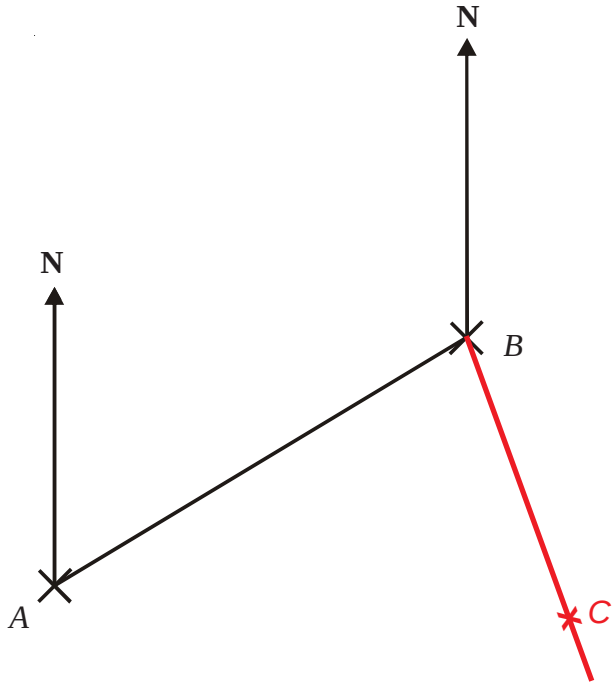


The bearing of a boat *R* from boat *P* is 050°
The bearing of boat *R* from boat *Q* is 320°

In the space above, draw an accurate diagram to show the position of boat *R*.
Mark the position of boat *R* with a cross (×). Label it *R*.

Bearings

1) The diagram shows the position of two telephone masts, *A* and *B*, on a map.

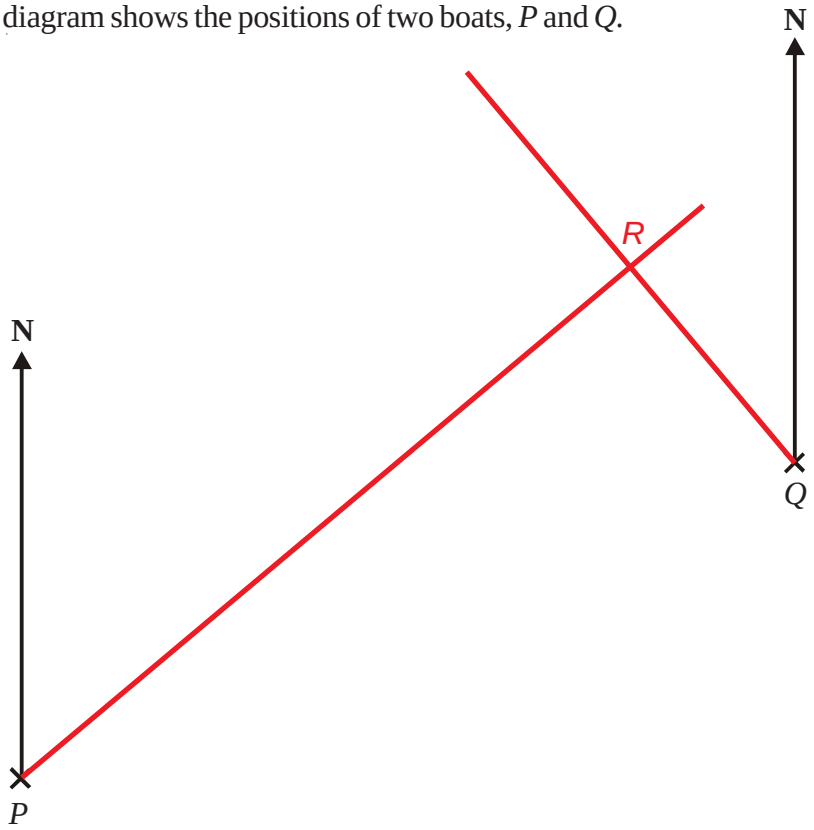


a) Measure the bearing of *B* from *A*. 059°

Another mast *C* is on a bearing of 160° from *B*.
On the map, *C* is 4 cm from *B*.

b) Mark the position of *C* with a cross and label it *C*.

2) The diagram shows the positions of two boats, *P* and *Q*.



The bearing of a boat *R* from boat *P* is 050°
The bearing of boat *R* from boat *Q* is 320°

In the space above, draw an accurate diagram to show the position of boat *R*.
Mark the position of boat *R* with a cross (×). Label it *R*.

Bearings

1) School *B* is due east of school *A*.
C is another school.
The bearing of *C* from *A* is 065°.
The bearing of *C* from *B* is 313°.

Complete the scale drawing below.
Mark with a cross the position of *C*.

2) In the diagram, point *A* marks the position of Middlewitch.
The position of Middlemarch is to be marked on the diagram as point *B*
On the diagram, mark with a cross the position of *B* given that:
B is on a bearing of 320° from *A* and
B is 5 cm from *A*

3) **Work out** the bearing of
a) *B* from *P*
b) *P* from *A*

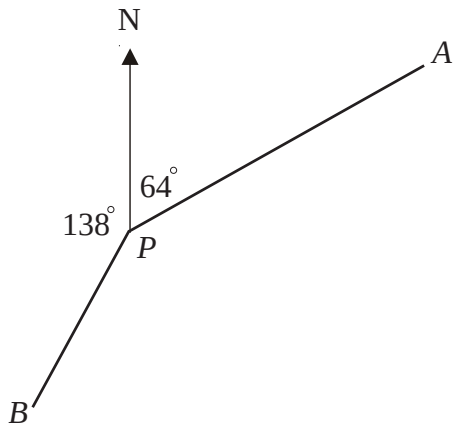
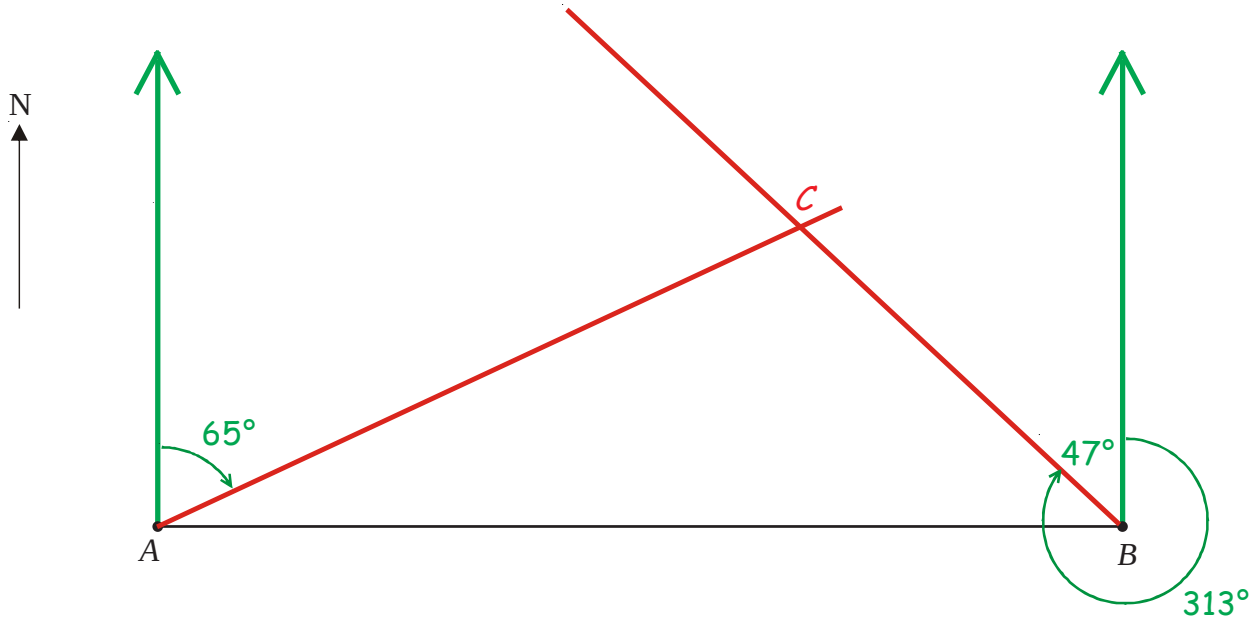


*Diagram **NOT** accurately drawn.*

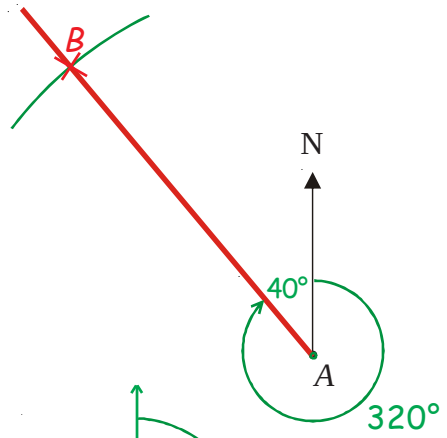
Bearings

1) School *B* is due east of school *A*.
C is another school.
The bearing of *C* from *A* is 065°.
The bearing of *C* from *B* is 313°.

Complete the scale drawing below.
Mark with a cross the position of *C*.



2) In the diagram, point *A* marks the position of Middlewitch.
The position of Middlemarch is to be marked on the diagram as point *B*
On the diagram, mark with a cross the position of *B* given that:
B is on a bearing of 320° from *A* and
B is 5 cm from *A*



3) **Work out** the bearing of
a) *B* from *P* 222°
b) *P* from *A* 244°

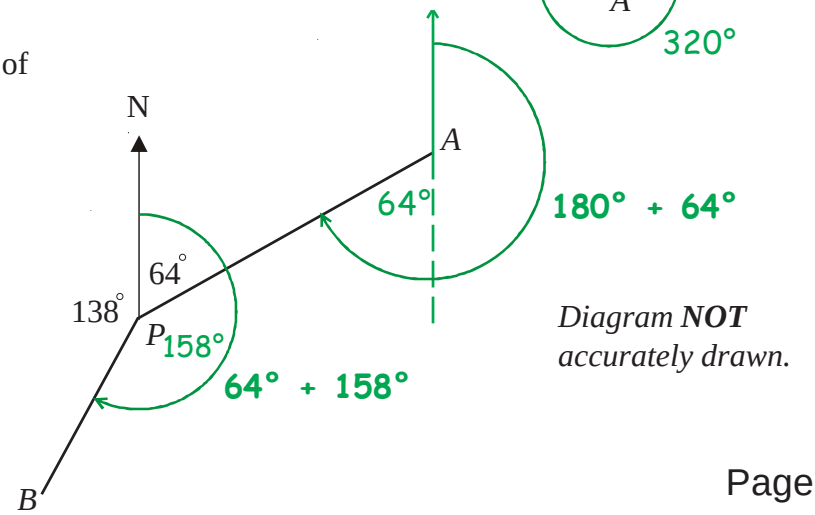


*Diagram **NOT** accurately drawn.*

Experimental Probabilities

1) Ahmad does a statistical experiment.
He throws a dice 600 times.
He scores one, 200 times.
Is the dice fair? Explain your answer

2) Chris has a biased coin.
The probability that the biased coin will land on a tail is 0.3
Chris is going to flip the coin 150 times.
Work out an estimate for the number of times the coin will land on a tail.

3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.
The dice is rolled 300 times.
Work out an estimate for the number of times the dice will land on a six.

4) On a biased dice, the probability of getting a three is 0.5
The dice is rolled 350 times.
Work out an estimate for the number of times the dice will land on a three.

5) Jenny throws a biased dice 100 times.
The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

a) She throws the dice once more.
Find an estimate for the probability that she will get a four.

b) If the dice is rolled 250 times, how many times would you expect to get a five?

Experimental Probabilities

1) Ahmad does a statistical experiment.
He throws a dice 600 times.
He scores one, 200 times.
Is the dice fair? Explain your answer Two possible answers:
No, you would expect to score 1 about 100 times.
Yes, although you would expect 1 about 100 times, you could still get it 200 times.

2) Chris has a biased coin.
The probability that the biased coin will land on a tail is 0.3
Chris is going to flip the coin 150 times.
Work out an estimate for the number of times the coin will land on a tail. 45 times
$0.3 \times 150 = 45$

3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.
The dice is rolled 300 times.
Work out an estimate for the number of times the dice will land on a six. 200 times
$\frac{2}{3} \times 300 = 200$

4) On a biased dice, the probability of getting a three is 0.5
The dice is rolled 350 times.
Work out an estimate for the number of times the dice will land on a three. 175 times
$0.5 \times 350 = 175$

5) Jenny throws a biased dice 100 times.
The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

a) She throws the dice once more.
Find an estimate for the probability that she will get a four. $\frac{24}{100}$ or 0.24

b) If the dice is rolled 250 times, how many times would you expect to get a five? 45 times
$\frac{18}{100} \times 250 = 45$

Averages from a Table

1) Tom carried out a survey of the number of school dinners 34 students had in one week.

The table shows this information.

Number of school dinners	Frequency	
0	0	
1	7	
2	14	
3	7	
4	4	
5	2	

Calculate the mean number of school dinners.
Give your answer to 1 decimal place.

2) Sindy recorded the time, in minutes, that her train was late over 100 days.
Information about these times is shown in the table.

Time (t minutes)	Frequency		
$0 < t \leqslant 6$	15		
$6 < t \leqslant 12$	23		
$12 < t \leqslant 18$	28		
$18 < t \leqslant 24$	19		
$24 < t \leqslant 30$	15		

Calculate an estimate for the mean time that her train was late.
Give your answer to 1 decimal place.

3) Tony asked 32 men about the number of children they had.

The table shows information about his results.

Number of children	Frequency	
0	10	
1	5	
2	7	
3	8	
4	2	
more than 4	0	

a) Find the mode.

b) Calculate the mean to 1 decimal place.

Averages from a Table

1) Tom carried out a survey of the number of school dinners 34 students had in one week.

The table shows this information.

Number of school dinners	Frequency	
0	0	
1	7	
2	14	
3	7	
4	4	
5	2	

Calculate the mean number of school dinners. 2.4
Give your answer to 1 decimal place.

2) Sindy recorded the time, in minutes, that her train was late over 100 days.
Information about these times is shown in the table.

Time (t minutes)	Frequency	Midpoint	MP × Frequency
$0 < t \leqslant 6$	15	3	45
$6 < t \leqslant 12$	23	9	207
$12 < t \leqslant 18$	28	15	420
$18 < t \leqslant 24$	19	21	399
$24 < t \leqslant 30$	15	27	405
	100		1476

Calculate an estimate for the mean time that her train was late.
Give your answer to 1 decimal place. 14.8 minutes

3) Tony asked 32 men about the number of children they had.

The table shows information about his results.

Number of children	Frequency	
0	10	
1	5	
2	7	
3	8	
4	2	
more than 4	0	

a) Find the mode. 0 children

b) Calculate the mean to 1 decimal place. 1.6 children

Averages from a Table

1) The table shows some information about the heights (h cm) of 100 plants.

Height (h cm)	**Frequency**		
$120 < h \leqslant 130$	9		
$130 < h \leqslant 140$	18		
$140 < h \leqslant 150$	27		
$150 < h \leqslant 160$	31		
$160 < h \leqslant 170$	15		

a) Find the class interval in which the median lies.

b) Work out an estimate for the mean height of the plants.

2) The table gives information about the number of books sold in a shop during each of the last 30 weeks.

Number of books (n)	**Frequency**		
$0 < n \leqslant 40$	2		
$40 < n \leqslant 80$	6		
$80 < n \leqslant 120$	13		
$120 < n \leqslant 160$	6		
$160 < n \leqslant 200$	3		

Calculate an estimate for the mean number of books sold each week.
Give your answer correct to 1 decimal place.

Averages from a Table

1) The table shows some information about the heights (h cm) of 100 plants.

Height (h cm)	Frequency	Midpoint	MP × Frequency
$120 < h \leqslant 130$	9	125	1125
$130 < h \leqslant 140$	18	135	2430
$140 < h \leqslant 150$	27	145	3915
$150 < h \leqslant 160$	31	155	4805
$160 < h \leqslant 170$	15	165	2475
	100		**14750**

a) Find the class interval in which the median lies. $140 < h \leqslant 150$

b) Work out an estimate for the mean height of the plants. 147.5 cm

2) The table gives information about the number of books sold in a shop during each of the last 30 weeks.

Number of books (n)	Frequency	Midpoint	MP × Frequency
$0 < n \leqslant 40$	2	20	40
$40 < n \leqslant 80$	6	60	360
$80 < n \leqslant 120$	13	100	1300
$120 < n \leqslant 160$	6	140	840
$160 < n \leqslant 200$	3	180	540
	30		**3080**

Calculate an estimate for the mean number of books sold each week. 102.7 books
Give your answer correct to 1 decimal place.

Averages from a Table

1) The number of pens in each pupil's pencil case in a classroom has been counted.
The results are displayed in a table.

Number of pens	Number of pupils
0	4
1	6
2	7
3	5
4	3
5	1

a) Work out the total number of pens in the classroom.

b) Write down the modal number of pens in a pencil case.

c) Work out the mean number of pens in a pencil case.

d) Work out the range of the number of pens in a pencil case.

2) Thomas is analysing the local football team.
He records the number of goals scored in each football match in the past twelve months.

Goals scored	Frequency
0	7
1	5
2	3
3	6
4	2
5	1
6	1

Thomas said that the mode is 7
Thomas is wrong.

a) Explain why.

b) Calculate the mean number of goals scored.

3) Tina recorded how long, in minutes, she watched TV for each day during a month.

Time (t in minutes)	Frequency
$10 < t \leqslant 20$	5
$20 < t \leqslant 30$	9
$30 < t \leqslant 45$	8
$45 < t \leqslant 60$	6
$60 < t \leqslant 90$	3

a) Find the class interval in which the median lies.

b) Work out an estimate for the mean amount of time Tina watched TV each day of this month.
Give your answer to the nearest minute.

Averages from a Table

1) The number of pens in each pupil's pencil case in a classroom has been counted.
The results are displayed in a table.

Number of pens	Number of pupils		
0	4	0 × 4	0
1	6	1 × 6	6
2	7	2 × 7	14
3	5	3 × 5	15
4	3	4 × 3	12
5	1	5 × 1	5
	26		52 Total

a) Work out the total number of pens in the classroom. 52 pens

b) Write down the modal number of pens in a pencil case. 2 pens

c) Work out the mean number of pens in a pencil case. 2 pens 52 ÷ 26

d) Work out the range of the number of pens in a pencil case. 5 pens 5 – 0

2) Thomas is analysing the local football team.
He records the number of goals scored in each football match in the past twelve months.

Goals scored	Frequency		
0	7	0 × 7	0
1	5	1 × 5	5
2	3	2 × 3	6
3	6	3 × 6	18
4	2	4 × 2	8
5	1	5 × 1	5
6	1	6 × 1	6
Total	25		48

Thomas said that the mode is 7
Thomas is wrong.

a) Explain why. Thomas gave the highest frequency instead of giving the number of "goals scored" associated with it.

b) Calculate the mean number of goals scored.

1.92 goals 48 ÷ 25

3) Tina recorded how long, in minutes, she watched TV for each day during a month.

Time (t in minutes)	Frequency
$10 < t \leqslant 20$	5
$20 < t \leqslant 30$	9
$30 < t \leqslant 45$	8
$45 < t \leqslant 60$	6
$60 < t \leqslant 90$	3

a) Find the class interval in which the median lies.

$30 < t \leqslant 45$

b) Work out an estimate for the mean amount of time Tina watched TV each day of this month.
Give your answer to the nearest minute.

37 minutes 1140 ÷ 31

Questionnaires

1) A survey into how people communicate with each other is carried out.
A questionnaire is designed and two of the questions used are shown below.
The questions are **not** suitable.
For each question, write down a reason why.

a) Do you prefer to communicate with your friend by phone (voice call) or by text message?

Yes ☐ No ☐

Reason .....
.....

b) How many text messages do you send?

1 ☐ 2 ☐ 3 ☐ 4 ☐

Reason .....
.....

2) A restaurant owner has made some changes.
He wants to find out what customers think of these changes.
He uses this question on a questionnaire.

"What do you think of the changes in the restaurant?"

☐ Excellent ☐ Very good ☐ Good

a) Write down what is wrong with this question.

This is another question on the questionnaire.

"How often do you come to the restaurant?"

☐ Very often ☐ Not often

b) i) Write down one thing that is wrong with this question.

ii) Design a better question to use.
You should include some response boxes.

Questionnaires

1) A survey into how people communicate with each other is carried out.
A questionnaire is designed and two of the questions used are shown below.
The questions are **not** suitable.
For each question, write down a reason why.

a) Do you prefer to communicate with your friend by phone (voice call) or by text message?

Yes ☐ No ☐

Reason This is not a question you can answer 'yes' or 'no' to.

b) How many text messages do you send?

1 ☐ 2 ☐ 3 ☐ 4 ☐

Reason Response boxes need to include '0' and 'more than 4'.
Question needs a time frame eg per day, per week.

2) A restaurant owner has made some changes.
He wants to find out what customers think of these changes.
He uses this question on a questionnaire.

"What do you think of the changes in the restaurant?"

☐ Excellent ☐ Very good ☐ Good

a) Write down what is wrong with this question.
There is no negative or neutral response box.

This is another question on the questionnaire.

"How often do you come to the restaurant?"

☐ Very often ☐ Not often

b) i) Write down one thing that is wrong with this question.
Question needs a time frame eg per week, per month.
Response boxes need to be more specific eg once a week, twice a week.

ii) Design a better question to use.
You should include some response boxes.
How many times do you visit this restaurant per month?

☐ None ☐ Once ☐ Twice ☐ More than twice

Standard Form

1) Change the following to normal (or ordinary) numbers.

a) 4.3×10^4 c) 7.03×10^3 e) 1.01×10^4

b) 6.79×10^6 d) 9.2×10^2 f) 4×10^5

2) Change the following to normal (or ordinary) numbers.

a) 4.3×10^{-4} c) 7.03×10^{-3} e) 1.01×10^{-4}

b) 6.79×10^{-6} d) 9.2×10^{-2} f) 4×10^{-5}

3) Change the following to standard form.

a) 360 c) 520 000 e) 1 003

b) 8 900 d) 60000 f) 6 450 000

4) Change the following to standard form.

a) 0.071 c) 0.00076 e) 0.00009

b) 0.0008 d) 0.0928 f) 0.00000173

5) Work out the following, giving your answer in standard form.

a) $3\,000 \times 5\,000$ d) $5 \times 4 \times 10^3$ g) $7 \times 10^2 \times 3 \times 10^{-4}$

b) 240×0.0002 e) $\dfrac{8 \times 10^4}{4 \times 10^2}$ h) $2 \times 3.6 \times 10^{-5}$

c) $9 \times 1.1 \times 10^7$ f) $9 \times 10^2 \times 2 \times 10^{-5}$ i) $6 \times 4.1 \times 10^3$

Standard Form

1) Change the following to normal (or ordinary) numbers.

a) 4.3×10^4
43 000

b) 6.79×10^6
6 790 000

c) 7.03×10^3
7 030

d) 9.2×10^2
920

e) 1.01×10^4
10 100

f) 4×10^5
400 000

2) Change the following to normal (or ordinary) numbers.

a) 4.3×10^{-4}
0.00043

b) 6.79×10^{-6}
0.00000679

c) 7.03×10^{-3}
0.00703

d) 9.2×10^{-2}
0.092

e) 1.01×10^{-4}
0.000101

f) 4×10^{-5}
0.00004

3) Change the following to standard form.

a) 360
3.6×10^2

b) 8 900
8.9×10^3

c) 520 000
5.2×10^5

d) 60000
6×10^4

e) 1 003
1.003×10^3

f) 6 450 000
6.45×10^6

4) Change the following to standard form.

a) 0.071
7.1×10^{-2}

b) 0.0008
8×10^{-4}

c) 0.00076
7.6×10^{-4}

d) 0.0928
9.28×10^{-2}

e) 0.00009
9×10^{-5}

f) 0.00000173
1.73×10^{-6}

5) Work out the following, giving your answer in standard form.

a) $3\,000 \times 5\,000$ 15 000 000
1.5×10^7

b) 240×0.0002 0.048
4.8×10^{-2}

c) $9 \times 1.1 \times 10^7$
9.9×10^7

d) $5 \times 4 \times 10^3$ 20×10^3
2×10^4

e) $\dfrac{8 \times 10^4}{4 \times 10^2}$
2×10^2

f) $9 \times 10^2 \times 2 \times 10^{-5}$ 18×10^{-3}
1.8×10^{-2}

g) $7 \times 10^2 \times 3 \times 10^{-4}$
2.1×10^{-1} 21×10^{-2}

h) $2 \times 3.6 \times 10^{-5}$
7.2×10^{-5}

i) $6 \times 4.1 \times 10^3$ 24.6×10^3
2.46×10^4

Standard Form

1) Work out the following, giving your answer in standard form.

a) $(6 \times 10^2) \times (8 \times 10^4)$

b) $(2 \times 10^5) + (3 \times 10^4)$

c) $\dfrac{3 \times 10^3}{6 \times 10^{-5}}$

d) $(9.2 \times 10^5) \div (2 \times 10^2)$

2) A spaceship travelled for 5×10^3 hours at a speed of 9×10^4 km/h.

a) Work out the distance travelled by the spaceship.
Give your answer in standard form.

Another spaceship travelled a distance of 2×10^7 km, last month.
This month it has travelled 5×10^6 km.

b) Work out the total distance travelled by the spaceship over these past two months.
Give your answer as a normal (or ordinary) number.

3) Work out the following, giving your answer in standard form,
correct to 2 significant figures.

a) $2.6 \times 10^3 \times 4.3 \times 10^4$

b) $(7.5 \times 10^5) \times (1.9 \times 10^{-2})$

c) $\dfrac{9.435 \times 10^5}{3.28 \times 10^3}$

d) $\dfrac{5.98 \times 10^8}{6.14 \times 10^{-2}}$

4) Work out the following, giving your answer in standard form
correct to 3 significant figures.

a) $\dfrac{5.76 \times 10^7 + 3.89 \times 10^9}{7.18 \times 10^{-2}}$

b) $\dfrac{7.2 \times 10^{-2} - 5.4 \times 10^{-1}}{9.25 \times 10^{-7}}$

c) $\dfrac{3 \times 10^8 \times 2 \times 10^7}{3 \times 10^8 + 2 \times 10^7}$

d) $\dfrac{3 \times 3.2 \times 10^{12} \times 1.5 \times 10^{12}}{3.2 \times 10^{12} - 1.5 \times 10^{12}}$

5) A microsecond is 0.000 001 seconds.

a) Write the number 0.000 001 in standard form.

A computer does a calculation in 3 microseconds.

b) How many of these calculations can the computer do in 1 second?
Give your answer in standard form, correct to 3 significant figures.

6) 340 000 tomato seeds weigh 1 gram.
Each tomato seed weighs the same.

a) Write the number 340 000 in standard form.

b) Calculate the weight, in grams, of one tomato seed.
Give your answer in standard form, correct to 2 significant figures.

Standard Form

1) Work out the following, giving your answer in standard form.

a) $(6 \times 10^2) \times (8 \times 10^4)$ 4.8×10^7

b) $(2 \times 10^5) + (3 \times 10^4)$ 2.3×10^5

c) $\dfrac{3 \times 10^3}{6 \times 10^{-5}}$ 5×10^7

d) $(9.2 \times 10^5) \div (2 \times 10^2)$ 4.6×10^3

2) A spaceship travelled for 5×10^3 hours at a speed of 9×10^4 km/h.

a) Work out the distance travelled by the spaceship.
Give your answer in standard form. 4.5×10^8 km

$D = S \times T$
$D = 5 \times 10^3 \times 9 \times 10^4$

Another spaceship travelled a distance of 2×10^7 km, last month.
This month it has travelled 5×10^6 km.

$2 \times 10^7 = 20\,000\,000$
$5 \times 10^6 = 5\,000\,000$

b) Work out the total distance travelled by the spaceship over these past two months.
Give your answer as a normal (or ordinary) number. 25 000 000 km

3) Work out the following, giving your answer in standard form,
correct to 2 significant figures.

a) $2.6 \times 10^3 \times 4.3 \times 10^4$ 1.1×10^8

b) $(7.5 \times 10^5) \times (1.9 \times 10^{-2})$ 1.4×10^4

c) $\dfrac{9.435 \times 10^5}{3.28 \times 10^3}$ 2.9×10^2

d) $\dfrac{5.98 \times 10^8}{6.14 \times 10^{-2}}$ 9.7×10^9

4) Work out the following, giving your answer in standard form
correct to 3 significant figures.

a) $\dfrac{5.76 \times 10^7 + 3.89 \times 10^9}{7.18 \times 10^{-2}}$ 5.50×10^{10}

b) $\dfrac{7.2 \times 10^{-2} - 5.4 \times 10^{-1}}{9.25 \times 10^{-7}}$ -5.06×10^5

c) $\dfrac{3 \times 10^8 \times 2 \times 10^7}{3 \times 10^8 + 2 \times 10^7}$ 1.88×10^7

d) $\dfrac{3 \times 3.2 \times 10^{12} \times 1.5 \times 10^{12}}{3.2 \times 10^{12} - 1.5 \times 10^{12}}$ 8.47×10^{12}

5) A microsecond is 0.000 001 seconds.

a) Write the number 0.000 001 in standard form. 1×10^{-6}

A computer does a calculation in 3 microseconds.

b) How many of these calculations can the computer do in 1 second? $1 \div (3 \times 10^{-6})$
Give your answer in standard form, correct to 3 significant figures. 3.33×10^5

6) 340 000 tomato seeds weigh 1 gram.
Each tomato seed weighs the same.

a) Write the number 340 000 in standard form. 3.4×10^5

b) Calculate the weight, in grams, of one tomato seed.
Give your answer in standard form, correct to 2 significant figures. 2.9×10^{-6}

$1 \div (3.4 \times 10^5)$

Percentage Increase and Decrease

1) A car dealer is comparing his sales over the past two years.
In 2006, he sold 175 cars.
In 2007, he sold 196 cars.

Work out the percentage increase in the number of cars sold.

2) In September 2005, the number of pupils attending MathsWatch College was 1352.
In September 2006, the number of pupils attending MathsWatch College was 1014.

Work out the percentage decrease in the number of pupils attending MathsWatch College.

3) The usual price of a shirt is £32.50
In a sale, the shirt is reduced to £29.25

What is the percentage reduction?

4) Olivia opened an account with £750 at the MathsWatch Bank.
After one year, the bank paid her interest.
She then had £795 in her account.

Work out, as a percentage, MathsWatch Bank's interest rate.

5) Keith buys a house for £270 000 and sells it two years later for £300 000.

What is his percentage profit?
Give your answer to 2 significant figures.

6) Shelley bought some items at a car boot sale and then sold them on ebay.
Work out the percentage profit or loss she made on each of these items.

a) Trainers bought for £15, sold for £20

b) DVD recorder bought for £42, sold for £60.90

c) Gold necklace bought for £90, sold for £78.30

d) A DVD collection bought for £120, sold for £81.60

Percentage Increase and Decrease

1) A car dealer is comparing his sales over the past two years.
In 2006, he sold 175 cars.
In 2007, he sold 196 cars.

Work out the percentage increase in the number of cars sold. 12%

$196 - 175 = 21$ $\quad \frac{21}{175} \times 100 = 12$

2) In September 2005, the number of pupils attending MathsWatch College was 1352.
In September 2006, the number of pupils attending MathsWatch College was 1014.

Work out the percentage decrease in the number of pupils attending MathsWatch College. 25%

$1352 - 1014 = 338$ $\quad \frac{338}{1352} \times 100 = 25$

3) The usual price of a shirt is £32.50
In a sale, the shirt is reduced to £29.25

What is the percentage reduction? 10%

$32.50 - 29.25 = 3.25$ $\quad \frac{3.25}{32.50} \times 100 = 10$

4) Olivia opened an account with £750 at the MathsWatch Bank.
After one year, the bank paid her interest.
She then had £795 in her account.

Work out, as a percentage, MathsWatch Bank's interest rate. 6%

$795 - 750 = 45$ $\quad \frac{45}{750} \times 100 = 6$

5) Keith buys a house for £270 000 and sells it two years later for £300 000.

What is his percentage profit?
Give your answer to 2 significant figures. 11%

$300\,000 - 270\,000 = 30\,000$ $\quad \frac{30\,000}{270\,000} \times 100 = 11$

6) Shelley bought some items at a car boot sale and then sold them on ebay.
Work out the percentage profit or loss she made on each of these items.

a) Trainers bought for £15, sold for £20 33.3% profit

b) DVD recorder bought for £42, sold for £60.90 45% profit

c) Gold necklace bought for £90, sold for £78.30 13% loss

d) A DVD collection bought for £120, sold for £81.60 32% loss

Compound Interest and Depreciation

1) Henry places £6000 in an account which pays 4.6% compound interest each year.
Calculate the amount in his account after 2 years.

2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.
Calculate the amount Sarah has in her account after 4 years.

3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.
How much will Mary have in her account after 5 years?

4) Susan places £7900 in an account which pays 2.4% compound interest per year.
How much interest does she earn in 3 years?

5) Harry puts money into an account which pays 6% compound interest per year.
If he puts £23000 in the account for 5 years how much interest will he earn altogether?

---

6) Laura buys a new car for £14600.
The annual rate of depreciation is 23%.
How much is the car worth after 3 years?

7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years?

8) Sharon pays £3500 for a secondhand car.
The annual rate of depreciation of the car is 24%
How much will it be worth four years after she has bought it?

---

9) Dave places £17000 in an account which pays 4% compound interest per year.
How many years will it take before he has £19122.69 in the bank?

10) A new motorbike costs £8900.
The annual rate of depreciation is 18% per year.
After how many years will it be worth £2705.66?

Compound Interest and Depreciation

1) Henry places £6000 in an account which pays 4.6% compound interest each year.

Calculate the amount in his account after 2 years. £6564.70

$6000 \times 1.046^2 = 6564.70$

2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.

Calculate the amount Sarah has in her account after 4 years. £9983.62

$8600 \times 1.038^4 = 9983.62$

3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.

How much will Mary have in her account after 5 years? £13131.66

$10000 \times 1.056^5 = 13131.66$

4) Susan places £7900 in an account which pays 2.4% compound interest per year.

How much interest does she earn in 3 years? £582.56

$7900 \times 1.024^3 = 8482.56$ £8482.56 – £7900 = £582.56

5) Harry puts money into an account which pays 6% compound interest per year.

If he puts £23000 in the account for 5 years how much interest will he earn altogether? £7779.19

$23000 \times 1.06^5 = 30779.19$ £30779.19 – £23000 = £7779.19

---

6) Laura buys a new car for £14600.

The annual rate of depreciation is 23%.

How much is the car worth after 3 years? £6665.38

$14600 \times 0.77^3 = 6665.38$

7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years? £79.63

$650 \times 0.35^2 = 79.63$

8) Sharon pays £3500 for a secondhand car.

The annual rate of depreciation of the car is 24%

How much will it be worth four years after she has bought it? £1167.68

$3500 \times 0.76^4 = 1167.68$

---

9) Dave places £17000 in an account which pays 4% compound interest per year.

How many years will it take before he has £19122.69 in the bank? 3 years

$17000 \times 1.04^3 = 19122.69$

10) A new motorbike costs £8900.

The annual rate of depreciation is 18% per year.

After how many years will it be worth £2705.66? 6 years

$8900 \times 0.82^6 = 2705.66$

Reverse Percentage

1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26

Calculate the normal price of the shirt.

2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.

Calculate the normal price of the car.

3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75

Calculate the normal price of the DVD recorder.

4) A salesman gets a basic wage of £160 per week plus a commision of 30% of the sales he makes that week.
In one week his total wage was £640

Work out the value of the sales he made that week.

5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976

Work out the amount with which Jason opened his account.

6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.

Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.

a) Explain why

b) Work out Jonathan's weekly pay last year.

7) The price of all rail season tickets to London increased by 4%.

a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase.

b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase.

Reverse Percentage

1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26

Calculate the normal price of the shirt. £32.50
(26 ÷ 80) × 100 = 32.5

2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.

Calculate the normal price of the car. £7200
(6120 ÷ 85) × 100 = 7200

3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75

Calculate the normal price of the DVD recorder. £125
(108.75 ÷ 87) × 100 = 125

4) A salesman gets a basic wage of £160 per week plus a commision of 30% of the sales he makes that week.
In one week his total wage was £640

Work out the value of the sales he made that week. £1600
640 – 160 = 480
(480 ÷ 30) × 100 = 1600

5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976

Work out the amount with which Jason opened his account. £1900
(1976 ÷ 104) × 100 = 1900

6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.

Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.

a) Explain why Tess has calculated 20% of £960, and subtracted it.

b) Work out Jonathan's weekly pay last year. £800
(960 ÷ 120) × 100 = 800

7) The price of all rail season tickets to London increased by 4%.

a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase. £3060 (122.40 ÷ 4) × 100 = 3060

b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase. £2820
(2932.80 ÷ 104) × 100 = 2820

Four Rules of Fractions

1) Work out the value of $2\frac{4}{5} - 1\frac{3}{4}$

Give your answer as a fraction in its simplest form.

2) a) Work out $\frac{3}{8} + \frac{1}{4}$

Give your answer in its simplest form.

b) Work out $\frac{2}{3} \times \frac{4}{5}$

3) Work out the value of $3\frac{1}{4} \times 2\frac{2}{3}$

Give your answer as a fraction in its simplest form.

4) a) Work out $2\frac{17}{20} - 1\frac{2}{5}$

b) Work out $2\frac{2}{3} \times 1\frac{3}{4}$

5) a) Work out $\frac{2}{3} \div \frac{5}{6}$

Give your fraction in its simplest form.

b) Work out $2\frac{1}{3} - 1\frac{2}{5}$

6) There are 300 people at a concert.

$\frac{1}{6}$ of the 300 people are boys.

$\frac{3}{10}$ of the 300 people are girls.

The rest of the people are adults.

Work out how many people are adults.

Four Rules of Fractions

1) Work out the value of $2\frac{4}{5} - 1\frac{3}{4}$ $1\frac{1}{20}$

Give your answer as a fraction in its simplest form.

2) a) Work out $\frac{3}{8} + \frac{1}{4}$ $\frac{5}{8}$

Give your answer in its simplest form.

b) Work out $\frac{2}{3} \times \frac{4}{5}$ $\frac{8}{15}$

3) Work out the value of $3\frac{1}{4} \times 2\frac{2}{3}$ $8\frac{2}{3}$

Give your answer as a fraction in its simplest form.

4) a) Work out $2\frac{17}{20} - 1\frac{2}{5}$ $1\frac{9}{20}$

b) Work out $2\frac{2}{3} \times 1\frac{3}{4}$ $4\frac{2}{3}$

5) a) Work out $\frac{2}{3} \div \frac{5}{6}$ $\frac{4}{5}$

Give your fraction in its simplest form.

b) Work out $2\frac{1}{3} - 1\frac{2}{5}$ $\frac{14}{15}$

6) There are 300 people at a concert.

$\frac{1}{6}$ of the 300 people are boys.

$\frac{3}{10}$ of the 300 people are girls.

The rest of the people are adults.

Work out how many people are adults. 160

Solving Quadratic Equations by Factorising

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$

b) $x^2 + 9x + 20 = 0$

c) $x^2 + x - 6 = 0$

d) $x^2 + 5x - 24 = 0$

e) $x^2 - 6x + 8 = 0$

f) $x^2 - 3x - 28 = 0$

g) $2x^2 + 7x + 3 = 0$

h) $6x^2 + 11x + 3 = 0$

i) $3x^2 + 13x - 10 = 0$

j) $3x^2 - 34x + 63 = 0$

2) Lucy said that -1 is the only solution of x that satisfies the equation
$x^2 + 2x + 1 = 0$

Was Lucy correct?
Show working to justify your answer

3) Ben said that -5 is the only solution of x that satisfies the equation
$x^2 + 10x + 25 = 0$

Was Ben correct?
Show working to justify your answer

Solving Quadratic Equations by Factorising

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$ $(x + 2)(x + 3) = 0$ $x = -2$ or -3

b) $x^2 + 9x + 20 = 0$ $(x + 4)(x + 5) = 0$ $x = -4$ or -5

c) $x^2 + x - 6 = 0$ $(x + 3)(x - 2) = 0$ $x = -3$ or 2

d) $x^2 + 5x - 24 = 0$ $(x + 8)(x - 3) = 0$ $x = -8$ or 3

e) $x^2 - 6x + 8 = 0$ $(x - 2)(x - 4) = 0$ $x = 2$ or 4

f) $x^2 - 3x - 28 = 0$ $(x - 7)(x + 4) = 0$ $x = 7$ or -4

g) $2x^2 + 7x + 3 = 0$ $(x + 3)(2x + 1) = 0$ $x = -3$ or $-\frac{1}{2}$

h) $6x^2 + 11x + 3 = 0$ $(2x + 3)(3x + 1) = 0$ $x = -\frac{3}{2}$ or $-\frac{1}{3}$

i) $3x^2 + 13x - 10 = 0$ $(x + 5)(3x - 2) = 0$ $x = -5$ or $\frac{2}{3}$

j) $3x^2 - 34x + 63 = 0$ $(3x - 7)(x - 9) = 0$ $x = \frac{7}{3}$ or 9

2) Lucy said that -1 is the only solution of x that satisfies the equation
$x^2 + 2x + 1 = 0$

Was Lucy correct? Yes

Show working to justify your answer

$x^2 + 2x + 1 = 0$
$(x + 1)(x + 1) = 0$
so $x = -1$

3) Ben said that -5 is the only solution of x that satisfies the equation
$x^2 + 10x + 25 = 0$

Was Ben correct? Yes

Show working to justify your answer

$x^2 + 10x + 25 = 0$
$(x + 5)(x + 5) = 0$
so $x = -5$

The Difference of Two Squares

1) Factorise

a) $x^2 - 16$

b) $a^2 - b^2$

c) $y^2 - 9$

d) $x^2 - 1$

e) $x^2 - \frac{1}{4}$

f) $x^2 - \frac{1}{9}$

2) Factorise

a) $x^2 - 4y^2$

b) $9a^2 - b^2$

c) $9x^2 - 16y^2$

d) $\frac{1}{4}x^2 - y^2$

e) $4x^2 - 25y^2$

f) $x^2 - \frac{1}{9}y^2$

3) Simplify

a) $\frac{y^2 - 4}{y + 2} \times \frac{5}{y + 5}$

b) $\frac{3}{2x + 1} \times \frac{4x^2 - 1}{x - 2}$

c) $\frac{12x^2 + 8x}{9x^2 - 4}$

d) $\frac{25a^2 - 16b^2}{10ab - 8b^2}$

4) Solve

a) $4x^2 - 16 = 0$

b) $25x^2 = 1$

c) $49x^2 = 121$

d) $9x^2 - 9 = 7$

The Difference of Two Squares

1) Factorise

a) $x^2 - 16$ $(x - 4)(x + 4)$

b) $a^2 - b^2$ $(a - b)(a + b)$

c) $y^2 - 9$ $(y - 3)(y + 3)$

d) $x^2 - 1$ $(x - 1)(x + 1)$

e) $x^2 - \frac{1}{4}$ $(x - \frac{1}{2})(x + \frac{1}{2})$

f) $x^2 - \frac{1}{9}$ $(x - \frac{1}{3})(x + \frac{1}{3})$

2) Factorise

a) $x^2 - 4y^2$
$(x - 2y)(x + 2y)$

b) $9a^2 - b^2$
$(3a - b)(3a + b)$

c) $9x^2 - 16y^2$
$(3x - 4y)(3x + 4y)$

d) $\frac{1}{4}x^2 - y^2$
$(\frac{1}{2}x - y)(\frac{1}{2}x + y)$

e) $4x^2 - 25y^2$
$(2x - 5y)(2x + 5y)$

f) $x^2 - \frac{1}{9}y^2$
$(x - \frac{1}{3}y)(x + \frac{1}{3}y)$

3) Simplify

a) $\frac{y^2 - 4}{y + 2} \times \frac{5}{y + 5}$ $\frac{5(y - 2)}{y + 5}$ $\frac{(y - 2)\cancel{(y + 2)}}{\cancel{y + 2}} \times \frac{5}{y + 5}$

b) $\frac{3}{2x + 1} \times \frac{4x^2 - 1}{x - 2}$ $\frac{3(2x - 1)}{x - 2}$ $\frac{3}{\cancel{2x + 1}} \times \frac{(2x - 1)\cancel{(2x + 1)}}{x - 2}$

c) $\frac{12x^2 + 8x}{9x^2 - 4}$ $\frac{4x}{3x - 2}$ $\frac{4x\cancel{(3x + 2)}}{(3x - 2)\cancel{(3x + 2)}}$

d) $\frac{25a^2 - 16b^2}{10ab - 8b^2}$ $\frac{5a + 4b}{2b}$ $\frac{\cancel{(5a - 4b)}(5a + 4b)}{2b\cancel{(5a - 4b)}}$

4) Solve

a) $4x^2 - 16 = 0$ $(2x - 4)(2x + 4) = 0$
$x = 2$, $x = -2$

b) $25x^2 = 1$ $(5x - 1)(5x + 1) = 0$
$x = \frac{1}{5}$, $x = -\frac{1}{5}$

c) $49x^2 = 121$ $(7x - 11)(7x + 11) = 0$
$x = 1\frac{4}{7}$, $x = -1\frac{4}{7}$

d) $9x^2 - 9 = 7$ $(3x - 4)(3x + 4) = 0$
$x = 1\frac{1}{3}$, $x = -1\frac{1}{3}$

Simultaneous Linear Equations

1) Solve

$$4x + 3y = 6$$
$$5x - 3y = 21$$

2) Solve

$$4x + 3y = 19$$
$$3x - 5y = 7$$

3) Solve

$$3x + 5y = 13$$
$$2x + 3y = 8$$

4) Solve

$$x + 4y = 5$$
$$4x - 2y = 11$$

5) Solve

$$2a + b = 3$$
$$4a - 5b = 20$$

6) Solve

$$5x + 3y = 4$$
$$3x + 4y = 9$$

7) Solve

$$6x - 2y = 13$$
$$2x + 3y = -3$$

8) Solve

$$3a - 2b = 14$$
$$4a + 3b = 13$$

9) Solve

$$5x + 4y = 5$$
$$2x + 7y = 29$$

10) Solve

$$6x - 4y = 39$$
$$2x + y = 6$$

Simultaneous Linear Equations

1) Solve

$4x + 3y = 6$
$5x - 3y = 21$

$x = 3$ and $y = -2$

2) Solve

$4x + 3y = 19$
$3x - 5y = 7$

$x = 4$ and $y = 1$

3) Solve

$3x + 5y = 13$
$2x + 3y = 8$

$x = 1$ and $y = 2$

4) Solve

$x + 4y = 5$
$4x - 2y = 11$

$x = 3$ and $y = 0.5$

5) Solve

$2a + b = 3$
$4a - 5b = 20$

$a = 2.5$ and $b = -2$

6) Solve

$5x + 3y = 4$
$3x + 4y = 9$

$x = -1$ and $y = 3$

7) Solve

$6x - 2y = 13$
$2x + 3y = -3$

$x = 1.5$ and $y = -2$

8) Solve

$3a - 2b = 14$
$4a + 3b = 13$

$a = 4$ and $b = -1$

9) Solve

$5x + 4y = 5$
$2x + 7y = 29$

$x = -3$ and $y = 5$

10) Solve

$6x - 4y = 39$
$2x + y = 6$

$x = 4.5$ and $y = -3$

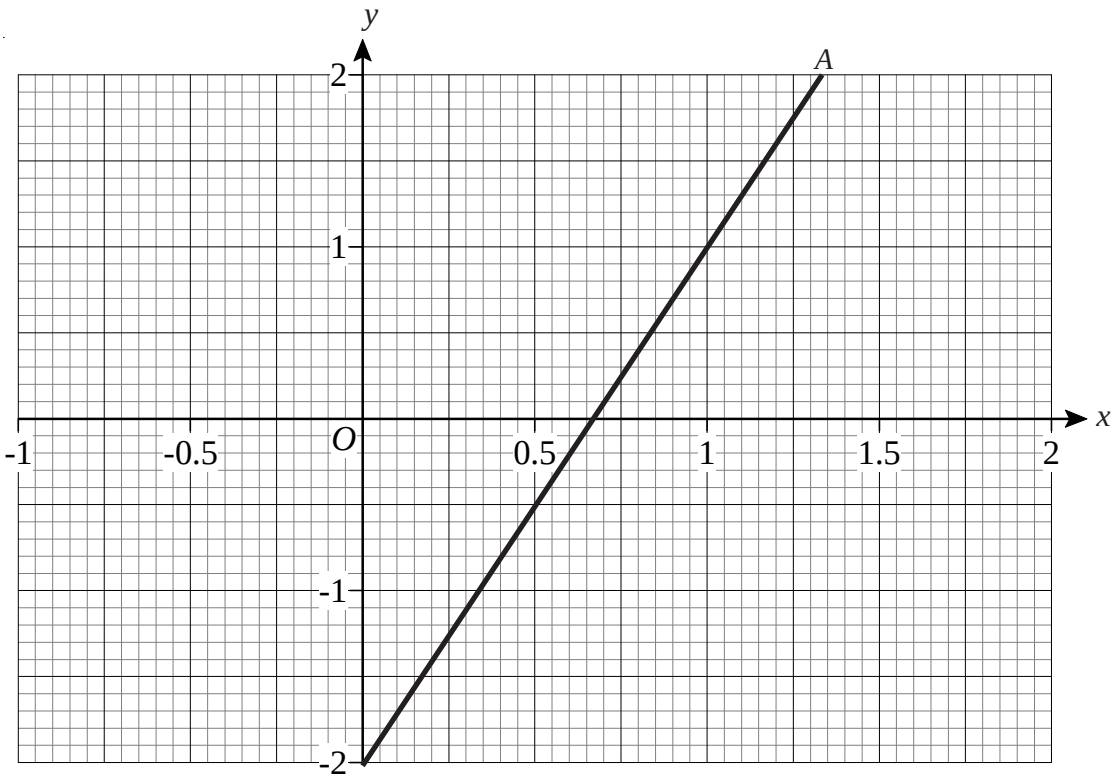
Understanding $y = mx + c$

gradient — cuts the y-axis

1) a) Find the equation of line A on the grid below.

b) Draw the line B, with equation $y = x - 1$.

c) Draw the line C, with equation $y = 1 - 2x$.



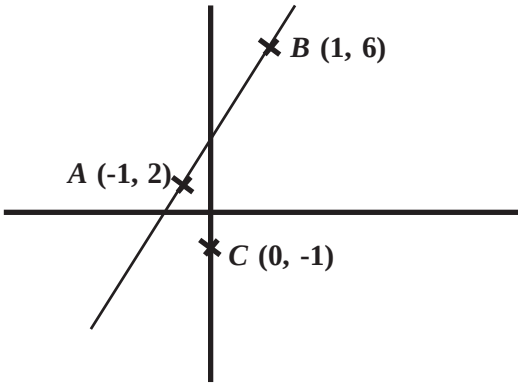
2) A straight line passes through points (0, 4) and (3, 13).
What is its equation?

3) A straight line passes through points (0, 7) and (2, -1).
What is its equation?

4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
What is its equation?

5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
What is its equation?

6) A is the point (-1, 2).
B is the point (1, 6).
C is the point (0, -1).
Find the equation of the line which passes through C and is parallel to AB.



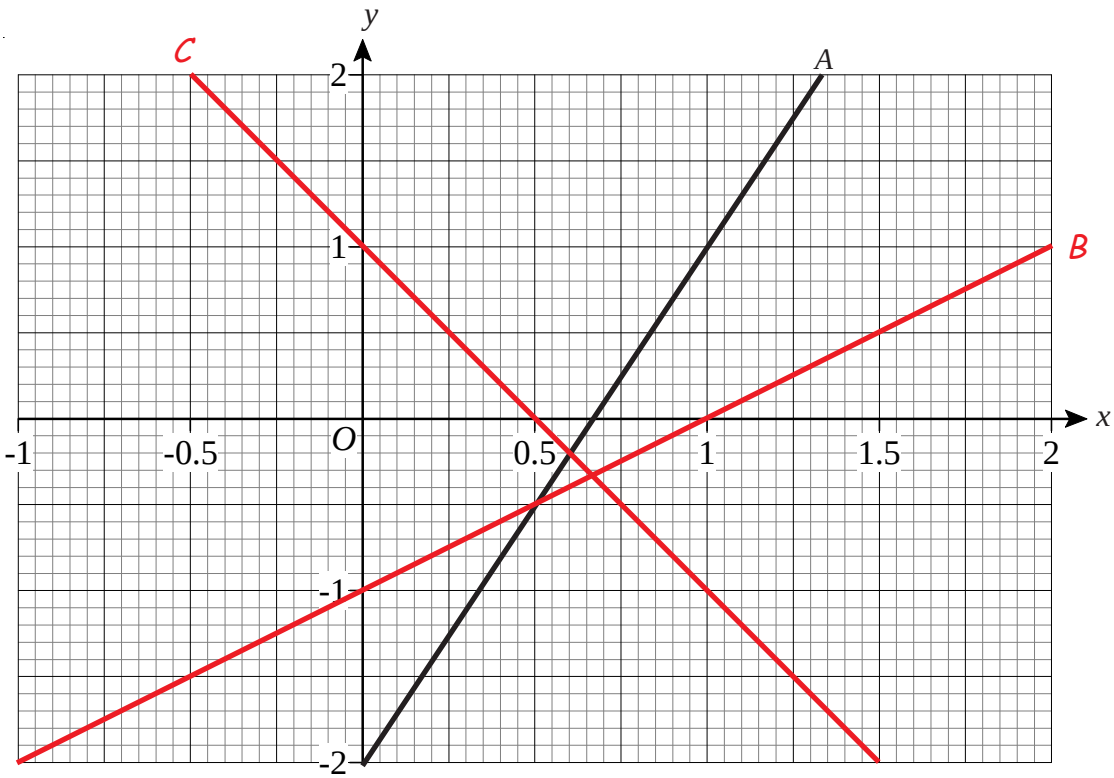
Understanding $y = mx + c$

gradient — cuts the y-axis

1) a) Find the equation of line A on the grid below. $y = 3x - 2$

b) Draw the line B, with equation $y = x - 1$.

c) Draw the line C, with equation $y = 1 - 2x$.



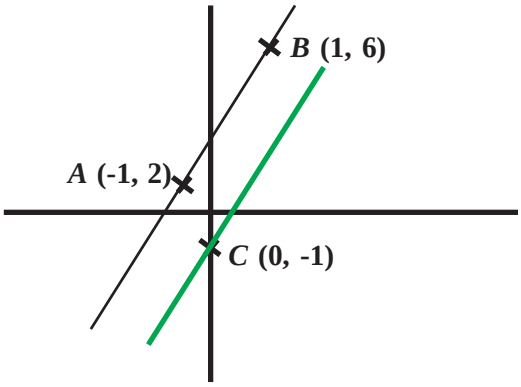
2) A straight line passes through points (0, 4) and (3, 13).
What is its equation? $y = 3x + 4$

3) A straight line passes through points (0, 7) and (2, -1).
What is its equation? $y = -4x + 7$

4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
What is its equation? $y = 3x + 5$

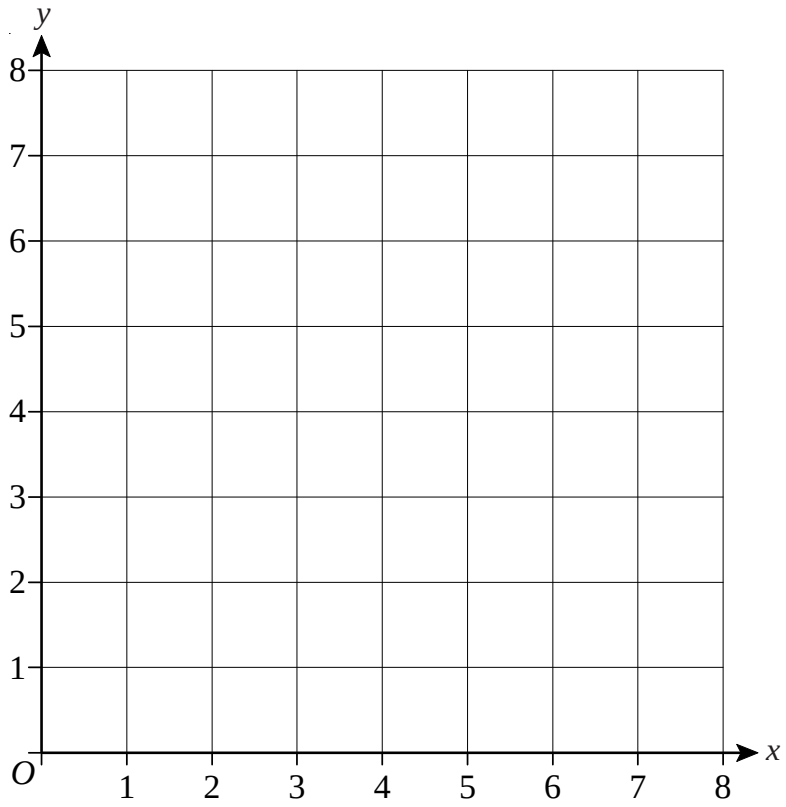
5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
What is its equation? $y = 2x - 4$

6) A is the point (-1, 2).
B is the point (1, 6).
C is the point (0, -1).
Find the equation of the line which passes through C and is parallel to AB. $y = 2x - 1$

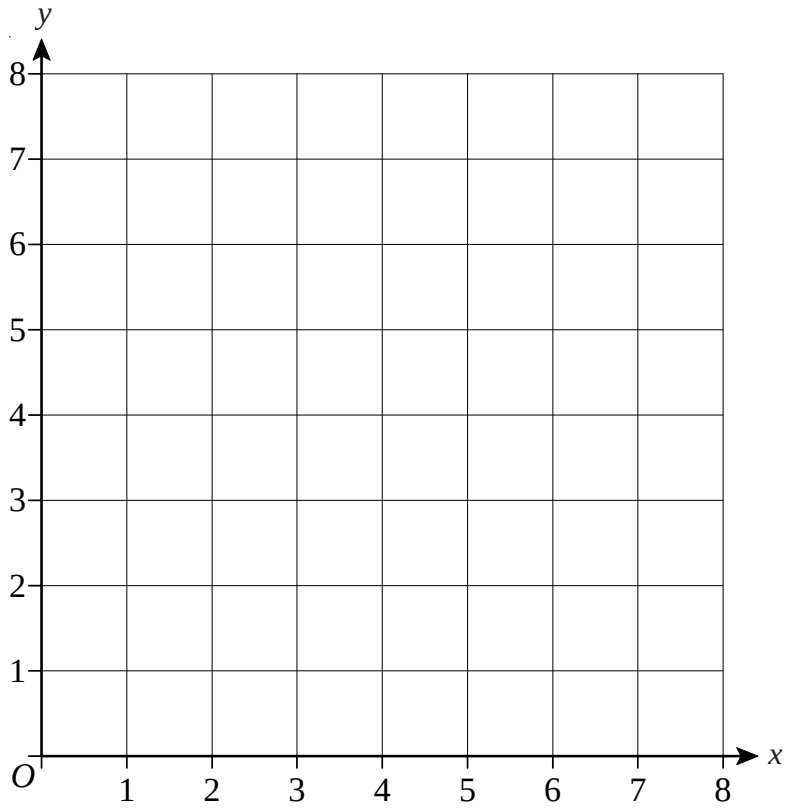


Regions

1) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $x \geqslant 1$ $y \geqslant x$ $x + y \leqslant 7$

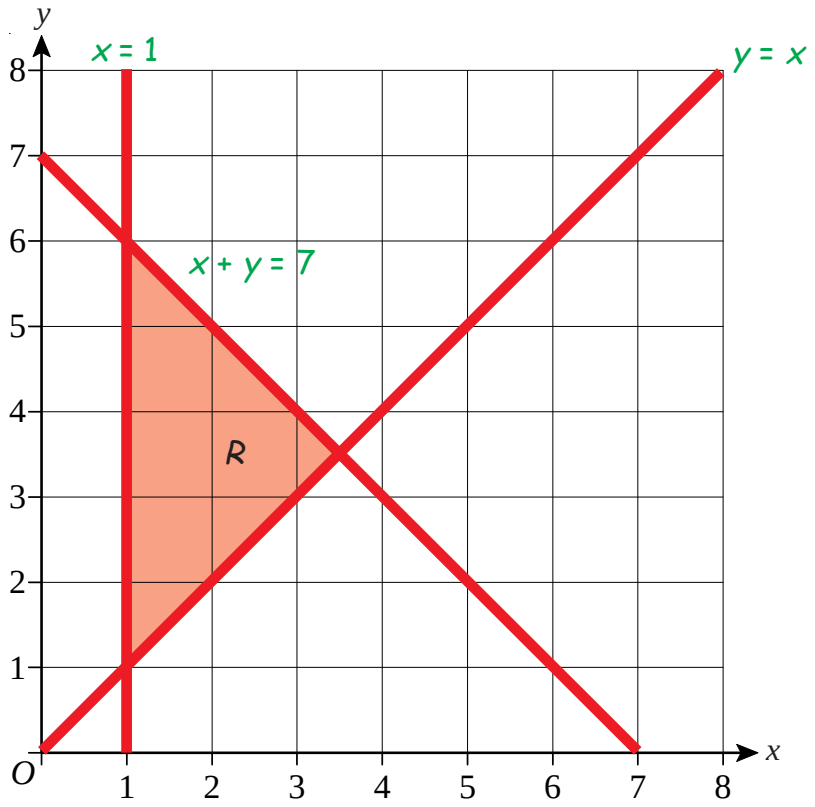


2) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $y \geqslant x + 1$ $y \leqslant 5$ $x \geqslant 1$

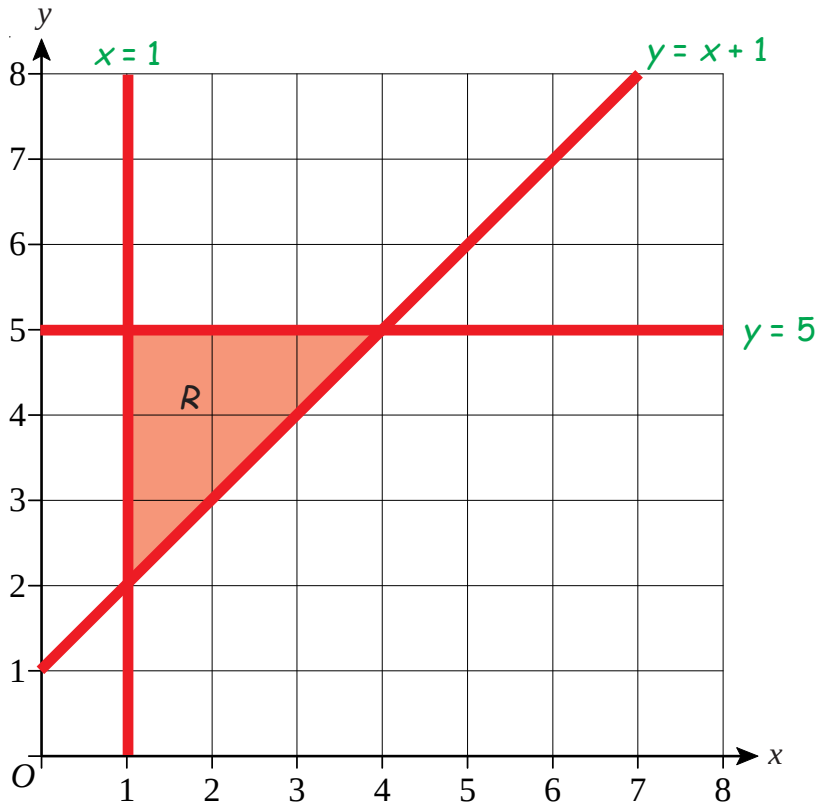


Regions

1) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $x \geqslant 1$ $y \geqslant x$ $x + y \leqslant 7$



2) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $y \geqslant x + 1$ $y \leqslant 5$ $x \geqslant 1$



Graphs of Cubic and Reciprocal Functions

1) a) Complete this table of values for

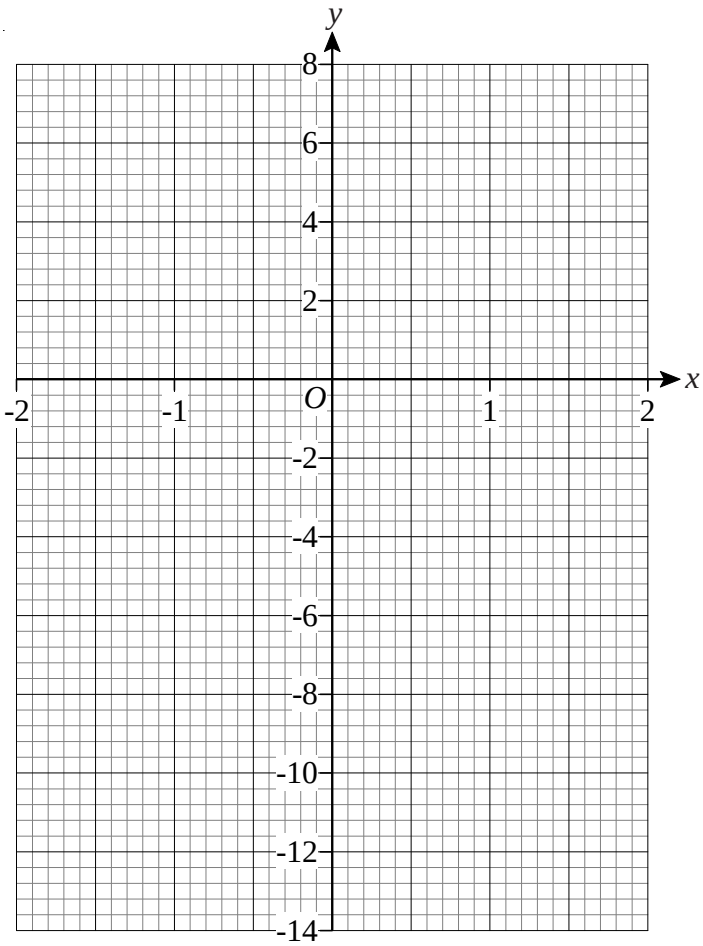
$$y = x^3 + x - 4$$

x	–2	–1	0	1	2
y	–14			–2	

b) On the grid, draw the graph of

$$y = x^3 + x - 4$$

c) Use the graph to find the value of x when $y = 2$



2) a) Complete this table of values for

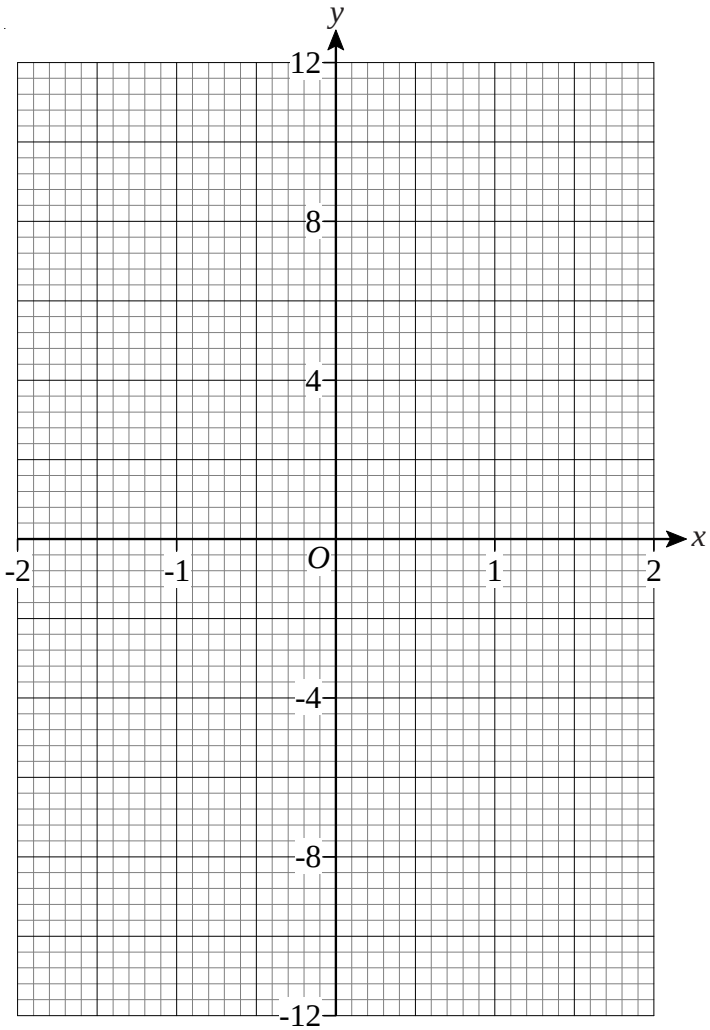
$$y = x^3 + 2x$$

x	–2	–1	0	1	2
y	–12		0		

b) On the grid, draw the graph of

$$y = x^3 + 2x$$

c) Use the graph to find the value of x when $y = -6$



3) Sketch the graph of $y = 1 + \frac{1}{x}$

Graphs of Cubic and Reciprocal Functions

1) a) Complete this table of values for

$y = x^3 + x - 4$

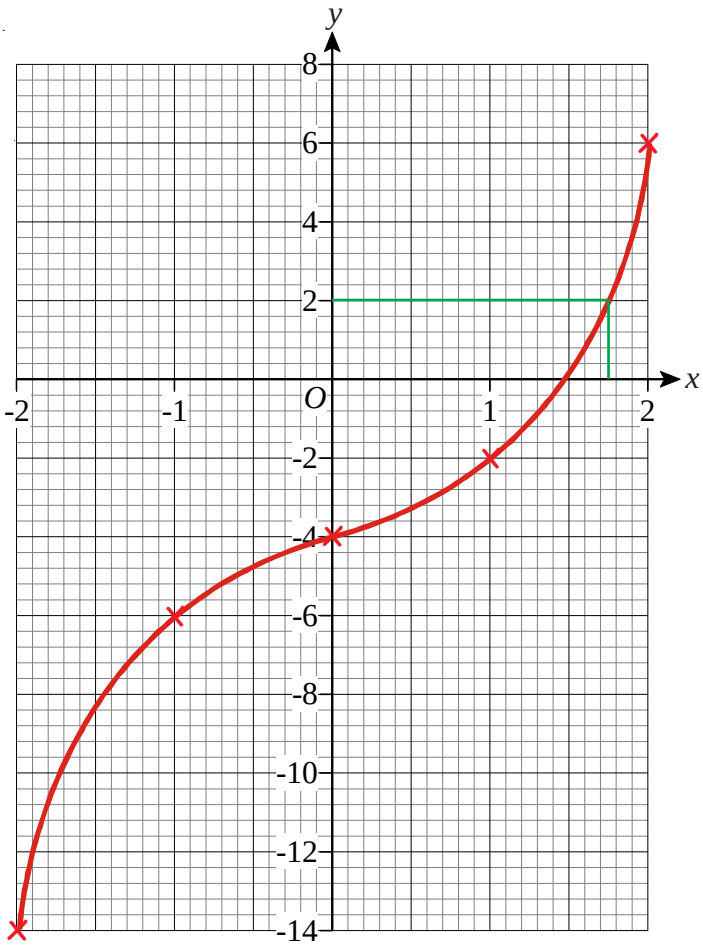
x	–2	–1	0	1	2
y	–14	-6	-4	–2	6

b) On the grid, draw the graph of

$y = x^3 + x - 4$

c) Use the graph to find the value of x when $y = 2$

$x = 1.75$



2) a) Complete this table of values for

$y = x^3 + 2x$

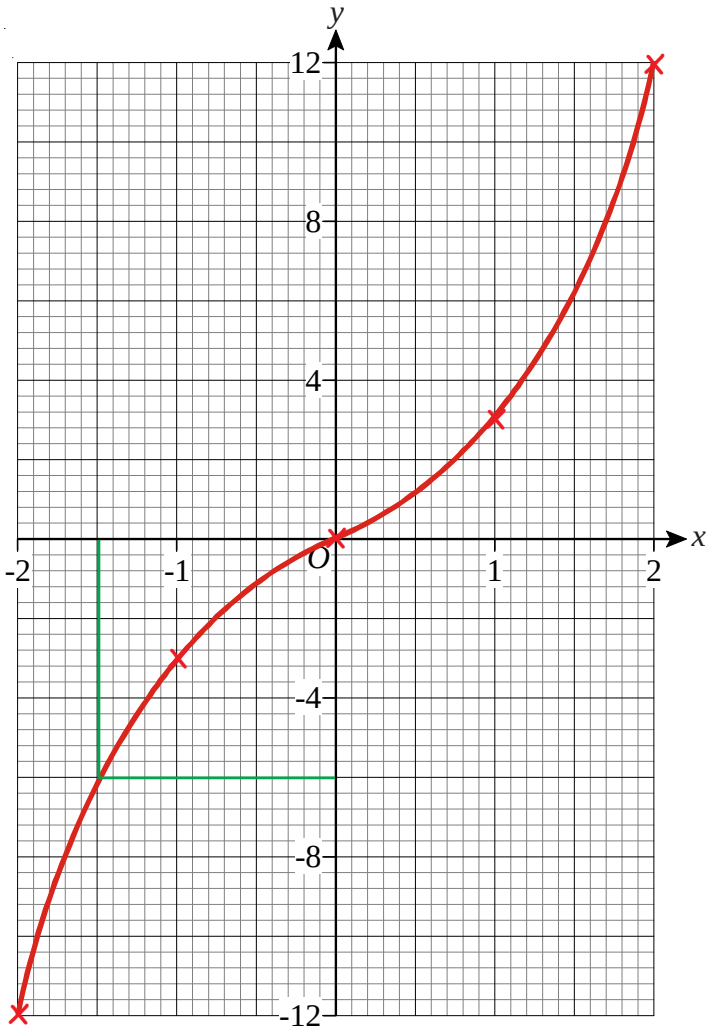
x	–2	–1	0	1	2
y	–12	-3	0	3	12

b) On the grid, draw the graph of

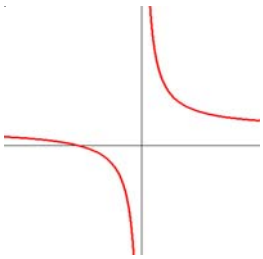
$y = x^3 + 2x$

c) Use the graph to find the value of x when $y = -6$

$x = -1.5$



3) Sketch the graph of $y = 1 + \frac{1}{x}$

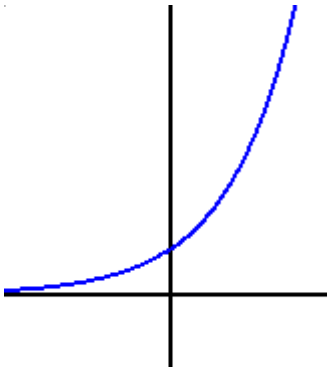


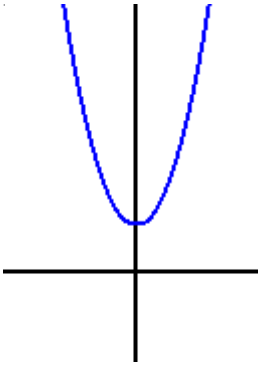
Recognise the Shapes of Functions

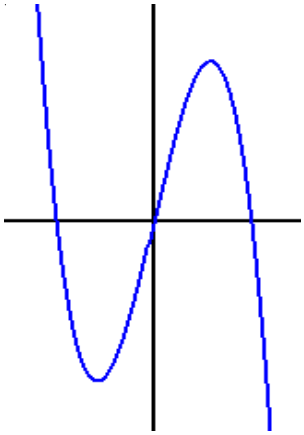
1) Match each of the functions below, with the correct sketch of its graph.

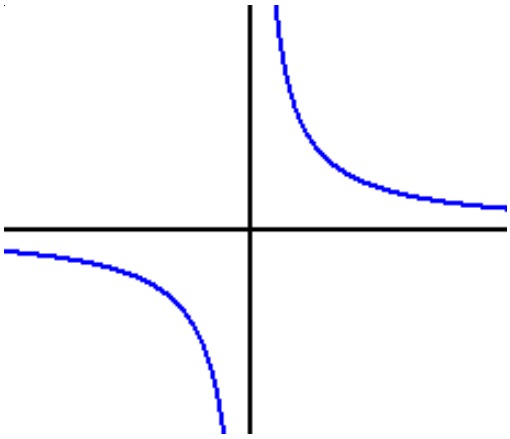
a) $y = 3x^3$ b) $y = \frac{-2}{x}$ c) $y = 3x - 1$ d) $y = 2^x$

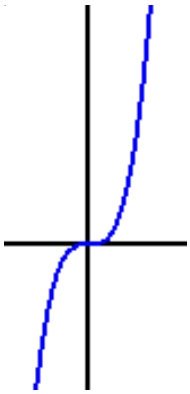
e) $y = 2x^2 + 1$ f) $y = \frac{2}{x}$ g) $y = 5x - x^3$ h) $y = -2x^3$

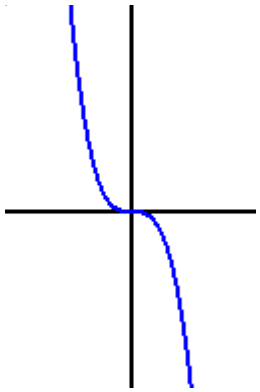


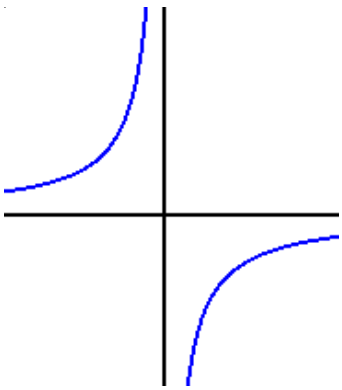


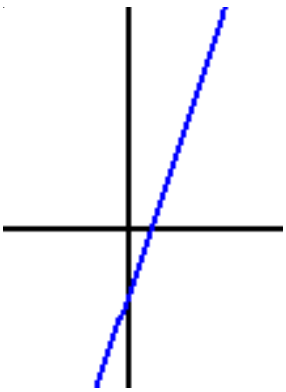










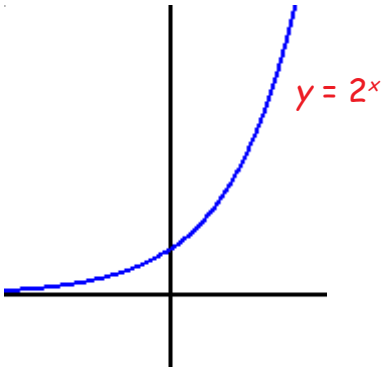


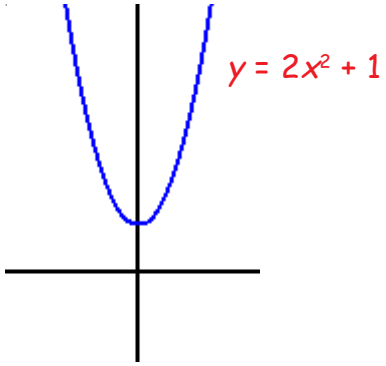
Recognise the Shapes of Functions

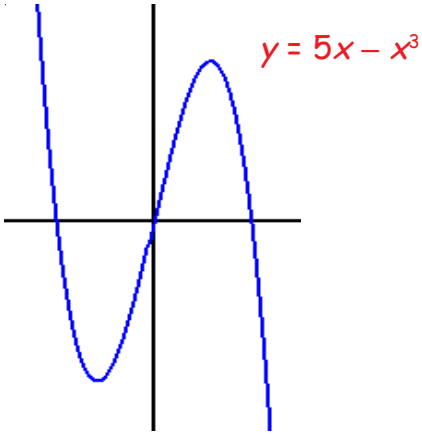
1) Match each of the functions below, with the correct sketch of its graph.

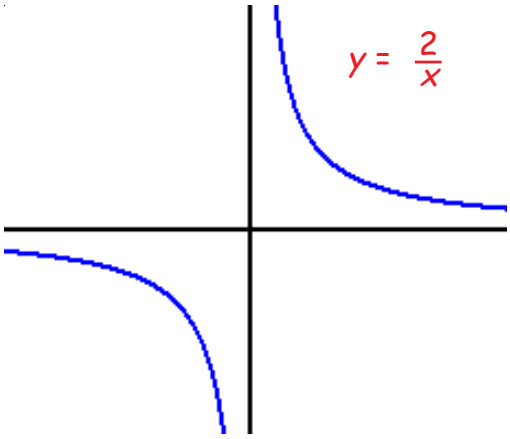
a) $y = 3x^3$ b) $y = \frac{-2}{x}$ c) $y = 3x - 1$ d) $y = 2^x$

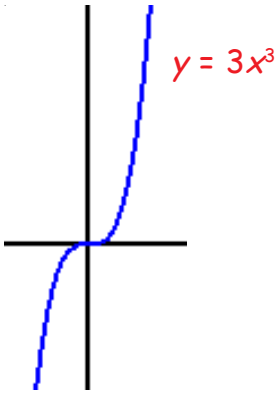
e) $y = 2x^2 + 1$ f) $y = \frac{2}{x}$ g) $y = 5x - x^3$ h) $y = -2x^3$

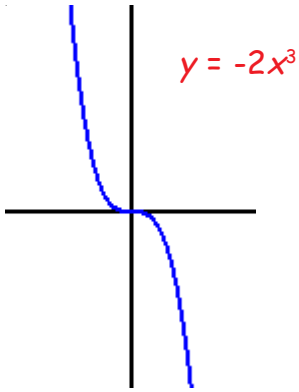


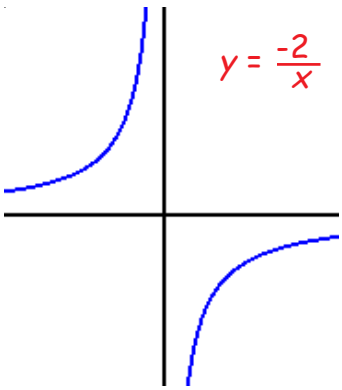


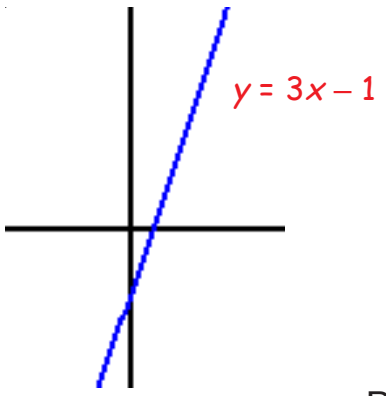








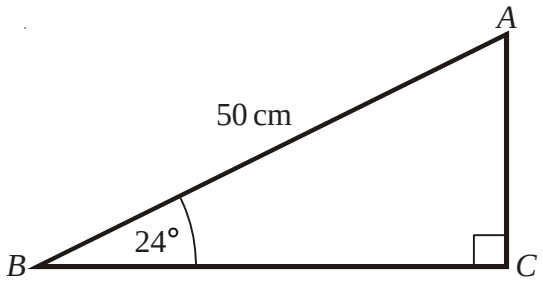




Trigonometry

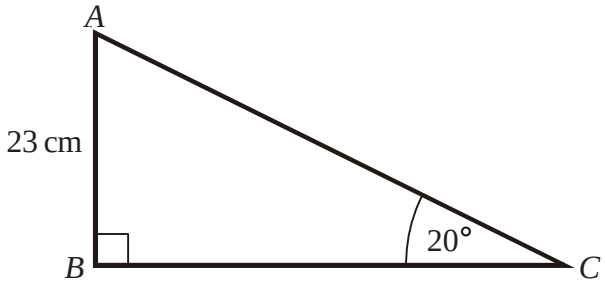
1) *ABC* is a right-angled triangle.
AB = 50 cm.
Angle *ABC* = 24°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.



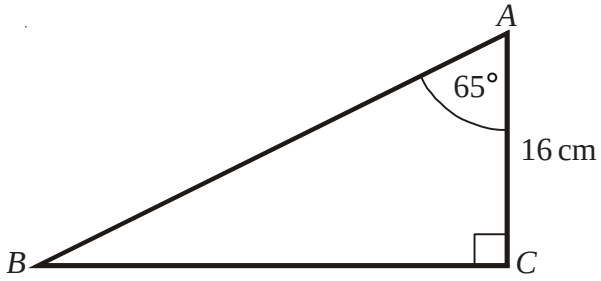
2) *ABC* is a right-angled triangle.
AB = 23 cm.
Angle *BCA* = 20°

Work out the length of *AC*.
Give your answer correct to 1 decimal place.



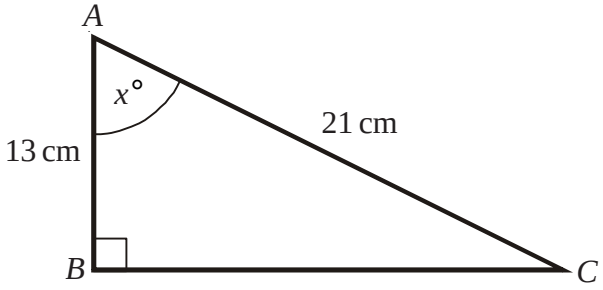
3) *ABC* is a right-angled triangle.
AC = 16 cm.
Angle *CAB* = 65°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.



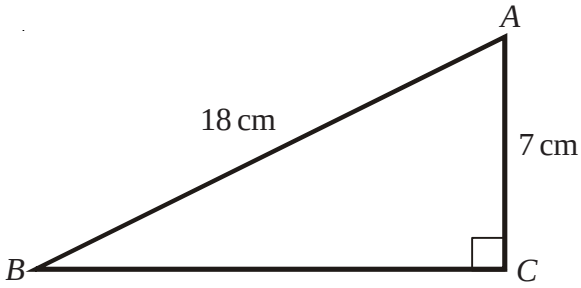
4) *ABC* is a right-angled triangle.
AB = 13 cm.
AC = 21 cm.

Work out the size of angle *x*.
Give your answer correct to 1 decimal place.



5) *ABC* is a right-angled triangle.
AB = 18 cm.
AC = 7 cm.

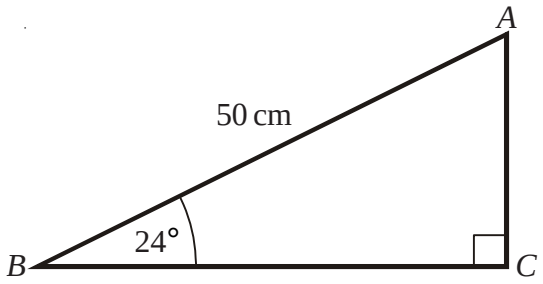
Work out the size of angle *ABC*.
Give your answer correct to 1 decimal place.



Trigonometry

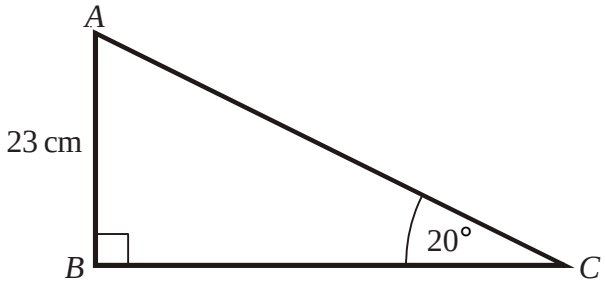
1) *ABC* is a right-angled triangle.
AB = 50 cm.
Angle *ABC* = 24°

Work out the length of *BC*. 45.7 cm
Give your answer correct to 1 decimal place.



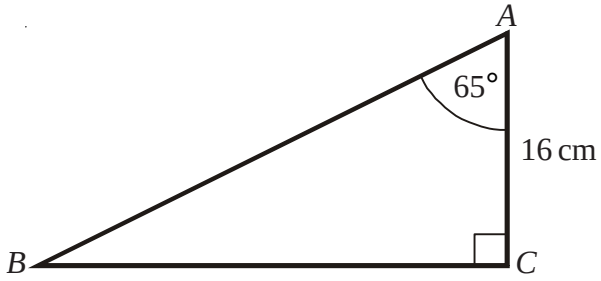
2) *ABC* is a right-angled triangle.
AB = 23 cm.
Angle *BCA* = 20°

Work out the length of *AC*. 67.2 cm
Give your answer correct to 1 decimal place.



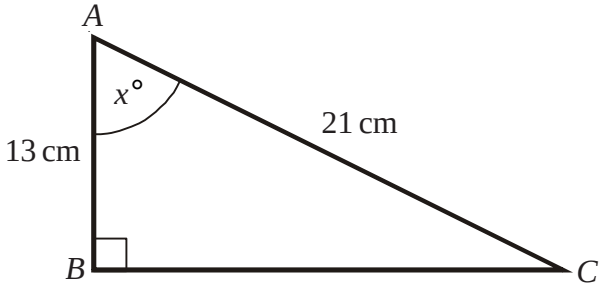
3) *ABC* is a right-angled triangle.
AC = 16 cm.
Angle *CAB* = 65°

Work out the length of *BC*. 34.3 cm
Give your answer correct to 1 decimal place.



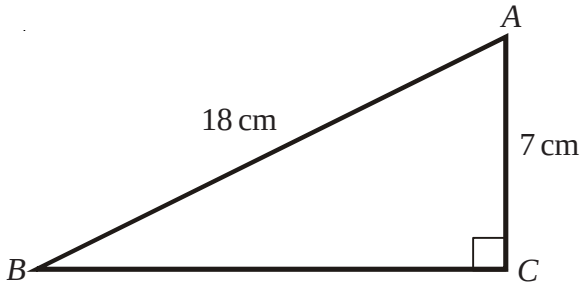
4) *ABC* is a right-angled triangle.
AB = 13 cm.
AC = 21 cm.

Work out the size of angle *x*. 51.8°
Give your answer correct to 1 decimal place.



5) *ABC* is a right-angled triangle.
AB = 18 cm.
AC = 7 cm.

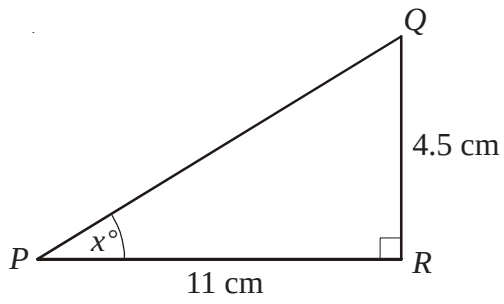
Work out the size of angle *ABC*. 22.9°
Give your answer correct to 1 decimal place.



Trigonometry

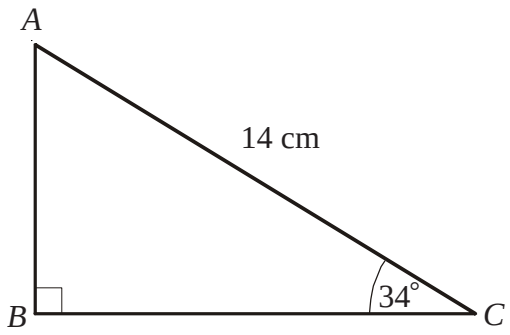
1) *PQR* is a right-angled triangle.
PR = 11 cm.
QR = 4.5 cm
Angle *PRQ* = 90˚

Work out the value of *x*.
Give your answer correct to 1 decimal place.



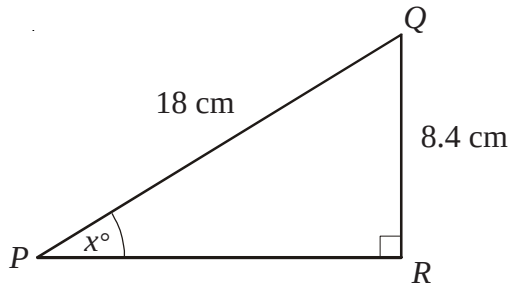
2) *AC* = 14 cm.
Angle *ABC* = 90˚
Angle *ACB* = 34˚

Calculate the length of *BC*.
Give your answer correct to
3 significant figures.



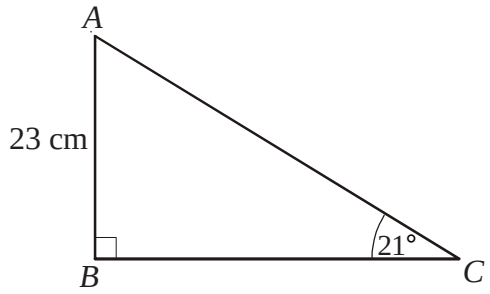
3) *PQR* is a right-angled triangle.
PQ = 18 cm.
QR = 8.4 cm
Angle *PRQ* = 90˚

Work out the value of *x*.
Give your answer correct to 1 decimal place.



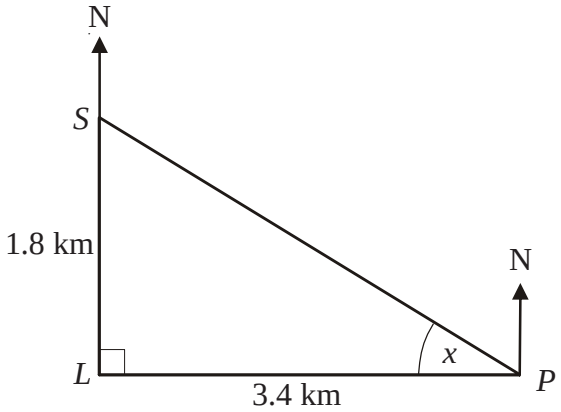
4) *AB* = 23 cm.
Angle *ABC* = 90˚
Angle *ACB* = 21˚

Calculate the length of *AC*.
Give your answer correct to
3 significant figures.



5) A lighthouse, *L*, is 3.4 km due West of a port, *P*.
A ship, *S*, is 1.8 km due North of the lighthouse, *L*.

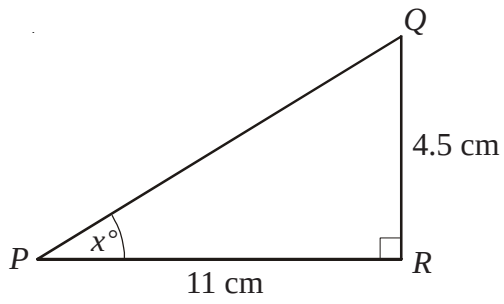
Calculate the size of the angle marked *x*.
Give your answer correct to 3 significant figures.



Trigonometry

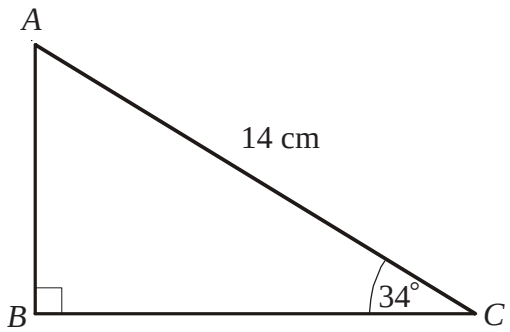
1) *PQR* is a right-angled triangle.
PR = 11 cm.
QR = 4.5 cm
Angle *PRQ* = 90˚

Work out the value of *x*. 22.2°
Give your answer correct to 1 decimal place.



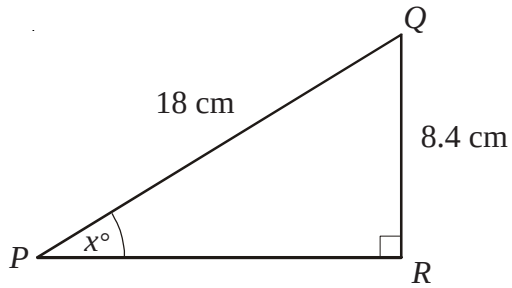
2) *AC* = 14 cm.
Angle *ABC* = 90˚
Angle *ACB* = 34˚

Calculate the length of *BC*. 11.6 cm
Give your answer correct to
3 significant figures.



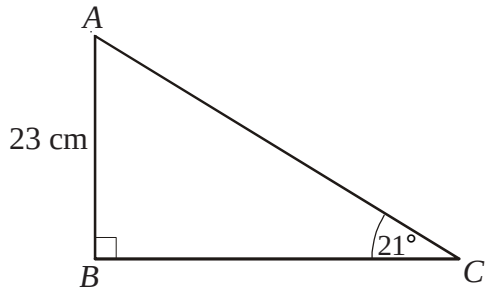
3) *PQR* is a right-angled triangle.
PQ = 18 cm.
QR = 8.4 cm
Angle *PRQ* = 90˚

Work out the value of *x*. 27.8°
Give your answer correct to 1 decimal place.



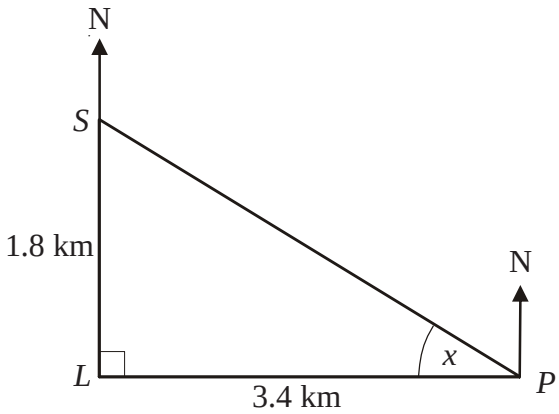
4) *AB* = 23 cm.
Angle *ABC* = 90˚
Angle *ACB* = 21˚

Calculate the length of *AC*. 64.2 cm
Give your answer correct to
3 significant figures.



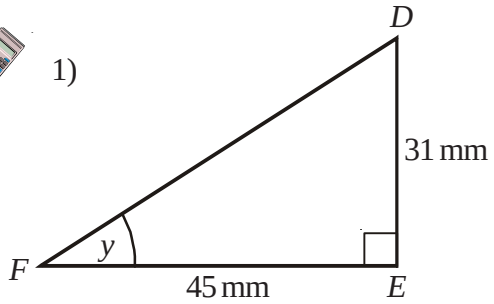
5) A lighthouse, *L*, is 3.4 km due West of a port, *P*.
A ship, *S*, is 1.8 km due North of the lighthouse, *L*.

Calculate the size of the angle marked *x*. 27.9°
Give your answer correct to 3 significant figures.



Trigonometry

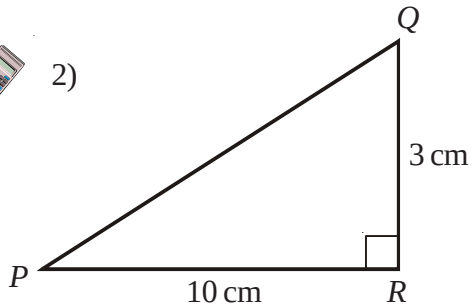
1)



DEF is a right-angled triangle.
DE = 31 mm
FE = 45 mm

Calculate the size of angle *y*.
Give your answer correct to one decimal place.

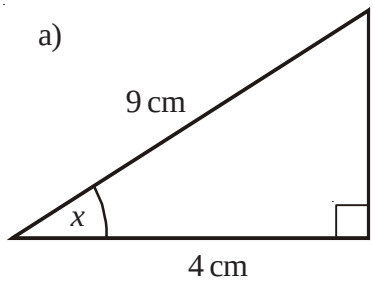
2)



PQR is a right-angled triangle.
QR = 3 cm
PR = 10 cm

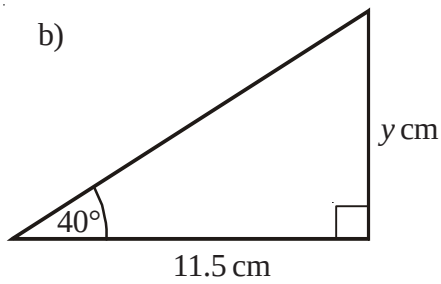
Work out the size of angle *RPQ*.
Give your answer correct to three significant figures.

3) a)



Calculate the size of the angle marked *x*.
Give your answer correct to one decimal place.

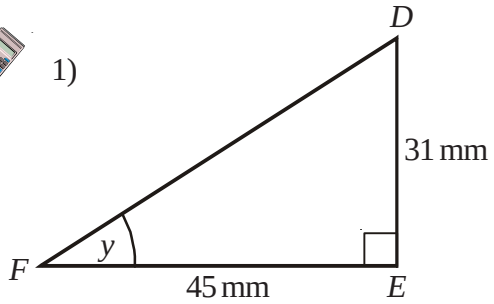
b)



Calculate the value of *y*.
Give your answer correct to one decimal place.

Trigonometry

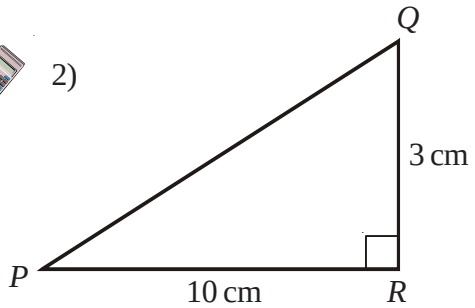
1)



DEF is a right-angled triangle.
DE = 31 mm
FE = 45 mm

Calculate the size of angle *y*. 34.6°
Give your answer correct to one decimal place.

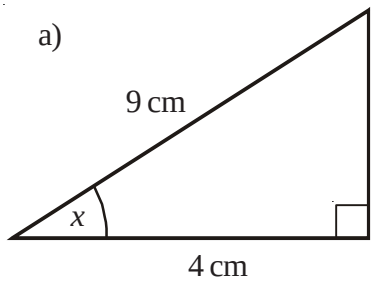
2)



PQR is a right-angled triangle.
QR = 3 cm
PR = 10 cm

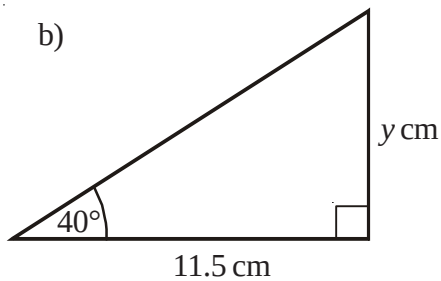
Work out the size of angle *RPQ*. 16.7°
Give your answer correct to three significant figures.

3) a)



Calculate the size of the angle marked *x*. 63.6°
Give your answer correct to one decimal place.

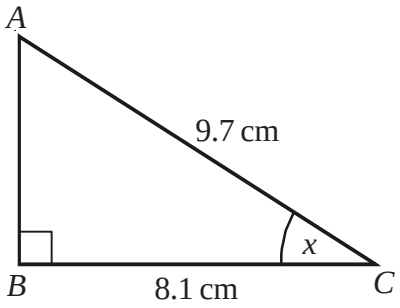
b)



Calculate the value of *y*. 9.6 cm
Give your answer correct to one decimal place.

Trigonometry

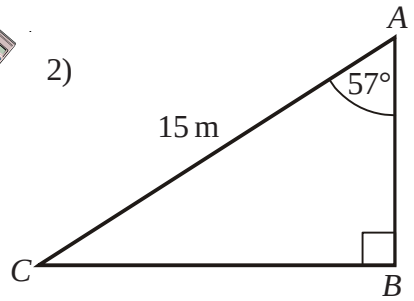
1)



ABC is a right-angled triangle.
AC = 9.7 cm
BC = 8.1 cm

Calculate the size of the angle marked *x*.
Give your answer correct to three significant figures.

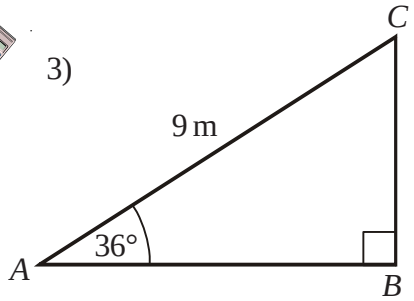
2)



ABC is a right-angled triangle.
AC = 15 m
Angle *CAB* = 57°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

3)

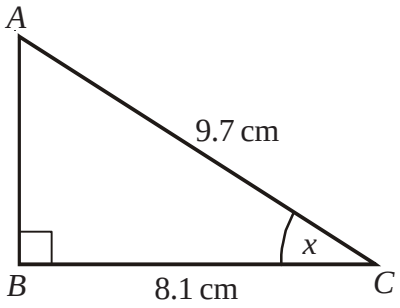


ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

Trigonometry

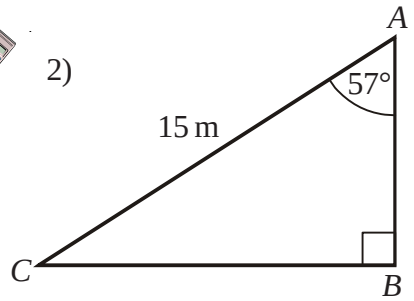
1)



ABC is a right-angled triangle.
AC = 9.7 cm
BC = 8.1 cm

Calculate the size of the angle marked *x*. 33.4°
Give your answer correct to three significant figures.

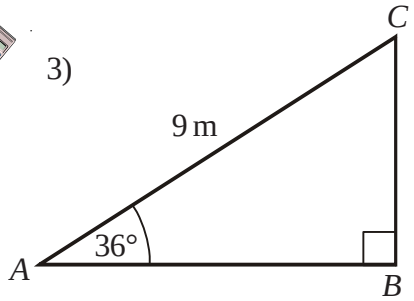
2)



ABC is a right-angled triangle.
AC = 15 m
Angle *CAB* = 57°

Calculate the length of *AB*. 8.17 m
Give your answer correct to three significant figures.

3)

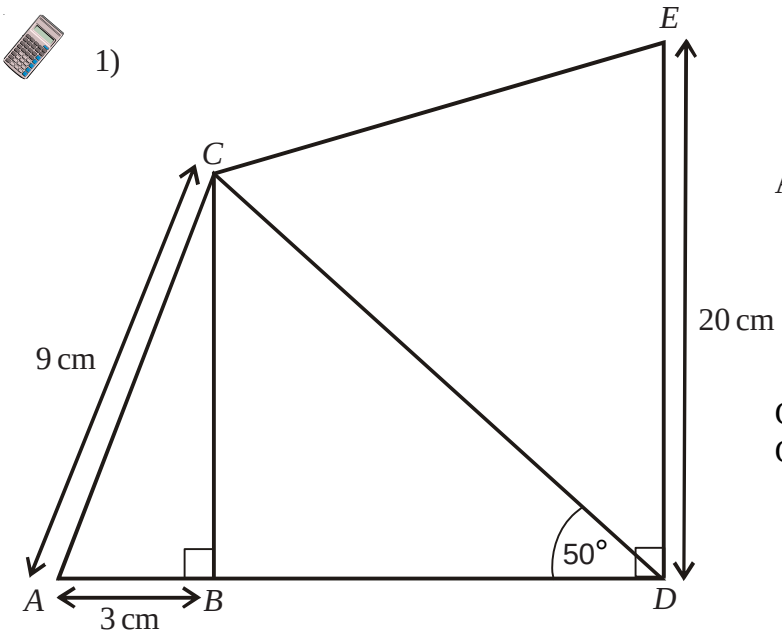


ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

Calculate the length of *AB*. 7.28 m
Give your answer correct to three significant figures.

Trigonometry

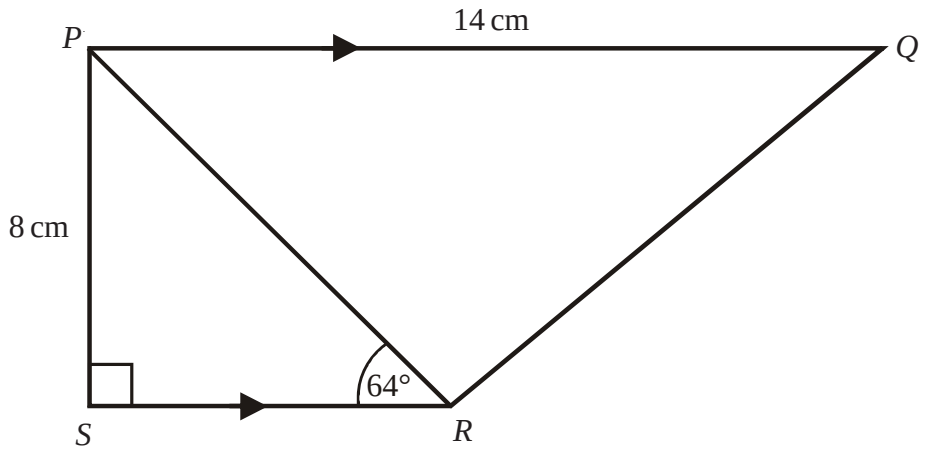
1)



$AC = 9$ cm
$AB = 3$ cm
$DE = 20$ cm
Angle ABC = angle CBD = angle $BDE = 90°$

Calculate the length of CD.
Give your answer to 3 significant figures.

2)

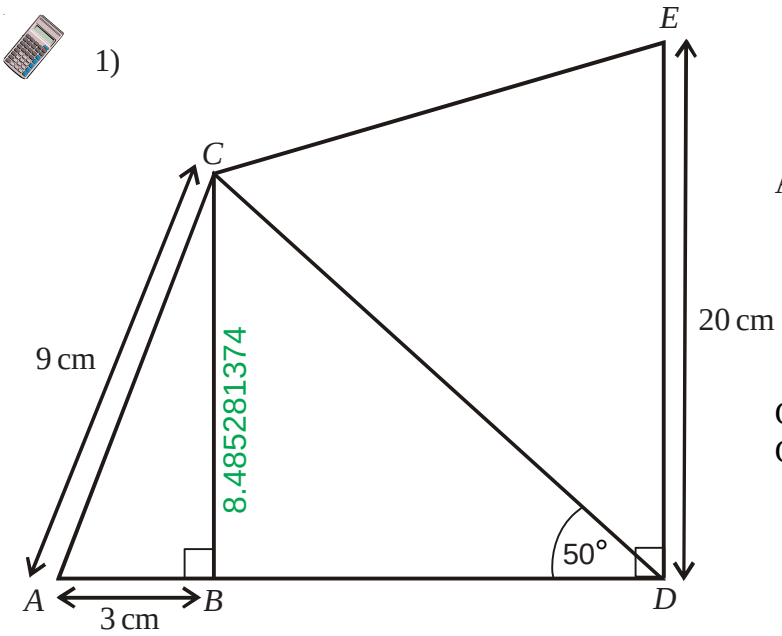


$PQRS$ is a trapezium.
PQ is parallel to SR.
Angle $PSR = 90°$
Angle $PRS = 64°$
$PQ = 14$ cm.
$PS = 8$ cm.

Work out the length of PR.
Give your answer correct to 3 significant figures.

Trigonometry

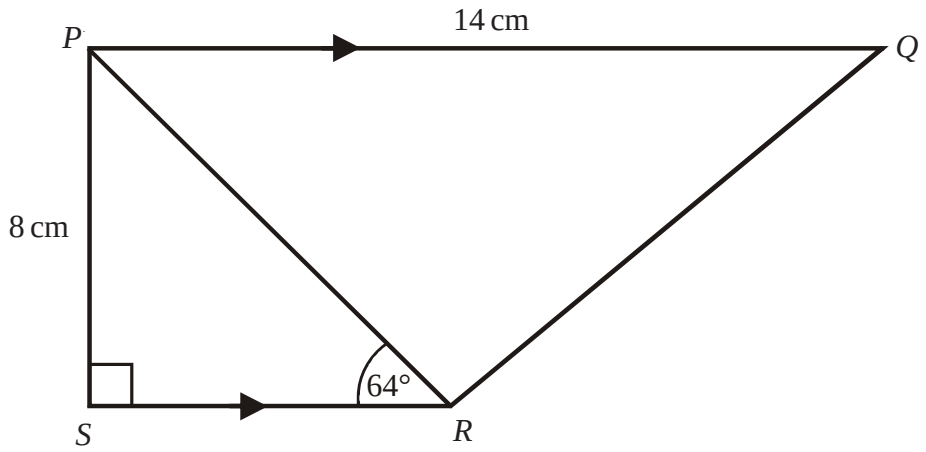
1)



$AC = 9$ cm
$AB = 3$ cm
$DE = 20$ cm
Angle ABC = angle CBD = angle $BDE = 90°$

Calculate the length of CD. 11.1 cm
Give your answer to 3 significant figures.

2)



$PQRS$ is a trapezium.
PQ is parallel to SR.
Angle $PSR = 90°$
Angle $PRS = 64°$
$PQ = 14$ cm.
$PS = 8$ cm.

Work out the length of PR. 8.90 cm
Give your answer correct to 3 significant figures.

Bearings by Trigonometry

1)

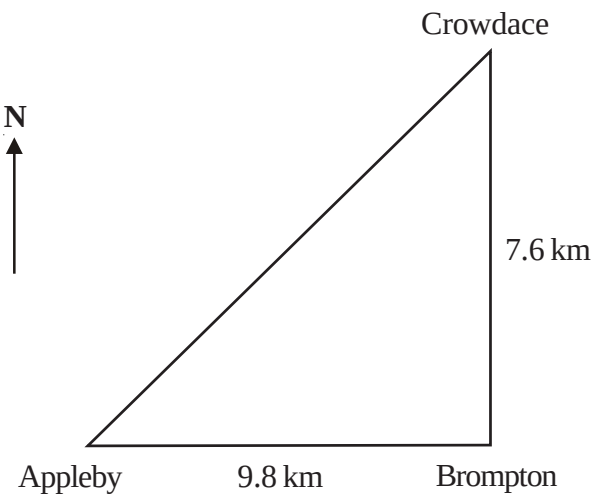


Diagram **NOT** accurately drawn.

Appleby, Brompton and Crowdace are three towns.

Appleby is 9.8 km due west of Brompton.
Brompton is 7.6 km due south of Crowdace.

a) Calculate the bearing of Crowdace from Appleby.
Give your answer correct to 1 decimal place.

b) Calculate the bearing of Appleby from Crowdace.
Give your answer correct to 1 decimal place.

2)

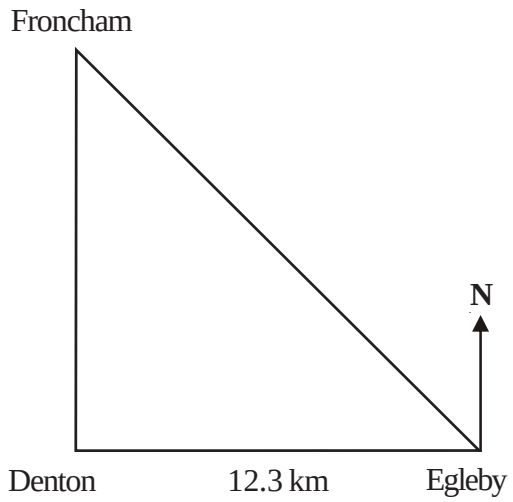


Diagram **NOT** accurately drawn.

Denton, Egleby and Froncham are three towns.

Egleby is 12.3 km due east of Denton.
Froncham is due north of Denton and on a bearing of 320° from Egleby.

Calculate the distance between Froncham and Egleby.
Give your answer correct to 1 decimal place.

Bearings by Trigonometry

1)

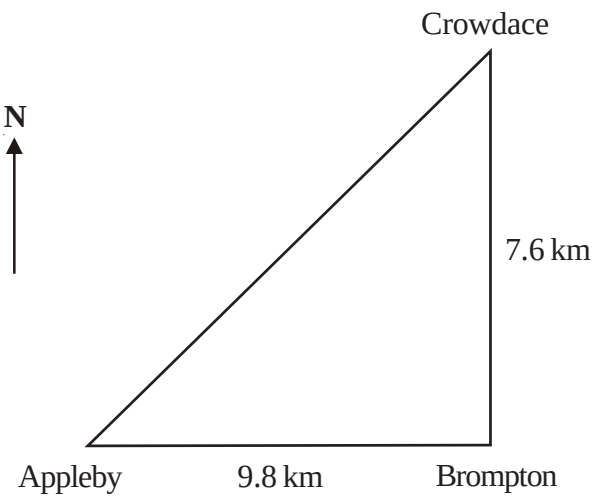


Diagram **NOT** accurately drawn.

Appleby, Brompton and Crowdace are three towns.

Appleby is 9.8 km due west of Brompton.
Brompton is 7.6 km due south of Crowdace.

a) Calculate the bearing of Crowdace from Appleby.
Give your answer correct to 1 decimal place. 052.2°

b) Calculate the bearing of Appleby from Crowdace.
Give your answer correct to 1 decimal place. 232.2°

2)

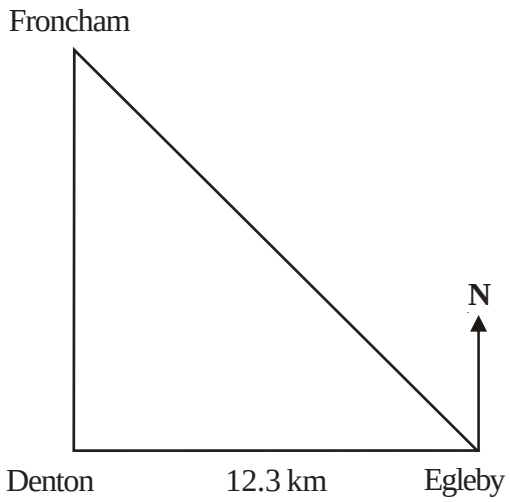


Diagram **NOT** accurately drawn.

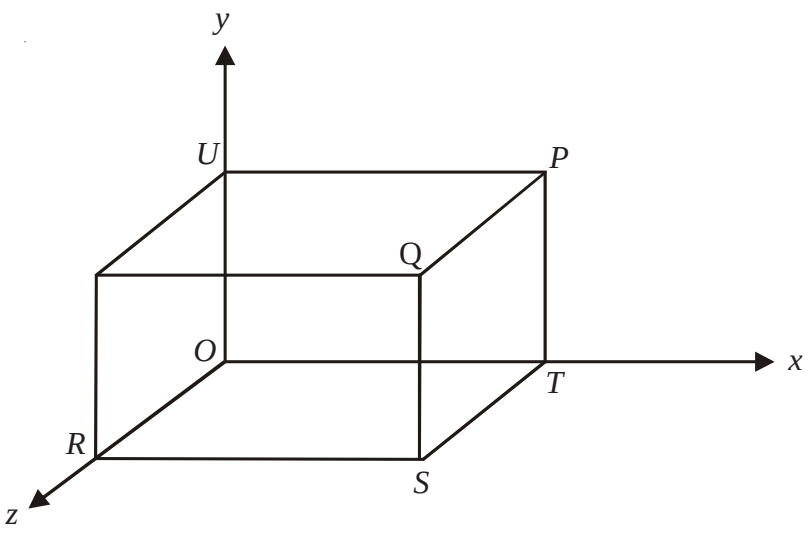
Denton, Egleby and Froncham are three towns.

Egleby is 12.3 km due east of Denton.
Froncham is due north of Denton and on a bearing of 320° from Egleby.

Calculate the distance between Froncham and Egleby.
Give your answer correct to 1 decimal place. 19.1 km

3-D Coordinates

1) A cuboid lies on the coordinate axes.



The point Q has coordinates (5, 3, 4)

a) Write down the coordinates of the point P.

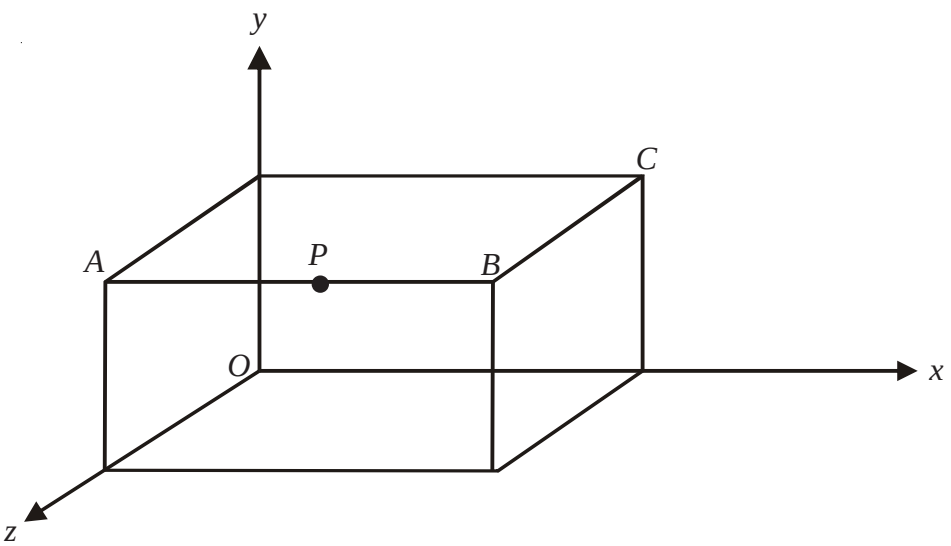
b) Write down the coordinates of the point T.

c) Write down the coordinates of the point S.

d) Write down the coordinates of the point R.

e) Write down the coordinates of the point U.

2) A cuboid lies on the coordinate axes.



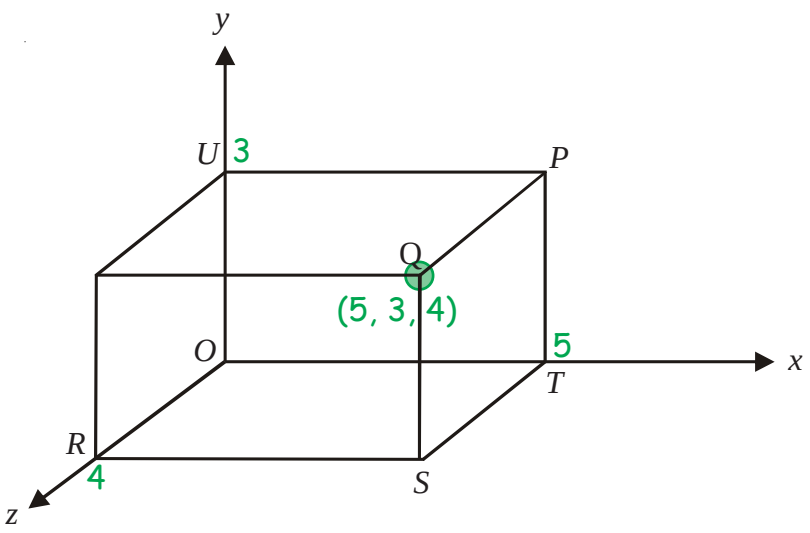
Point P lies half way between A and B and has coordinates (3, 4, 5).

a) Write down the coordinates of B.

b) Write down the coordinates of C.

3-D Coordinates

1) A cuboid lies on the coordinate axes.



The point Q has coordinates (5, 3, 4)

a) Write down the coordinates of the point P. (5, 3, 0)

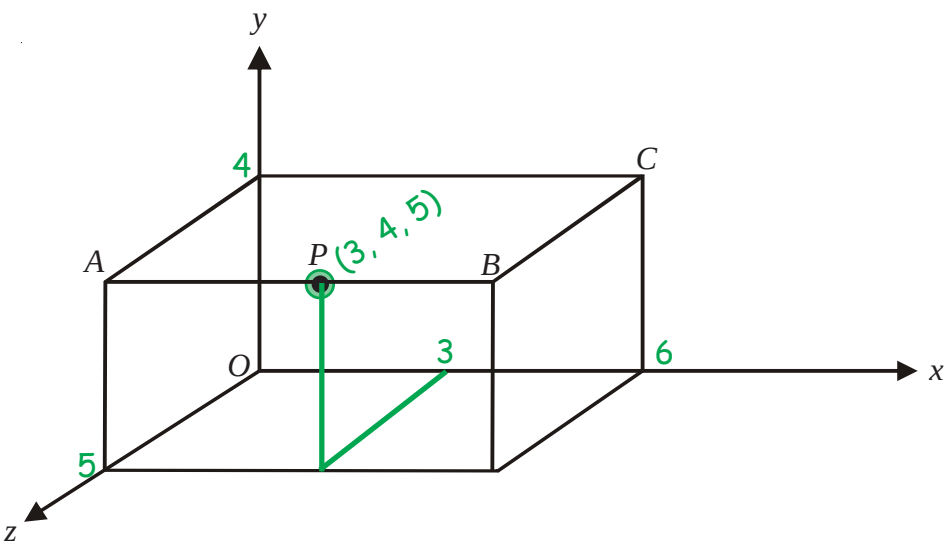
b) Write down the coordinates of the point T. (5, 0, 0)

c) Write down the coordinates of the point S. (5, 0, 4)

d) Write down the coordinates of the point R. (0, 0, 4)

e) Write down the coordinates of the point U. (0, 3, 0)

2) A cuboid lies on the coordinate axes.



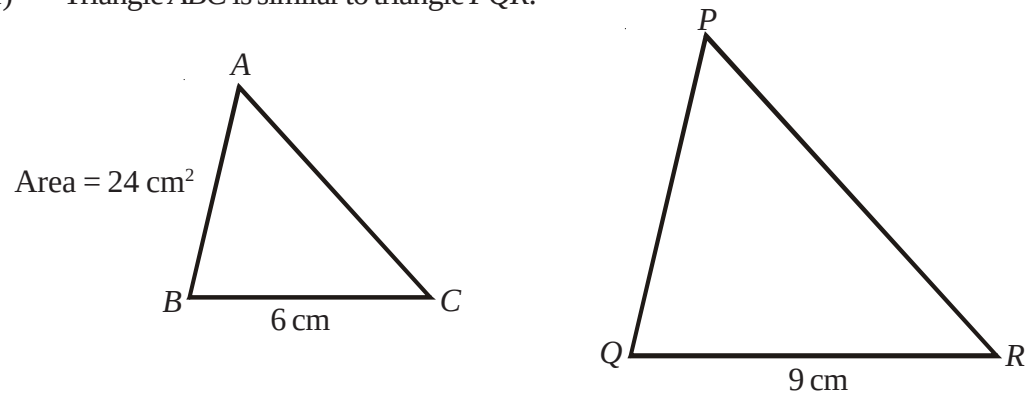
Point P lies half way between A and B and has coordinates (3, 4, 5).

a) Write down the coordinates of B. (6, 4, 5)

b) Write down the coordinates of C. (6, 4, 0)

Similar Shapes

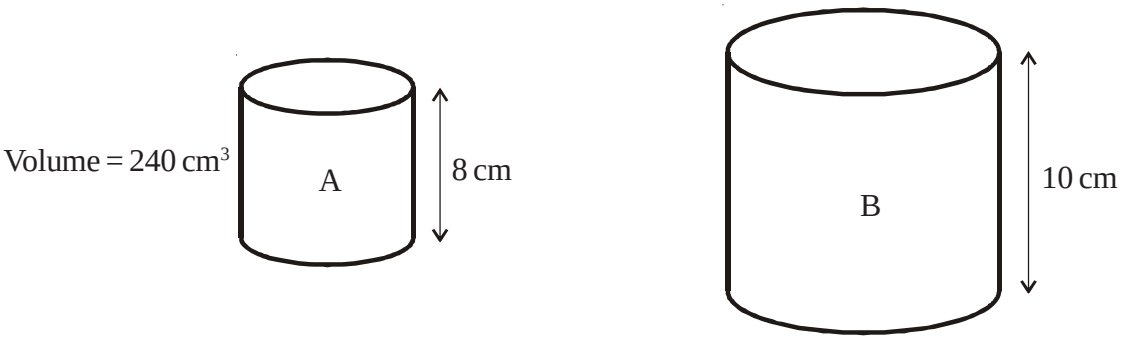
1) Triangle *ABC* is similar to triangle *PQR*.



The area of triangle *ABC* is 24 cm^2.

Calculate the area of triangle *PQR*.

2) Cylinder A is mathematically similar to cylinder B.



The volume of cylinder A is 240 cm^3

Calculate the volume of cylinder B.

3) P and Q are two geometrically similar solid shapes.

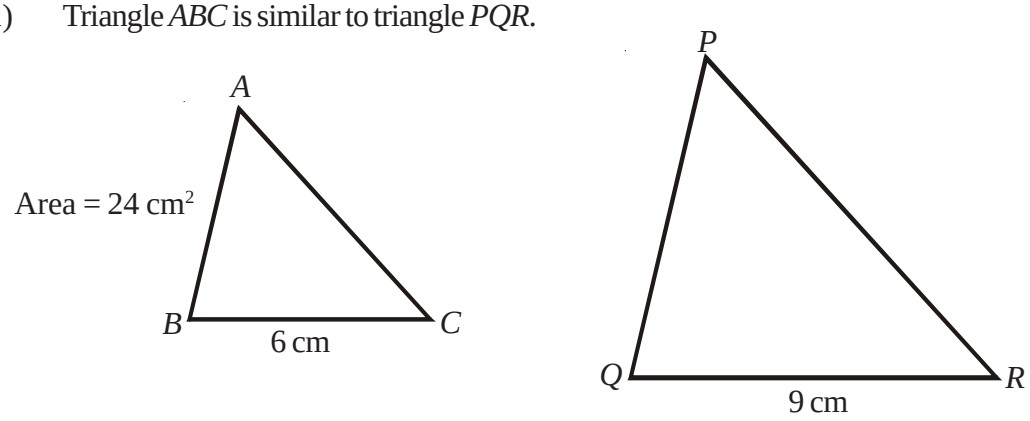
The total surface area of shape P is 540 cm^2.
The total surface area of shape Q is 2160 cm^2.

The volume of shape P is 2700 cm^3.

Calculate the volume of shape Q.

Similar Shapes

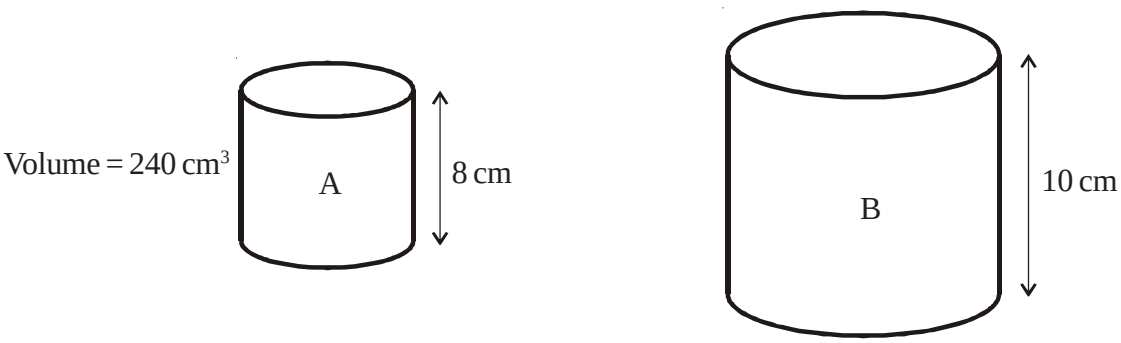
1) Triangle *ABC* is similar to triangle *PQR*.



The area of triangle *ABC* is 24 cm².

Calculate the area of triangle *PQR*. 54 cm²

2) Cylinder A is mathematically similar to cylinder B.



The volume of cylinder A is 240 cm³

Calculate the volume of cylinder B. 468.75 cm³

3) P and Q are two geometrically similar solid shapes.

The total surface area of shape P is 540 cm².
The total surface area of shape Q is 2160 cm².

The volume of shape P is 2700 cm³.

Calculate the volume of shape Q. 21600 cm³

Area scale factor
2160 ÷ 540 = 4

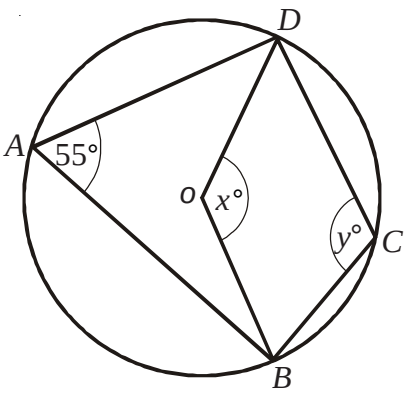
Linear scale factor
$\sqrt{4} = 2$

Volume scale factor
$2^3 = 8$

2700 × 8 = 21600 cm³

Circle Theorems

1)

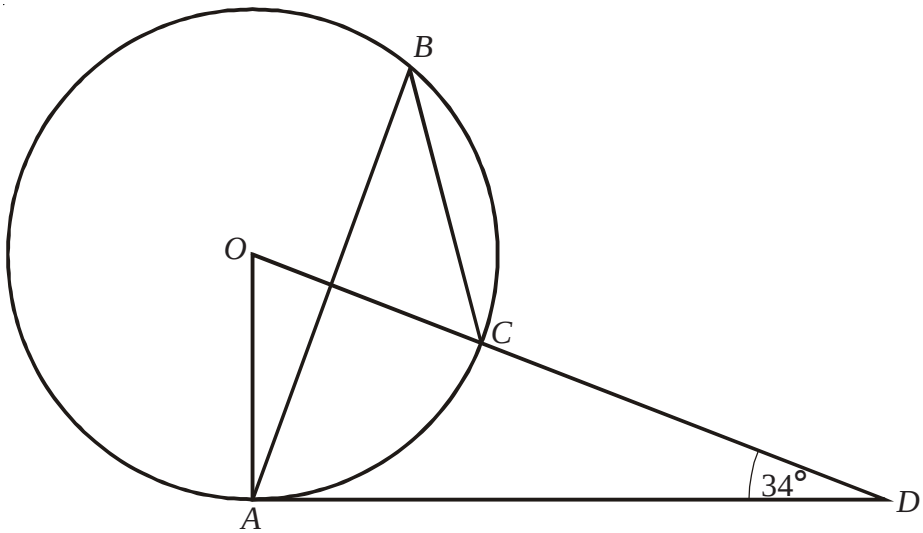


In the diagram, *A*, *B*, *C*, and *D* are points on the circumference of a circle, centre *O*.
Angle *BAD* = 55°.
Angle *BOD* = *x*°.
Angle *BCD* = *y*°.

a) (i) Work out the value of *x*.
(ii) Give a reason for your answer.

b) (i) Work out the value of *y*.
(ii) Give a reason for your answer.

2)



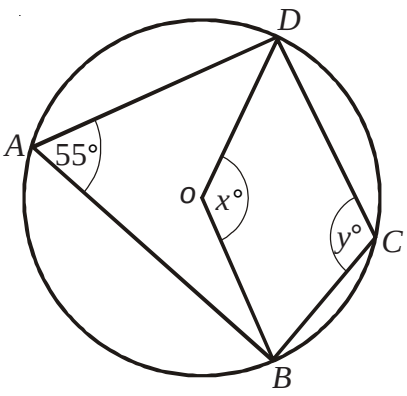
The diagram shows a circle centre *O*.
A, *B* and *C* are points on the circumference.
DCO is a straight line and *DA* is a tangent to the circle.
Angle *ADO* = 34°

a) Work out the size of angle *AOD*.

b) (i) Work out the size of angle *ABC*.
(ii) Give a reason for your answer.

Circle Theorems

1)



In the diagram, *A*, *B*, *C*, and *D* are points on the circumference of a circle, centre *O*.
Angle *BAD* = 55°.
Angle *BOD* = *x*°.
Angle *BCD* = *y*°.

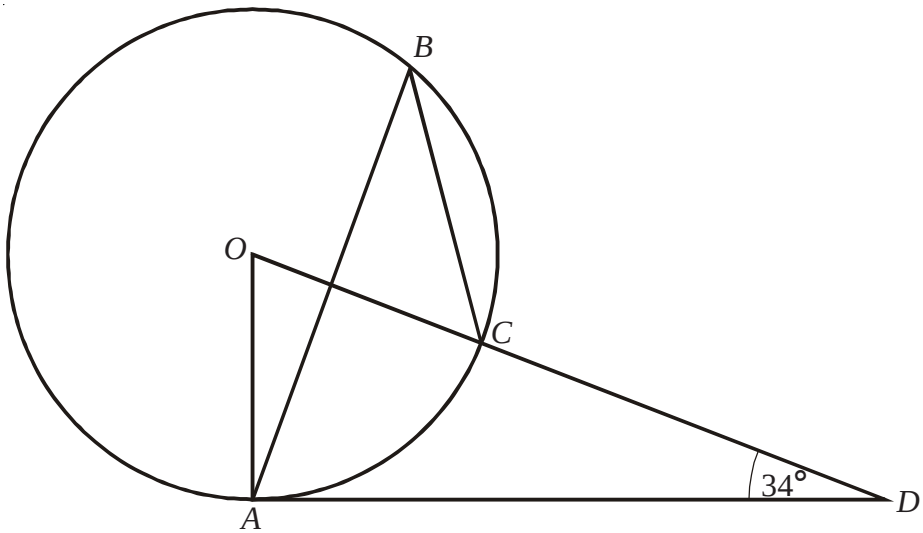
a) (i) Work out the value of *x*. 110°

(ii) Give a reason for your answer.
Angle at centre of circle is twice the angle on the circumference

b) (i) Work out the value of *y*. 125°

(ii) Give a reason for your answer.
Opposite angles of cyclic quadrilateral add up to 180°

2)



The diagram shows a circle centre *O*.
A, *B* and *C* are points on the circumference.
DCO is a straight line and *DA* is a tangent to the circle.
Angle *ADO* = 34°

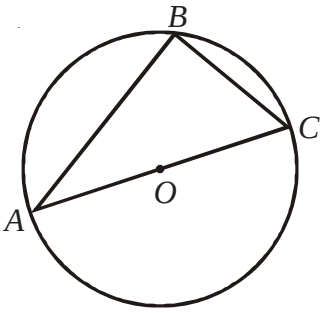
a) Work out the size of angle *AOD*. 56°

b) (i) Work out the size of angle *ABC*. 28°

(ii) Give a reason for your answer.
Angle at centre of circle is twice the angle on the circumference

Circle Theorems

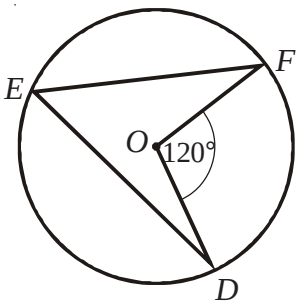
1)



A, *B* and *C* are points on the circumference of a circle centre *O*.
AC is a diameter of the circle.

a) (i) Write down the size of angle *ABC*.

(ii) Give a reason for your answer.



D, *E* and *F* are points on the circumference of a circle, centre *O*.
Angle *DOF* = 120°.

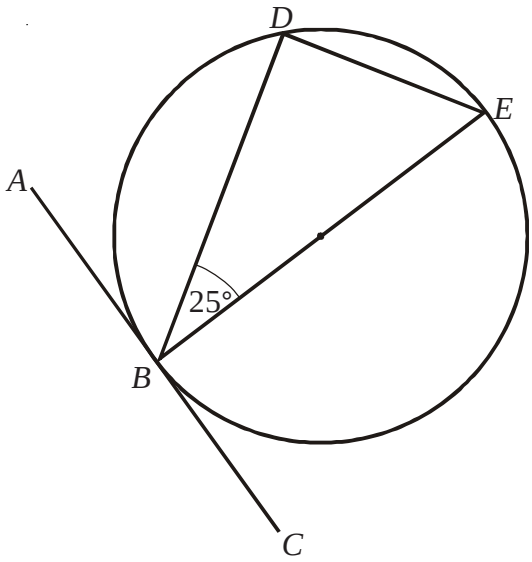
b) (i) Work out the size of angle *DEF*.

(ii) Give a reason for your answer.

2) *B*, *D* and *E* are points on a circle centre *O*.
ABC is a tangent to the circle.
BE is a diameter of the circle.
Angle *DBE* = 25°.

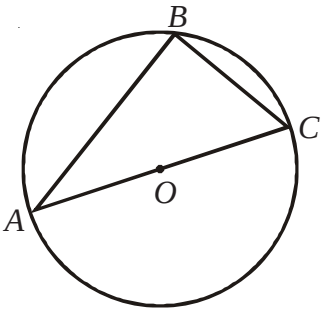
a) Find the size of angle *ABD*.
Give a reason for your answer.

b) Find the size of angle *DEB*.
Give a reason for your answer.



Circle Theorems

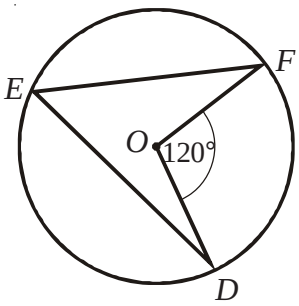
1)



A, *B* and *C* are points on the circumference of a circle centre *O*.
AC is a diameter of the circle.

a) (i) Write down the size of angle *ABC*. 90°

(ii) Give a reason for your answer.
Angle in a semi-circle is 90°



D, *E* and *F* are points on the circumference of a circle, centre *O*.
Angle *DOF* = 120°.

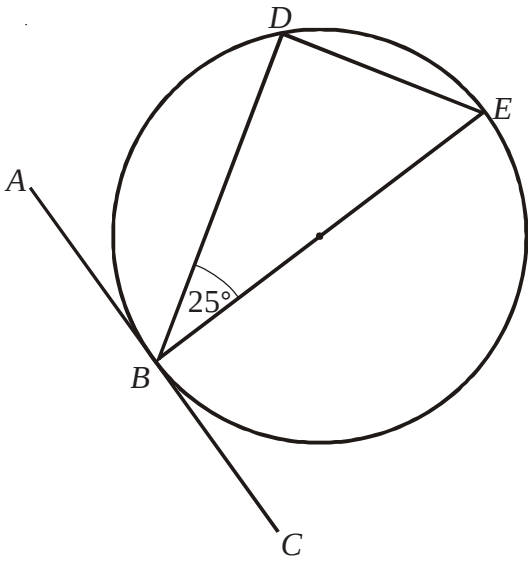
b) (i) Work out the size of angle *DEF*. 60°

(ii) Give a reason for your answer.
Angle at centre of circle is twice the angle on the circumference

2) *B*, *D* and *E* are points on a circle centre *O*.
ABC is a tangent to the circle.
BE is a diameter of the circle.
Angle *DBE* = 25°.

a) Find the size of angle *ABD*. 65°
Give a reason for your answer.
Radius meets a tangent at 90°

b) Find the size of angle *DEB*. 65°
Give a reason for your answer.
Alternate segment theorem



Circle Theorems

1) In the diagram, A, B and C are points on the circumference of a circle, centre O. PA and PB are tangents to the circle. Angle $ACB = 72^\circ$.

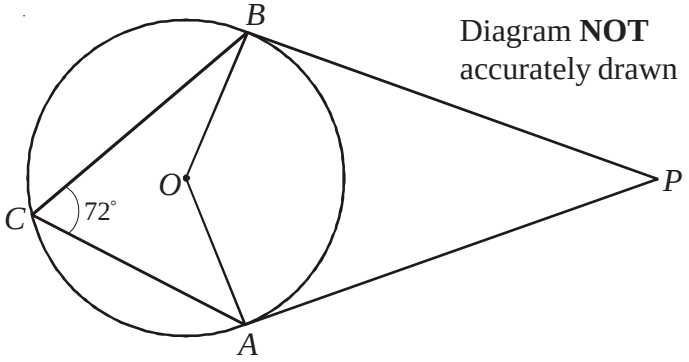


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle AOB.

(ii) Give a reason for your answer.

b) Work out the size of angle APB.

---

2) P, Q, R and S are points on the circle. PQ is a diameter of the circle. Angle $RPQ = 32^\circ$.

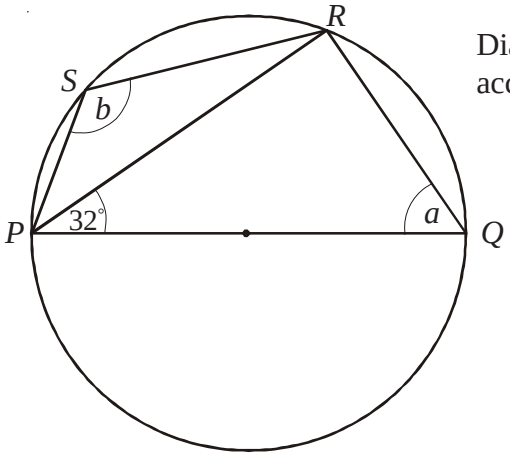


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle PQR.

(ii) Give reasons for your answer.

b) (i) Work out the size of angle PSR.

(ii) Give a reason for your answer.

---

3) The diagram shows a circle, centre O. AC is a diameter. Angle $BAC = 31^\circ$. D is a point on AC such that angle BDA is a right angle.

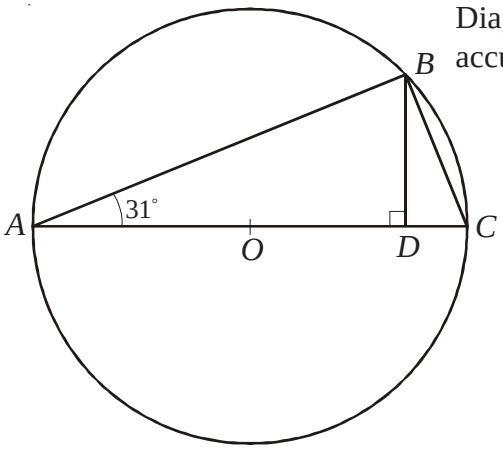


Diagram **NOT** accurately drawn

a) Work out the size of angle BCA. Give reasons for your answer.

b) Calculate the size of angle DBC.

c) Calculate the size of angle BOA.

---

4) A, B, C and D are four points on the circumference of a circle. ABE and DCE are straight lines. Angle $BAC = 21^\circ$. Angle $EBC = 58^\circ$.

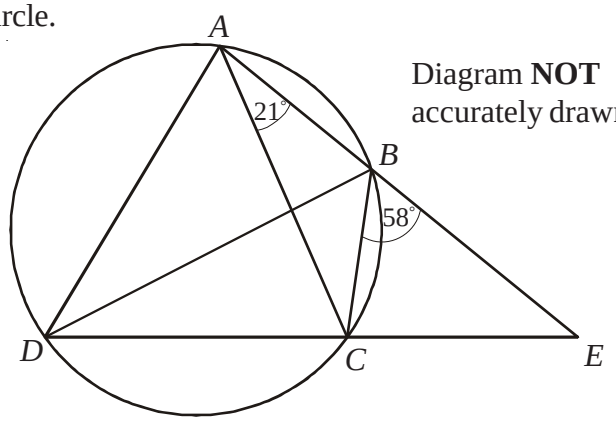


Diagram **NOT** accurately drawn

a) Find the size of angle ADC.

b) Find the size of angle ADB.

Angle $CAD = 69^\circ$.

c) Is BD a diameter of the circle? You must explain your answer.

Circle Theorems

1) In the diagram, *A*, *B* and *C* are points on the circumference of a circle, centre *O*. *PA* and *PB* are tangents to the circle. Angle *ACB* = 72°.

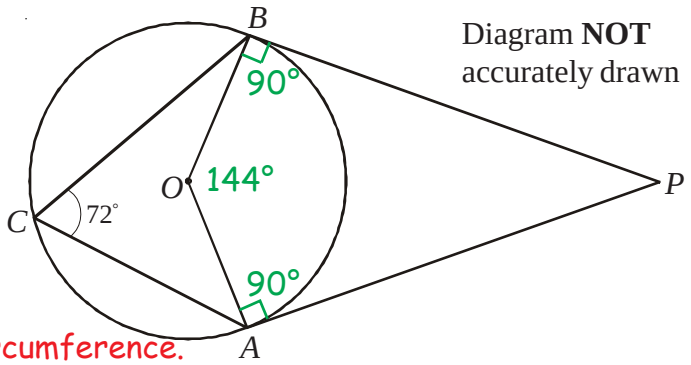


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle *AOB*. 144°

(ii) Give a reason for your answer.
Angle at centre is twice angle on circumference.

b) Work out the size of angle *APB*. 36°

---

2) *P*, *Q*, *R* and *S* are points on the circle. *PQ* is a diameter of the circle. Angle *RPQ* = 32°.

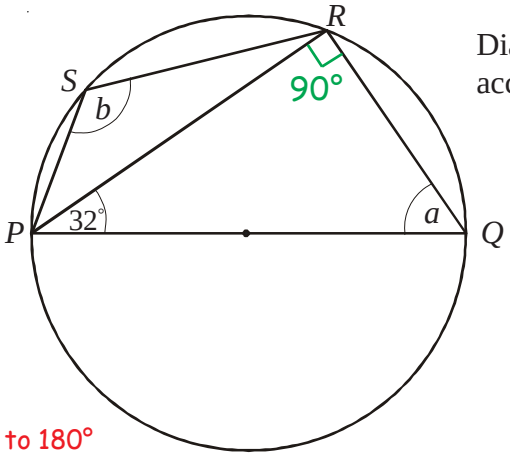


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle *PQR*. 58°

(ii) Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°

b) (i) Work out the size of angle *PSR*. 122°

(ii) Give a reason for your answer.
Opposite angles of a cyclic quadrilateral add to 180°

---

3) The diagram shows a circle, centre *O*. *AC* is a diameter. Angle *BAC* = 31°. D is a point on *AC* such that angle *BDA* is a right angle.

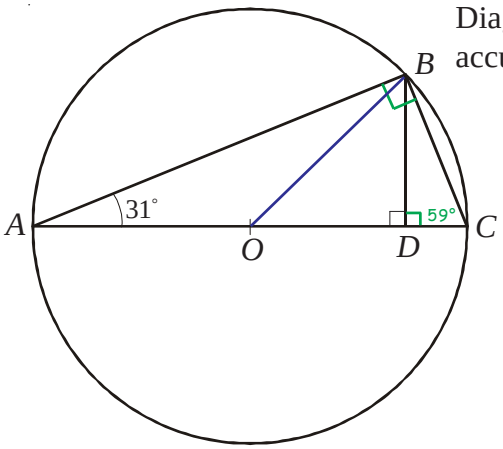


Diagram **NOT** accurately drawn

a) Work out the size of angle *BCA*. 59°
Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°

b) Calculate the size of angle *DBC*. 31°

c) Calculate the size of angle *BOA*. 118°

---

4) *A*, *B*, *C* and *D* are four points on the circumference of a circle. *ABE* and *DCE* are straight lines.
Angle *BAC* = 21°. Angle *EBC* = 58°.

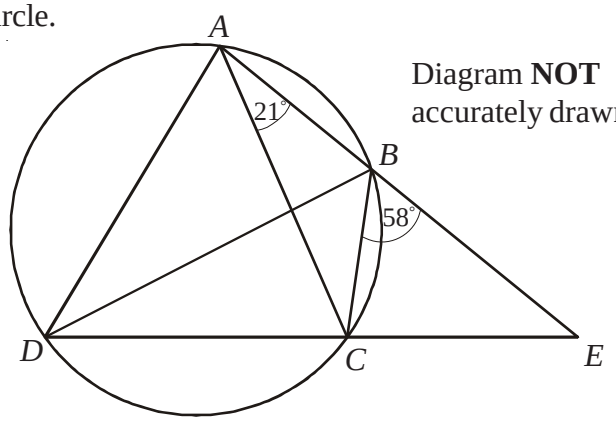


Diagram **NOT** accurately drawn

a) Find the size of angle *ADC*. 58°

b) Find the size of angle *ADB*. 37°

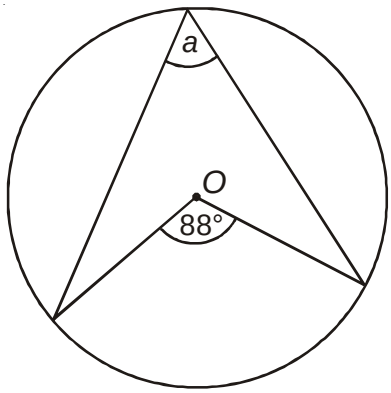
Angle *CAD* = 69°.

c) Is *BD* a diameter of the circle? Yes
You must explain your answer.
Angle *DAB* = 69° + 21° = 90°
BD subtends 90° on the circumference. Therefore *BD* is a diameter.

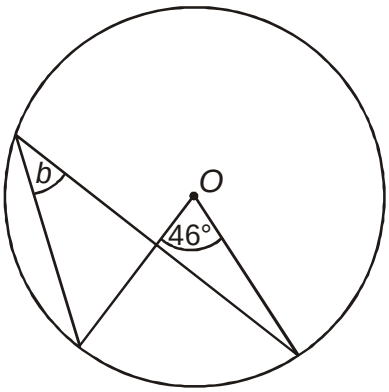
All questions

Circle Theorems

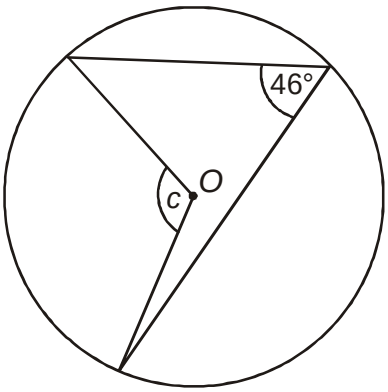
1) a = ____



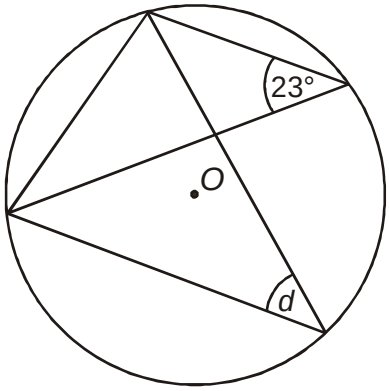
2) b = ____



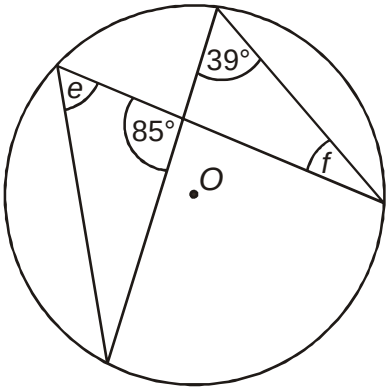
3) c = ____



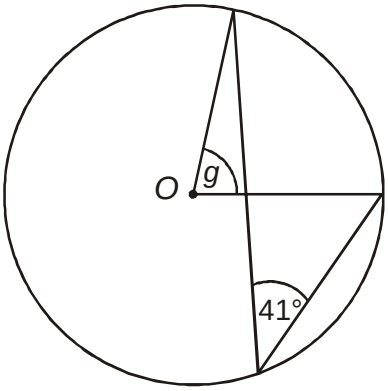
4) d = ____



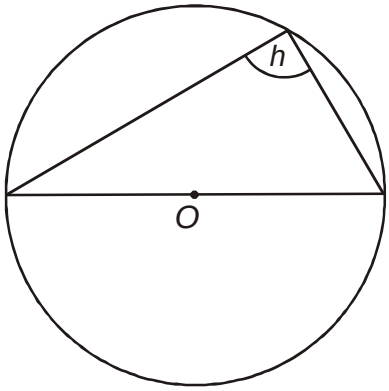
5) e = ____ f = ____



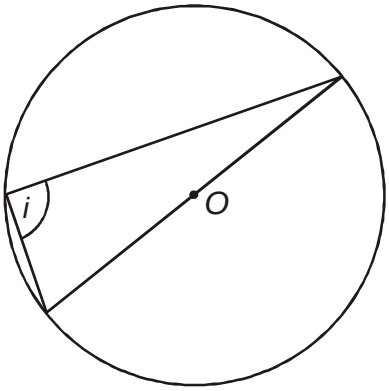
6) g = ____



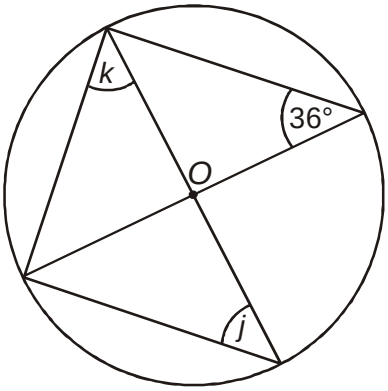
7) h = ____



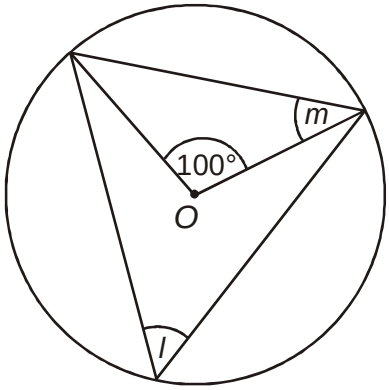
8) i = ____



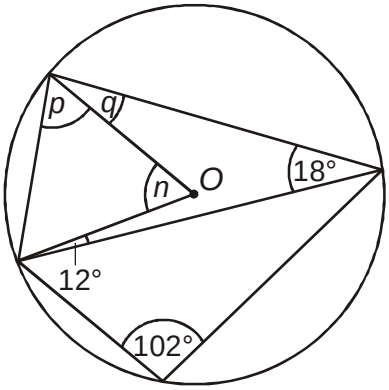
9) j = ____ k = ____



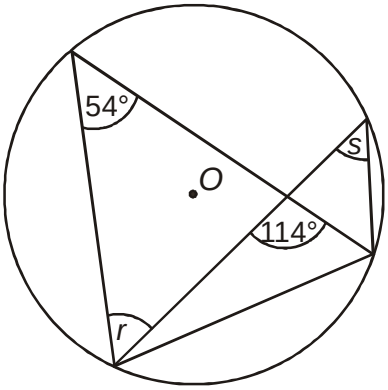
10) l = ____ m = ____



11) n = ____ p = ____ q = ____



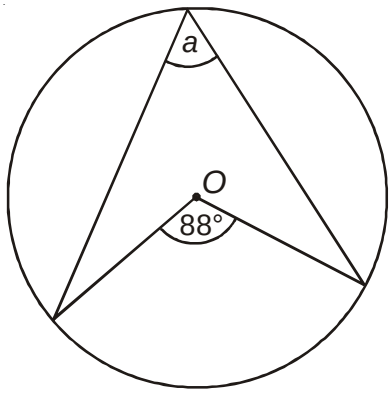
12) r = ____ s = ____



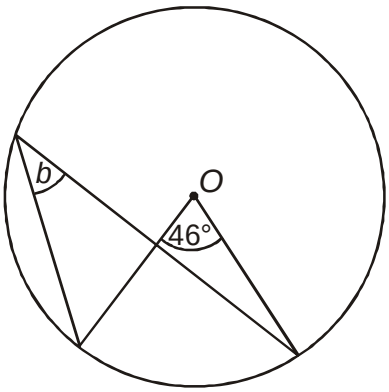
All questions

Circle Theorems

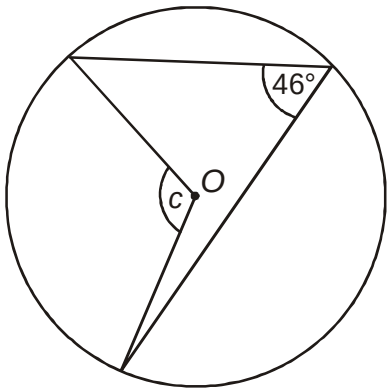
1) a = 44°



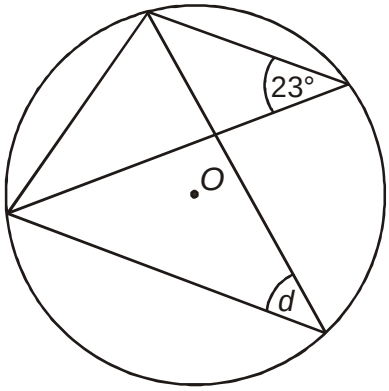
2) b = 23°



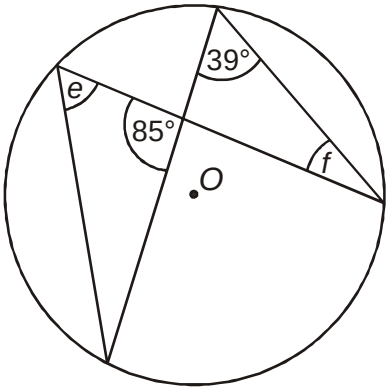
3) c = 92°



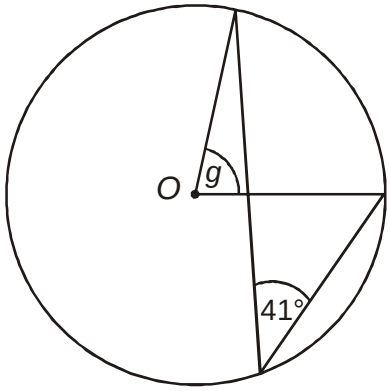
4) d = 23°



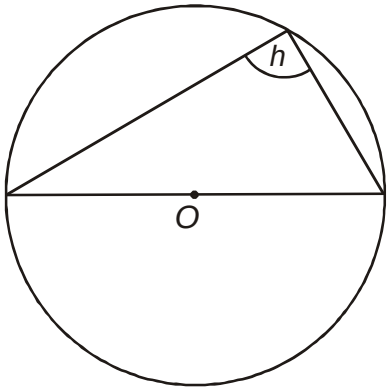
5) e = 39° f = 56°



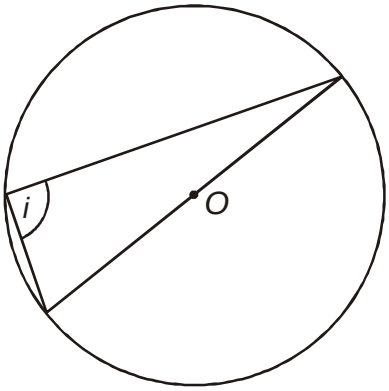
6) g = 82°



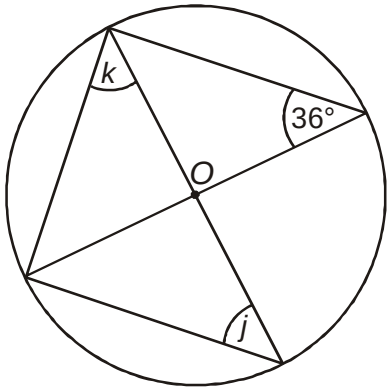
7) h = 90°



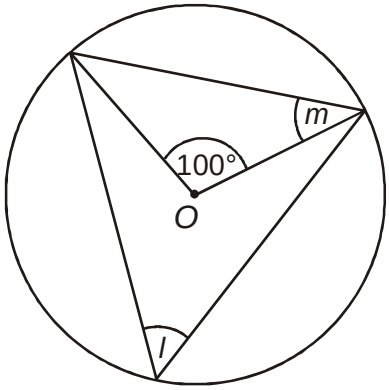
8) i = 90°



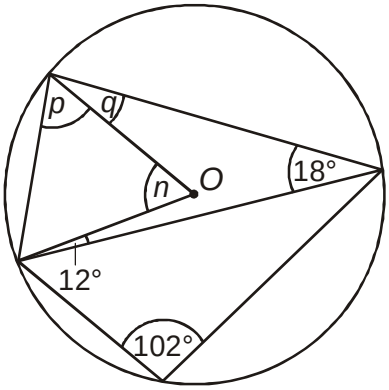
9) j = 36° k = 54°



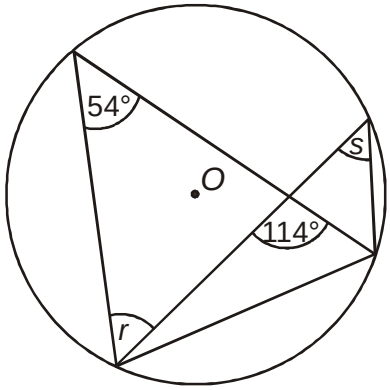
10) l = 50° m = 40°



11) n = 36° p = 72° q = 6°



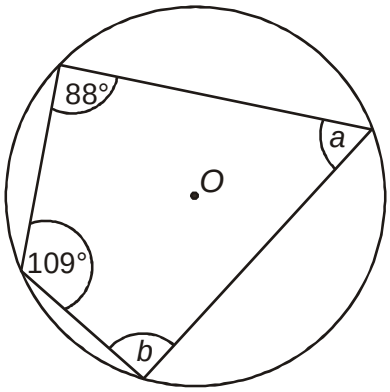
12) r = 60° s = 54°



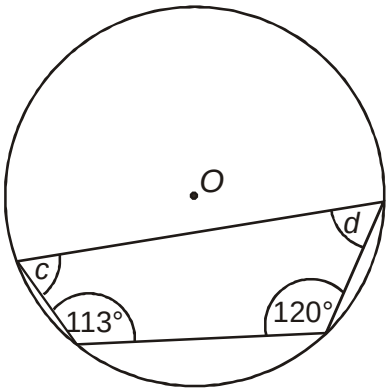
All questions

Circle Theorems

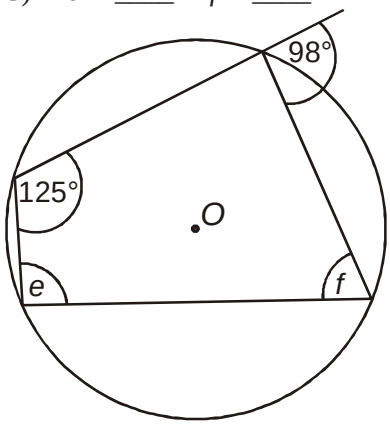
1) a = ____ b = ____



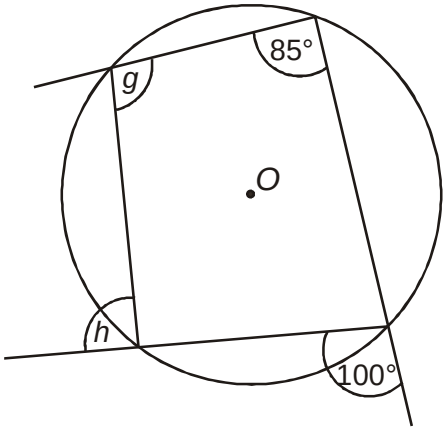
2) c = ____ d = ____



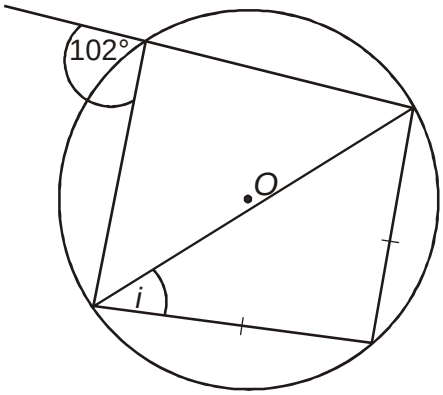
3) e = ____ f = ____



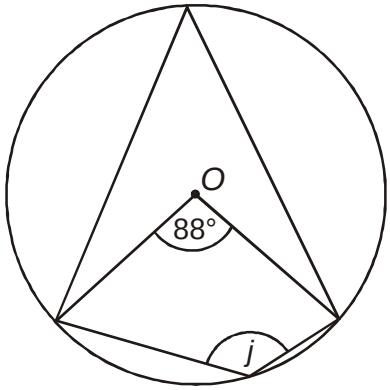
4) g = ____ h = ____



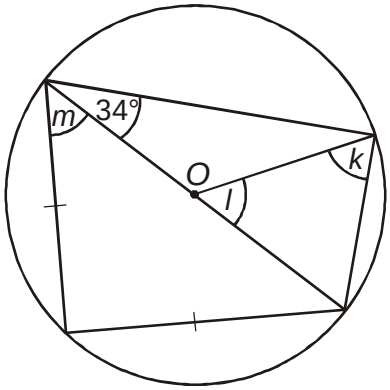
5) i = ____



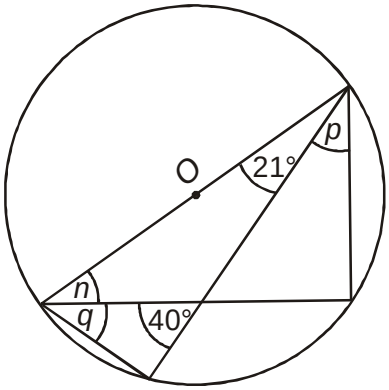
6) j = ____



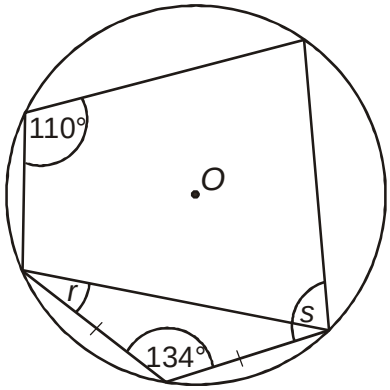
7) k = ____ l = ____ m = ____



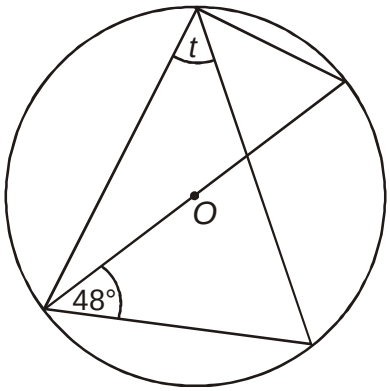
8) n = ____ p = ____ q = ____



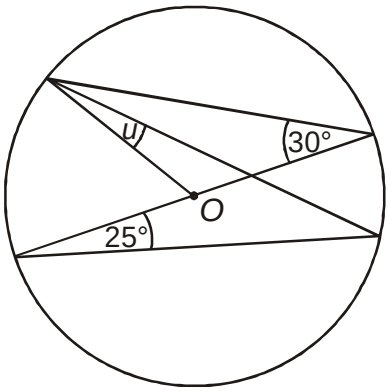
9) r = ____ s = ____



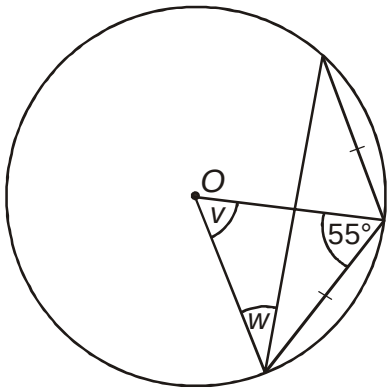
10) t = ____



11) u = ____



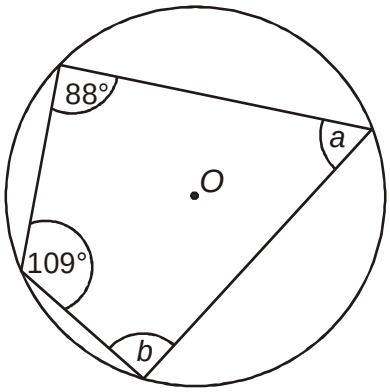
12) v = ____ w = ____



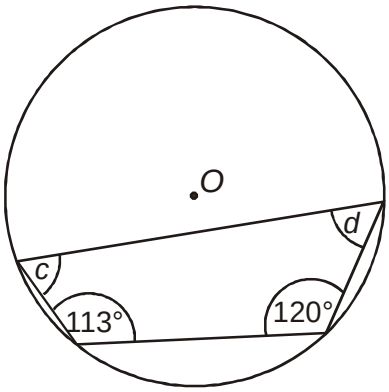
All questions

Circle Theorems

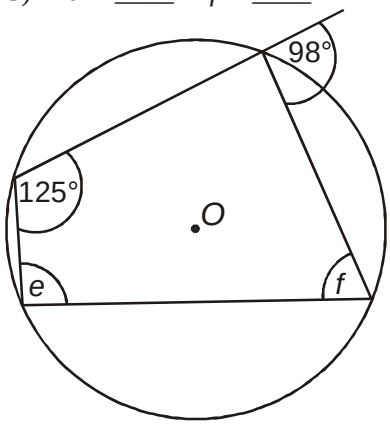
1) a = 71° b = 92°



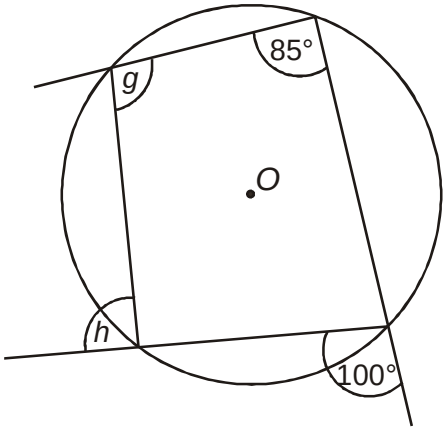
2) c = 60° d = 67°



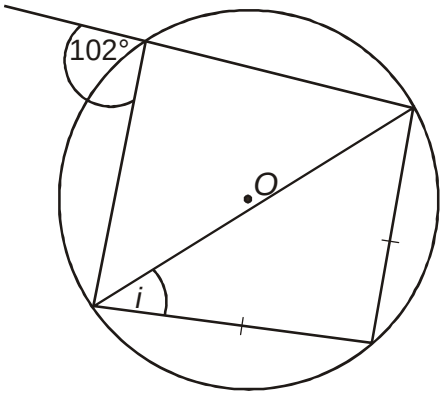
3) e = 98° f = 55°



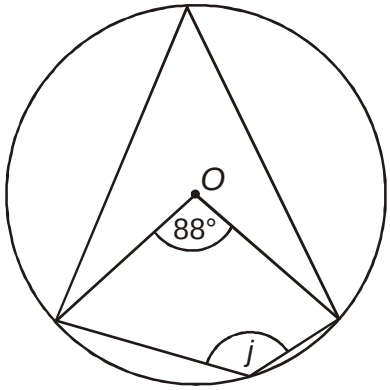
4) g = 100° h = 85°



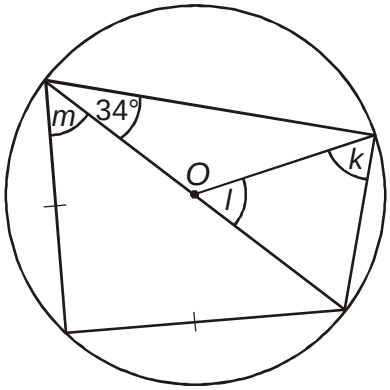
5) i = 39°



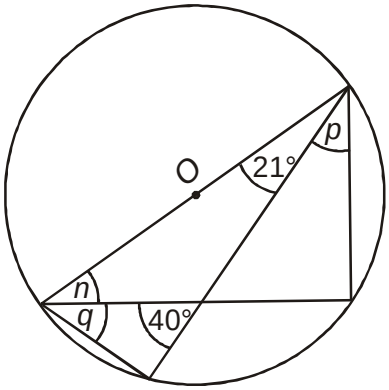
6) j = 136°



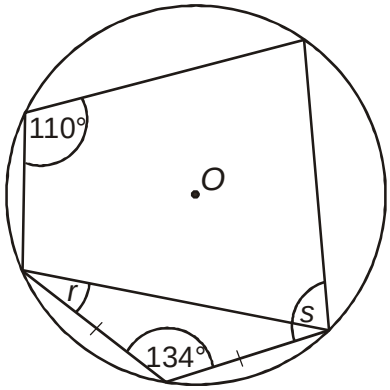
7) k = 56° l = 68° m = 45°



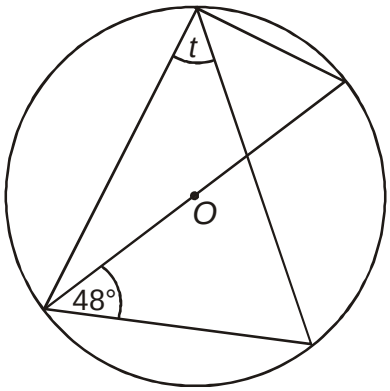
8) n = 19° p = 50° q = 50°



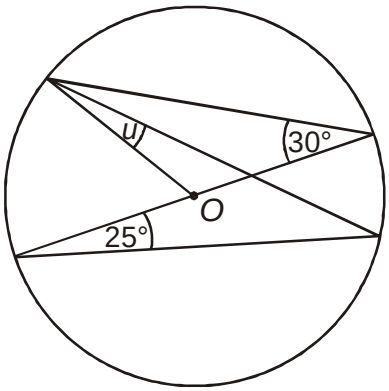
9) r = 23° s = 93°



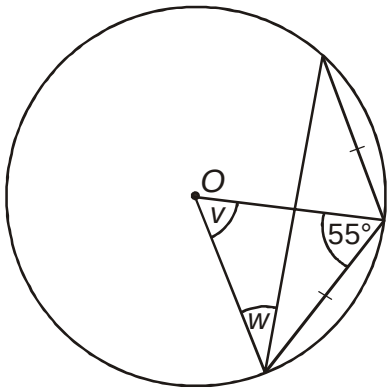
10) t = 42°



11) u = 5°



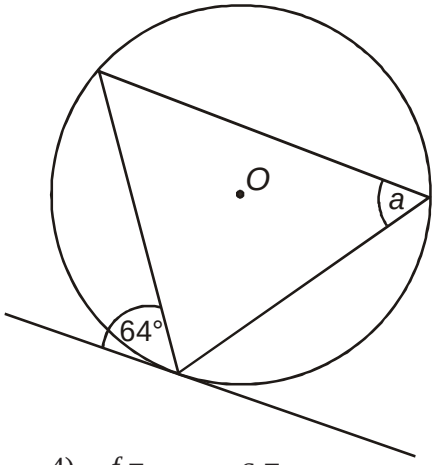
12) v = 70° w = 20°



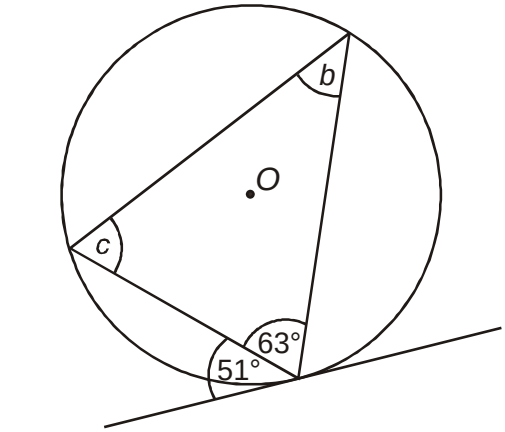
All questions

Circle Theorems

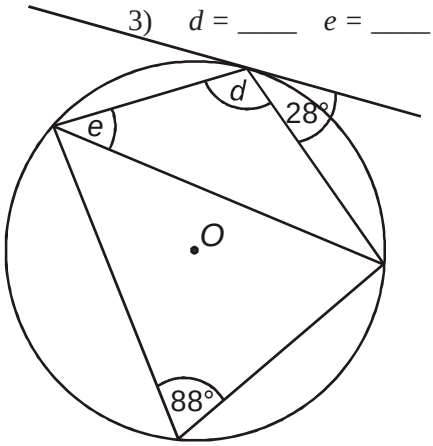
1) a = ____



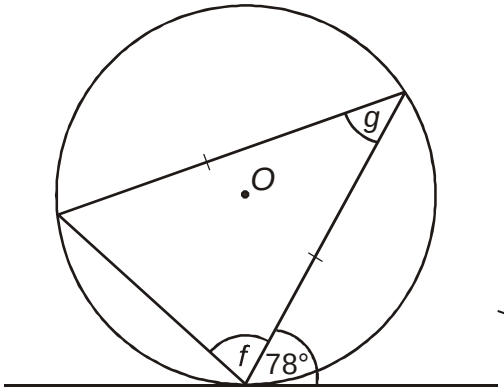
2) b = ____ c = ____



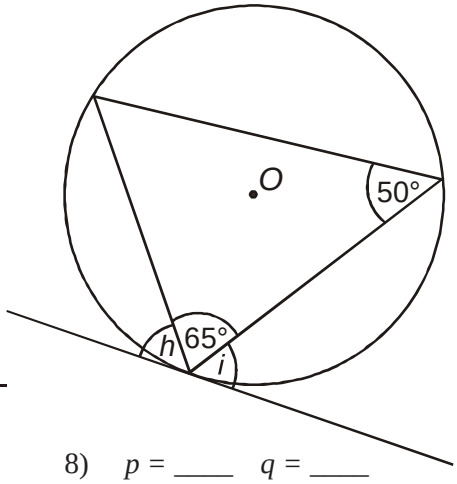
3) d = ____ e = ____



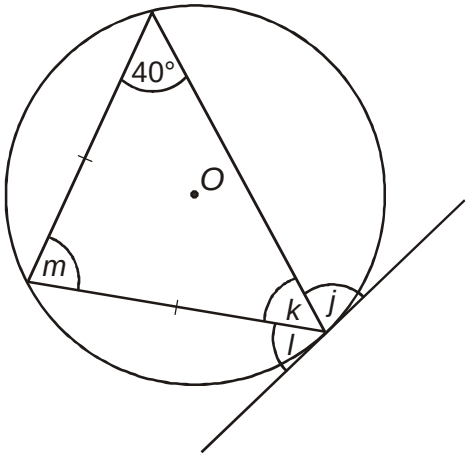
4) f = ____ g = ____



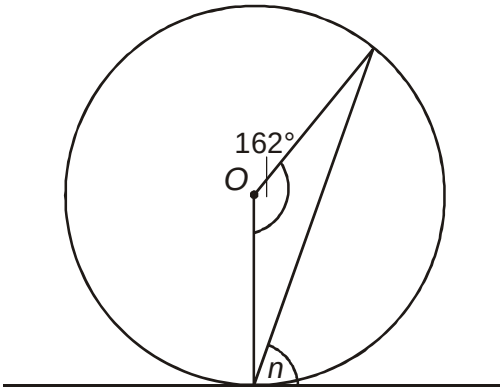
5) h = ____ i = ____



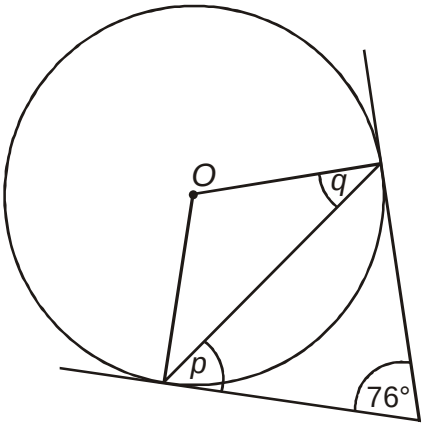
6) j = ____ k = ____ l = ____ m = ____



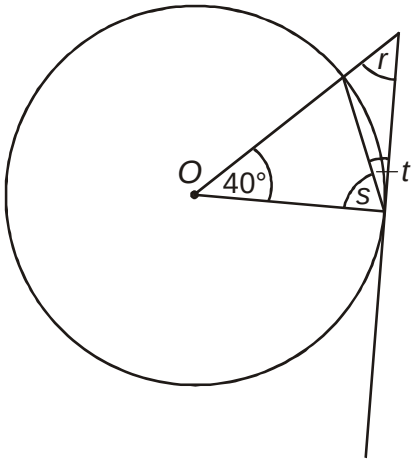
7) n = ____



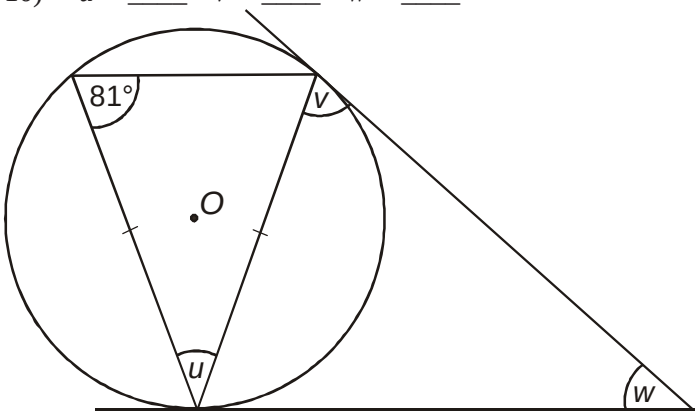
8) p = ____ q = ____



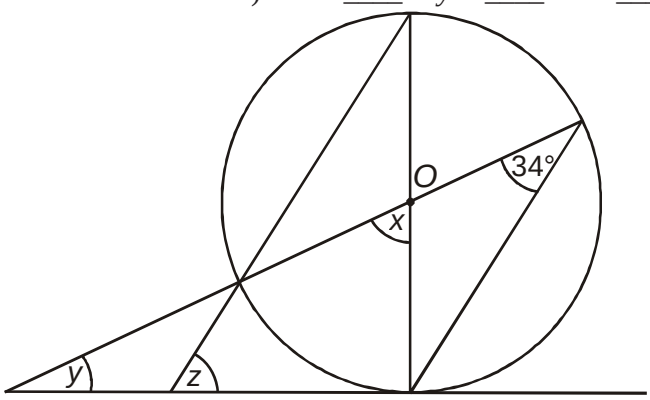
9) r = ____ s = ____ t = ____



10) u = ____ v = ____ w = ____



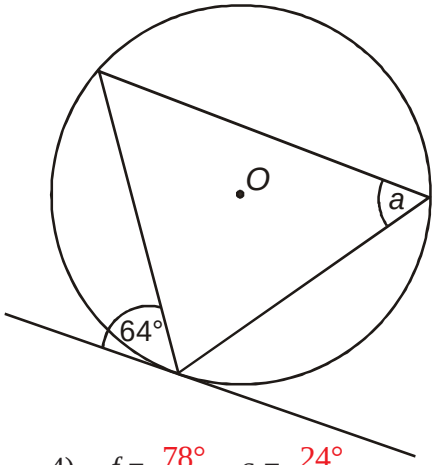
11) x = ____ y = ____ z = ____



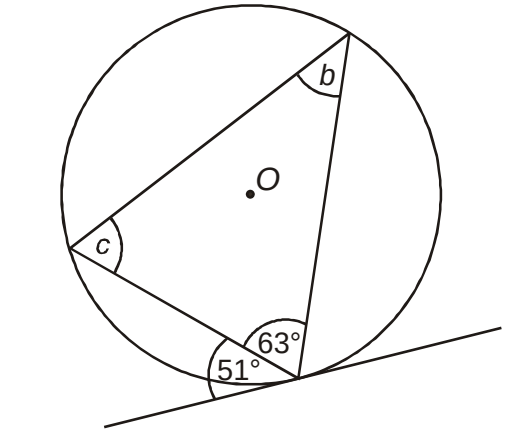
All questions

Circle Theorems

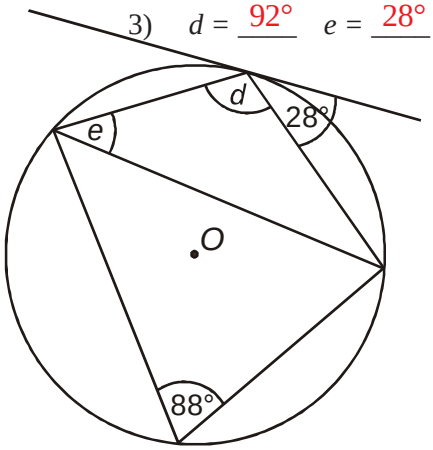
1) a = 64°



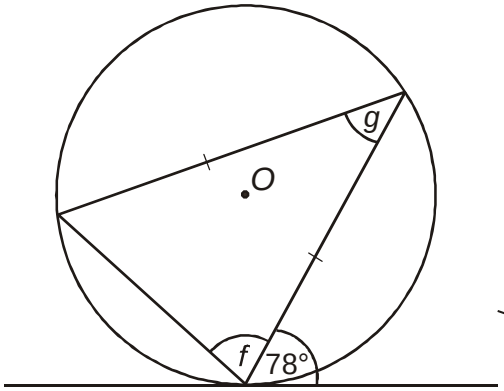
2) b = 51° c = 66°



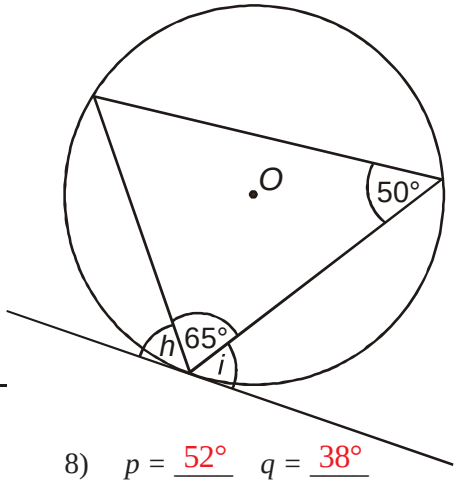
3) d = 92° e = 28°



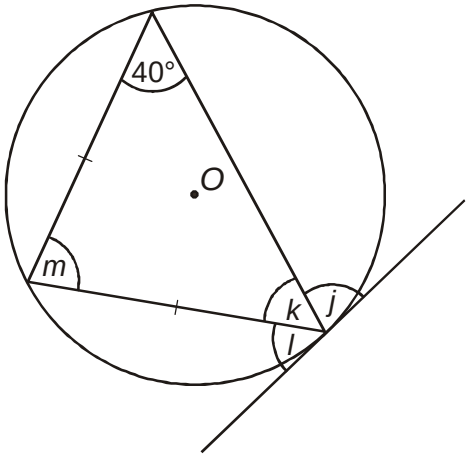
4) f = 78° g = 24°



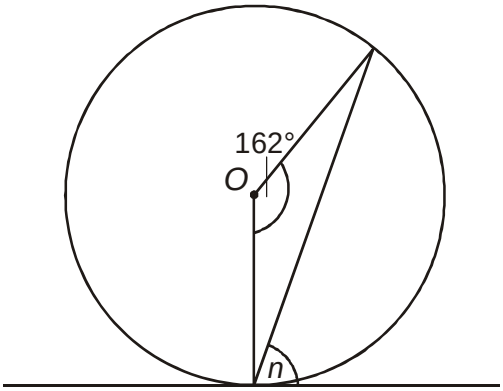
5) h = 50° i = 65°



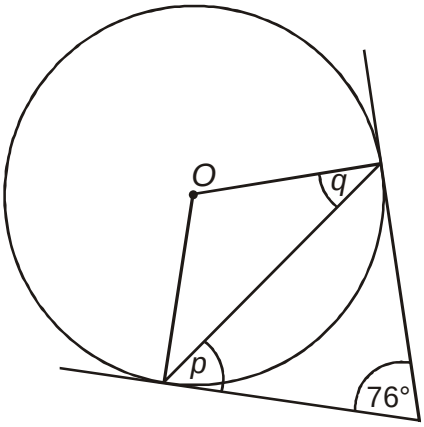
6) j = 100° k = 40° l = 40° m = 100°



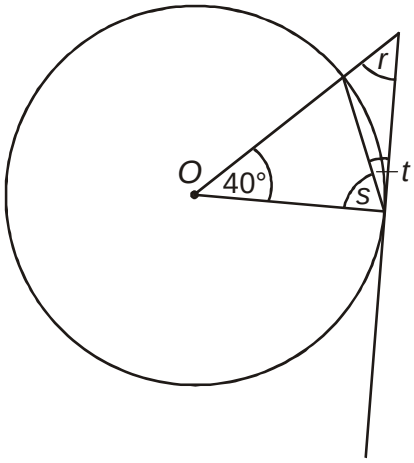
7) n = 81°



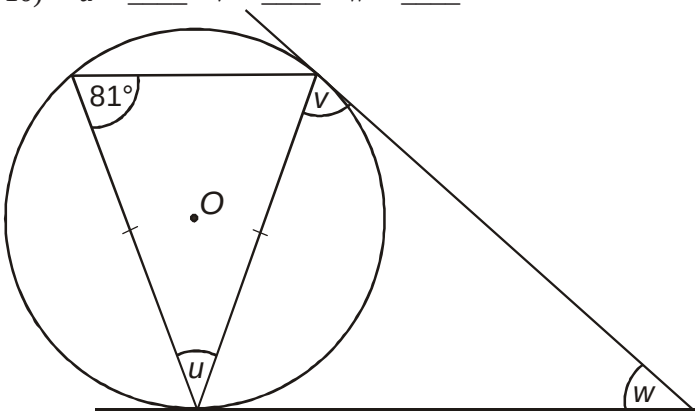
8) p = 52° q = 38°



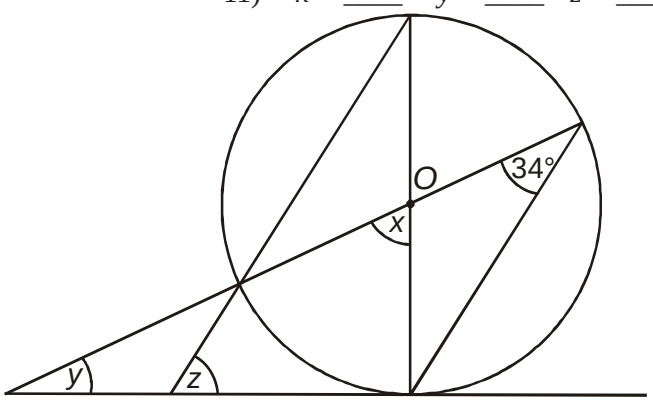
9) r = 50° s = 70° t = 20°



10) u = 18° v = 81° w = 18°



11) x = 68° y = 22° z = 56°



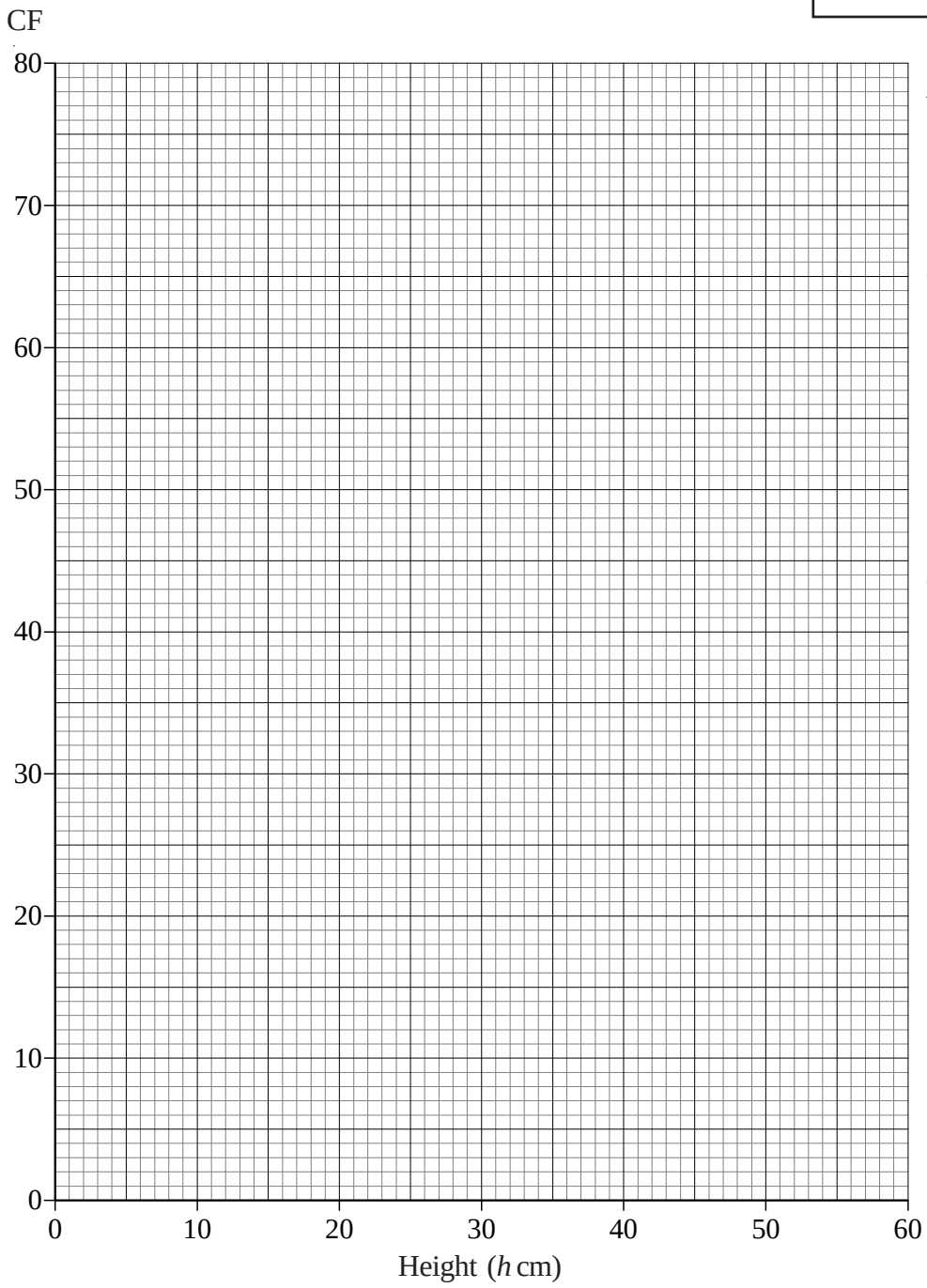
Cumulative Frequency

1) The heights of 80 plants were measured and can be seen in the table, below.

Height (h cm)	Frequency
$0 < h \leqslant 10$	2
$10 < h \leqslant 20$	5
$20 < h \leqslant 30$	19
$30 < h \leqslant 40$	38
$40 < h \leqslant 50$	13
$50 < h \leqslant 60$	3

a) Complete the cumulative frequency table for the plants.

Height (h cm)	Cumulative Frequency
$0 < h \leqslant 10$	2
$0 < h \leqslant 20$	
$0 < h \leqslant 30$	
$0 < h \leqslant 40$	
$0 < h \leqslant 50$	
$0 < h \leqslant 60$	



b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

(i) the median height of a plant.

(ii) the interquartile range of the heights of the plants.

d) Use your graph to estimate how many plants had a height that was greater than 45cm.

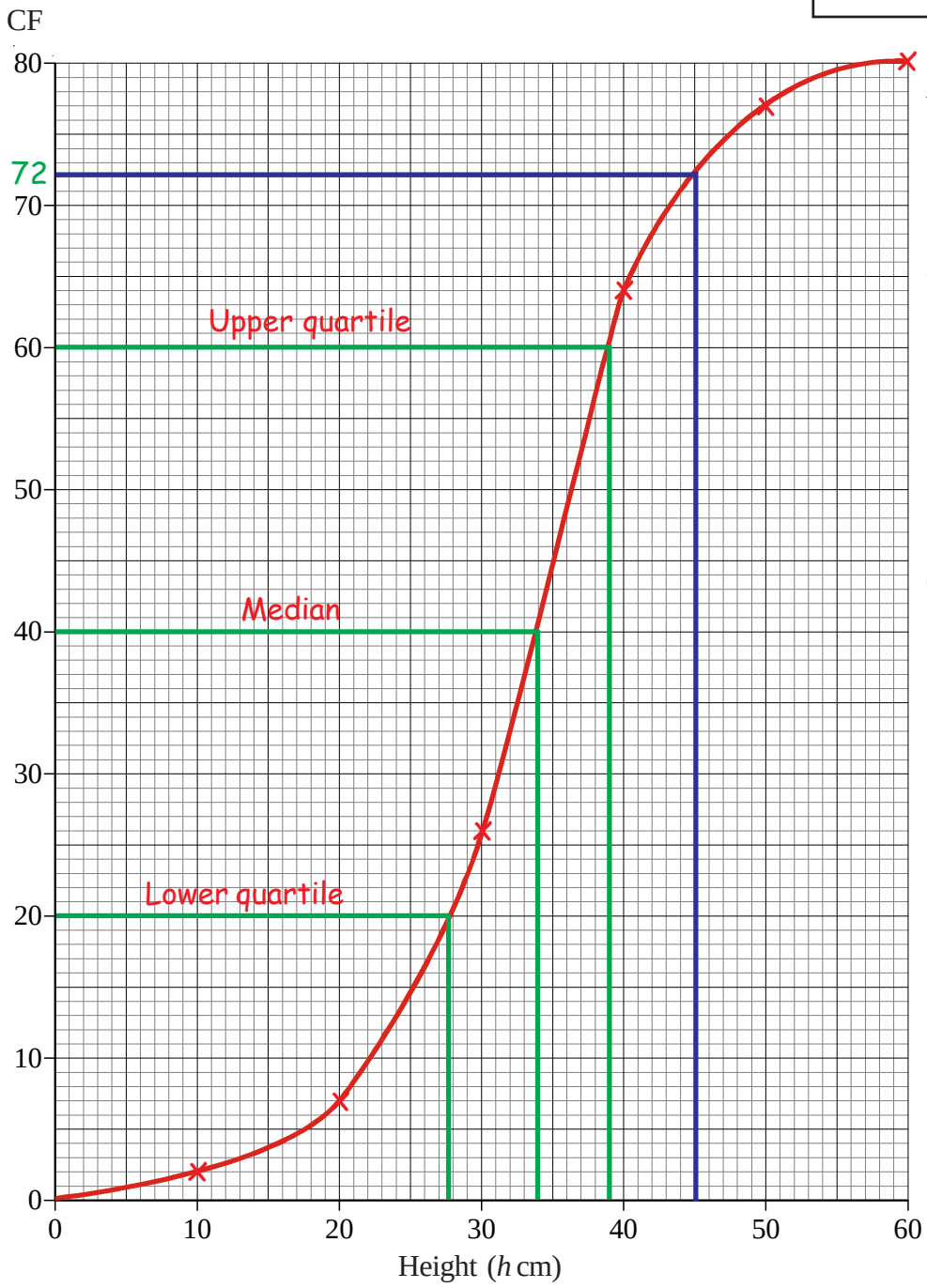
Cumulative Frequency

1) The heights of 80 plants were measured and can be seen in the table, below.

Height (h cm)	Frequency
$0 < h \leqslant 10$	2
$10 < h \leqslant 20$	5
$20 < h \leqslant 30$	19
$30 < h \leqslant 40$	38
$40 < h \leqslant 50$	13
$50 < h \leqslant 60$	3

a) Complete the cumulative frequency table for the plants.

Height (h cm)	Cumulative Frequency
$0 < h \leqslant 10$	2
$0 < h \leqslant 20$	7
$0 < h \leqslant 30$	26
$0 < h \leqslant 40$	64
$0 < h \leqslant 50$	77
$0 < h \leqslant 60$	80



b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

(i) the median height of a plant.
34 cm

(ii) the interquartile range of the heights of the plants.
39 – 27.7 = 11.3 cm

d) Use your graph to estimate how many plants had a height that was greater than 45cm.
80 – 72 = 8 plants

Cumulative Frequency

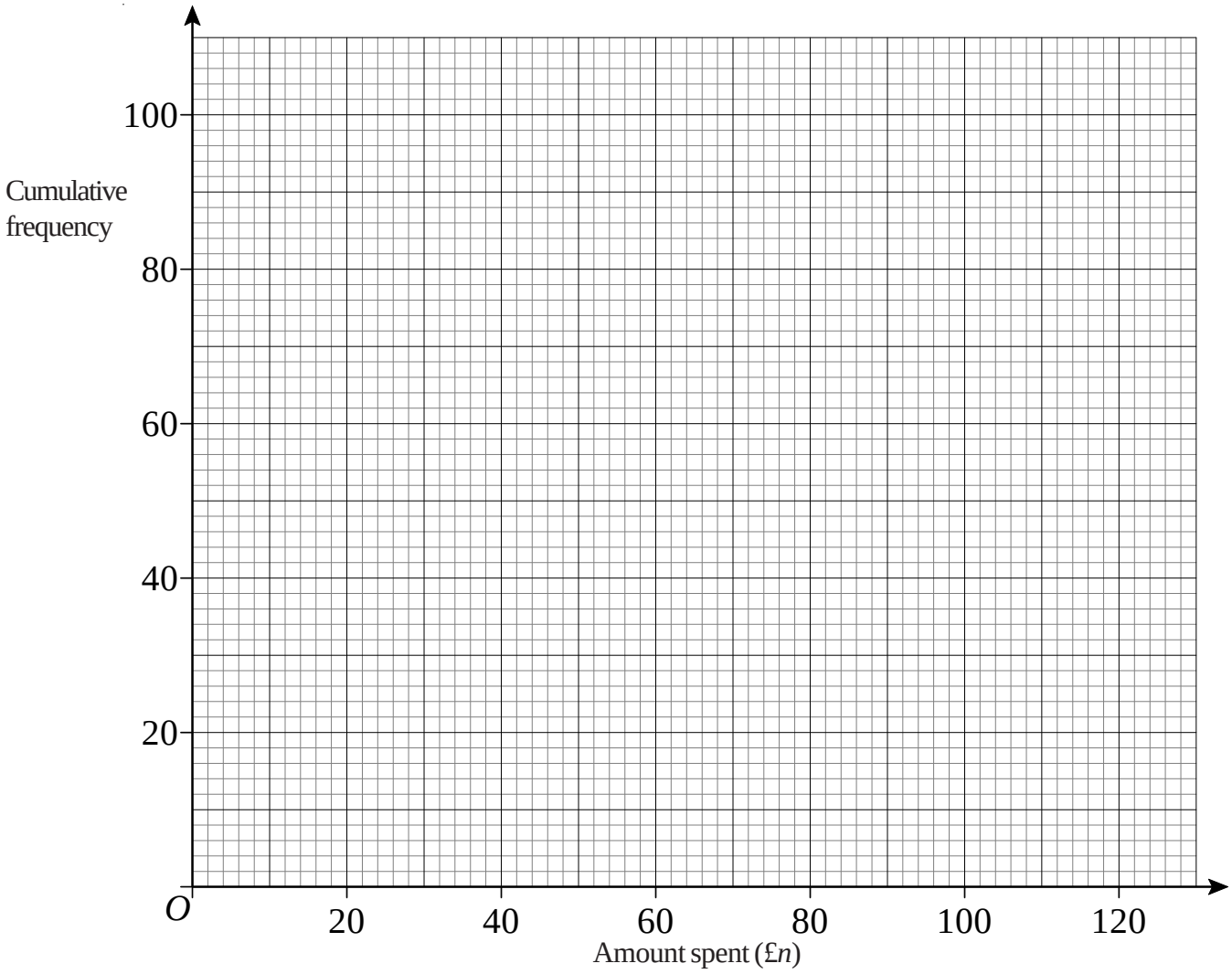
1) The table shows information about the amount spent by 100 customers in a supermarket.

Amount spent (£n)	Frequency
$0 < n \leqslant 20$	17
$20 < n \leqslant 40$	23
$40 < n \leqslant 60$	36
$60 < n \leqslant 80$	14
$80 < n \leqslant 100$	8
$100 < n \leqslant 120$	2

a) Complete the cumulative frequency table for this information.

Amount spent (£n)	Cumulative frequency
$0 < n \leqslant 20$	17
$0 < n \leqslant 40$	
$0 < n \leqslant 60$	
$0 < n \leqslant 80$	
$0 < n \leqslant 100$	
$0 < n \leqslant 120$	

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median amount spent.

d) Use your graph to find an estimate for the interquartile range of the amount of money spent.

Cumulative Frequency

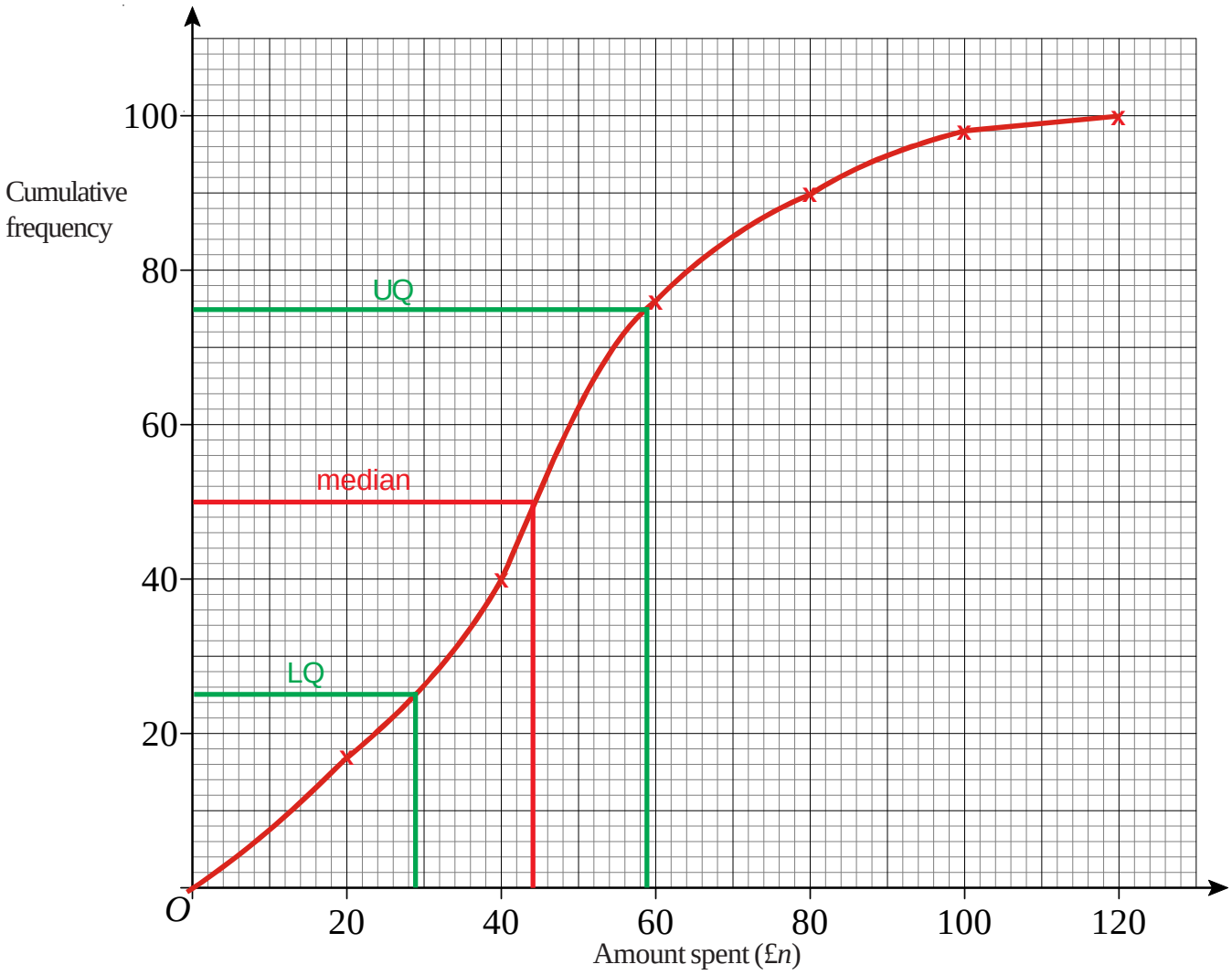
1) The table shows information about the amount spent by 100 customers in a supermarket.

Amount spent (£n)	Frequency
$0 < n \leqslant 20$	17
$20 < n \leqslant 40$	23
$40 < n \leqslant 60$	36
$60 < n \leqslant 80$	14
$80 < n \leqslant 100$	8
$100 < n \leqslant 120$	2

a) Complete the cumulative frequency table for this information.

Amount spent (£n)	Cumulative frequency
$0 < n \leqslant 20$	17
$0 < n \leqslant 40$	40
$0 < n \leqslant 60$	76
$0 < n \leqslant 80$	90
$0 < n \leqslant 100$	98
$0 < n \leqslant 120$	100

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median amount spent. £44

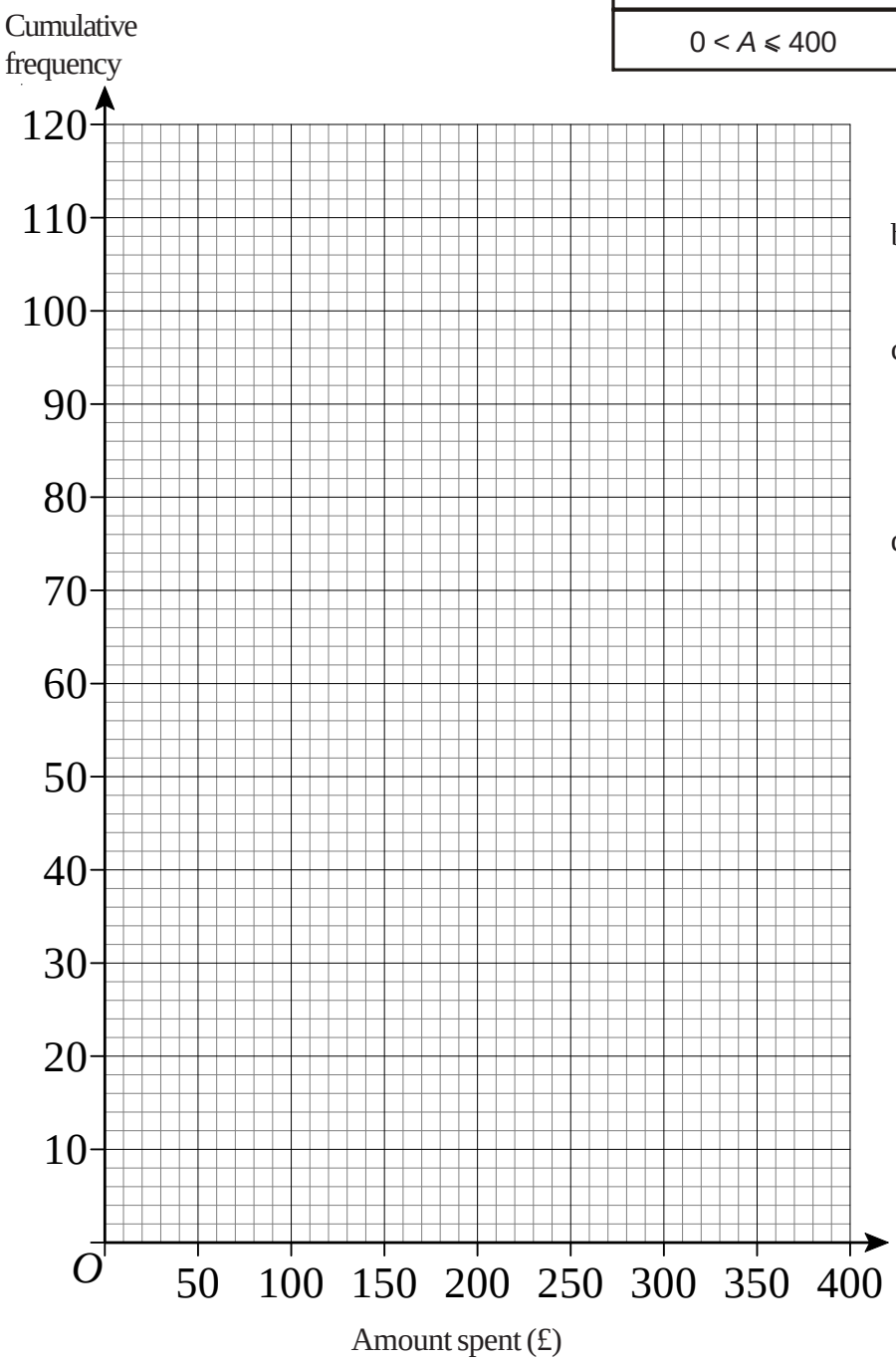
d) Use your graph to find an estimate for the interquartile range of the amount of money spent. £59 – £29 = £30

Cumulative Frequency

1) Fred did a survey about the amount of money spent by 120 men at Christmas.
The cumulative frequency table gives some information about the amounts of money spent by the 120 men.

Amount (£A) spent	Cumulative frequency
$0 < A \leqslant 100$	12
$0 < A \leqslant 150$	26
$0 < A \leqslant 200$	42
$0 < A \leqslant 250$	64
$0 < A \leqslant 300$	93
$0 < A \leqslant 350$	112
$0 < A \leqslant 400$	120

a) On the grid, draw a cumulative frequency diagram.



b) Use your cumulative frequency diagram to estimate the median.

c) Use your cumulative frequency diagram to estimate the interquartile range of the amount of money spent.

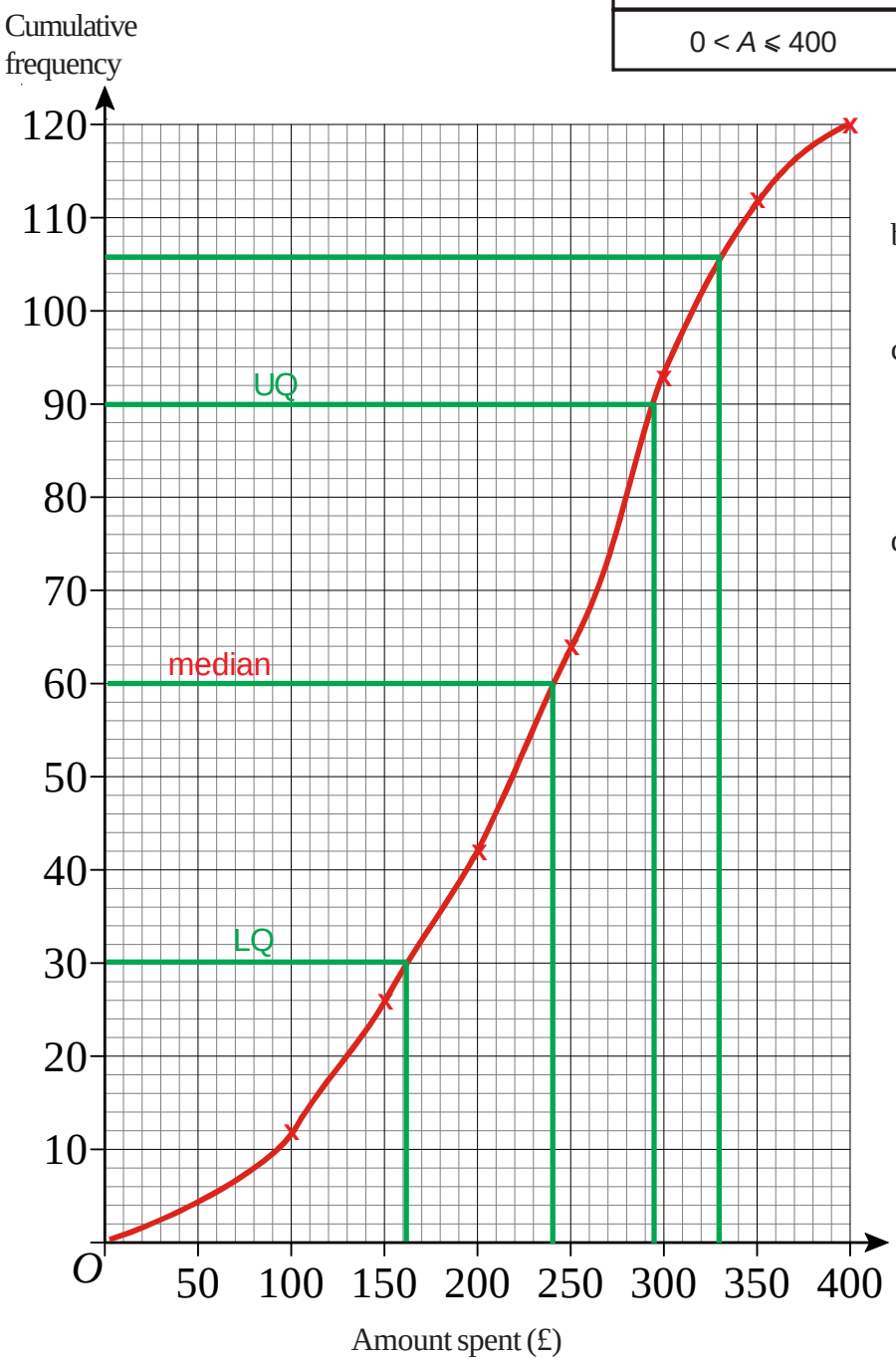
d) Use your cumulative frequency diagram to estimate the number of men who spent more than £330.

Cumulative Frequency

1) Fred did a survey about the amount of money spent by 120 men at Christmas.
The cumulative frequency table gives some information about the amounts of money spent by the 120 men.

Amount (£A) spent	Cumulative frequency
$0 < A \leqslant 100$	12
$0 < A \leqslant 150$	26
$0 < A \leqslant 200$	42
$0 < A \leqslant 250$	64
$0 < A \leqslant 300$	93
$0 < A \leqslant 350$	112
$0 < A \leqslant 400$	120

a) On the grid, draw a cumulative frequency diagram.



b) Use your cumulative frequency diagram to estimate the median.
£240

c) Use your cumulative frequency diagram to estimate the interquartile range of the amount of money spent. £295 – £160 = £135

d) Use your cumulative frequency diagram to estimate the number of men who spent more than £330.
14

Cumulative Frequency

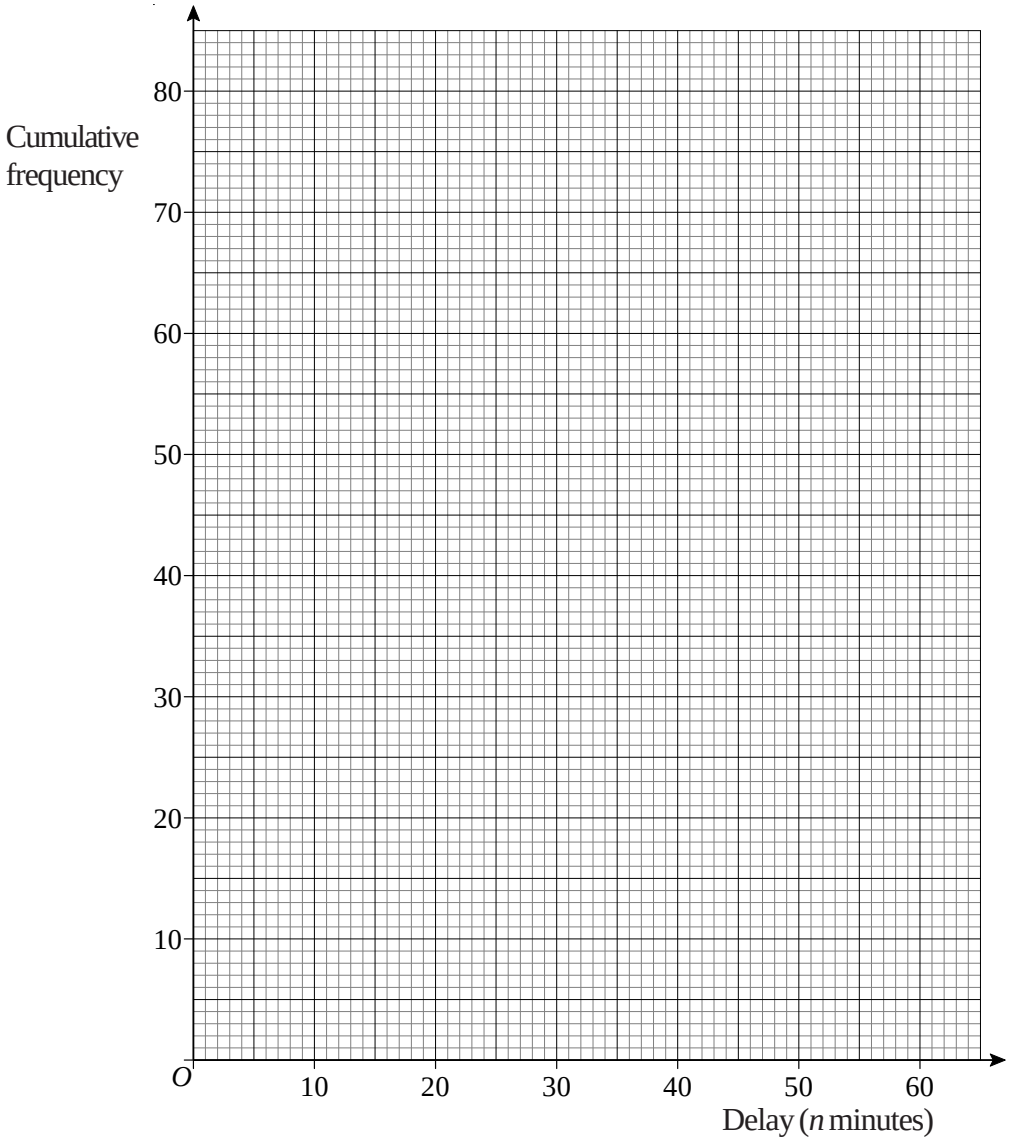
1) The table gives some information about the delay, in minutes, of 80 trains.

a) Complete the cumulative frequency table.

Delay (n minutes)	Frequency
$0 < n \leqslant 20$	16
$20 < n \leqslant 30$	27
$30 < n \leqslant 40$	22
$40 < n \leqslant 50$	10
$50 < n \leqslant 60$	5

Delay (n minutes)	Cumulative Frequency
$0 < n \leqslant 20$	
$0 < n \leqslant 30$	
$0 < n \leqslant 40$	
$0 < n \leqslant 50$	
$0 < n \leqslant 60$	

b) On the grid below, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for

(i) the median delay.

(ii) the interquartile range of the delays.

(iii) the number of trains delayed for more than 53 minutes.

Cumulative Frequency

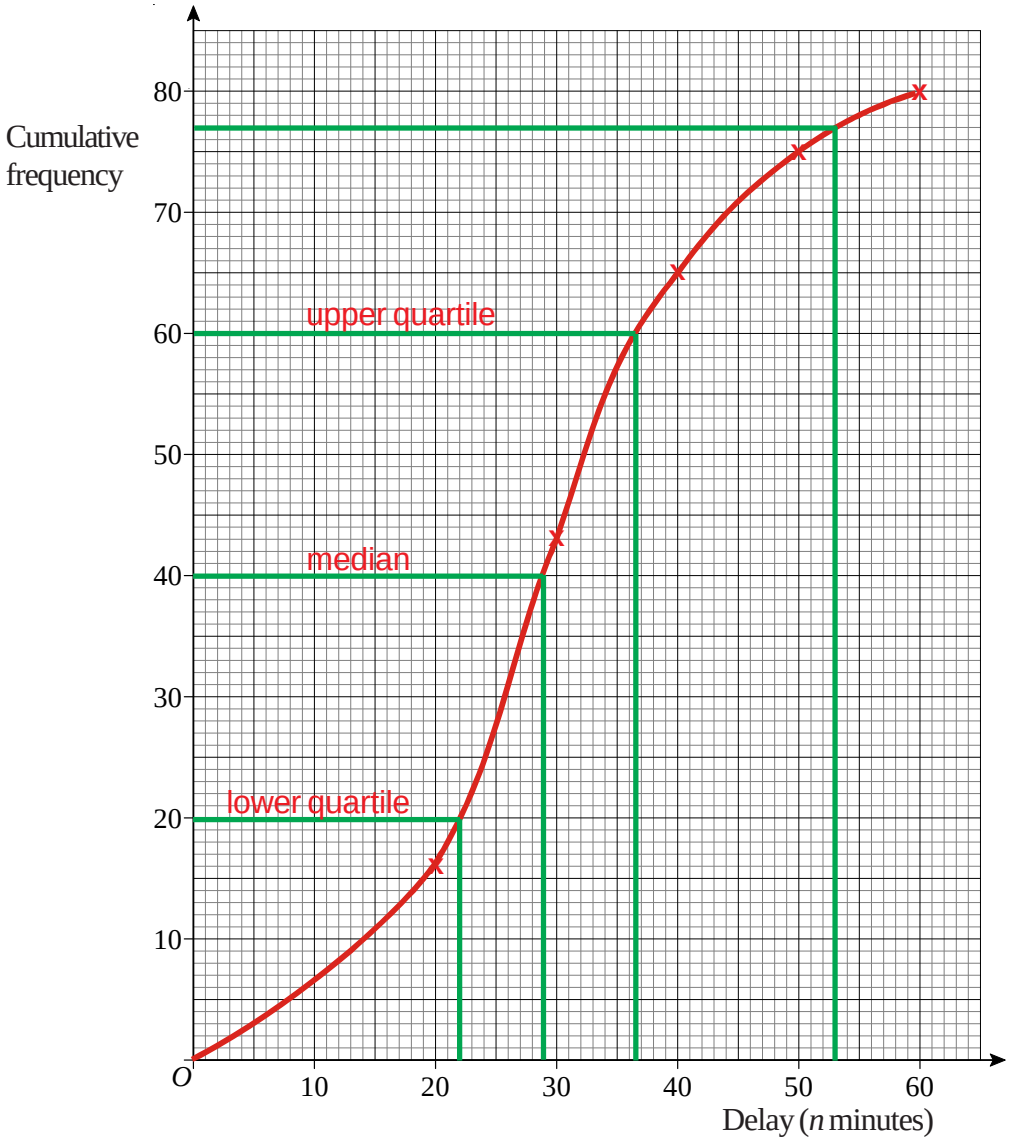
1) The table gives some information about the delay, in minutes, of 80 trains.

a) Complete the cumulative frequency table.

Delay (n minutes)	Frequency
$0 < n \leqslant 20$	16
$20 < n \leqslant 30$	27
$30 < n \leqslant 40$	22
$40 < n \leqslant 50$	10
$50 < n \leqslant 60$	5

Delay (n minutes)	Cumulative Frequency
$0 < n \leqslant 20$	16
$0 < n \leqslant 30$	43
$0 < n \leqslant 40$	65
$0 < n \leqslant 50$	75
$0 < n \leqslant 60$	80

b) On the grid below, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for

(i) the median delay. 29 minutes

(ii) the interquartile range of the delays. 36.5 – 22 = 14.5 minutes

(iii) the number of trains delayed for more than 53 minutes. 3

Cumulative Frequency

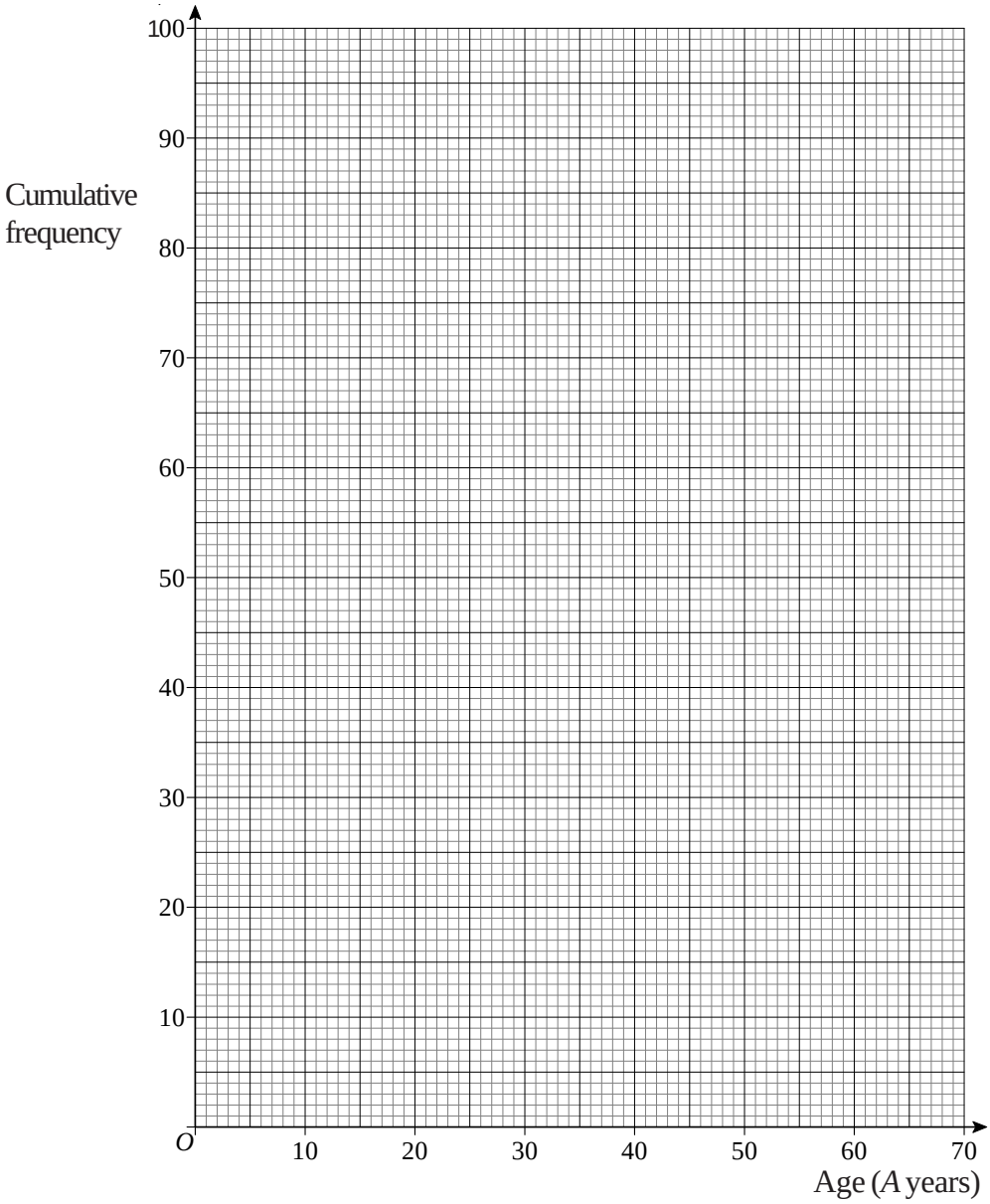
1) There are 100 teachers at Sam's school.
Sam found out the age of each teacher.
The table gives information about her results.

Age (A years)	Frequency
$20 < A \leqslant 30$	25
$30 < A \leqslant 40$	36
$40 < A \leqslant 50$	22
$50 < A \leqslant 60$	11
$60 < A \leqslant 70$	6

a) Complete the cumulative frequency table

Age (A years)	Cumulative Frequency
$20 < A \leqslant 30$	25
$20 < A \leqslant 40$	
$20 < A \leqslant 50$	
$20 < A \leqslant 60$	
$20 < A \leqslant 70$	

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median age.

d) Use your graph to find an estimate for the number of these teachers who are **older** than 56 years old.

Cumulative Frequency

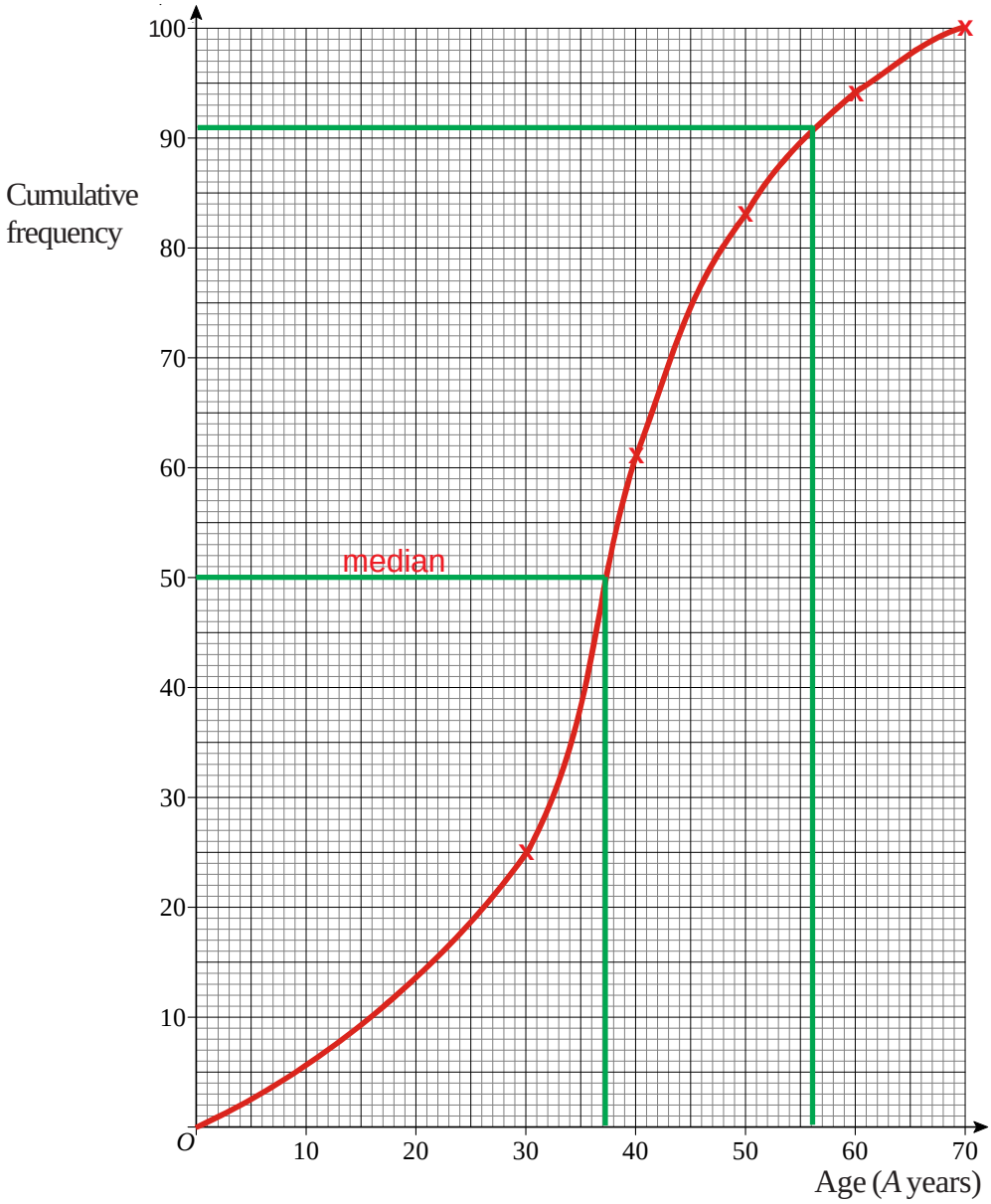
1) There are 100 teachers at Sam's school.
Sam found out the age of each teacher.
The table gives information about her results.

Age (A years)	Frequency
$20 < A \leqslant 30$	25
$30 < A \leqslant 40$	36
$40 < A \leqslant 50$	22
$50 < A \leqslant 60$	11
$60 < A \leqslant 70$	6

a) Complete the cumulative frequency table

Age (A years)	Cumulative Frequency
$20 < A \leqslant 30$	25
$20 < A \leqslant 40$	61
$20 < A \leqslant 50$	83
$20 < A \leqslant 60$	94
$20 < A \leqslant 70$	100

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median age. 37 years

d) Use your graph to find an estimate for the number of these teachers who are **older** than 56 years old. 9

Cumulative Frequency

1) This table shows information about the time, *m* minutes, it takes to show each of 120 films.

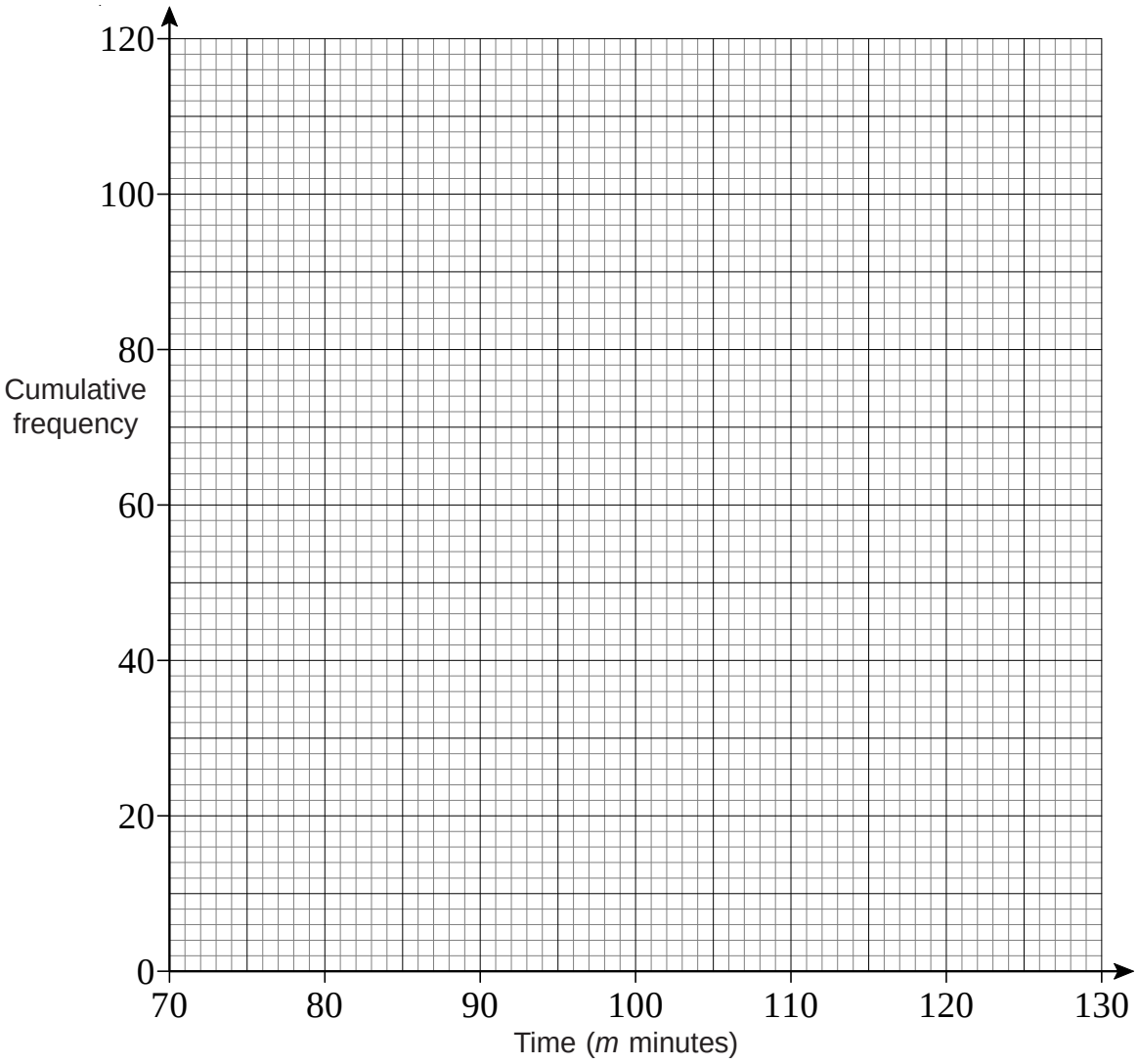
Time (*m* minutes)	Frequency
$70 < m \leqslant 80$	3
$80 < m \leqslant 90$	13
$90 < m \leqslant 100$	34
$100 < m \leqslant 110$	32
$110 < m \leqslant 120$	26
$120 < m \leqslant 130$	12

a) Write down the modal class interval.

b) Complete this cumulative frequency table.

Time (*m* minutes)	Cumulative frequency
$70 < m \leqslant 80$	3
$70 < m \leqslant 90$	
$70 < m \leqslant 100$	
$70 < m \leqslant 110$	
$70 < m \leqslant 120$	
$70 < m \leqslant 130$	

c) On the grid, draw a cumulative frequency graph for your cumulative frequency table.



d) Use your graph to find an estimate for the median.

e) Use your graph to find an estimate for the interquartile range of times.

f) Use your graph to find an estimate for the number of films which take longer than 115 minutes to show.

Cumulative Frequency

1) This table shows information about the time, m minutes, it takes to show each of 120 films.

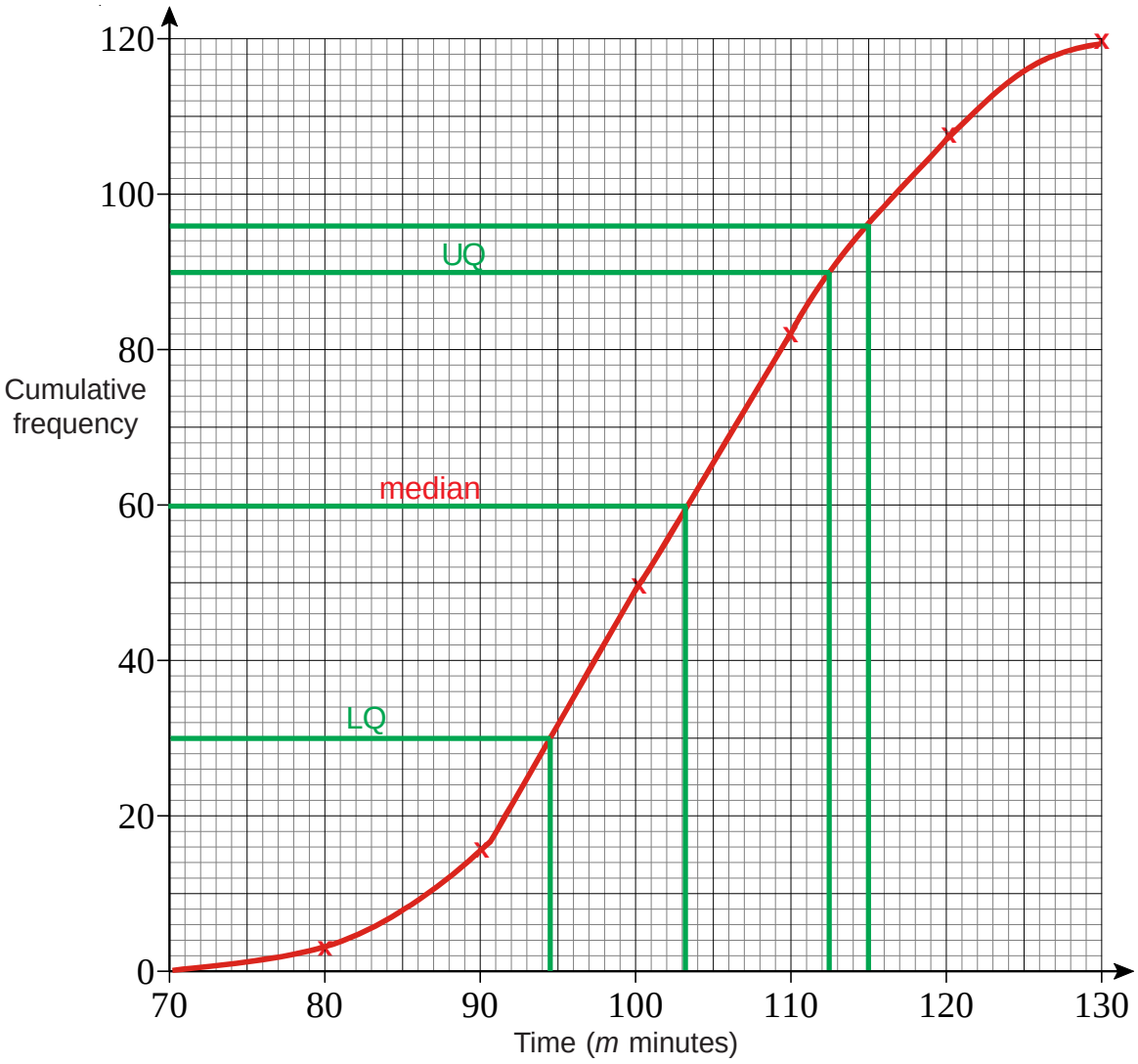
Time (m minutes)	Frequency
$70 < m \leqslant 80$	3
$80 < m \leqslant 90$	13
$90 < m \leqslant 100$	34
$100 < m \leqslant 110$	32
$110 < m \leqslant 120$	26
$120 < m \leqslant 130$	12

a) Write down the modal class interval. $90 < m \leqslant 100$

b) Complete this cumulative frequency table.

Time (m minutes)	Cumulative frequency
$70 < m \leqslant 80$	3
$70 < m \leqslant 90$	16
$70 < m \leqslant 100$	50
$70 < m \leqslant 110$	82
$70 < m \leqslant 120$	108
$70 < m \leqslant 130$	120

c) On the grid, draw a cumulative frequency graph for your cumulative frequency table.



d) Use your graph to find an estimate for the median. 103 minutes

e) Use your graph to find an estimate for the interquartile range of times. 112.5 – 94.5 = 18 minutes

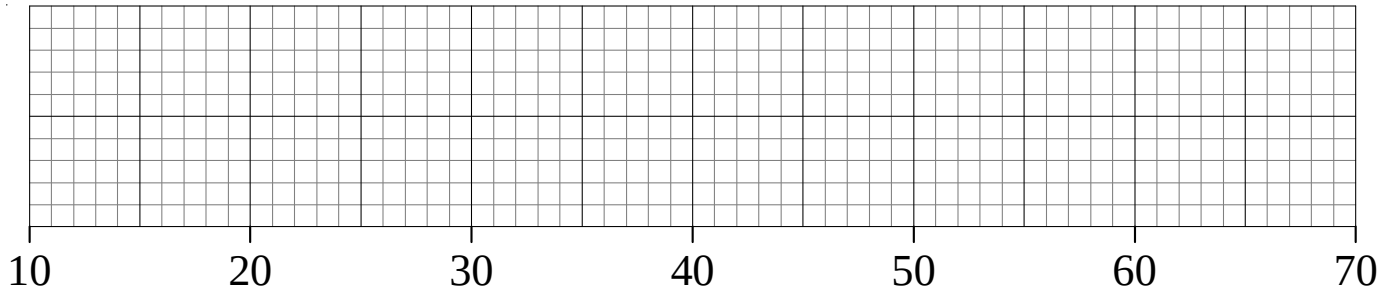
f) Use your graph to find an estimate for the number of films which take longer than 115 minutes to show. 24 films

Box Plots

1) The ages of 20 teachers are listed below.

22, 22, 24, 25, 27, 27, 28, 29, 29, 29, 34, 35, 41, 43, 44, 49, 55, 57, 58, 58

a) On the grid below, draw a box plot to show the information about the teachers.



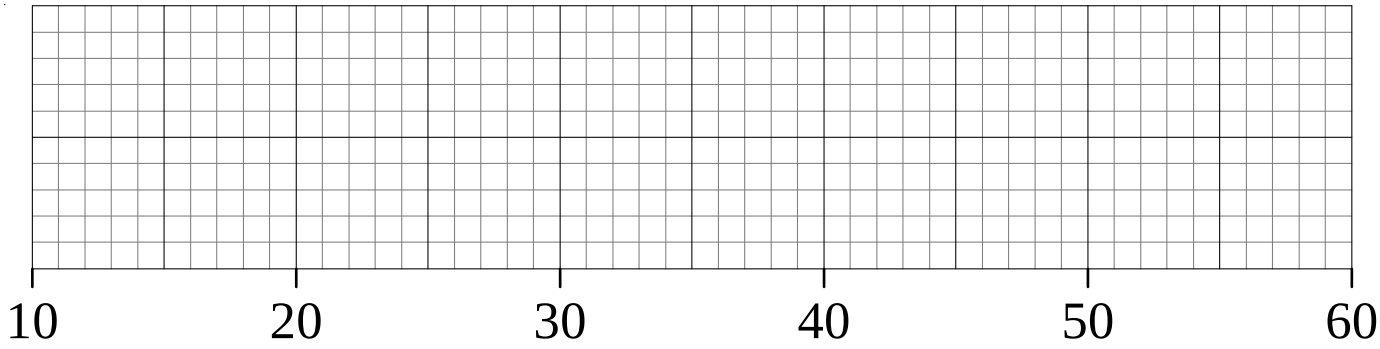
b) What is the interquartile range of the ages of the teachers?

2) A warehouse has 60 employees working in it.

The age of the youngest employee is 16 years.
The age of the oldest employee is 55 years.

The median age is 37 years.
The lower quartile age is 29 years.
The upper quartile age is 43 years.

On the grid below, draw a box plot to show information about the ages of the employees.



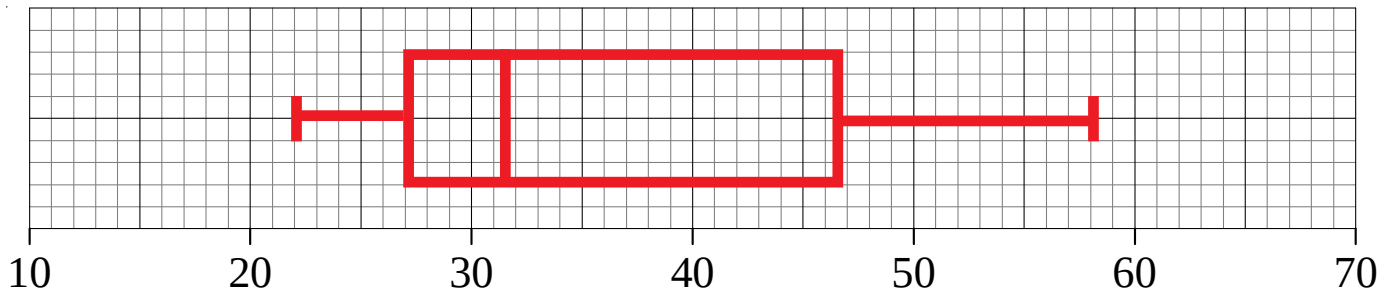
Box Plots

1) The ages of 20 teachers are listed below.

27 31.5 46.5

22, 22, 24, 25, 27, 27, 28, 29, 29, 29, 34, 35, 41, 43, 44, 49, 55, 57, 58, 58

a) On the grid below, draw a box plot to show the information about the teachers.



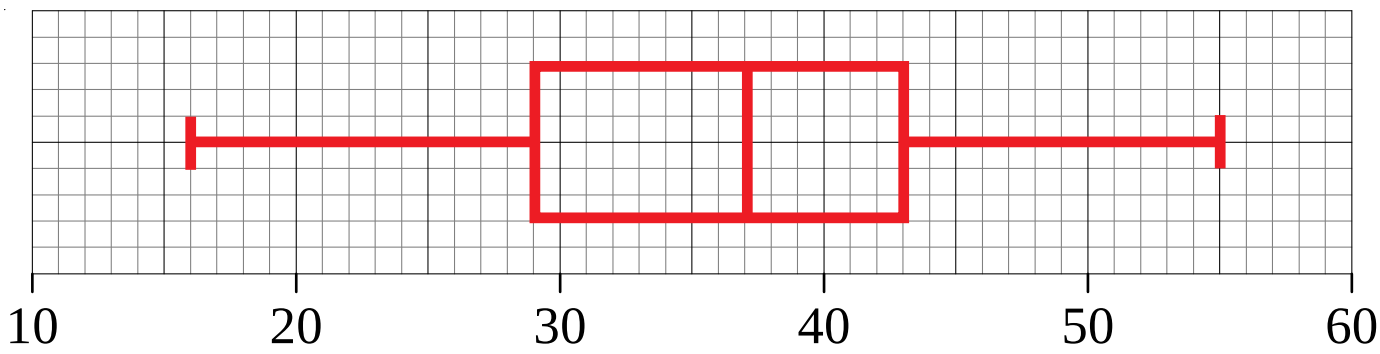
b) What is the interquartile range of the ages of the teachers? 19.5 years

2) A warehouse has 60 employees working in it.

The age of the youngest employee is 16 years.
The age of the oldest employee is 55 years.

The median age is 37 years.
The lower quartile age is 29 years.
The upper quartile age is 43 years.

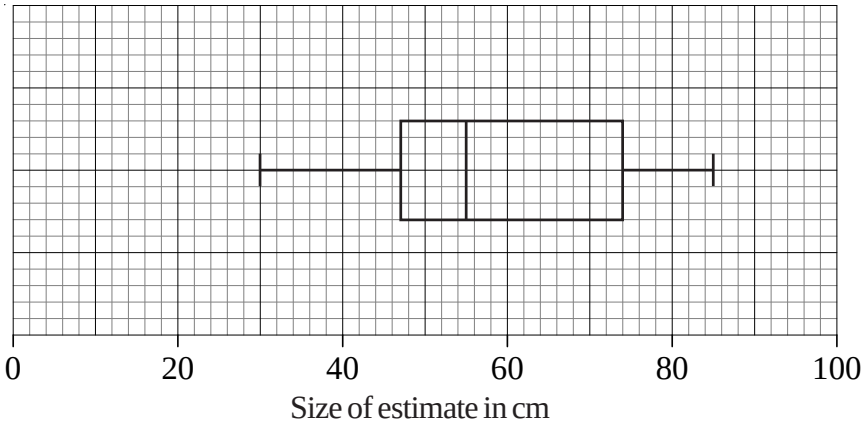
On the grid below, draw a box plot to show information about the ages of the employees.



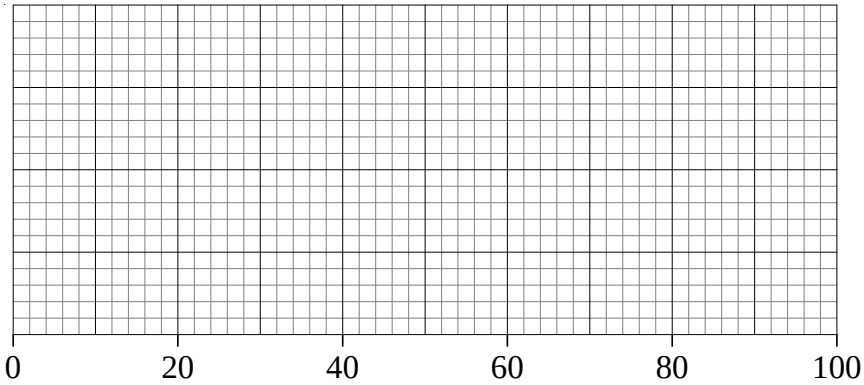
Box Plots

1) Terry drew a line of length 60 cm.
He asked some children to estimate the length of the line he had drawn.
He recorded their estimates.
The box plot gives some information about these estimates.

Children's estimates



Adults' estimates



a) Write down the median of the children's estimates.

b) Write down the interquartile range of the children's estimates.

Terry then asked some adults to estimate the length of the line he had drawn.
The table gives some information about the adults' estimates.

	Length
Lowest estimate	20 cm
Lower quartile	45 cm
Median	62 cm
Upper quartile	75 cm
Highest estimate	95 cm

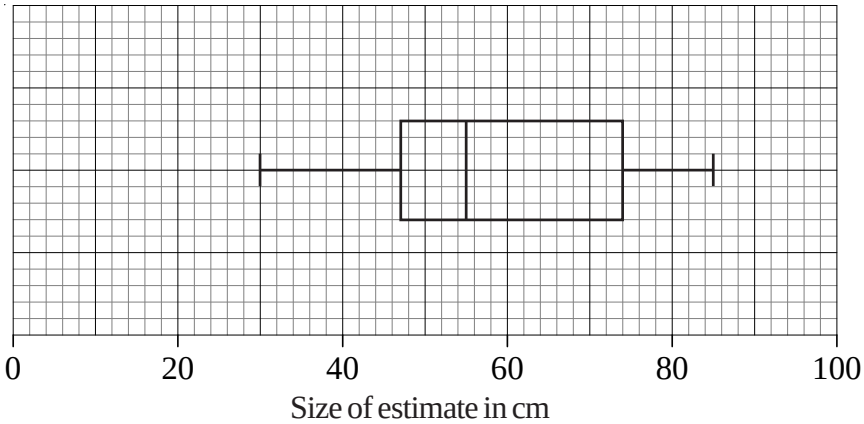
c) On the grid above, draw a box plot to show this information.

d) Use the two box plots to compare the distribution of the children's estimates with the distribution of the adults' estimates.

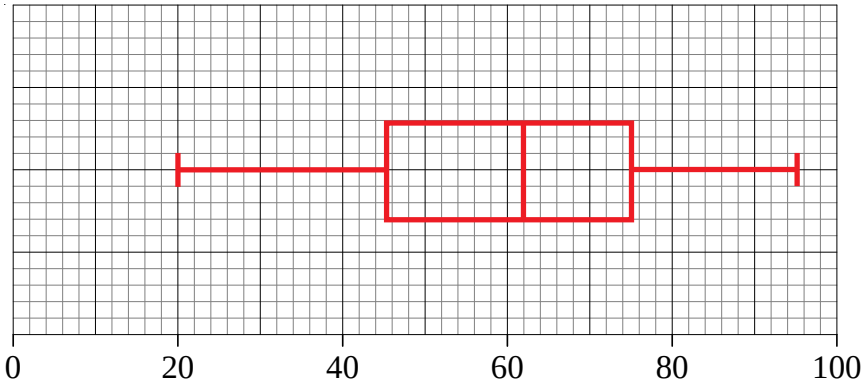
Box Plots

1) Terry drew a line of length 60 cm.
He asked some children to estimate the length of the line he had drawn.
He recorded their estimates.
The box plot gives some information about these estimates.

Children's estimates



Adults' estimates



a) Write down the median of the children's estimates. 55 cm

b) Write down the interquartile range of the children's estimates. 74 – 47 = 27 cm

Terry then asked some adults to estimate the length of the line he had drawn.
The table gives some information about the adults' estimates.

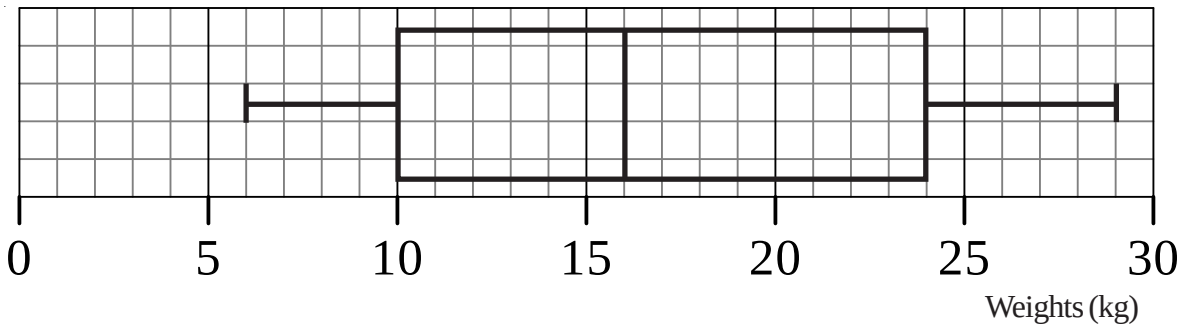
	Length
Lowest estimate	20 cm
Lower quartile	45 cm
Median	62 cm
Upper quartile	75 cm
Highest estimate	95 cm

c) On the grid above, draw a box plot to show this information.

d) Use the two box plots to compare the distribution of the children's estimates with the distribution of the adults' estimates. The median estimate is bigger for adults
or The interquartile range is bigger for adults
or The range is bigger for adults

Box Plots

1) The box plot gives information about the distribution of the weights of bags on a plane.



a) Claude says that the heaviest bag weighs 24 kg.
He is **wrong**.
Explain why.

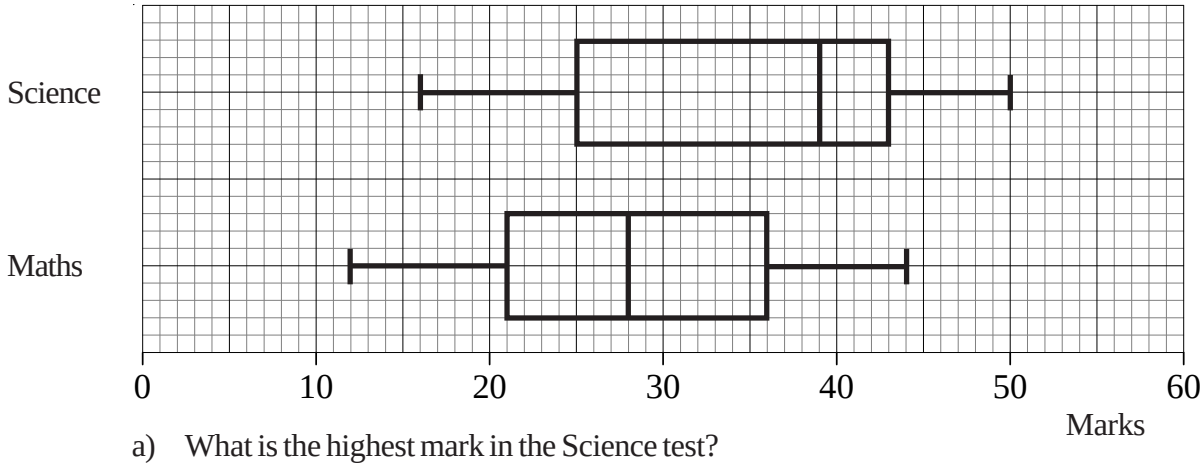
b) Write down the median weight.

c) Work out the interquartile range of the weights.

There are 240 bags on the plane.

d) Work out the number of bags with a weight of 10 kg or less.

2) The box plots show the distribution of marks in a Science and Maths test for a group of students.



a) What is the highest mark in the Science test?

b) Compare the distribution of the marks in the Science test and marks in the Maths test.

1 .....

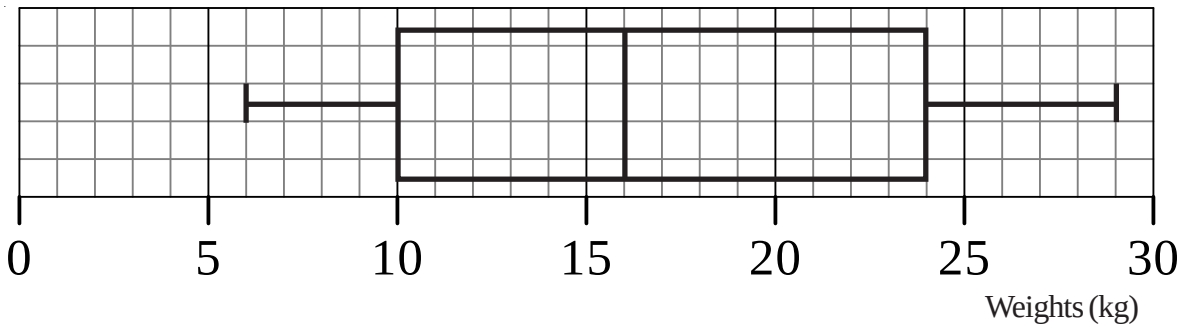
.....

2 .....

.....

Box Plots

1) The box plot gives information about the distribution of the weights of bags on a plane.



a) Claude says that the heaviest bag weighs 24 kg.
He is **wrong**.
Explain why. The heaviest bag is 29 kg

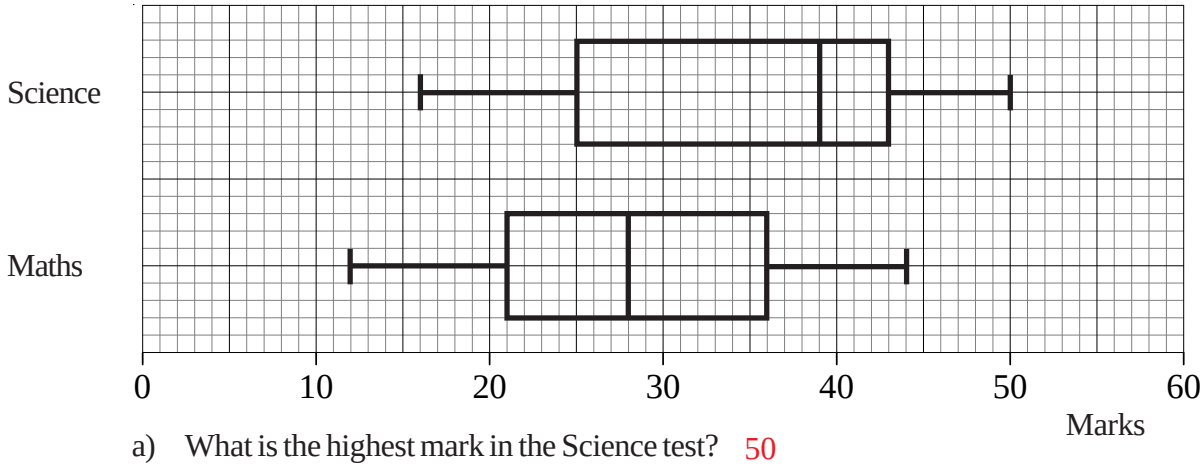
b) Write down the median weight. 16 kg

c) Work out the interquartile range of the weights. 24 – 10 = 14 kg

There are 240 bags on the plane.

d) Work out the number of bags with a weight of 10 kg or less. 60 bags
10 kg is the lower quartile which means a quarter of 240 bags are 10 kg or less. A quarter of 240 is 60.

2) The box plots show the distribution of marks in a Science and Maths test for a group of students.

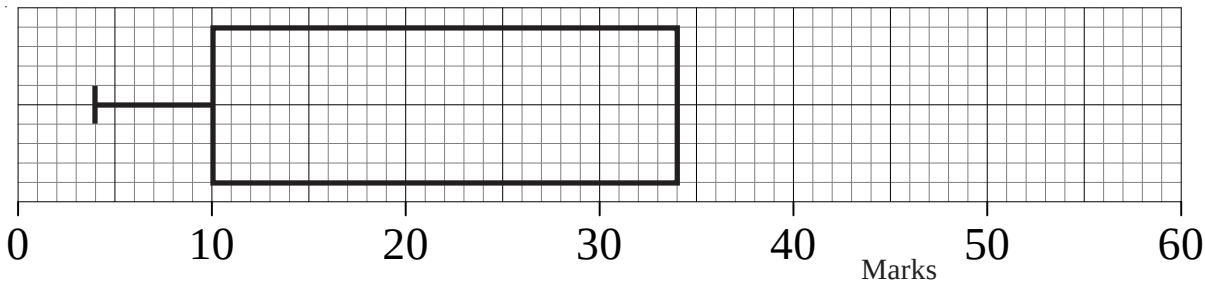


a) What is the highest mark in the Science test? 50

b) Compare the distribution of the marks in the Science test and marks in the Maths test.
1 The interquartile range for Science is bigger than for Maths.
2 The median Science mark is bigger than the median Maths mark.

Box Plots

1) The incomplete box plot and table show some information about some marks.

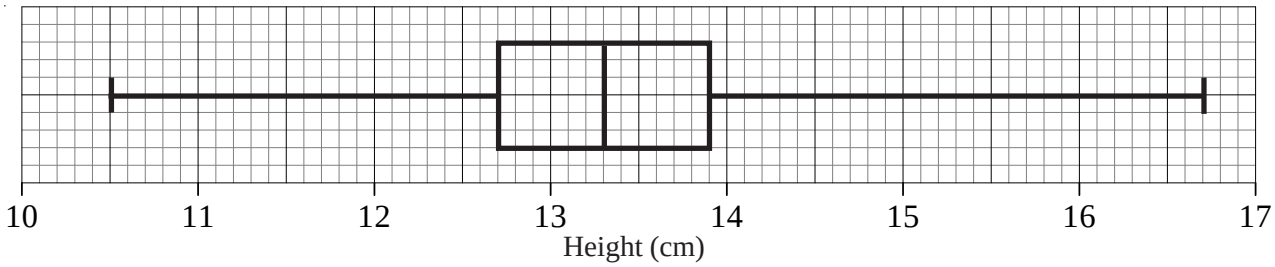


	Marks
Lowest mark	4
Lower quartile	
Median	30
Upper quartile	34
Highest mark	55

a) Use the information in the table to complete the box plot.

b) Use the information in the box plot to complete the table.

2) Kim measured the height, in cm, of each tomato plant in her greenhouse.
She used the results to draw the box plot shown below.



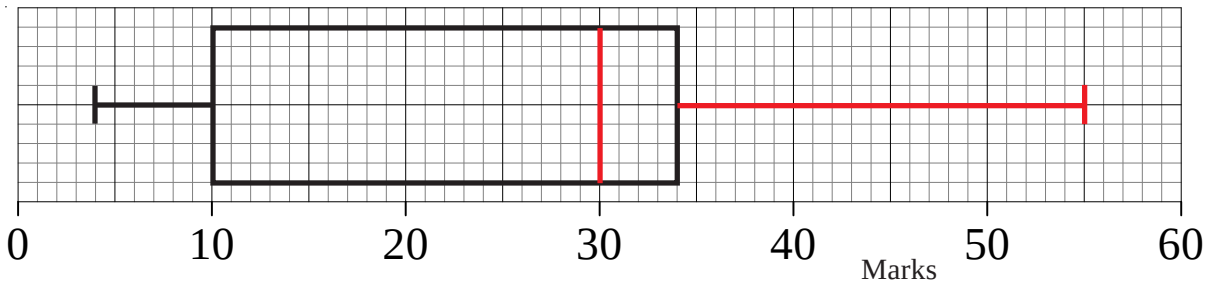
a) Write down the median height.

b) Work out the interquartile range.

c) Explain why the interquartile range may be a better measure of spread than the range.

Box Plots

1) The incomplete box plot and table show some information about some marks.

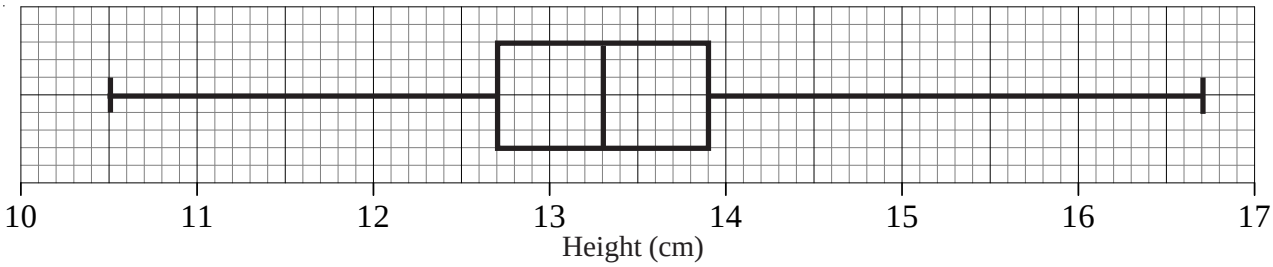


	Marks
Lowest mark	4
Lower quartile	10
Median	30
Upper quartile	34
Highest mark	55

a) Use the information in the table to complete the box plot.

b) Use the information in the box plot to complete the table.

2) Kim measured the height, in cm, of each tomato plant in her greenhouse.
She used the results to draw the box plot shown below.



a) Write down the median height. 13.3 cm

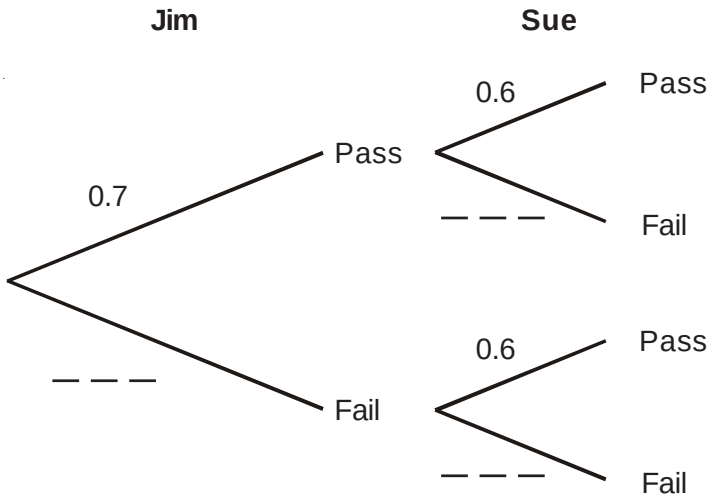
b) Work out the interquartile range. 13.9 – 12.7 = 1.2 cm

c) Explain why the interquartile range may be a better measure of spread than the range. It avoids the outlandishly tall and short plants.

Simple Tree Diagrams

1) Jim and Sue each take a driving test.
The probability that Jim will pass the driving test is 0.7
The probability that Sue will pass the driving test is 0.6

a) Complete the probability tree diagram.



b) Work out the probability that both Jim and Sue will pass the driving test.

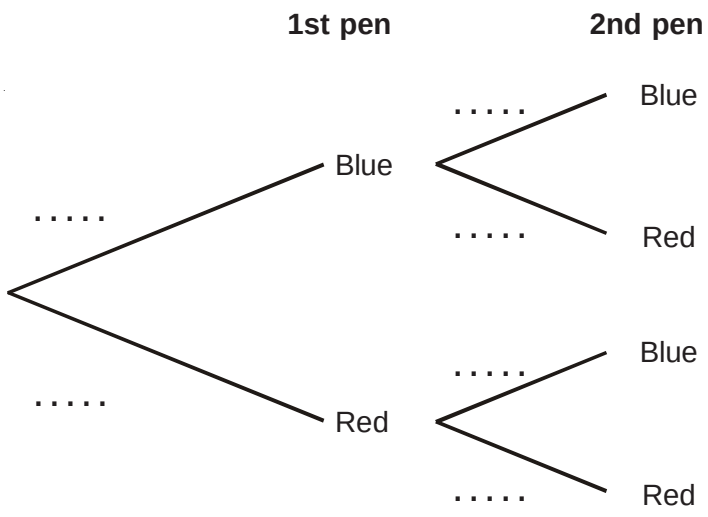
c) Work out the probability that only one of them will pass the driving test.

2) Terri has 7 pens in a box.
2 of the pens are blue.
5 of the pens are red.

Terri takes at random a pen from the box and writes down its colour.
Terri puts the pen back in the box.

Then Terri takes at random a second pen from the box and writes down its colour.

a) Complete the probability tree diagram.

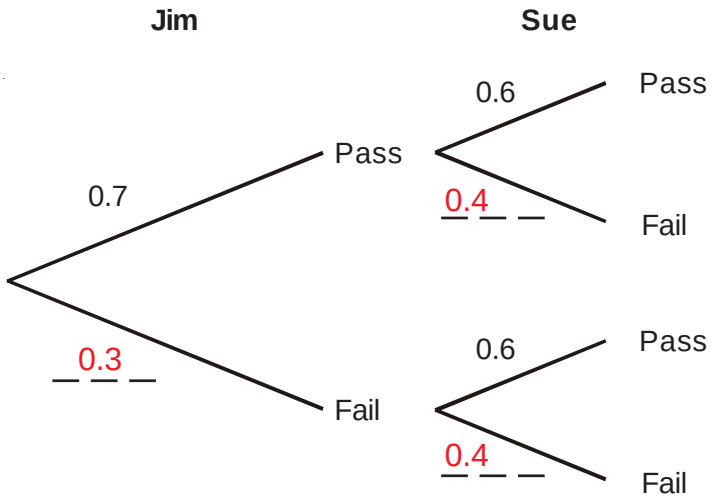


b) Work out the probability that Terri takes exactly one pen of each colour from the box.

Simple Tree Diagrams

1) Jim and Sue each take a driving test.
The probability that Jim will pass the driving test is 0.7
The probability that Sue will pass the driving test is 0.6

a) Complete the probability tree diagram.



b) Work out the probability that both Jim and Sue will pass the driving test. 0.42

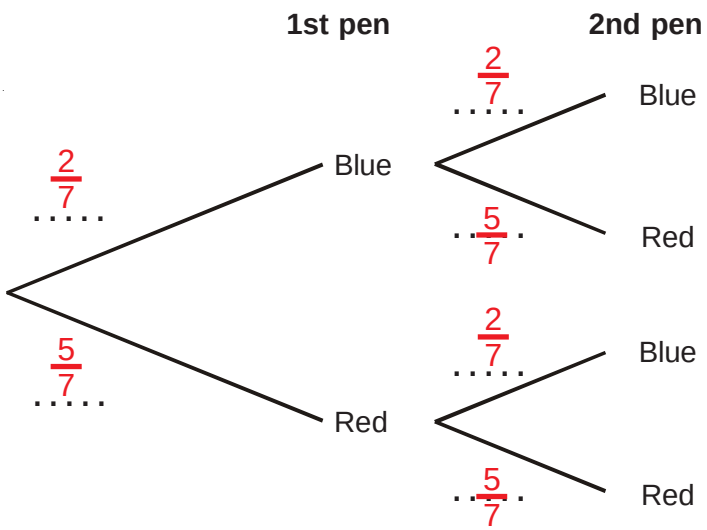
c) Work out the probability that only one of them will pass the driving test. 0.28 + 0.18 = 0.46

2) Terri has 7 pens in a box.
2 of the pens are blue.
5 of the pens are red.

Terri takes at random a pen from the box and writes down its colour.
Terri puts the pen back in the box.

Then Terri takes at random a second pen from the box and writes down its colour.

a) Complete the probability tree diagram.



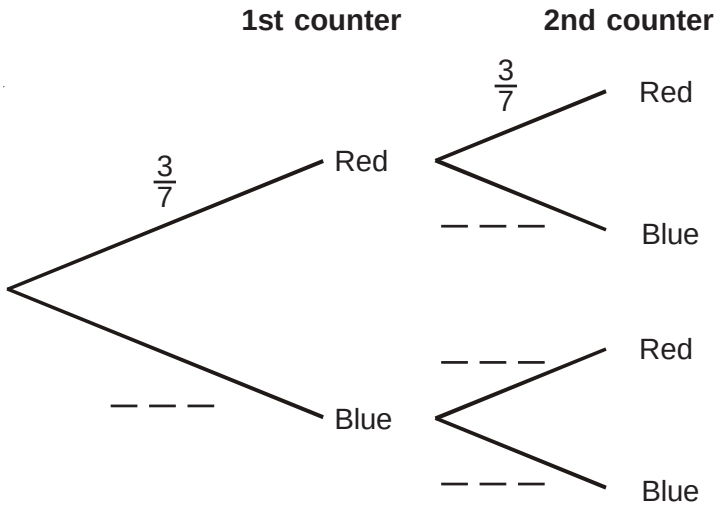
$\frac{10}{49} + \frac{10}{49} = \frac{20}{49}$

b) Work out the probability that Terri takes exactly one pen of each colour from the box.

Simple Tree Diagrams

1) Tim puts 3 red counters and 4 blue counters in a bag.
He takes at random a counter from the bag.
He writes down the colour of the counter.
He puts the counter in the bag again.
He then takes at random a second counter from the bag.

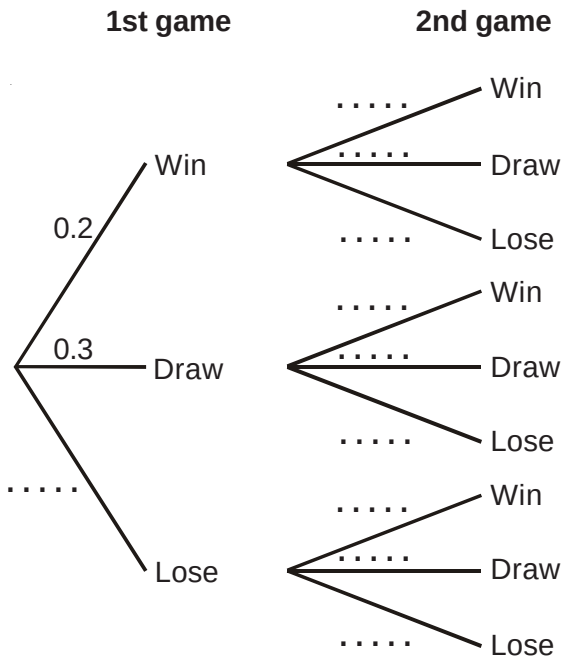
a) Complete the probability tree diagram.



b) Work out the probability that Tim takes two red counters.

2) In a game of chess, a player can either win, lose or draw.
The probability that Jane wins any game of chess is 0.2
The probability that Jane draws any game of chess is 0.3
Jane plays 2 games of chess.

a) Complete the probability tree diagram.

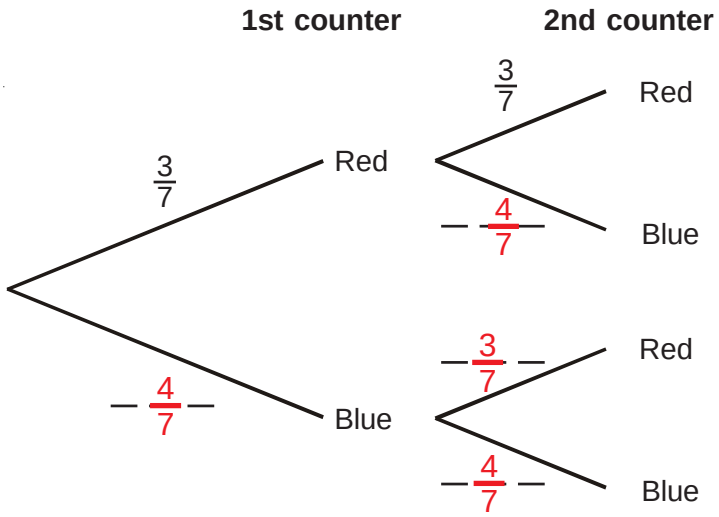


b) Work out the probability that Jane will win both games.

Simple Tree Diagrams

1) Tim puts 3 red counters and 4 blue counters in a bag.
He takes at random a counter from the bag.
He writes down the colour of the counter.
He puts the counter in the bag again.
He then takes at random a second counter from the bag.

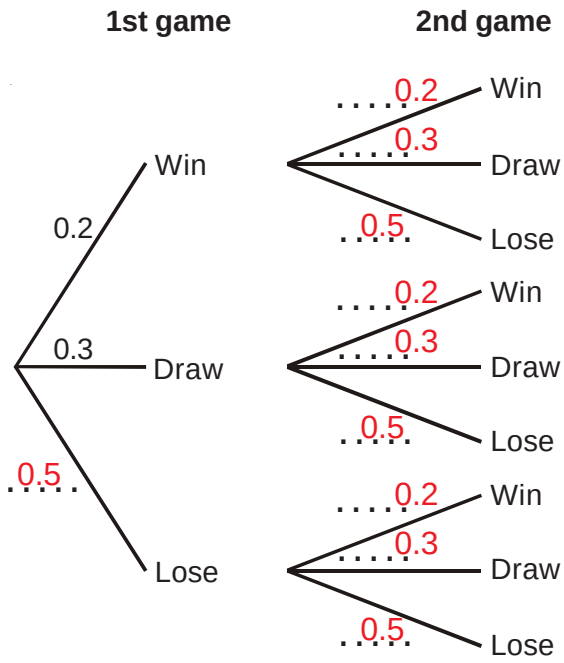
a) Complete the probability tree diagram.



b) Work out the probability that Tim takes two red counters. $\frac{9}{49}$

2) In a game of chess, a player can either win, lose or draw.
The probability that Jane wins any game of chess is 0.2
The probability that Jane draws any game of chess is 0.3
Jane plays 2 games of chess.

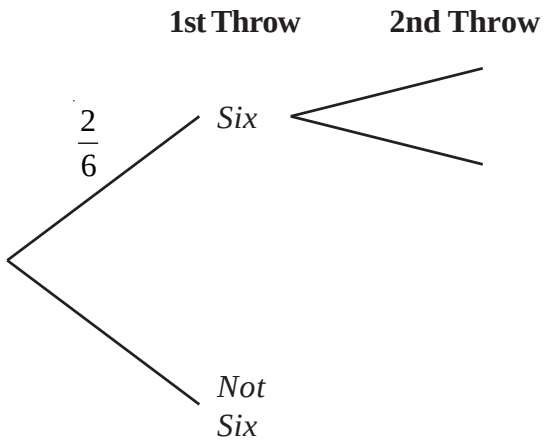
a) Complete the probability tree diagram.



b) Work out the probability that Jane will win both games. 0.04

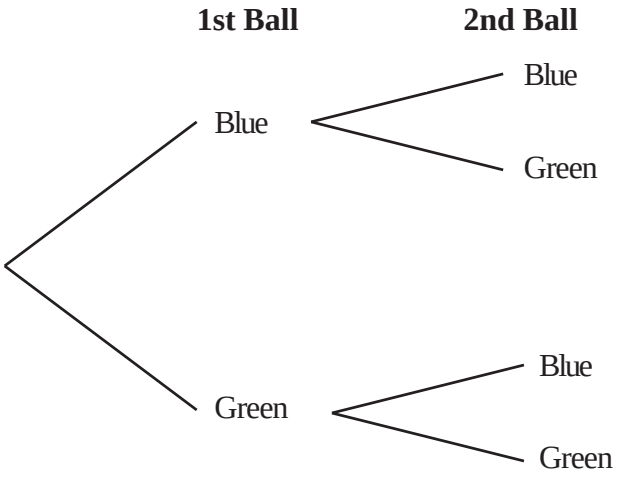
Simple Tree Diagrams

1) Lucy throws a biased dice twice.
Complete the probability tree diagram to show the outcomes.
Label clearly the branches of the tree diagram.



2) A bag contains 10 coloured balls.
7 of the balls are blue and 3 of the balls are green.
Nathan is going to take a ball, replace it, and then take a second ball.

a) Complete the tree diagram.



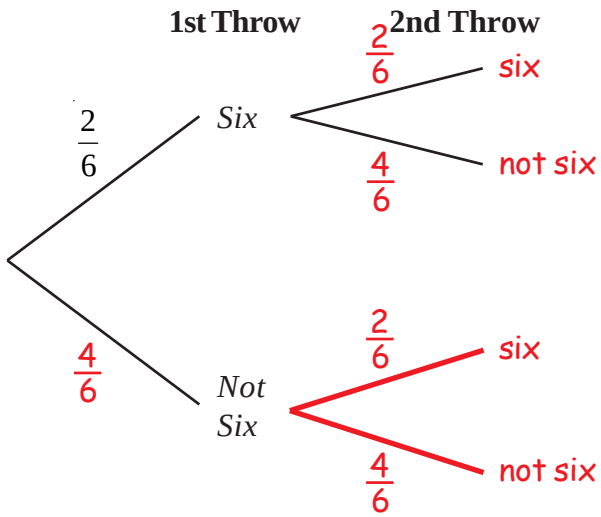
b) Work out the probability that Nathan will take two blue balls.

c) Work out the probability that Nathan will take one of each coloured balls.

d) Work out the probability that Nathan will take two balls of the same colour.

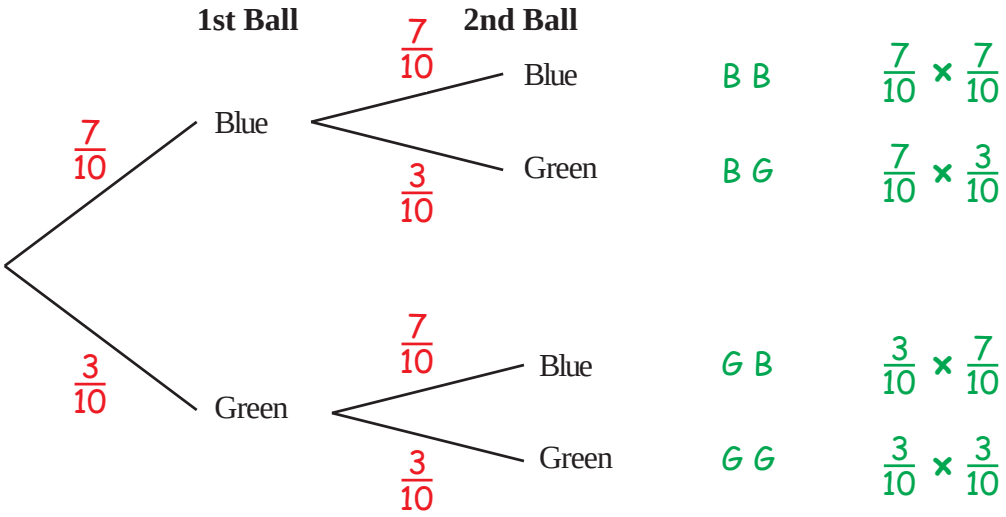
Simple Tree Diagrams

1) Lucy throws a biased dice twice.
Complete the probability tree diagram to show the outcomes.
Label clearly the branches of the tree diagram.



2) A bag contains 10 coloured balls.
7 of the balls are blue and 3 of the balls are green.
Nathan is going to take a ball, replace it, and then take a second ball.

a) Complete the tree diagram.



b) Work out the probability that Nathan will take two blue balls. $\frac{49}{100}$ $\frac{7}{10} \times \frac{7}{10}$

c) Work out the probability that Nathan will take one of each coloured balls. $\frac{42}{100}$ $\frac{21}{100} + \frac{21}{100}$

d) Work out the probability that Nathan will take two balls of the same colour. $\frac{58}{100}$ $\frac{49}{100} + \frac{9}{100}$

Harder Tree Diagrams

1) There are 5 red pens, 3 blue pens and 2 green pens in a box.
Jerry takes at random a pen from the box and gives the pen to his friend.
Jerry then takes at random another pen from the box.
Work out the probability that both pens are the same colour.

2) There are 3 red sweets, 2 blue sweets and 4 green sweets in a bag.
Jack takes a sweet at random.
He eats the sweet.
He then takes another sweet at random.

Work out the probability that both sweets are the same colour.

3) There are 13 buttons in a bag.
9 buttons are white.
4 buttons are black.
Carol takes a button at random from the bag, and keeps it.
She now takes another button from the bag.

Work out the probability that Carol takes a button of each colour.

Harder Tree Diagrams

1) There are 5 red pens, 3 blue pens and 2 green pens in a box.
Jerry takes at random a pen from the box and gives the pen to his friend.
Jerry then takes at random another pen from the box.
Work out the probability that both pens are the same colour. $\frac{28}{90}$

2) There are 3 red sweets, 2 blue sweets and 4 green sweets in a bag.
Jack takes a sweet at random.
He eats the sweet.
He then takes another sweet at random.

Work out the probability that both sweets are the same colour. $\frac{20}{72}$

3) There are 13 buttons in a bag.
9 buttons are white.
4 buttons are black.
Carol takes a button at random from the bag, and keeps it.
She now takes another button from the bag.

Work out the probability that Carol takes a button of each colour. $\frac{72}{156}$

Harder Tree Diagrams

1) A bag contains 7 green and 3 yellow balls.
A ball is taken from the bag at random and not replaced.
Another ball is taken from the bag at random.

a) Draw a tree diagram to show all the possibilities.
b) What is the probability that both balls are different colours?

2) A box contains 5 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
Another counter is taken at random.

a) Draw a tree diagram to show all the possibilities.
b) What is the probability of choosing at least one blue counter?
c) What is the probability of choosing two counters of the same colour?
d) What is the probability of choosing two counters of different colours?

3) A box contains 4 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
A second counter is taken from the box at random and not replaced.
A third counter is taken from the box.

a) Draw a tree diagram to show all the possibilities.
b) What is the probability that all three counters are the same colour?
c) What is the probability that exactly two of the counters are red?

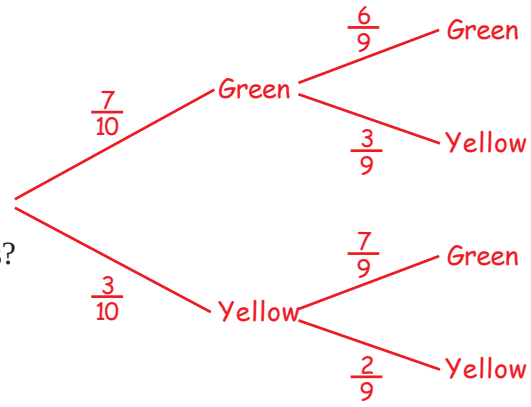
Harder Tree Diagrams

1) A bag contains 7 green and 3 yellow balls.
A ball is taken from the bag at random and not replaced.
Another ball is taken from the bag at random.

a) Draw a tree diagram to show all the possibilities.

b) What is the probability that both balls are different colours?
$\frac{42}{90}$

a)



2) A box contains 5 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
Another counter is taken at random.

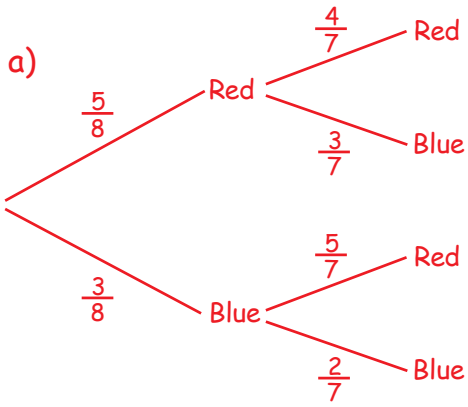
a) Draw a tree diagram to show all the possibilities.

b) What is the probability of choosing at least one blue counter? $\frac{36}{56}$

c) What is the probability of choosing two counters of the same colour? $\frac{26}{56}$

d) What is the probability of choosing two counters of different colours? $\frac{30}{56}$

a)



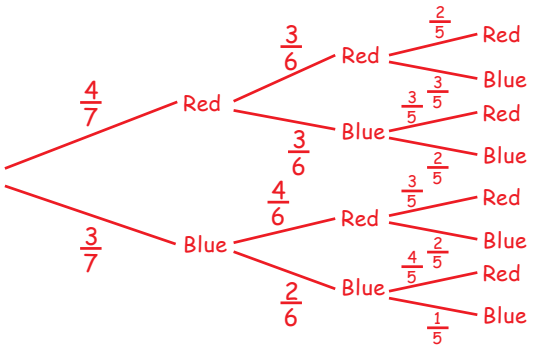
3) A box contains 4 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
A second counter is taken from the box at random and not replaced.
A third counter is taken from the box.

a) Draw a tree diagram to show all the possibilities.

b) What is the probability that all three counters are the same colour? $\frac{30}{210}$

c) What is the probability that exactly two of the counters are red? $\frac{108}{210}$

a)

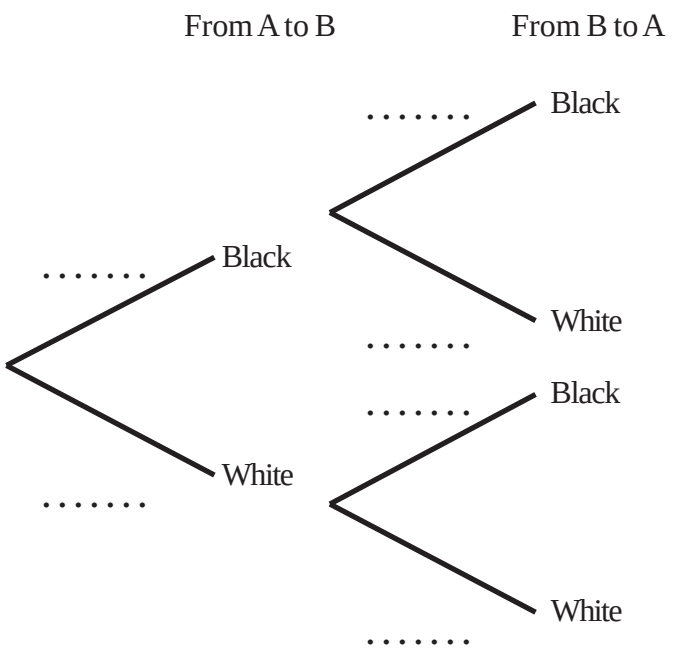


Harder Tree Diagrams

1) Sara has two boxes.
There are 6 black and 4 white counters in box A.
There are 7 black and 3 white counters in box B.

Sara takes at random a counter from box A and puts it in box B.
She then takes at random a counter from box B and puts it in box A.

a) Complete the probability tree diagram.



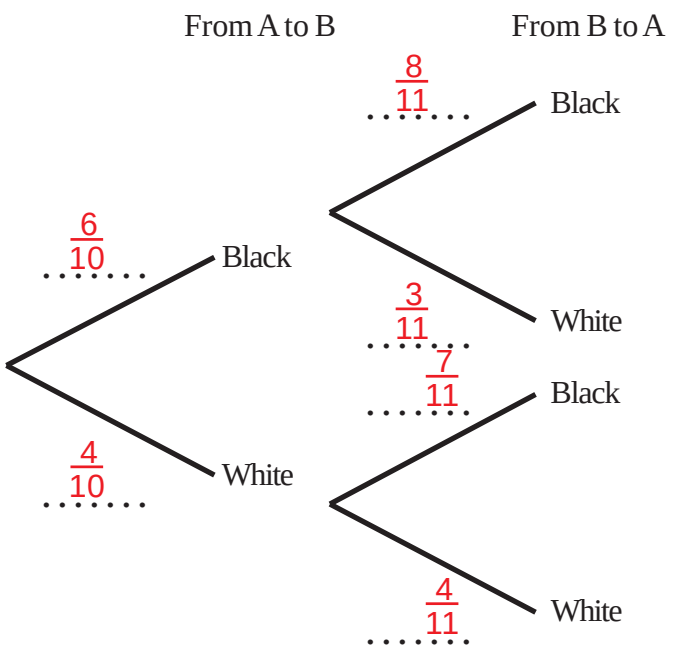
b) Find the probability that after Sara has put the counters from box B into box A there will still be 6 black counters and 4 white counters in box A.

Harder Tree Diagrams

1) Sara has two boxes.
There are 6 black and 4 white counters in box A.
There are 7 black and 3 white counters in box B.

Sara takes at random a counter from box A and puts it in box B.
She then takes at random a counter from box B and puts it in box A.

a) Complete the probability tree diagram.



b) Find the probability that after Sara has put the counters from box B into box A there will still be 6 black counters and 4 white counters in box A. $\frac{64}{110}$

Recurring Decimals

1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \frac{8}{11}$

2) a) Change $\frac{4}{9}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \frac{19}{33}$

3) a) Change $\frac{3}{11}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$

4) a) Change $\frac{1}{6}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{1}3\dot{5} = \frac{5}{37}$

5) a) Convert the recurring decimal $0.\dot{2}6\dot{1}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.2\dot{7} = \frac{5}{18}$

6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \frac{3}{22}$

Recurring Decimals

1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form. $\frac{4}{11}$

$x = 0.3636...$
$100x = 36.3636...$
$99x = 36$
$x = \frac{36}{99} = \frac{4}{11}$

b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \frac{8}{11}$

$0.\dot{7}\dot{2} = 2 \times 0.\dot{3}\dot{6}$
$0.\dot{7}\dot{2} = 2 \times \frac{4}{11}$
$0.\dot{7}\dot{2} = \frac{8}{11}$

2) a) Change $\frac{4}{9}$ to a decimal. $0.\dot{4}$

$$\begin{array}{r} 0.44 \\ 9\,\overline{)\,4\,\overset{4}{0}\,\overset{4}{0}} \end{array}$$

b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \frac{19}{33}$

$x = 0.5757...$
$100x = 57.5757...$
$99x = 57$
$x = \frac{57}{99} = \frac{19}{33}$

3) a) Change $\frac{3}{11}$ to a decimal. $0.\dot{2}\dot{7}$

b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$

$x = 0.4545...$
$100x = 45.4545...$
$99x = 45$
$x = \frac{45}{99} = \frac{15}{33}$

4) a) Change $\frac{1}{6}$ to a decimal. $0.1\dot{6}$

$$\begin{array}{r} 0.166 \\ 6\,\overline{)\,1\,\overset{4}{0}\,\overset{4}{0}\,\overset{4}{0}} \end{array}$$

b) Prove that the recurring decimal $0.\dot{1}3\dot{5} = \frac{5}{37}$

$x = 0.135135...$
$1000x = 135.135135...$
$999x = 135$
$x = \frac{135}{999} = \frac{5}{37}$

5) a) Convert the recurring decimal $0.\dot{2}6\dot{1}$ to a fraction in its simplest form. $\frac{29}{111}$

$0.\dot{2}6\dot{1} = \frac{261}{999}$

b) Prove that the recurring decimal $0.2\dot{7} = \frac{5}{18}$

$x = 0.2777...$
$100x = 27.777...$
$99x = 27.5$
$x = \frac{27.5}{99} = \frac{55}{198} = \frac{5}{18}$

6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form.

$x = 5.222...$
$10x = 52.222...$
$9x = 47$
$x = \frac{47}{9} = 5\frac{2}{9}$

b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \frac{3}{22}$

$x = 0.13636...$
$100x = 13.63636...$
$99x = 13.5$
$x = \frac{13.5}{99} = \frac{27}{198} = \frac{3}{22}$

Fractional and Negative Indices

1) Simplify the following:

a) $y^4 \times y^5$

b) $x^2 \times x^6$

c) $(p^4)^5$

d) $(x^3)^2$

e) $(x^4)^{-2}$

f) $(x^{-3})^{-5}$

g) $x^7 \div x^2$

h) $\dfrac{t^5}{t^3}$

2) Work out the value of the following, leaving your answer in fraction form when necessary

a) 5^0

b) 4^{-2}

c) 5^{-3}

d) $49^{\frac{1}{2}}$

e) $8^{\frac{1}{3}}$

f) $32^{\frac{2}{5}}$

g) $16^{-\frac{1}{2}}$

h) $27^{-\frac{1}{3}}$

i) $64^{-\frac{2}{3}}$

3) $5\sqrt{5}$ can be written in the form 5^n.

Calculate the value of n.

4) $2\sqrt{8}$ can be written in the form 2^n.

Calculate the value of n.

5) $a = 2^x$, $b = 2^y$

Express in terms of a and b

(i) 2^{x+y}

(ii) 2^{2x}

(iii) 2^{x+2y}

Fractional and Negative Indices

1) Simplify the following:

a) $y^4 \times y^5$ y^9

b) $x^2 \times x^6$ x^8

c) $(p^4)^5$ p^{20}

d) $(x^3)^2$ x^6

e) $(x^4)^{-2}$ x^{-8}

f) $(x^{-3})^{-5}$ x^{15}

g) $x^7 \div x^2$ x^5

h) $\dfrac{t^5}{t^3}$ t^2

2) Work out the value of the following, leaving your answer in fraction form when necessary

a) 5^0 1

b) 4^{-2} $\frac{1}{16}$

c) 5^{-3} $\frac{1}{125}$

d) $49^{\frac{1}{2}}$ 7

e) $8^{\frac{1}{3}}$ 2

f) $32^{\frac{2}{5}}$ 4

g) $16^{-\frac{1}{2}}$ $\frac{1}{4}$

h) $27^{-\frac{1}{3}}$ $\frac{1}{3}$

i) $64^{-\frac{2}{3}}$ $\frac{1}{16}$

3) $5\sqrt{5}$ can be written in the form 5^n.

Calculate the value of n. $1\frac{1}{2}$

4) $2\sqrt{8}$ can be written in the form 2^n.

Calculate the value of n. $2\frac{1}{2}$

5) $a = 2^x$, $b = 2^y$

Express in terms of a and b

(i) 2^{x+y} ab

(ii) 2^{2x} a^2

(iii) 2^{x+2y} ab^2

Surds

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$

b) $\sqrt{3} \times \sqrt{3}$

c) $\sqrt{20}$

d) $\sqrt{24}$

e) $\sqrt{72}$

f) $\sqrt{200}$

g) $\sqrt{\frac{2}{25}}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$

b) $\sqrt{8} \times \sqrt{32}$

c) $\sqrt{99} \times \sqrt{22}$

d) $\sqrt{45} \times \sqrt{20}$

e) $\sqrt{18} \times \sqrt{128}$

f) $\sqrt{28} \times \sqrt{175}$

3) Expand and simplify where possible:

a) $\sqrt{3}(3-\sqrt{3})$

b) $\sqrt{2}(6+2\sqrt{2})$

c) $\sqrt{7}(2+3\sqrt{7})$

d) $\sqrt{2}(\sqrt{32}-\sqrt{8})$

4) Expand and simplify where possible:

a) $(1+\sqrt{2})(1-\sqrt{2})$

b) $(3+\sqrt{5})(2-\sqrt{5})$

c) $(\sqrt{3}+2)(\sqrt{3}+4)$

d) $(\sqrt{5}-3)(\sqrt{5}+1)$

e) $(2+\sqrt{7})(2-\sqrt{7})$

f) $(\sqrt{6}-3)^2$

5) Work out the following, giving your answer in its simplest form:

a) $\frac{(5+\sqrt{3})(5-\sqrt{3})}{\sqrt{22}}$

b) $\frac{(4-\sqrt{5})(4+\sqrt{5})}{\sqrt{11}}$

c) $\frac{(3-\sqrt{2})(3+\sqrt{2})}{\sqrt{14}}$

d) $\frac{(\sqrt{3}+1)^2}{\sqrt{3}}$

e) $\frac{(\sqrt{5}+3)^2}{\sqrt{20}}$

f) $\frac{(5-\sqrt{5})(2+2\sqrt{5})}{\sqrt{20}}$

Surds

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$ 7

b) $\sqrt{3} \times \sqrt{3}$ 3

c) $\sqrt{20}$ $2\sqrt{5}$

d) $\sqrt{24}$ $2\sqrt{6}$

e) $\sqrt{72}$ $6\sqrt{2}$

f) $\sqrt{200}$ $10\sqrt{2}$

g) $\sqrt{\frac{2}{25}}$ $\frac{\sqrt{2}}{5}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$ 6

b) $\sqrt{8} \times \sqrt{32}$ 16

c) $\sqrt{99} \times \sqrt{22}$ $33\sqrt{2}$

d) $\sqrt{45} \times \sqrt{20}$ 30

e) $\sqrt{18} \times \sqrt{128}$ 48

f) $\sqrt{28} \times \sqrt{175}$ 70

3) Expand and simplify where possible:

a) $\sqrt{3}(3-\sqrt{3})$ $3\sqrt{3} - 3$

b) $\sqrt{2}(6+2\sqrt{2})$ $6\sqrt{2} + 4$

c) $\sqrt{7}(2+3\sqrt{7})$ $2\sqrt{7} + 21$

d) $\sqrt{2}(\sqrt{32}-\sqrt{8})$ 4

4) Expand and simplify where possible:

a) $(1+\sqrt{2})(1-\sqrt{2})$ -1

b) $(3+\sqrt{5})(2-\sqrt{5})$ $1 - \sqrt{5}$

c) $(\sqrt{3}+2)(\sqrt{3}+4)$ $11 + 6\sqrt{3}$

d) $(\sqrt{5}-3)(\sqrt{5}+1)$ $2 - 2\sqrt{5}$

e) $(2+\sqrt{7})(2-\sqrt{7})$ -3

f) $(\sqrt{6}-3)^2$ $15 - 6\sqrt{6}$

5) Work out the following, giving your answer in its simplest form:

a) $\frac{(5+\sqrt{3})(5-\sqrt{3})}{\sqrt{22}}$ $\sqrt{22}$

b) $\frac{(4-\sqrt{5})(4+\sqrt{5})}{\sqrt{11}}$ $\sqrt{11}$

c) $\frac{(3-\sqrt{2})(3+\sqrt{2})}{\sqrt{14}}$ $\frac{\sqrt{14}}{2}$

d) $\frac{(\sqrt{3}+1)^2}{\sqrt{3}}$ $\frac{4\sqrt{3} + 6}{3}$

e) $\frac{(\sqrt{5}+3)^2}{\sqrt{20}}$ $\frac{7\sqrt{5} + 15}{5}$

f) $\frac{(5-\sqrt{5})(2+2\sqrt{5})}{\sqrt{20}}$ 4

Surds

1) $\sqrt{5} = 5^k$

a) Write down the value of k.

b) Expand and simplify $(2+\sqrt{5})(1+\sqrt{5})$

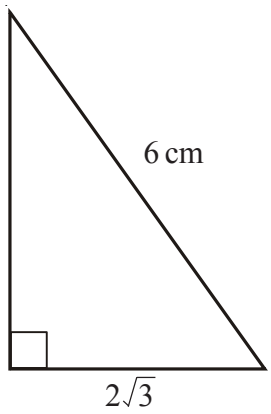
Give your answer in the form $a + b\sqrt{c}$

where a, b and c are integers.

2) The diagram shows a right-angled triangle with lengths of sides as indicated.

The area of the triangle is A cm^2

Show that $A = k\sqrt{2}$ giving the value of k.



3) a) Find the value of $64^{-\frac{2}{3}}$

b) Given that

$$\frac{8-\sqrt{18}}{\sqrt{2}} = a + b\sqrt{2}$$, where a and b are integers,

find the value of a and the value of b.

4) Work out $(2+\sqrt{3})(2-\sqrt{3})$

Give your answer in its simplest form.

Surds

1) $\sqrt{5} = 5^k$

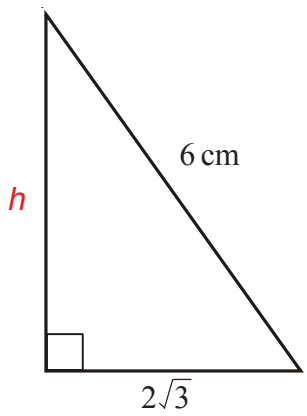
a) Write down the value of k. $\frac{1}{2}$

b) Expand and simplify $(2+\sqrt{5})(1+\sqrt{5})$

Give your answer in the form $a + b\sqrt{c}$ $7 + 3\sqrt{5}$

where a, b and c are integers.

2) The diagram shows a right-angled triangle with lengths of sides as indicated.



The area of the triangle is A cm^2

Show that $A = k\sqrt{2}$ giving the value of k.

$h^2 = 6^2 - (2\sqrt{3})^2$
$= 36 - 12$
$= 24$

$h = \sqrt{24}$
$h = 2\sqrt{6}$

Area $= \dfrac{2\sqrt{3} \times 2\sqrt{6}}{2}$

$= 2\sqrt{3}\sqrt{6}$
$= 2\sqrt{18}$
$= 6\sqrt{2}$ $k = 6$

3) a) Find the value of $64^{-\frac{2}{3}}$ $\frac{1}{16}$

b) Given that

$$\frac{8-\sqrt{18}}{\sqrt{2}} = a + b\sqrt{2}$$, where a and b are integers,

find the value of a and the value of b.

$\dfrac{8-\sqrt{18}}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{8\sqrt{2}-\sqrt{36}}{2}$

$= \dfrac{8\sqrt{2}-6}{2}$

$= 4\sqrt{2} - 3$

$= -3 + 4\sqrt{2}$

$a = -3$ and $b = 4$

4) Work out $(2+\sqrt{3})(2-\sqrt{3})$ 1

Give your answer in its simplest form.

Rationalising the Denominator

1) Rationalise the denominator, simplifying where possible:

a) $\dfrac{3}{\sqrt{2}}$

b) $\dfrac{2}{\sqrt{2}}$

c) $\dfrac{3\sqrt{2}}{\sqrt{7}}$

d) $\dfrac{\sqrt{5}}{\sqrt{10}}$

e) $\dfrac{1}{4\sqrt{8}}$

f) $\dfrac{\sqrt{15}}{\sqrt{3}}$

g) $\dfrac{1}{\sqrt{27}}$

2) Rationalise the denominator of $\dfrac{1}{\sqrt{3}}$

3) Rationalise the denominator of $\dfrac{1}{8\sqrt{8}}$ giving the answer in the form $\dfrac{\sqrt{2}}{p}$

Rationalising the Denominator

1) Rationalise the denominator, simplifying where possible:

a) $\frac{3}{\sqrt{2}}$ $\frac{3\sqrt{2}}{2}$

b) $\frac{2}{\sqrt{2}}$ $\sqrt{2}$

c) $\frac{3\sqrt{2}}{\sqrt{7}}$ $\frac{3\sqrt{14}}{7}$

d) $\frac{\sqrt{5}}{\sqrt{10}}$ $\frac{\sqrt{2}}{2}$

e) $\frac{1}{4\sqrt{8}}$ $\frac{\sqrt{2}}{16}$

f) $\frac{\sqrt{15}}{\sqrt{3}}$ $\sqrt{5}$

g) $\frac{1}{\sqrt{27}}$ $\frac{\sqrt{3}}{9}$

2) Rationalise the denominator of $\frac{1}{\sqrt{3}}$ $\frac{\sqrt{3}}{3}$

3) Rationalise the denominator of $\frac{1}{8\sqrt{8}}$ giving the answer in the form $\frac{\sqrt{2}}{p}$ $\frac{\sqrt{2}}{32}$

Direct and Inverse Proportion

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x.

b) Calculate the value of y when $x = 350$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V.

b) Calculate the value of P when $V = 2$

5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m^2, of the sphere.

When $A = 100$, $T = 30$.

Find the value of T when $A = 60$.
Give your answer correct to 3 significant figures.

Direct and Inverse Proportion

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$ $\quad M = 540$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x. $\quad y = \frac{x}{50}$ or $y = 0.02x$

b) Calculate the value of y when $x = 350$ $\quad y = 7$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$ $\quad D = 1406.25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V. $\quad P = \frac{48}{V}$

b) Calculate the value of P when $V = 2$ $\quad 24$

5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m^2, of the sphere.

When $A = 100$, $T = 30$.

Find the value of T when $A = 60$. $\quad T = 23.2$ secs
Give your answer correct to 3 significant figures.

Direct and Inverse Proportion

1) x is directly proportional to y.
When $x = 21$, then $y = 3$.

a) Express x in terms of y.

b) Find the value of x when y is equal to 10.

2) a is inversely proportional to b.
When $a = 12$, then $b = 4$.

a) Find a formula for a in terms of b.

b) Find the value of a when b is equal to 8.

c) Find the value of b when a is equal to 4.

3) The variables u and v are in inverse proportion to one another.
When $u = 3$, then $v = 8$.

Find the value of u when $v = 12$.

4) p is directly proportional to the square of q.
$p = 75$ when $q = 5$

a) Express p in terms of q.

b) Work out the value of p when $q = 7$.

c) Work out the positive value of q when $p = 27$.

5) y is directly proportional to x^2.
When $x = 3$, then $y = 36$.

a) Express y in terms of x.

z is inversely proportional to x.
When $x = 4$, $z = 2$.

b) Show that $z = c\,y^n$, where c and n are numbers and $c > 0$.
You must find the values of c and n.

Direct and Inverse Proportion

1) x is directly proportional to y.
When $x = 21$, then $y = 3$.

a) Express x in terms of y. $x = 7y$

b) Find the value of x when y is equal to 10. 70

2) a is inversely proportional to b.
When $a = 12$, then $b = 4$.

a) Find a formula for a in terms of b. $a = \frac{48}{b}$

b) Find the value of a when b is equal to 8. 6

c) Find the value of b when a is equal to 4. 12

3) The variables u and v are in inverse proportion to one another.
When $u = 3$, then $v = 8$.

Find the value of u when $v = 12$. $u = 2$

4) p is directly proportional to the square of q.
$p = 75$ when $q = 5$

a) Express p in terms of q. $p = 3q^2$

b) Work out the value of p when $q = 7$. $p = 147$

c) Work out the positive value of q when $p = 27$. $q = 3$

5) y is directly proportional to x^2.
When $x = 3$, then $y = 36$.

a) Express y in terms of x. $y = 4x^2$

z is inversely proportional to x.
When $x = 4$, $z = 2$.

b) Show that $z = c\,y^n$, where c and n are numbers and $c > 0$.
You must find the values of c and n.

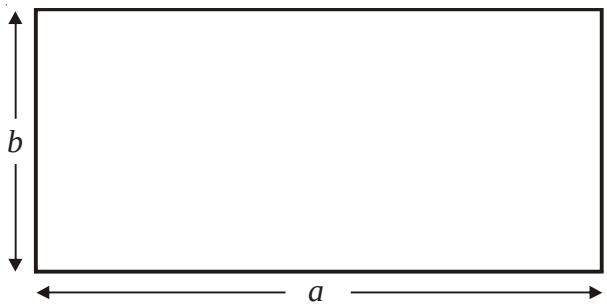
$z = 16y^{-0.5}$

$c = 16$
$n = -0.5$

Upper and Lower Bounds

1) Here is a rectangle.

$a = 8.4$ cm correct to 1 decimal place.
$b = 3.6$ cm correct to 1 decimal place.



a) Calculate the upper bound of the area of the rectangle.
Write down all the figures on your calculator.

b) Find the area of this rectangle correct to an appropriate number of significant figures.

2) Terry measured the length and the width of a rectangle.

He measured the length to be 745 mm correct to the nearest 5 mm.
He measured the width to be 300 mm correct to the nearest 5 mm.

a) Calculate the lower bound for the area of this rectangle.
Give your answer correct to 3 significant figures.

b) Calculate the upper bound for the perimeter of the rectangle.

3) The voltage V of an electronic circuit is given by the formula

$$\boxed{V = IR}$$

where I is the current in amps
and R is the resistance in ohms.

Given that $V = 217$ correct to three significant figures,
$R = 12.4$ correct to three significant figures,

calculate the lower bound of I.

4) Sara drove for 237 miles, correct to the nearest mile.
She used 27.2 litres of petrol, to the nearest tenth of a litre.

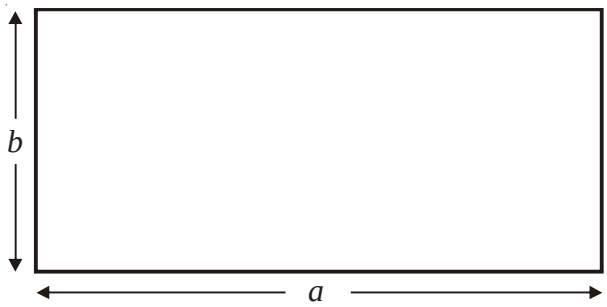
$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Sara's journey.
Give your answer correct to 2 decimal places.

Upper and Lower Bounds

1) Here is a rectangle.

$a = 8.4$ cm correct to 1 decimal place.
$b = 3.6$ cm correct to 1 decimal place.



a) Calculate the upper bound of the area of the rectangle. $8.45 \times 3.65 = 30.8425$ cm^2
Write down all the figures on your calculator.

b) Find the area of this rectangle correct to an appropriate number of significant figures. Lower bound for the area is 29.6425 cm^2
Area = 30 cm^2 correct to 1 significant figure

2) Terry measured the length and the width of a rectangle.

He measured the length to be 745 mm correct to the nearest 5 mm.
He measured the width to be 300 mm correct to the nearest 5 mm.

a) Calculate the lower bound for the area of this rectangle. 221000 mm^2
Give your answer correct to 3 significant figures.

b) Calculate the upper bound for the perimeter of the rectangle. 2100 mm

3) The voltage V of an electronic circuit is given by the formula

$$\boxed{V = IR}$$

where I is the current in amps
and R is the resistance in ohms.

Given that $V = 217$ correct to three significant figures,
$R = 12.4$ correct to three significant figures,

calculate the lower bound of I. 17.38955823 amps

4) Sara drove for 237 miles, correct to the nearest mile.
She used 27.2 litres of petrol, to the nearest tenth of a litre.

$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

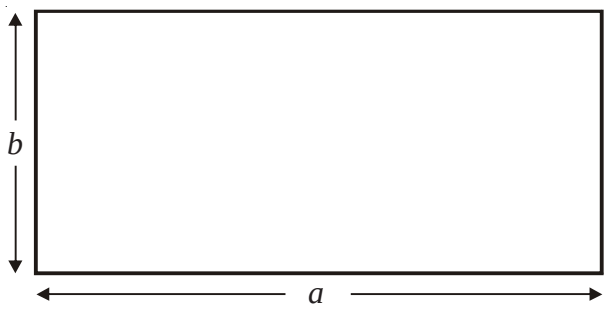
Work out the upper bound for the petrol consumption for Sara's journey. 8.75 miles per litre
Give your answer correct to 2 decimal places.

Upper and Lower Bounds

1)

The length of the rectangle, a,
is 45 cm correct to the nearest cm.

The width of the rectangle, b,
is 26 cm correct to the nearest cm.



Calculate the upper bound for the area of the rectangle.
Write down all the figures on your calculator display.

2) A field is in the shape of a rectangle.
The width of the field is 26 metres, measured to the nearest metre.

a) Work out the upper bound of the width of the field.

The length of the field is 135 metres, measured to the nearest 5 metres.

b) Work out the upper bound for the perimeter of the field.

3) A ball is thrown vertically upwards with a speed V metres per second.

The height, H metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where g m/s^2 is the acceleration due to gravity.

$V = 24.4$ correct to 3 significant figures.
$g = 9.8$ correct to 2 significant figures.

(i) Write down the lower bound of g.

(ii) Calculate the upper bound of H.
Give your answer correct to 3 significant figures.

4) $v = \sqrt{\frac{a}{b}}$

$a = 6.43$ correct to 2 decimal places.
$b = 5.514$ correct to 3 decimal places.

By considering bounds, work out the value of v to a suitable degree of accuracy.

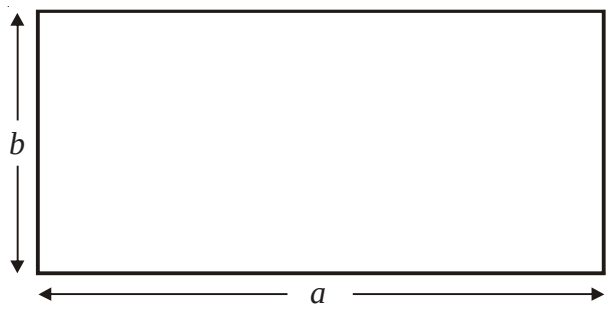
You must show all your working and give a reason for your final answer.

Upper and Lower Bounds

1)

The length of the rectangle, a,
is 45 cm correct to the nearest cm.

The width of the rectangle, b,
is 26 cm correct to the nearest cm.



Calculate the upper bound for the area of the rectangle. 1205.75 cm^2
Write down all the figures on your calculator display.

2) A field is in the shape of a rectangle.
The width of the field is 26 metres, measured to the nearest metre.

a) Work out the upper bound of the width of the field. 26.5 m

The length of the field is 135 metres, measured to the nearest 5 metres.

b) Work out the upper bound for the perimeter of the field. 328 m

3) A ball is thrown vertically upwards with a speed V metres per second.

The height, H metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where g m/s^2 is the acceleration due to gravity.

$V = 24.4$ correct to 3 significant figures.
$g = 9.8$ correct to 2 significant figures.

(i) Write down the lower bound of g. 9.75 m/s

(ii) Calculate the upper bound of H. 30.7 m
Give your answer correct to 3 significant figures.

4) $v = \sqrt{\frac{a}{b}}$

$a = 6.43$ correct to 2 decimal places. lower bound = 1.079402689
$b = 5.514$ correct to 3 decimal places. upper bound = 1.080340323

By considering bounds, work out the value of v to a suitable degree of accuracy.
v = 1.08 correct to two decimal places or three significant figures
You must show all your working and give a reason for your final answer.

Upper and Lower Bounds

1) $A = 11.3$ correct to 1 decimal place
$B = 300$ correct to 1 significant figure
$C = 9$ correct to the nearest integer

a) Calculate the upper bound for $A + B$.

b) Calculate the lower bound for $B \div C$.

c) Calculate the least possible value of AC.

d) Calculate the greatest possible value of $\dfrac{A+B}{B+C}$

2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

Using
$T = 1.2$ correct to 1 decimal place
$L = 4.50$ correct to 2 decimal places
$x = 40$ correct to the nearest integer

a) Calculate the lower bound for the value of g.
Give your answer correct to 3 decimal places.

b) Calculate the upper bound for the value of g.
Give your answer correct to 3 decimal places.

3) The diagram shows a triangle ABC.

$AB = 73$mm correct to 2 significant figures.
$BC = 80$mm correct to 1 significant figure.

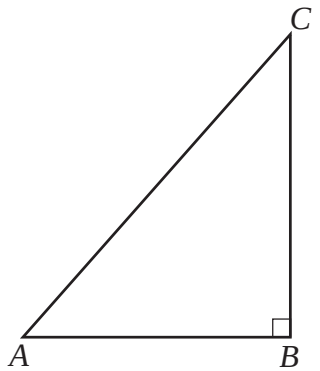


Diagram **NOT** accurately drawn

a) Write the upper and lower bounds of both AB and BC.

AB_{upper} = ... BC_{upper} = ...
AB_{lower} = ... BC_{lower} = ...

b) Calculate the upper bound for the area of the triangle ABC.

.....mm^2

Angle $CAB = x°$

c) Calculate the lower bound for the value of $\tan x°$.

Upper and Lower Bounds

1) $A = 11.3$ correct to 1 decimal place
$B = 300$ correct to 1 significant figure
$C = 9$ correct to the nearest integer

11.3 → 11.35, 11.25 | 300 → 350, 250 | 9 → 9.5, 8.5

a) Calculate the upper bound for $A + B$. 361.35
11.35 + 350 = 361.35

b) Calculate the lower bound for $B \div C$. 26.3 (1 dp)
250 ÷ 9.5 = 26.3 (1 dp)

c) Calculate the least possible value of AC. 95.625
11.25 × 8.5 = 95.625

d) Calculate the greatest possible value of $\frac{A+B}{B+C}$ 1.4 (1 dp) $\frac{11.35 + 350}{250 + 8.5} = 1.4$ (1 dp)

2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

Using
$T = 1.2$ correct to 1 decimal place
$L = 4.50$ correct to 2 decimal places
$x = 40$ correct to the nearest integer

1.2 → 1.25, 1.15 | 4.50 → 4.505, 4.495 | 40 → 40.5, 39.5

a) Calculate the lower bound for the value of g.
Give your answer correct to 3 decimal places. 8.859 $\frac{2 \times 4.495}{1.25^2 \times \sin 40.5} = 8.859$

b) Calculate the upper bound for the value of g.
Give your answer correct to 3 decimal places. 10.711 $\frac{2 \times 4.505}{1.15^2 \times \sin 39.5} = 10.711$

3) The diagram shows a triangle ABC.

$AB = 73$mm correct to 2 significant figures.
$BC = 80$mm correct to 1 significant figure.

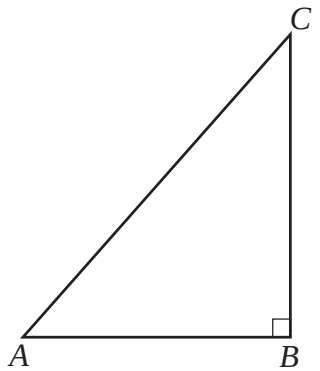


Diagram **NOT** accurately drawn

a) Write the upper and lower bounds of both AB and BC.

AB_{upper} = 73.5
AB_{lower} = 72.5

BC_{upper} = 85
BC_{lower} = 75

b) Calculate the upper bound for the area of the triangle ABC.

3123.75 mm² $\frac{73.5 \times 85}{2} = 3123.75$

Angle $CAB = x°$ $\tan x = \frac{O}{A} = \frac{BC}{AB} = \frac{75}{73.5} = 1.02$ (2 dp)

c) Calculate the lower bound for the value of $\tan x°$. 1.02 (2 dp)

Solve Quadratics Using the Formula

1) Solve the equation $x^2 + 4x + 1 = 0$
Give your answers correct to 3 decimal places.

2) Solve the equation $x^2 + 8x + 6 = 0$
Give your answers correct to 3 significant figures.

3) Solve the equation $x^2 - 3x - 2 = 0$
Give your answers correct to 3 significant figures.

4) Solve the equation $x^2 - 7x + 2 = 0$
Give your answers correct to 3 significant figures.

5) Solve the equation $2x^2 + 6x - 1 = 0$
Give your answers correct to 3 significant figures.

6) Solve the equation $3x^2 - 2x - 20 = 0$
Give your answers correct to 3 significant figures.

7) Solve the equation $x^2 - 14x - 161.25 = 0$

8) Solve the equation $17x^2 - 92x - 206 = 0$
Give your answers correct to 3 significant figures.

9) $x^2 + 10x = 300$
Find the positive value of x.
Give your answer correct to 3 significant figures.

10) $(x + 2)(x - 3) = 1$

a) Show that $x^2 - x - 7 = 0$

b) Solve the equation $x^2 - x - 7 = 0$

Give your answers correct to 3 significant figures.

Solve Quadratics Using the Formula

1) Solve the equation $x^2 + 4x + 1 = 0$
Give your answers correct to 3 decimal places.
$x = -0.268$ or $x = -3.732$

2) Solve the equation $x^2 + 8x + 6 = 0$
Give your answers correct to 3 significant figures.
$x = -0.838$ or $x = -7.16$

3) Solve the equation $x^2 - 3x - 2 = 0$
Give your answers correct to 3 significant figures.
$x = -0.562$ or $x = 3.56$

4) Solve the equation $x^2 - 7x + 2 = 0$
Give your answers correct to 3 significant figures.
$x = 0.298$ or $x = 6.70$

5) Solve the equation $2x^2 + 6x - 1 = 0$
Give your answers correct to 3 significant figures.
$x = -3.16$ or $x = 0.158$

6) Solve the equation $3x^2 - 2x - 20 = 0$
Give your answers correct to 3 significant figures.
$x = -2.27$ or $x = 2.94$

7) Solve the equation $x^2 - 14x - 161.25 = 0$
$x = -7.5$ or $x = 21.5$

8) Solve the equation $17x^2 - 92x - 206 = 0$
Give your answers correct to 3 significant figures.
$x = -1.70$ or $x = 7.11$

9) $x^2 + 10x = 300$
Find the positive value of x.
Give your answer correct to 3 significant figures.
$x = 13.0$

10) $(x + 2)(x - 3) = 1$

a) Show that $x^2 - x - 7 = 0$

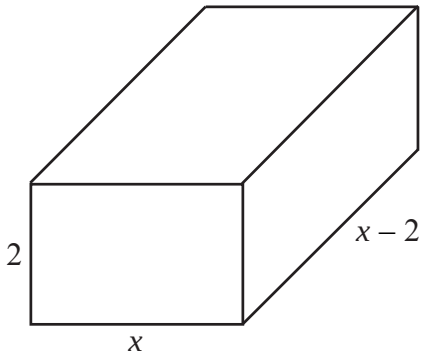
$x^2 - 3x + 2x - 6 = 1$
$x^2 - x - 6 = 1$
$x^2 - x - 7 = 0$

b) Solve the equation $x^2 - x - 7 = 0$

Give your answers correct to 3 significant figures.
$x = -2.19$ or $x = 3.19$

Solve Quadratics Using the Formula

1)



The diagram shows a cuboid.
All the measurements are in cm.

The volume of the cuboid is 52 cm^3.

a) Show that $2x^2 - 4x - 52 = 0$ for $x > 2$

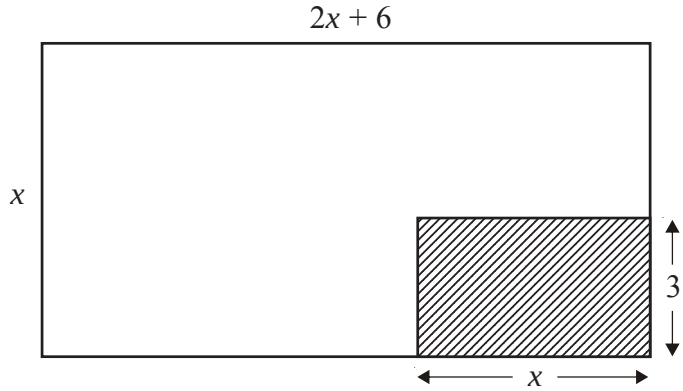
b) Solve the quadratic equation

$$2x^2 - 4x - 52 = 0$$

Give your solutions correct to 3 significant figures.
You must show your working.

2) The diagram below shows a large rectangle of length $(2x + 6)$ cm and width x cm.

A smaller rectangle of length x cm and width 3 cm is cut out and removed.



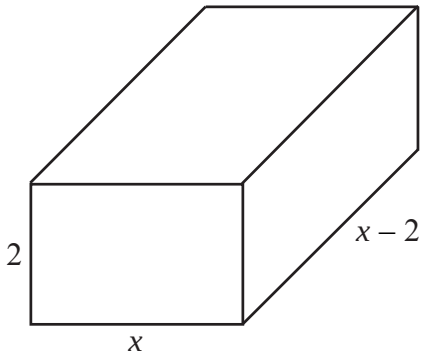
The area of the shape that is left is 100 cm^2.

a) Show that $2x^2 + 3x - 100 = 0$

b) Calculate the length of the smaller rectangle.
Give your answer correct to 3 significant figures.

Solve Quadratics Using the Formula

1)



The diagram shows a cuboid.
All the measurements are in cm.

The volume of the cuboid is 52 cm^3.

a) Show that $2x^2 - 4x - 52 = 0$ for $x > 2$

b) Solve the quadratic equation

$$2x^2 - 4x - 52 = 0$$

Give your solutions correct to 3 significant figures.
You must show your working.

length × width × height = volume

$2x(x - 2) = 52$

$2x^2 - 4x = 52$

$2x^2 - 4x - 52 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

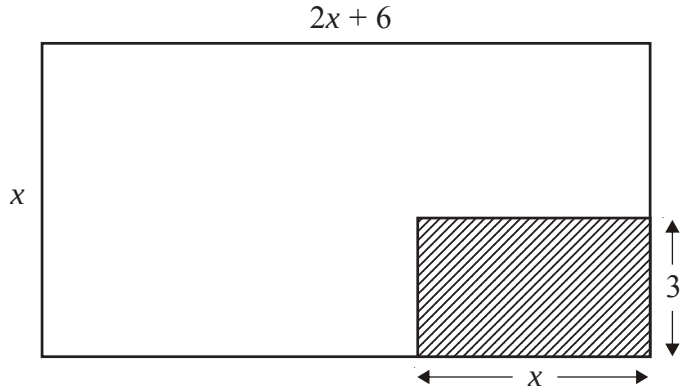
$$x = \frac{4 \pm \sqrt{(-4)^2 - 4 \times 2 \times (-52)}}{2 \times 2}$$

$$x = \frac{4 \pm \sqrt{432}}{4}$$

$x = 6.20$ or -4.20

2) The diagram below shows a large rectangle of length $(2x + 6)$ cm and width x cm.

A smaller rectangle of length x cm and width 3 cm is cut out and removed.



The area of the shape that is left is 100 cm^2.

a) Show that $2x^2 + 3x - 100 = 0$

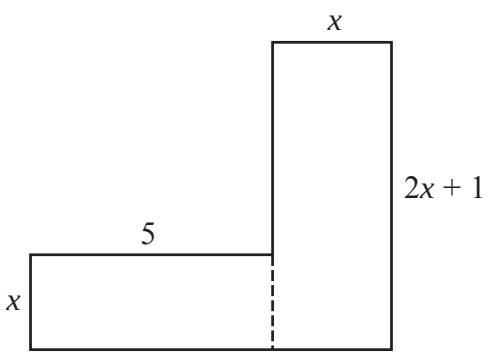
b) Calculate the length of the smaller rectangle.
Give your answer correct to 3 significant figures.

$x = 6.36$ cm

Area of large rectangle is $(2x + 6) \times x$
Area of shaded rectangle is $3x$
Area of shape that is left is
$(2x + 6) \times x - 3x = 100$
$\therefore 2x^2 + 3x = 100$
$\therefore 2x^2 + 3x - 100 = 0$

Solve Quadratics Using the Formula

1)



The diagram shows a 6-sided shape.
All the corners are right angles.
All the measurements are given in centimetres.

The area of the shape is 94 cm^2.

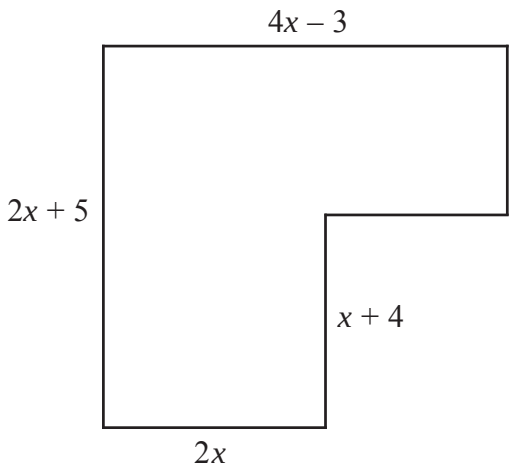
a) Show that $2x^2 + 6x - 94 = 0$

b) Solve the equation

$$2x^2 + 6x - 94 = 0$$

Give your solutions correct to 3 significant figures.

2) The diagram shows a 6-sided shape.
All the corners are right angles.



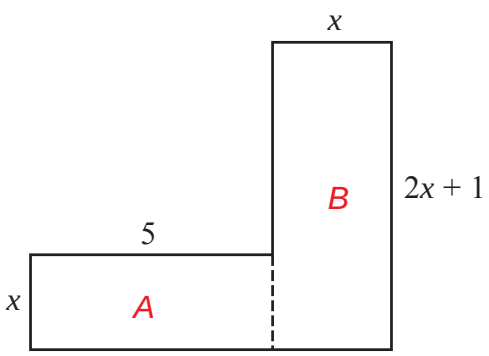
All the measurements are given in centimetres.

The area of the shape is 33 cm^2.

Work out the length of the longest side of the shape.
Give your answer correct to 2 significant figures.

Solve Quadratics Using the Formula

1)



The diagram shows a 6-sided shape.
All the corners are right angles.
All the measurements are given in centimetres.

The area of the shape is 94 cm^2.

a) Show that $2x^2 + 6x - 94 = 0$

Area of the whole shape is the sum of rectangle A and rectangle B.
Area of $A = 5x$
Area of $B = x(2x + 1)$
Area of whole shape $= 5x + x(2x + 1) = 94$
$5x + 2x^2 + x = 94$
$2x^2 + 6x - 94 = 0$

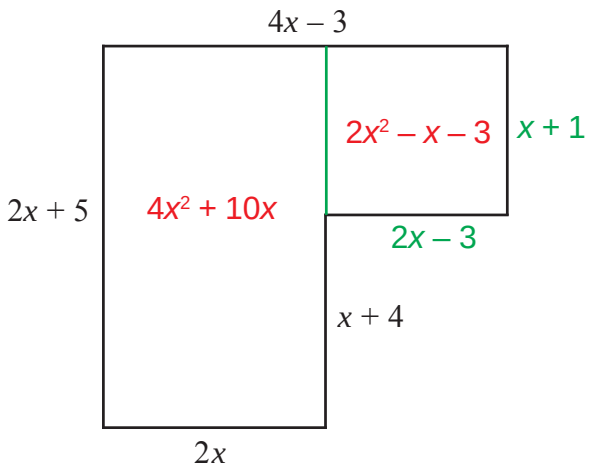
b) Solve the equation

$$2x^2 + 6x - 94 = 0$$

$x = 5.52$ or -8.52

Give your solutions correct to 3 significant figures.

2) The diagram shows a 6-sided shape.
All the corners are right angles.



All the measurements are given in centimetres.

The area of the shape is 33 cm^2.

Work out the length of the longest side of the shape.
Give your answer correct to 2 significant figures.

$4x^2 + 10x + 2x^2 - x - 3 = 33$
$6x^2 + 9x - 36 = 0$
$2x^2 + 3x - 12 = 0$

$x = -3.3$ or 1.8
Using $x = 1.8$ the longest side is given by $2x + 5$
$2x + 5 = 8.6$ cm

Completing the Square

1) Show that if $y = x^2 + 8x - 3$
then $y \geq -19$ for all values of x.

2) Show that if $y = x^2 - 10x + 30$
then $y \geq 5$ for all values of x.

3) The expression $x^2 + 4x + 10$ can be written in the form
$(x + p)^2 + q$ for all values of x.
Find the values of p and q.

4) Given that $x^2 - 6x + 17 = (x - p)^2 + q$ for all values of x,
find the value of p and the value of q.

5) For all values of x,

$$x^2 + 6x = (x + p)^2 + q$$

a) Find the values of p and q.

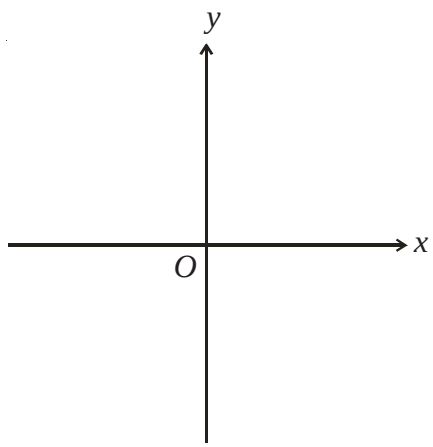
b) Find the minimum value of $x^2 + 6x$.

6) For all values of x,

$$x^2 - 8x - 5 = (x - p)^2 + q$$

a) Find the value of p and the value of q.

b) On the axes, sketch the graph of $y = x^2 - 8x - 5$.



c) Find the coordinates of the minimum point on the graph of $y = x^2 - 8x - 5$.

7) The expression $10x - x^2$ can be written in the form $p - (x - q)^2$ for all values of x.

a) Find the values of p and q.

b) The expression $10x - x^2$ has a maximum value.

(i) Find the maximum value of $10x - x^2$.

(ii) State the value of x for which this maximum value occurs.

Completing the Square

1) Show that if $y = x^2 + 8x - 3$
then $y \geq -19$ for all values of x.

$y = (x + 4)^2 - 16 - 3$
$y = (x + 4)^2 - 19$
$(x + 4)^2 \geqslant 0$
$y \geqslant -19$

2) Show that if $y = x^2 - 10x + 30$
then $y \geq 5$ for all values of x.

$y = (x - 5)^2 - 25 + 30$
$y = (x - 5)^2 + 5$
$(x - 5)^2 \geqslant 0$
$y \geqslant 5$

3) The expression $x^2 + 4x + 10$ can be written in the form
$(x + p)^2 + q$ for all values of x.
Find the values of p and q.

$(x + 2)^2 - 4 + 10$
$(x + 2)^2 + 6$

$p = 2$ and $q = 6$

4) Given that $x^2 - 6x + 17 = (x - p)^2 + q$ for all values of x,
find the value of p and the value of q.

$(x - 3)^2 - 9 + 17$
$(x - 3)^2 + 8$

$p = 3$ and $q = 8$

5) For all values of x,

$$x^2 + 6x = (x + p)^2 + q$$

$(x + 3)^2 - 9$

a) Find the values of p and q. $p = 3$ and $q = -9$

b) Find the minimum value of $x^2 + 6x$. -9

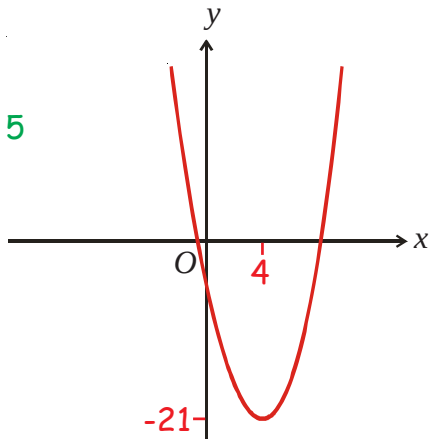
6) For all values of x,

$$x^2 - 8x - 5 = (x - p)^2 + q$$

$(x - 4)^2 - 16 - 5$
$(x - 4)^2 - 21$

a) Find the value of p and the value of q.
$p = 4$ and $q = -21$

b) On the axes, sketch the graph of $y = x^2 - 8x - 5$.



c) Find the coordinates of the minimum point on the graph of $y = x^2 - 8x - 5$.
(4, -21)

7) The expression $10x - x^2$ can be written in the form $p - (x - q)^2$ for all values of x.

$10x - x^2$ can be rearranged as
$-x^2 + 10x$
$-(x^2 - 10x)$
$-[(x - 5)^2 - 25]$
$-(x - 5)^2 + 25$ rearranged as
$25 - (x - 5)^2$

a) Find the values of p and q.
$p = 25$ and $q = 5$

b) The expression $10x - x^2$ has a maximum value.

(i) Find the maximum value of $10x - x^2$.
25

(ii) State the value of x for which this maximum value occurs.
$x = 5$

Proof

1) Show algebraically that the sum of two consecutive numbers is always odd.

2) Show algebraically that the product of two even numbers is always a multiple of four.

3) Show algebraically that the square of an odd number is always odd.

4) Prove, using algebra, that the difference between the squares of any two consecutive even numbers is always a multiple of four.

5) n is an integer.
Prove that $(2n + 1)(n + 3) + (2n + 1)(n - 2)$
is not a multiple of 2.

6) Prove that $(4n + 1)^2 - (4n - 1)^2$
is a multiple of eight for all positive integer values of n.

7) Prove algebraically that the sum of the squares of any three consecutive even numbers is always a multiple of four.

Proof

1) Show algebraically that the sum of two consecutive numbers is always odd.

$n + n + 1$
$2n + 1$

$2n$ is always even, so $2n + 1$ must always be odd.

2) Show algebraically that the product of two even numbers is always a multiple of four.

$2n \times 2m$
$4nm$

$4nm$ is always a multiple of four.

3) Show algebraically that the square of an odd number is always odd.

$(2n + 1)^2$
$4n^2 + 4n + 1$
$2(2n^2 + 2n) + 1$

$2(2n^2 + 2n)$ is always even, so $2(2n^2 + 2n) + 1$ must always be odd.

4) Prove, using algebra, that the difference between the squares of any two consecutive even numbers is always a multiple of four.

$(2n + 2)^2 - (2n)^2$
$4n^2 + 8n + 4 - 4n^2$
$8n + 4$

$4(2n + 1)$ which is a always a multiple of four.

5) n is an integer.
Prove that $(2n + 1)(n + 3) + (2n + 1)(n - 2)$ is not a multiple of 2.

$2n^2 + 7n + 3 + 2n^2 - 3n - 2$
$4n^2 + 4n + 1$
$2(2n^2 + 2n) + 1$

$2(2n^2 + 2n)$ is even, so $2(2n^2 + 2n) + 1$ must be odd (not a multiple of 2).

6) Prove that $(4n + 1)^2 - (4n - 1)^2$ is a multiple of eight for all positive integer values of n.

$(16n^2 + 8n + 1) - (16n^2 - 8n + 1)$
$16n^2 + 8n + 1 - 16n^2 + 8n - 1$
$16n$
$8(2n)$ which is always a multiple of eight.

7) Prove algebraically that the sum of the squares of any three consecutive even numbers is always a multiple of four.

$(2n)^2 + (2n + 2)^2 + (2n + 4)^2$
$4n^2 + 4n^2 + 8n + 4 + 4n^2 + 16n + 16$
$12n^2 + 24n + 20$

$4(3n^2 + 6n + 5)$ which is always a multiple of four.

Algebraic Fractions

1) Simplify fully

a) $\dfrac{9x^2}{21x^3}$

b) $\dfrac{10xy^3}{5y^2}$

c) $\dfrac{18a^3b^2}{2ab^2}$

d) $\dfrac{4x^2+12x}{10x}$

e) $\dfrac{2a^2b-14a^2b^3}{6a^3b^3}$

f) $\dfrac{5x^2y+5xy^2}{10x^2y^2}$

2) Simplify fully

a) $\dfrac{x^2+x}{x^2+6x+5}$

b) $\dfrac{x^2-6x+8}{2x^2-8x}$

c) $\dfrac{x^2+7x+10}{x^2+5x}$

3) a) Factorise $4x^2-12x+9$

b) Simplify $\dfrac{6x^2-7x-3}{4x^2-12x+9}$

Algebraic Fractions

1) Simplify fully

a) $\frac{9x^2}{21x^3}$ $\frac{3}{7x}$

b) $\frac{10xy^3}{5y^2}$ $2xy$

c) $\frac{18a^3b^2}{2ab^2}$ $9a^2$

d) $\frac{4x^2+12x}{10x}$ $\frac{2(x+3)}{5}$

e) $\frac{2a^2b-14a^2b^3}{6a^3b^3}$ $\frac{1-7b^2}{3ab^2}$

f) $\frac{5x^2y+5xy^2}{10x^2y^2}$ $\frac{x+y}{2xy}$

2) Simplify fully

a) $\frac{x^2+x}{x^2+6x+5}$ $\frac{x}{x+5}$

b) $\frac{x^2-6x+8}{2x^2-8x}$ $\frac{x-2}{2x}$

c) $\frac{x^2+7x+10}{x^2+5x}$ $\frac{x+2}{x}$

3) a) Factorise $4x^2-12x+9$ $(2x-3)^2$

b) Simplify $\frac{6x^2-7x-3}{4x^2-12x+9}$ $\frac{3x+1}{2x-3}$

Algebraic Fractions

1) Write as single fractions in their simplest form

a) $\frac{3}{x}+\frac{3}{2x}$

b) $\frac{5}{3x}-\frac{3}{4x}$

c) $\frac{x+2}{5}+\frac{x-1}{2}$

d) $\frac{3}{x+2}-\frac{5}{2x+1}$

2) a) Factorise $2x^2+7x+6$

b) Write as a single fraction in its simplest form $\frac{3}{x+2}+\frac{4x}{2x^2+7x+6}$

3) Solve

a) $\frac{1}{x}+\frac{1}{3x}=2$

b) $\frac{1}{x-2}+\frac{3}{x+6}=\frac{1}{2}$

c) $\frac{1}{x-5}+\frac{6}{x}=2$

d) $\frac{7}{x+2}+\frac{1}{x-1}=4$

e) $\frac{3}{x+2}+\frac{1}{x-2}=\frac{7}{x^2-4}$

f) $\frac{x}{2x-1}+\frac{2}{x+2}=1$

Algebraic Fractions

1) Write as single fractions in their simplest form

a) $\frac{3}{x}+\frac{3}{2x}$ $\frac{9}{2x}$

b) $\frac{5}{3x}-\frac{3}{4x}$ $\frac{11}{12x}$

c) $\frac{x+2}{5}+\frac{x-1}{2}$ $\frac{7x-1}{10}$

d) $\frac{3}{x+2}-\frac{5}{2x+1}$ $\frac{x-7}{(x+2)(2x+1)}$

2) a) Factorise $2x^2+7x+6$ $(x+2)(2x+3)$

b) Write as a single fraction in its simplest form $\frac{3}{x+2}+\frac{4x}{2x^2+7x+6}$ $\frac{10x+9}{(x+2)(2x+3)}$

3) Solve

a) $\frac{1}{x}+\frac{1}{3x}=2$ $x=\frac{2}{3}$

b) $\frac{1}{x-2}+\frac{3}{x+6}=\frac{1}{2}$ $x=-2$ or 6

c) $\frac{1}{x-5}+\frac{6}{x}=2$ $x=2.5$ or 6

d) $\frac{7}{x+2}+\frac{1}{x-1}=4$ $x=-0.5$ or 1.5

e) $\frac{3}{x+2}+\frac{1}{x-2}=\frac{7}{x^2-4}$ $x=2.75$

f) $\frac{x}{2x-1}+\frac{2}{x+2}=1$ $x=0$ or 3

Rearranging Difficult Fomulae

1) Make c the subject of the formula.

$v = 2a + 3b + c$

2) Make t the subject of the formula.

$A = \pi t + 5t$

3) Make s the subject of the formula.

$R = 3s + \pi s + 2t$

4) $k = \dfrac{l}{m - l}$

a) Make l the subject of the formula.

b) Make m the subject of the formula.

5) $A = \dfrac{k(x+5)}{3}$

Make x the subject of the formula.

6) $R = \dfrac{u + v^2}{u + v}$

Make u the subject of the formula.

7) $\dfrac{3x+2}{5} = \dfrac{y}{10+y}$

Make y the subject of the formula.

8) $\sqrt{\dfrac{a-3}{5}} = 4b$

Rearrange this formula to give a in terms of b.

9) $S = 2\pi d\sqrt{h^2 + d^2}$

Rearrange this formula to make h the subject.

Rearranging Difficult Fomulae

1) Make c the subject of the formula.

$v = 2a + 3b + c$ $\quad c = v - 2a - 3b$

2) Make t the subject of the formula.

$A = \pi t + 5t$ $\quad t = \dfrac{A}{\pi + 5}$

3) Make s the subject of the formula.

$R = 3s + \pi s + 2t$

$R - 2t = 3s + \pi s$

$R - 2t = s(3 + \pi)$

4) $k = \dfrac{l}{m - l}$

a) Make l the subject of the formula. $l = \dfrac{km}{1 + k}$

b) Make m the subject of the formula. $m = \dfrac{l + kl}{k}$

5) $A = \dfrac{k(x+5)}{3}$

Make x the subject of the formula. $x = \dfrac{3A - 5k}{k}$

$3A = k(x + 5)$

$3A = kx + 5k$

$3A - 5k = kx$

6) $R = \dfrac{u + v^2}{u + v}$

Make u the subject of the formula. $u = \dfrac{v^2 - Rv}{R - 1}$

$R(u + v) = u + v^2$

$Ru + Rv = u + v^2$

$Ru - u = v^2 - Rv$

$u(R - 1) = v^2 - Rv$

7) $\dfrac{3x+2}{5} = \dfrac{y}{10+y}$

Make y the subject of the formula. $y = \dfrac{30x + 20}{3 - 3x}$

$(3x + 2)(10 + y) = 5y$

$30x + 3xy + 20 + 2y = 5y$

$30x + 20 = 5y - 3xy - 2y$

$30x + 20 = 3y - 3xy$

$30x + 20 = y(3 - 3x)$

8) $\sqrt{\dfrac{a-3}{5}} = 4b$

Rearrange this formula to give a in terms of b. $a = 80b^2 + 3$

$\dfrac{a - 3}{5} = 16b^2$

$a - 3 = 80b^2$

9) $S = 2\pi d\sqrt{h^2 + d^2}$

Rearrange this formula to make h the subject. $h = \sqrt{\dfrac{S^2}{4\pi^2 d^2} - d^2}$

$\dfrac{S}{2\pi d} = \sqrt{h^2 + d^2}$

$\dfrac{S^2}{4\pi^2 d^2} = h^2 + d^2$

$\dfrac{S^2}{4\pi^2 d^2} - d^2 = h^2$

Simultaneous Equations with a Quadratic

1) Solve these simultaneous equations.

$y = x$

$y = x^2 - 6$

2) Solve these simultaneous equations.

$y = x^2 - 4$

$y = 3x$

3) Solve these simultaneous equations.

$y = x^2 - x - 13$

$y = x + 2$

4) Solve these simultaneous equations.

$y = x^2 - 35$

$x - y = 5$

5) Solve these simultaneous equations.

$x^2 + y^2 = 26$

$y + 6 = x$

6) Sarah said that the line $y = 7$ cuts the curve $x^2 + y^2 = 25$ at two points.

a) By eliminating y show that Sarah is **not** correct.

b) By eliminating y, find the solutions to the simultaneous equations

$x^2 + y^2 = 25$

$y = 3x - 9$

Simultaneous Equations with a Quadratic

1) Solve these simultaneous equations.

$y = x$

$y = x^2 - 6$

$x = 3$ and $y = 3$

$x = -2$ and $y = -2$

$x = x^2 - 6$
$x^2 - x - 6 = 0$
$(x - 3)(x + 2) = 0$
$x = 3$ or $x = -2$

2) Solve these simultaneous equations.

$y = x^2 - 4$

$y = 3x$

$x = 4$ and $y = 12$

$x = -1$ and $y = -3$

$3x = x^2 - 4$
$x^2 - 3x - 4 = 0$
$(x - 4)(x + 1) = 0$
$x = 4$ or $x = -1$

3) Solve these simultaneous equations.

$y = x^2 - x - 13$

$y = x + 2$

$x = 5$ and $y = 7$

$x = -3$ and $y = -1$

$x + 2 = x^2 - x - 13$
$x^2 - 2x - 15 = 0$
$(x - 5)(x + 3) = 0$
$x = 5$ or $x = -3$

4) Solve these simultaneous equations.

$y = x^2 - 35$

$x - y = 5$

$x = 6$ and $y = 1$

$x = -5$ and $y = -10$

$y = x - 5$
$x - 5 = x^2 - 35$
$x^2 - x - 30 = 0$
$(x - 6)(x + 5) = 0$
$x = 6$ or $x = -5$

5) Solve these simultaneous equations.

$x^2 + y^2 = 26$

$y + 6 = x$

$x = 5$ and $y = -1$

$x = 1$ and $y = -5$

$y = x - 6$
$x^2 + (x - 6)^2 = 26$
$x^2 + x^2 - 12x + 10 = 0$
$2x^2 - 12x + 10 = 0$
$x^2 - 6x + 5 = 0$
$(x - 5)(x - 1) = 0$
$x = 5$ or $x = 1$

6) Sarah said that the line $y = 7$ cuts the curve $x^2 + y^2 = 25$ at two points.

a) By eliminating y show that Sarah is **not** correct.

$x^2 + 49 = 25$
$x^2 = -24$

There is no solution to $x^2 = -24$ hence $y = 7$ does not cut the curve.

b) By eliminating y, find the solutions to the simultaneous equations

$x^2 + y^2 = 25$

$y = 3x - 9$

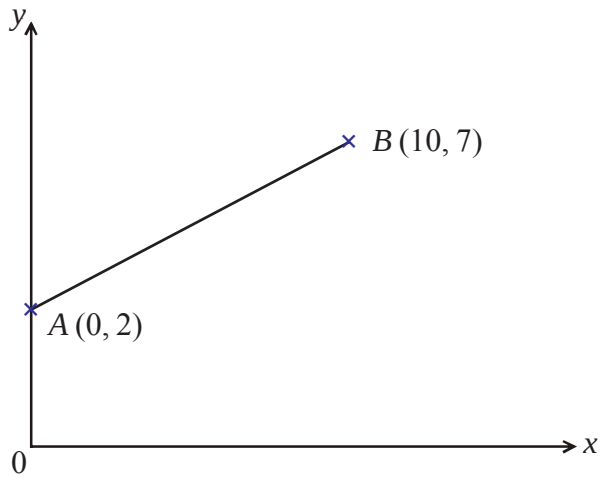
$x = 1.4$ and $y = -4.8$

$x = 4$ and $y = 3$

$x^2 + (3x - 9)^2 = 25$
$x^2 + 9x^2 - 54x + 81 = 25$
$10x^2 - 54x + 56 = 0$
$5x^2 - 27x + 28 = 0$
$(5x - 7)(x - 4) = 0$
$x = 1.4$ or $x = 4$

Gradients of Lines

1)



A is the point (0, 2)
B is the point (10, 7)

a) Write down the equation of the straight line which passes through points *A* and *B*.

b) Find the equation of the line perpendicular to *AB* passing through *B*.

2) A straight line has equation $y = 2x - 5$
The point *P* lies on the straight line.
The *y* coordinate of *P* is -6

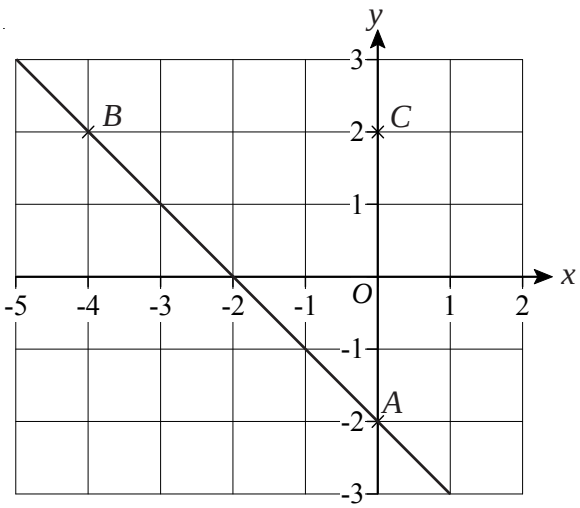
a) Find the *x* coordinate of *P*.

A straight line ***L*** is parallel to $y = 2x - 5$ and passes through the point (3, 2).

b) Find the equation of line ***L***.

c) Find the equation of the line that is perpendicular to line ***L*** and passes through point (3, 2).

3) In the diagram *A* is the point (0, -2)
B is the point (-4, 2)
C is the point (0, 2)

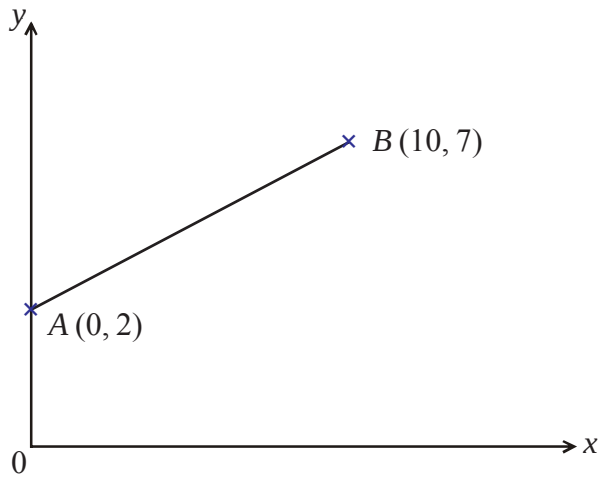


a) Find the equation of the line that passes through *C* and is parallel to *AB*.

b) Find the equation of the line that passes through *C* and is perpendicular to *AB*.

Gradients of Lines

1)



A is the point (0, 2)
B is the point (10, 7)

a) Write down the equation of the straight line which passes through points *A* and *B*. $y = \frac{1}{2}x + 2$

b) Find the equation of the line perpendicular to *AB* passing through *B*. $y = -2x + 27$

2) A straight line has equation $y = 2x - 5$
The point *P* lies on the straight line.
The *y* coordinate of *P* is -6

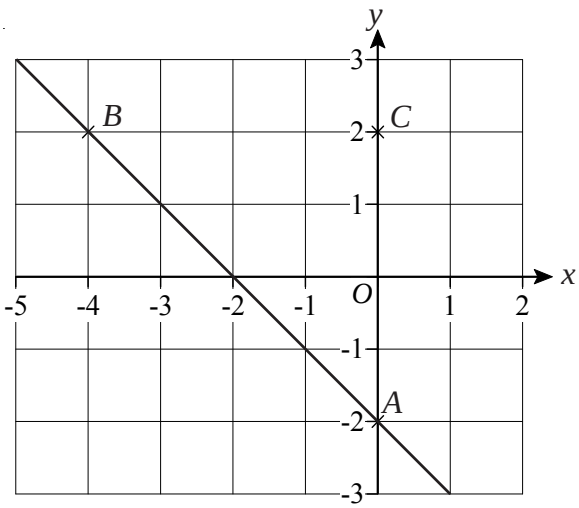
a) Find the *x* coordinate of *P*. $x = -0.5$

A straight line ***L*** is parallel to $y = 2x - 5$ and passes through the point (3, 2).

b) Find the equation of line ***L***. $y = 2x - 4$

c) Find the equation of the line that is perpendicular to line ***L*** and passes through point (3, 2).
$y = -\frac{1}{2}x + 3\frac{1}{2}$

3) In the diagram *A* is the point (0, -2)
B is the point (-4, 2)
C is the point (0, 2)



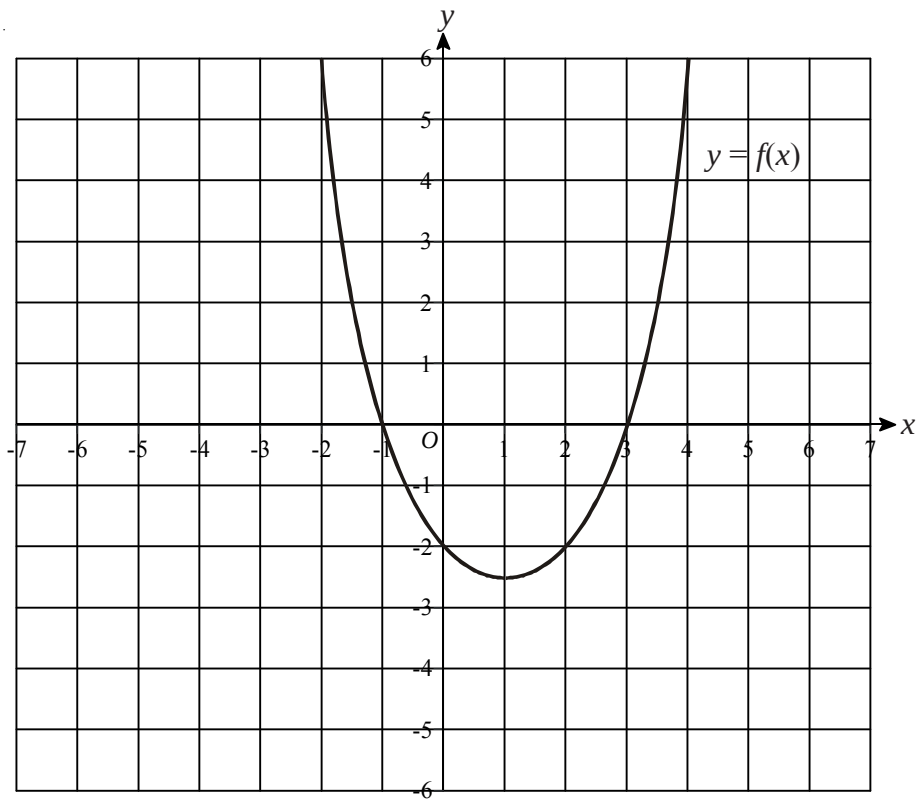
a) Find the equation of the line that passes through *C* and is parallel to *AB*. $y = -x + 2$

b) Find the equation of the line that passes through *C* and is perpendicular to *AB*. $y = x + 2$

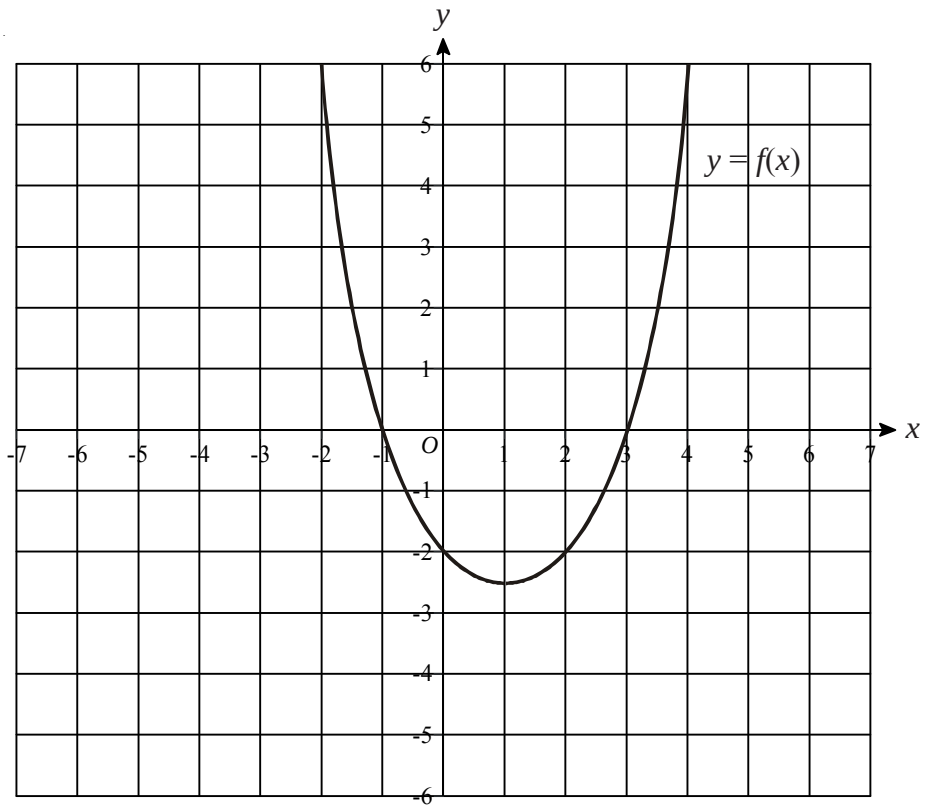
Transformations of Functions

1) The graph of $y = f(x)$ is shown on the grids.

a) On this grid, sketch the graph of $y = f(x - 3)$



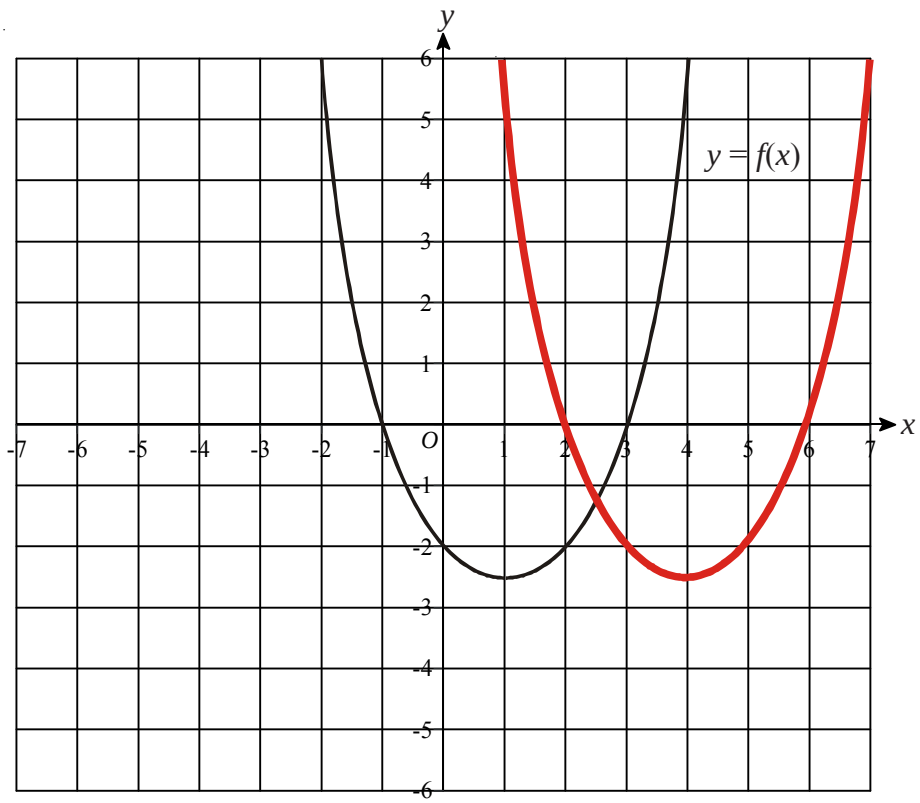
b) On this grid sketch the graph of $y = -f(x)$



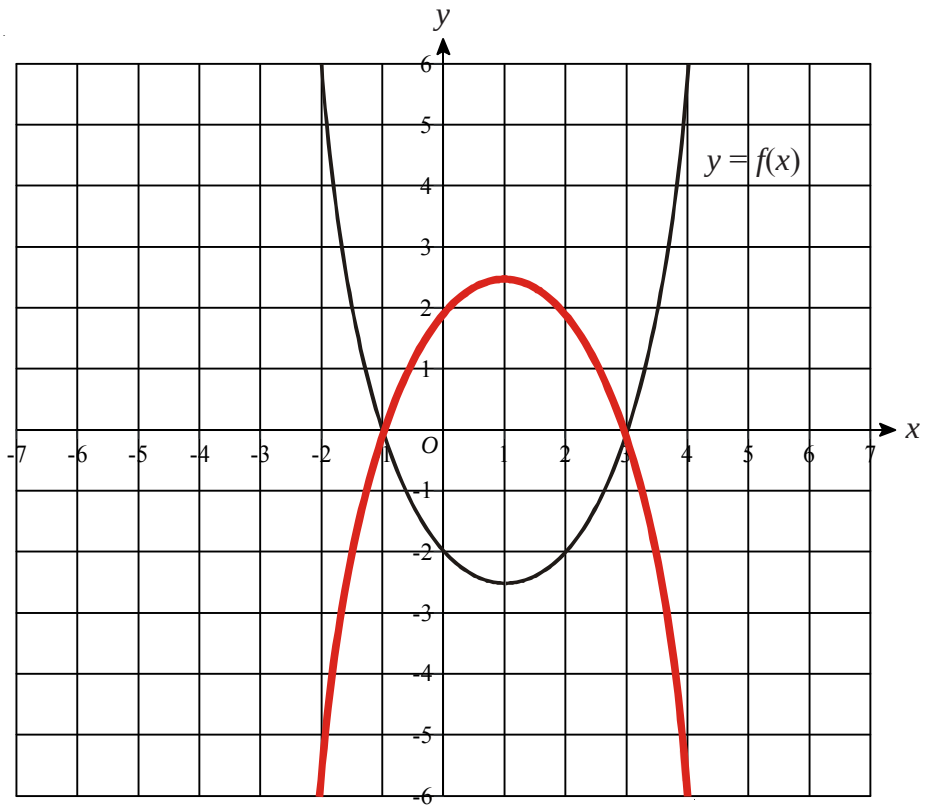
Transformations of Functions

1) The graph of $y = f(x)$ is shown on the grids.

a) On this grid, sketch the graph of $y = f(x - 3)$

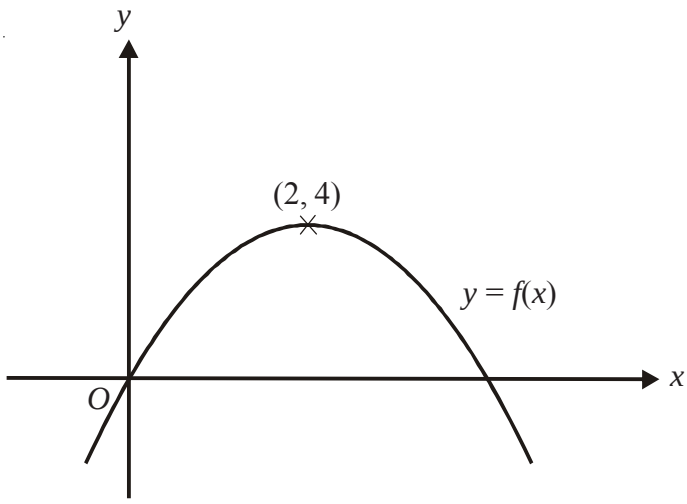


b) On this grid sketch the graph of $y = -f(x)$



Transformations of Functions

1)



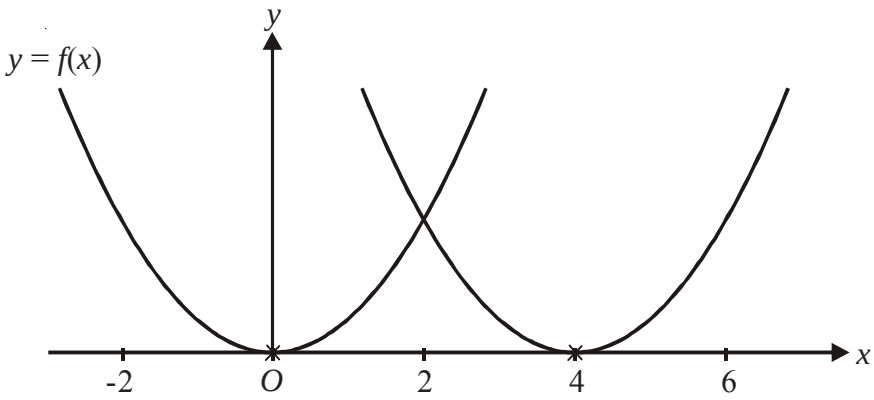
The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the maximum point of this curve are (2, 4).

Write down the coordinates of the maximum point of the curve with equation

a) $y = f(x - 2)$

b) $y = 2f(x)$

2)

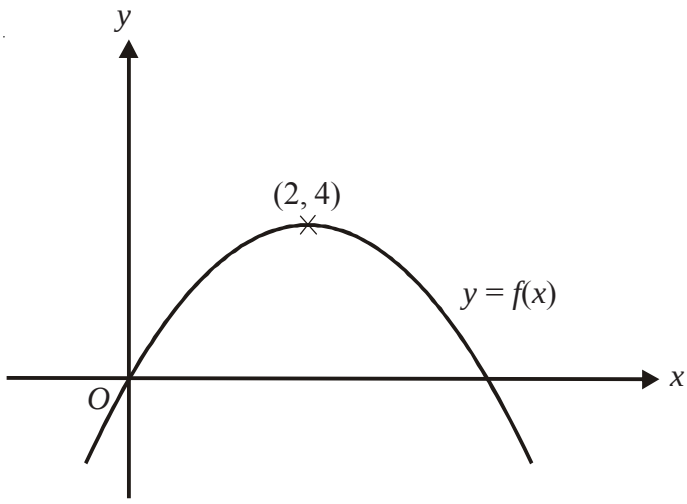


The curve with equation $y = f(x)$ is translated so that the point at (0, 0) is mapped onto the point (4, 0).

Find the equation of the translated curve.

Transformations of Functions

1)



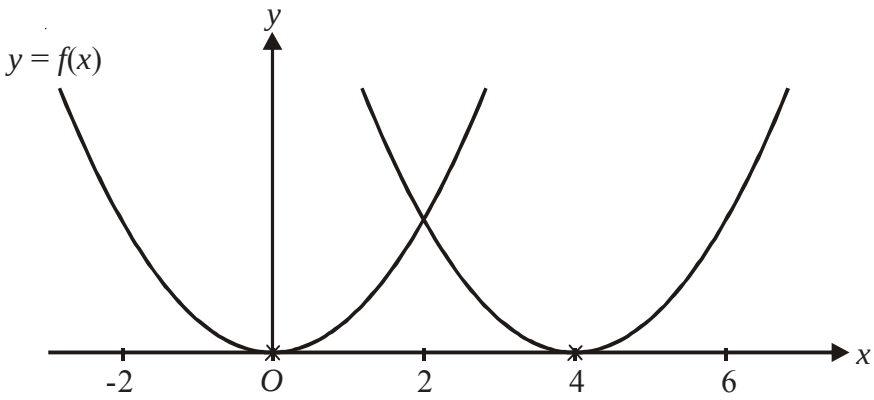
The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the maximum point of this curve are (2, 4).

Write down the coordinates of the maximum point of the curve with equation

a) $y = f(x - 2)$ (4, 4)

b) $y = 2f(x)$ (2, 8)

2)

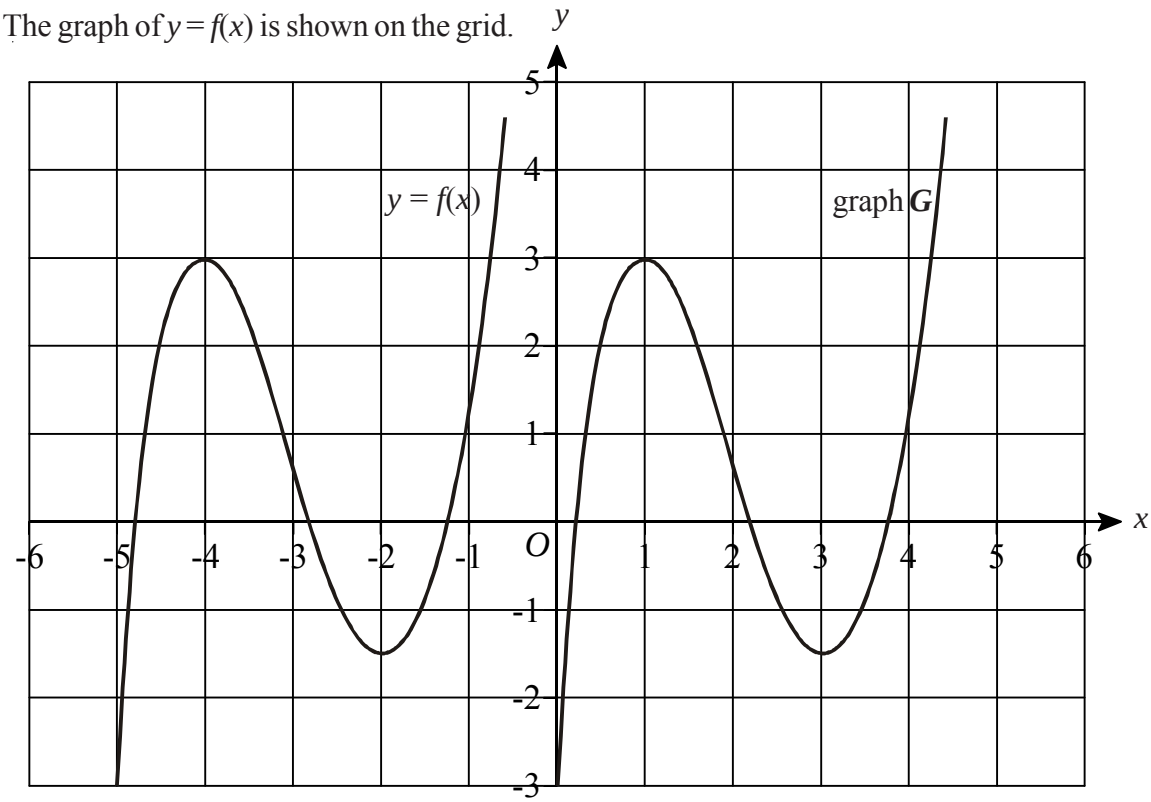


The curve with equation $y = f(x)$ is translated so that the point at (0, 0) is mapped onto the point (4, 0).

Find the equation of the translated curve. $y = f(x - 4)$

Transformations of Functions

1) The graph of $y = f(x)$ is shown on the grid.



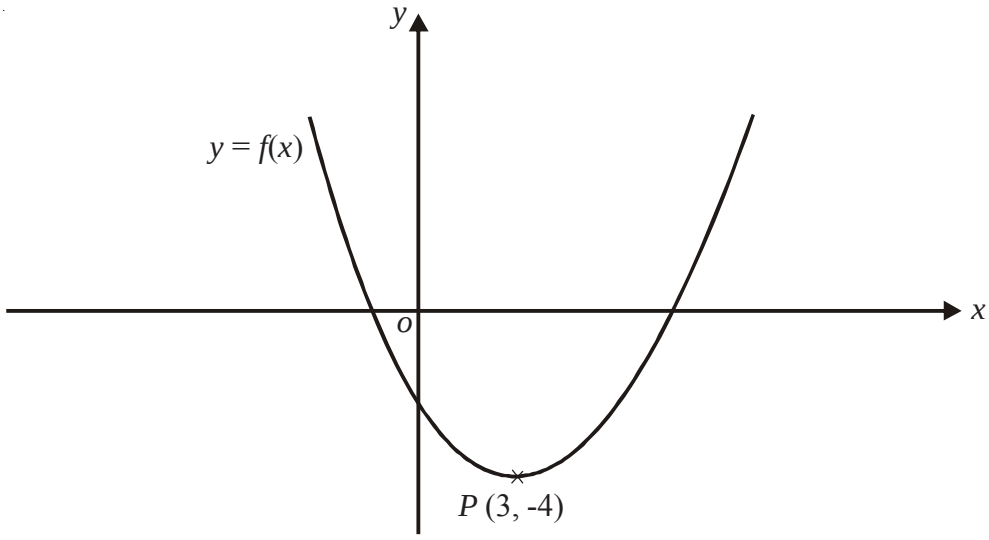
The graph ***G*** is a translation of the graph of $y = f(x)$.

a) Write down, in terms of f, the equation of graph ***G***.

The graph of $y = f(x)$ has a maximum point at (-4, 3).

b) Write down the coordinates of the maximum point of the graph $y = f(-x)$.

2) This is a sketch of the curve with the equation $y = f(x)$.
The only minimum point of the curve is at P (3, -4).

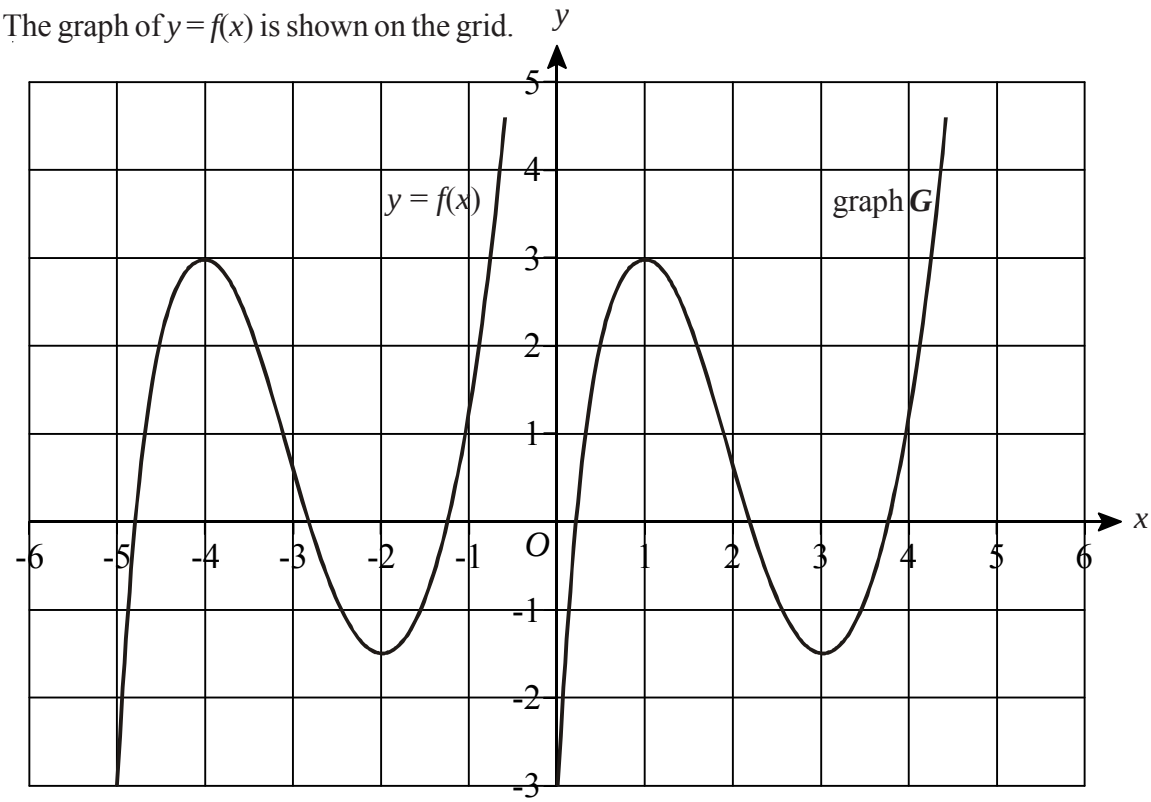


a) Write down the coordinates of the minimum point of the curve with the equation $y = f(x - 2)$

b) Write down the coordinates of the minimum point of the curve with the equation $y = f(x + 5) + 6$

Transformations of Functions

1) The graph of $y = f(x)$ is shown on the grid.



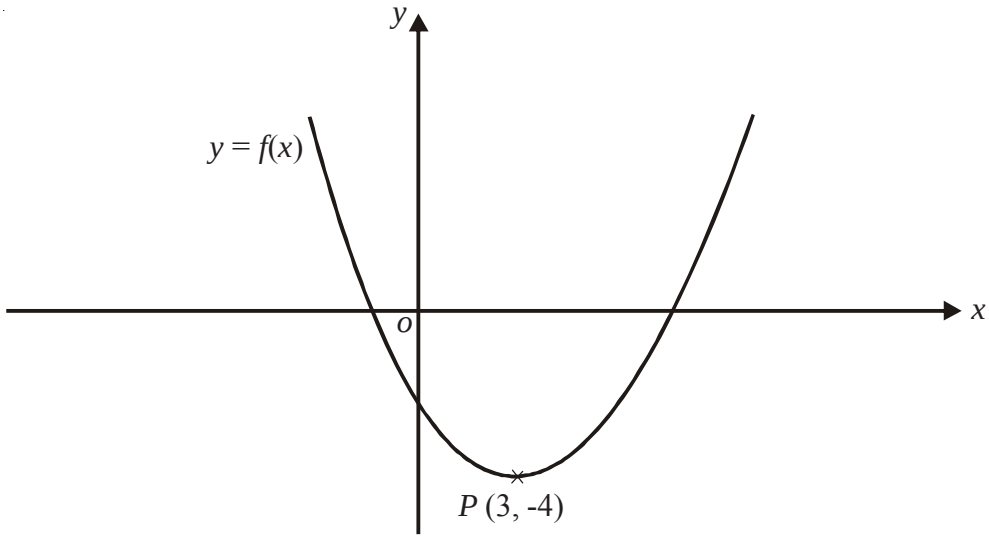
The graph ***G*** is a translation of the graph of $y = f(x)$.

a) Write down, in terms of f, the equation of graph ***G***. $y = f(x - 5)$

The graph of $y = f(x)$ has a maximum point at (-4, 3).

b) Write down the coordinates of the maximum point of the graph $y = f(-x)$. (4, 3)

2) This is a sketch of the curve with the equation $y = f(x)$.
The only minimum point of the curve is at P (3, -4).

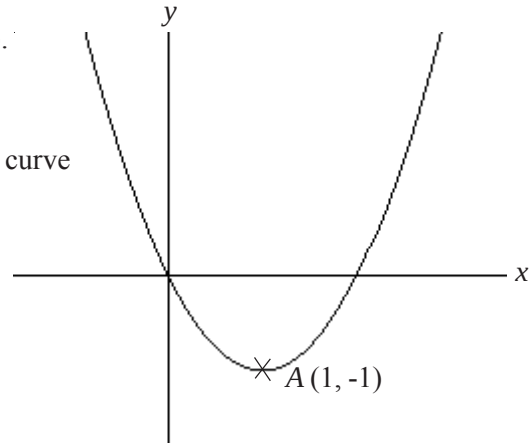


a) Write down the coordinates of the minimum point of the curve with the equation $y = f(x - 2)$ (5, -4)

b) Write down the coordinates of the minimum point of the curve with the equation $y = f(x + 5) + 6$ (-2, 2)

Transformations of Functions

1) This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O.
The only vertex of the curve is at A (1, -1)



a) Write down the coordinates of the vertex of the curve with equation

(i) $y = f(x - 3)$

(ii) $y = f(x) - 5$

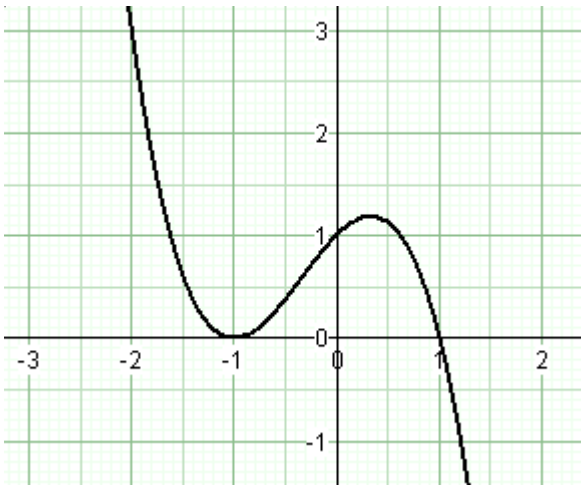
(iii) $y = -f(x)$

(iv) $y = f(2x)$

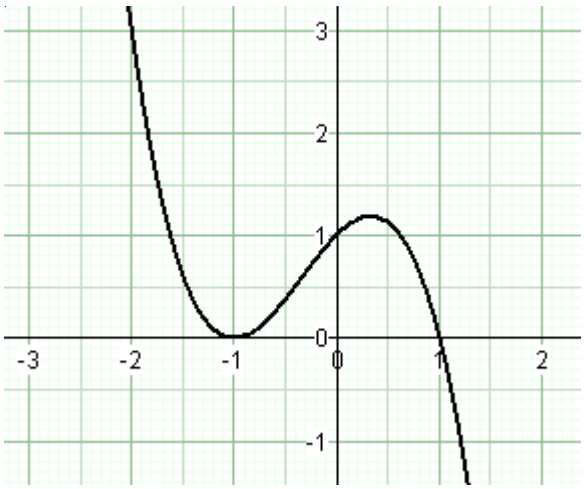
b) The curve $y = x^2$ has been translated to give the curve $y = f(x)$.
Find $f(x)$ in terms of x.

2) The graph of $y = f(x)$ is shown on the grids.

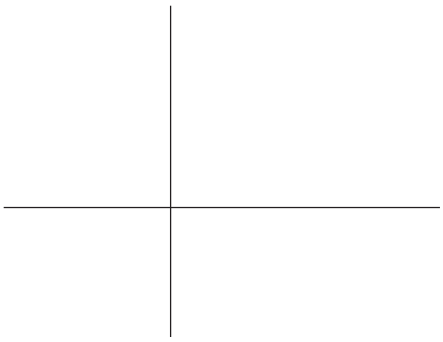
a) On this grid, sketch the graph of $y = f(x - 1)$



b) On this grid, sketch the graph of $y = 2f(x)$

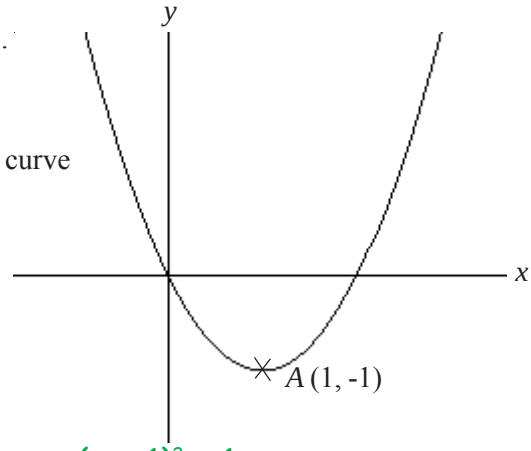


3) Sketch the graph of $y = (x - 2)^2 + 3$
State the coordinates of the vertex.



Transformations of Functions

1) This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O.
The only vertex of the curve is at A (1, -1)



a) Write down the coordinates of the vertex of the curve with equation

(i) $y = f(x - 3)$ (4, -1)

(ii) $y = f(x) - 5$ (1, -6)

(iii) $y = -f(x)$ (1, 1)

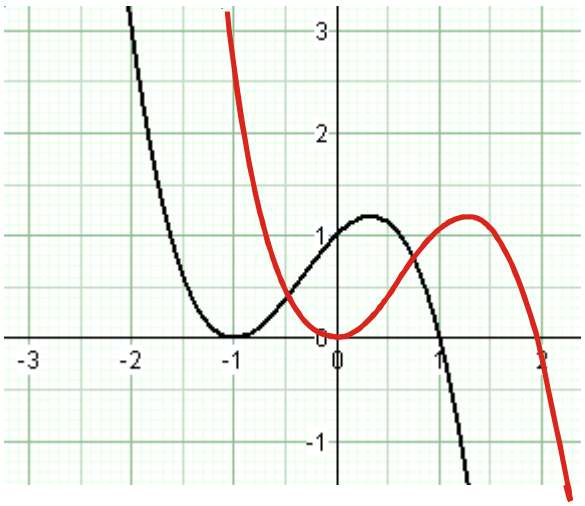
(iv) $y = f(2x)$ ($\frac{1}{2}$, -1)

b) The curve $y = x^2$ has been translated to give the curve $y = f(x)$.
Find $f(x)$ in terms of x. $y = x^2 - 2x$

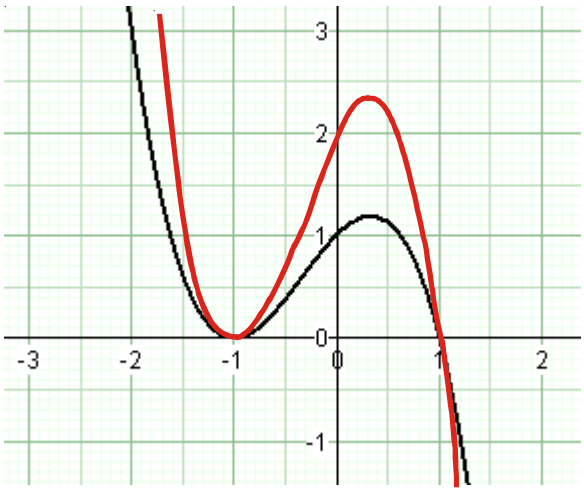
$y = (x - 1)^2 - 1$
$y = x^2 - 2x + 1 - 1$
$y = x^2 - 2x$

2) The graph of $y = f(x)$ is shown on the grids.

a) On this grid, sketch the graph of $y = f(x - 1)$

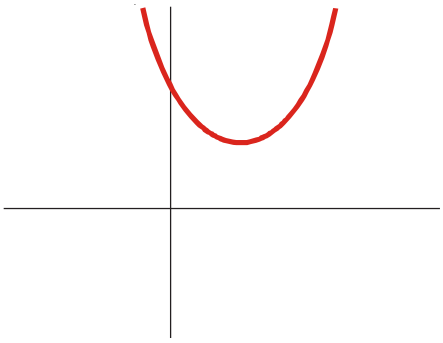


b) On this grid, sketch the graph of $y = 2f(x)$



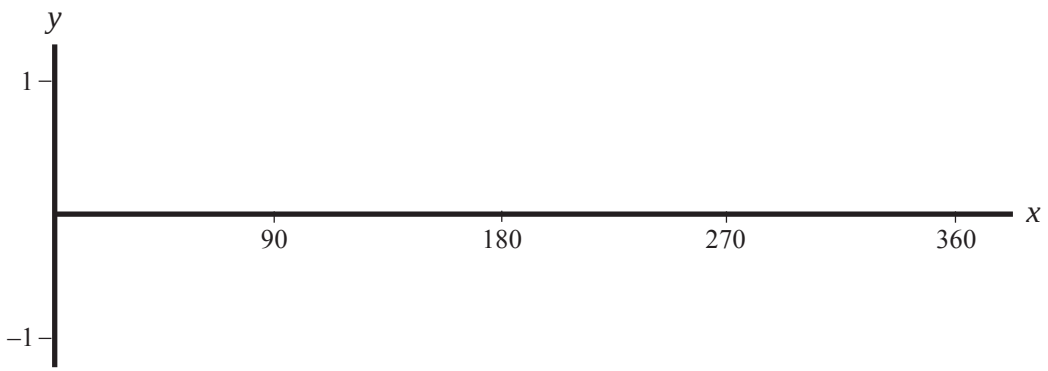
3) Sketch the graph of $y = (x - 2)^2 + 3$
State the coordinates of the vertex.

vertex is at (2, 3)



Graphs of Trigonometric Functions

1) On the axes below below, draw a sketch-graph to show $y = \sin x$

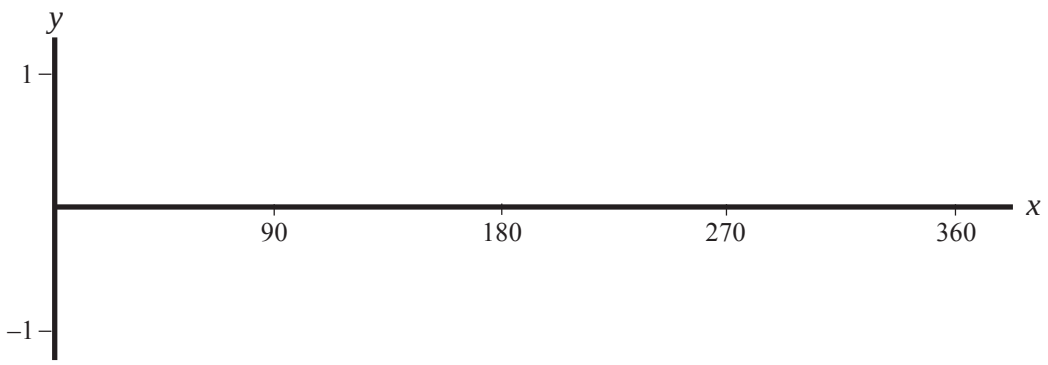


Given that $\sin 30° = 0.5$, write down the value of:

(i) $\sin 150°$

(ii) $\sin 330°$

2) On the axes below, draw a sketch-graph to show $y = \cos x$



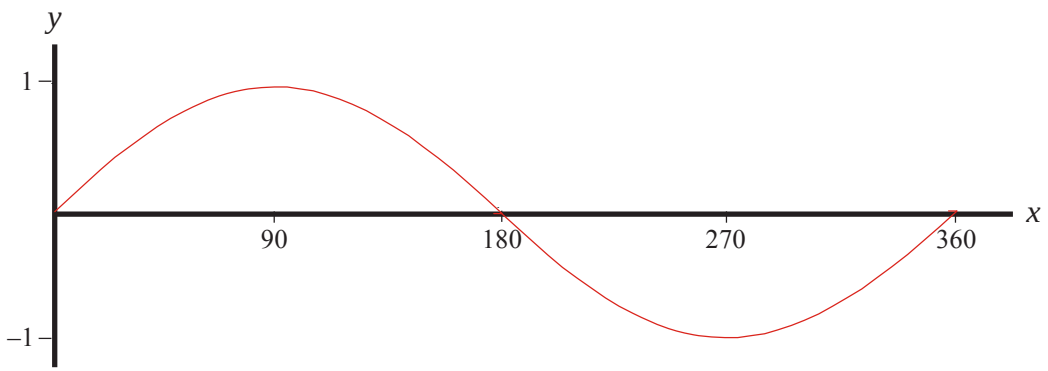
Given that $\cos 60° = 0.5$, write down the value of:

(i) $\cos 120°$

(ii) $\cos 240°$

Graphs of Trigonometric Functions

1) On the axes below below, draw a sketch-graph to show $y = \sin x$

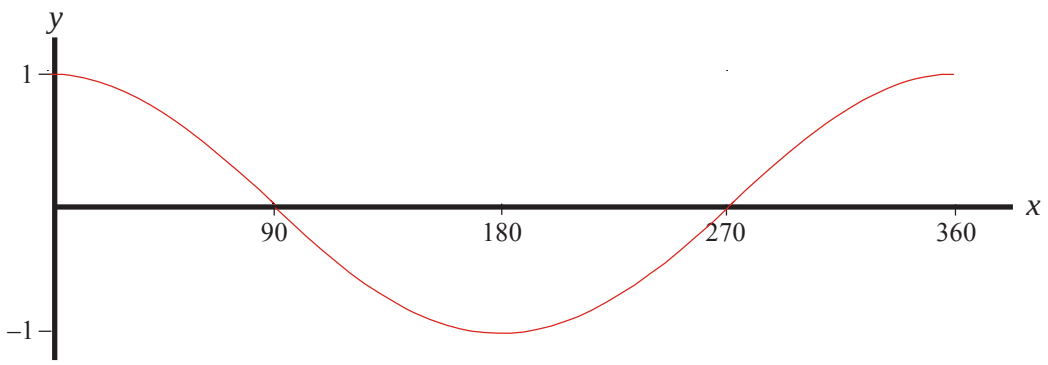


Given that $\sin 30° = 0.5$, write down the value of:

(i) $\sin 150°$ 0.5

(ii) $\sin 330°$ -0.5

2) On the axes below, draw a sketch-graph to show $y = \cos x$



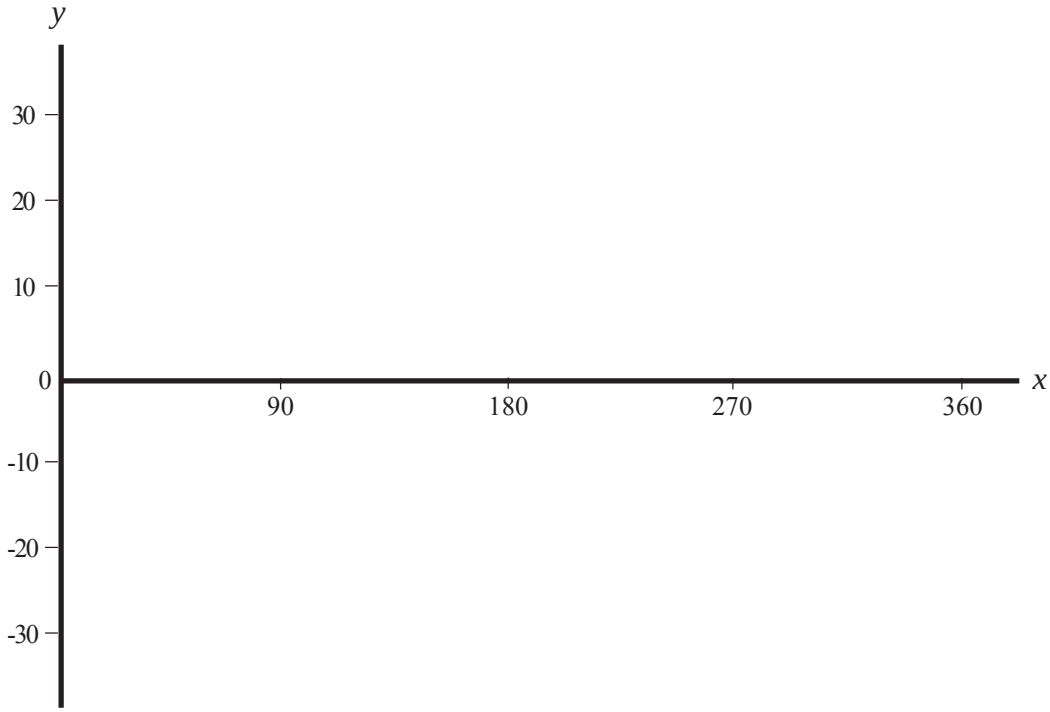
Given that $\cos 60° = 0.5$, write down the value of:

(i) $\cos 120°$ -0.5

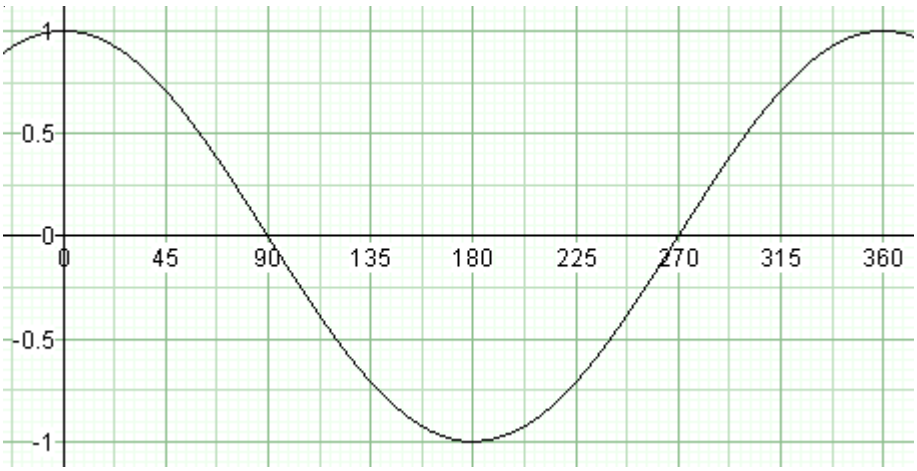
(ii) $\cos 240°$ -0.5

Graphs of Trigonometric Functions

1) On the axes below, draw a sketch-graph to show $y = \tan x$



2) Here is the graph of the curve $y = \cos x$ for $0 \leqslant x \leqslant 360^\circ$.

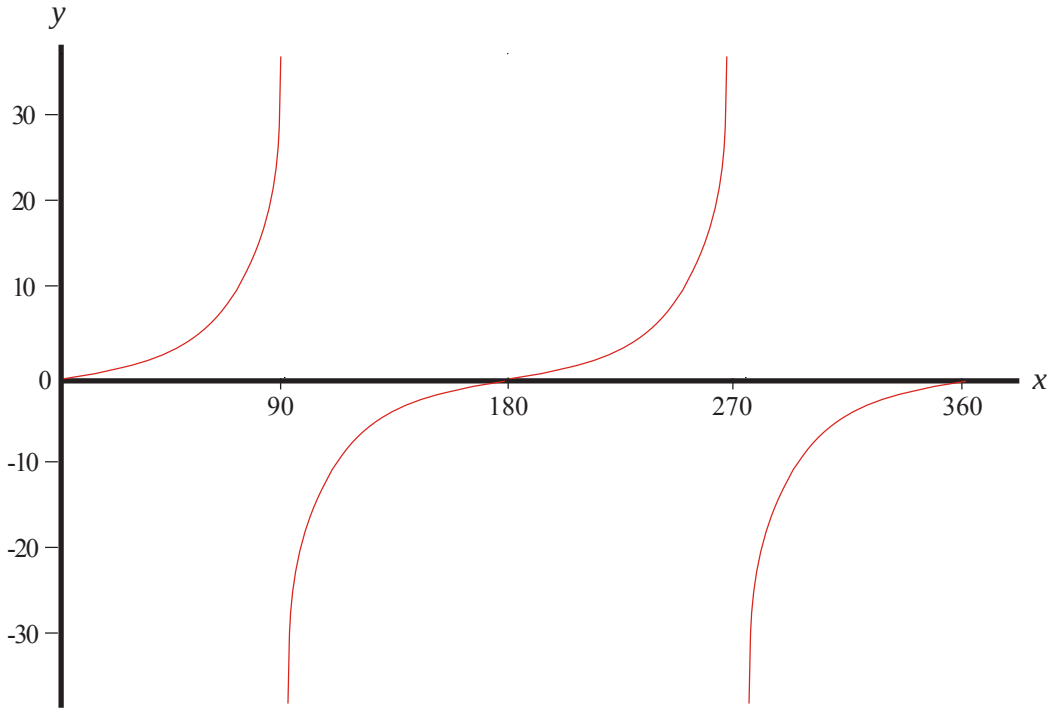


a) Use the graph to solve $\cos x = 0.75$ for $0 \leqslant x \leqslant 360^\circ$

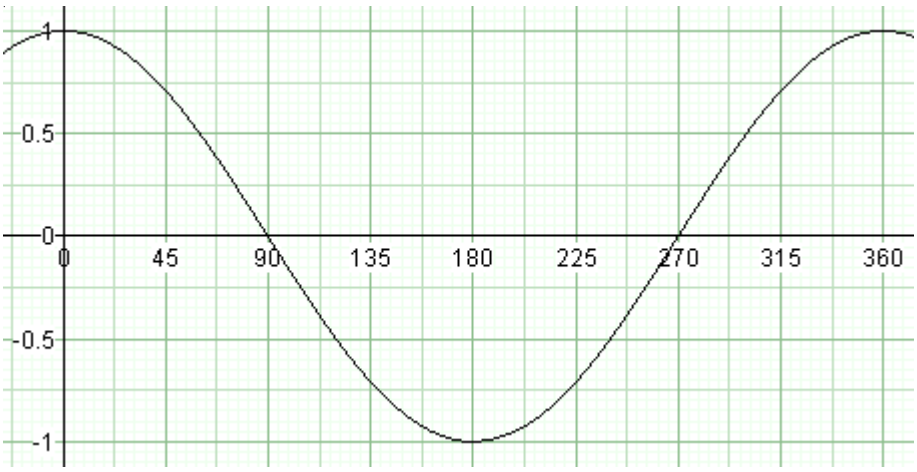
b) Use the graph to solve $\cos x = -0.75$ for $0 \leqslant x \leqslant 360^\circ$

Graphs of Trigonometric Functions

1) On the axes below, draw a sketch-graph to show $y = \tan x$



2) Here is the graph of the curve $y = \cos x$ for $0 \leqslant x \leqslant 360^\circ$.

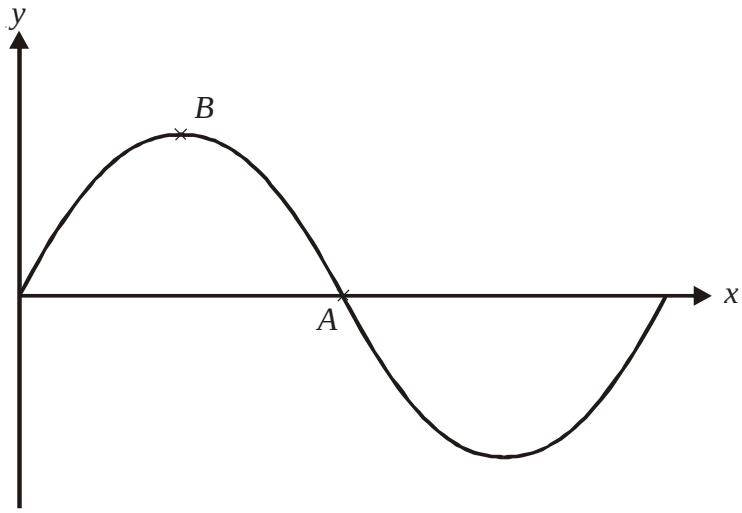


a) Use the graph to solve $\cos x = 0.75$ for $0 \leqslant x \leqslant 360^\circ$ $x = 42^\circ$ and 318°

b) Use the graph to solve $\cos x = -0.75$ for $0 \leqslant x \leqslant 360^\circ$ $x = 138^\circ$ and 222°

Transformations of Trigonometric Functions

1) The diagram below shows the graph of $y = 2\sin x$, for values of x between 0 and 360°.

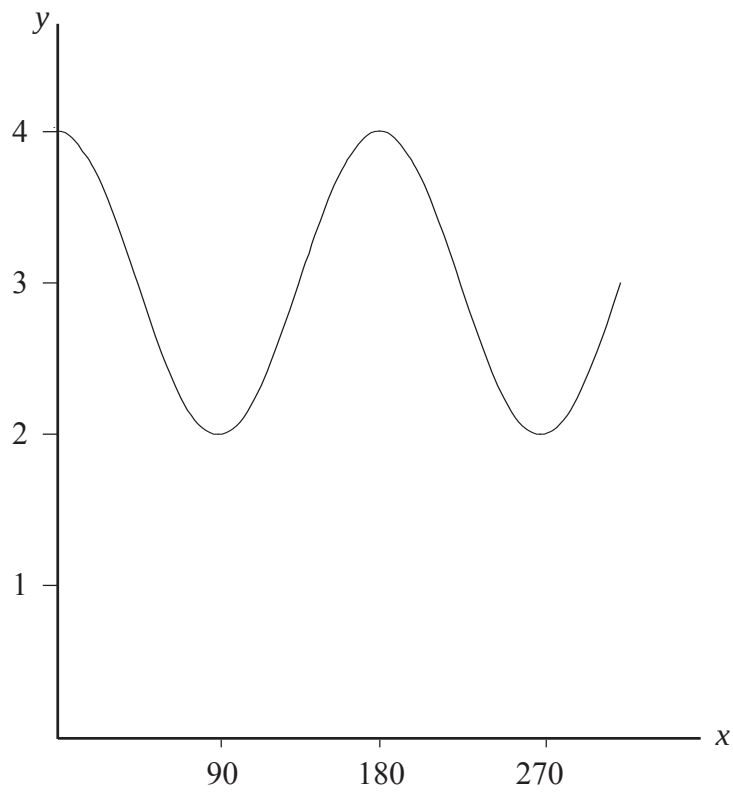


The curve cuts the x axis at the point A.
The graph has a maximum at the point B.

a) (i) Write down the coordinates of A.
(ii) Write down the coordinates of B.

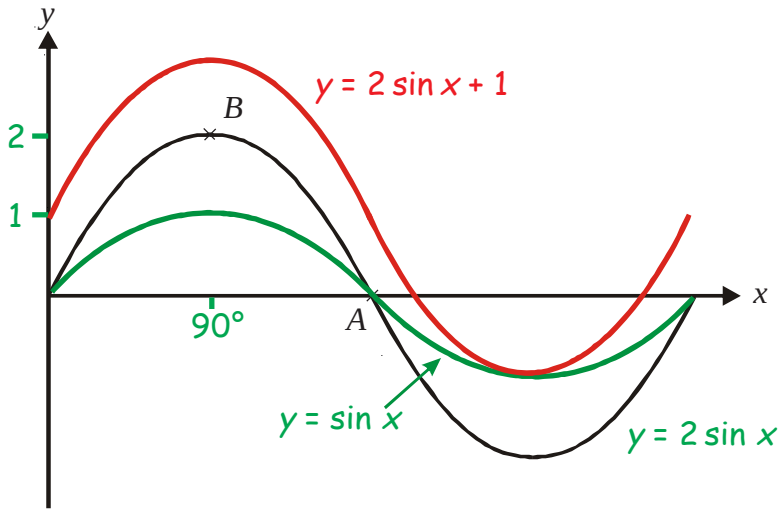
b) On the same diagram, sketch the graph of $y = 2\sin x + 1$ for values of x between 0° and 360°.

2) The diagram below shows the graph of $y = \cos \boldsymbol{a}x + \boldsymbol{b}$, for values of x between 0° and 300°.
Work out the values of $\boldsymbol{a}$ and $\boldsymbol{b}$.



Transformations of Trigonometric Functions

1) The diagram below shows the graph of $y = 2\sin x$, for values of x between 0 and 360°.



The curve cuts the x axis at the point A.
The graph has a maximum at the point B.

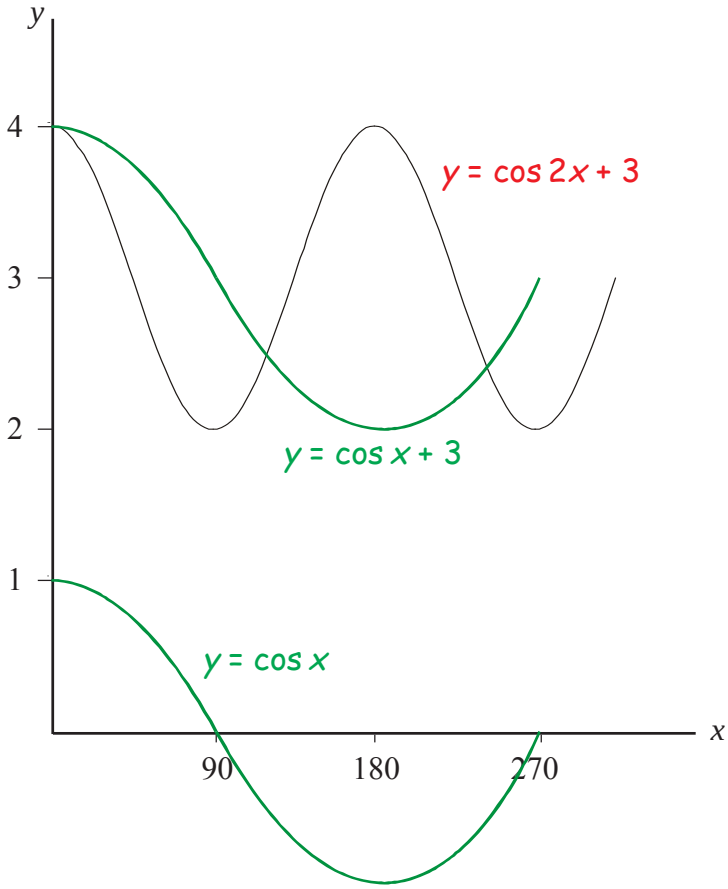
a) (i) Write down the coordinates of A. (180°, 0)

(ii) Write down the coordinates of B. (90°, 2)

b) On the same diagram, sketch the graph of $y = 2\sin x + 1$ for values of x between 0° and 360°.

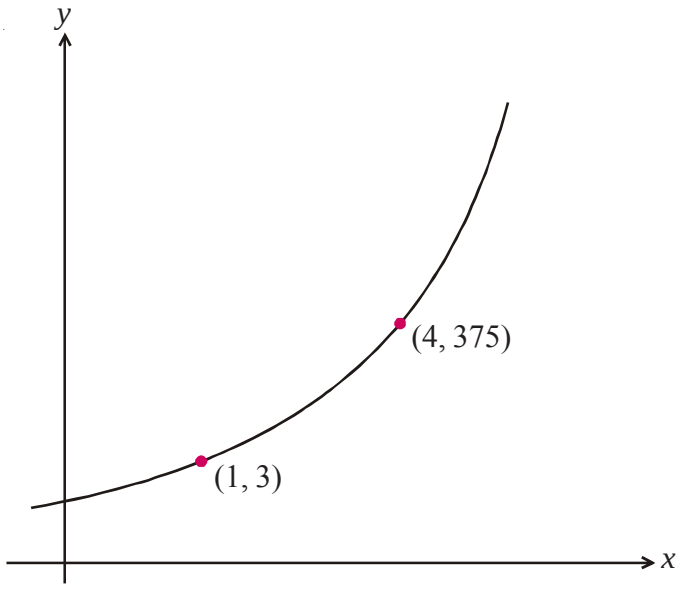
2) The diagram below shows the graph of $y = \cos \boldsymbol{a}x + \boldsymbol{b}$, for values of x between 0° and 300°.

Work out the values of $\boldsymbol{a}$ and $\boldsymbol{b}$. $a = 2$ $b = 3$



Graphs of Exponential Functions

1)



The sketch-graph shows a curve with equation $y = pq^x$.

The curve passes through the points (1, 3) and (4, 375).

Calculate the value of p and the value of q.

2) The graph shows the number of bacteria living in a petri dish.
The number N of bacteria at time t is given by the relation:

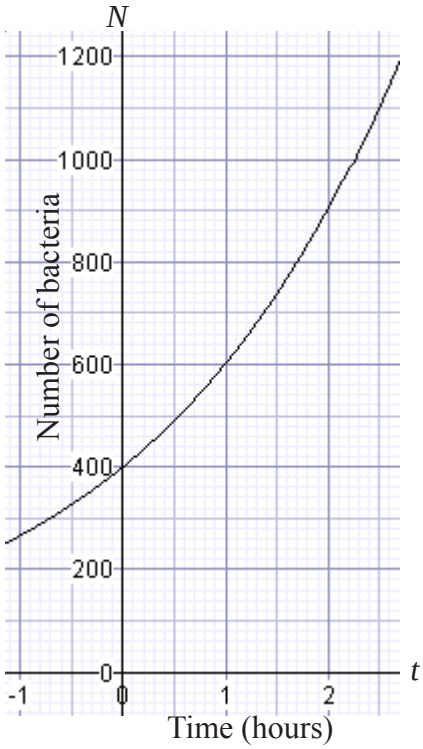
$$N = a \times b^t$$

The curve passes through the point (0, 400).

a) Use this information to show that $a = 400$.

The curve also passes through (2, 900).

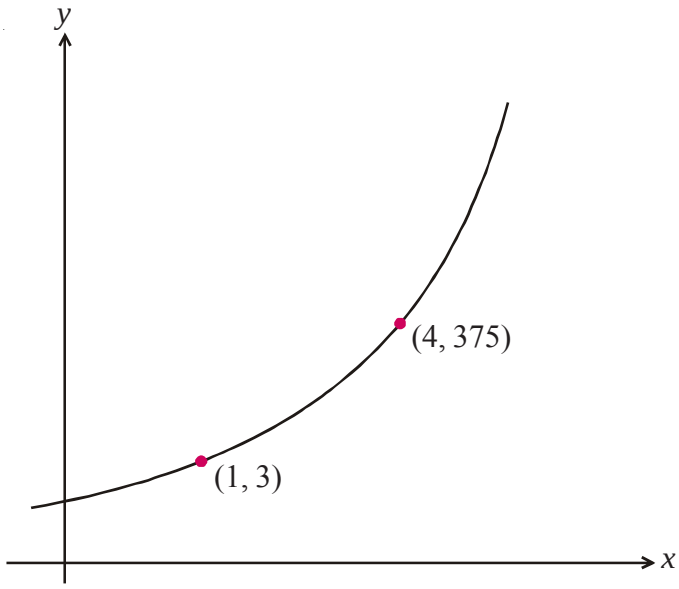
b) Use this information to find the value of b.



c) Work out the number of bacteria in the dish at time $t = 3$.

Graphs of Exponential Functions

1)



Using (1, 3)

$y = pq^x$
$3 = pq^1$
$3 = pq$
$p = \frac{3}{q}$

Using (4, 375)

$y = pq^x$
$375 = pq^4$

Replacing p with $\frac{3}{q}$

$375 = pq^4$
$375 = \frac{3}{q} \times q^4$
$375 = 3q^3$
$q^3 = 125$
$q = 5$

$p = \frac{3}{q}$
$p = \frac{3}{5}$

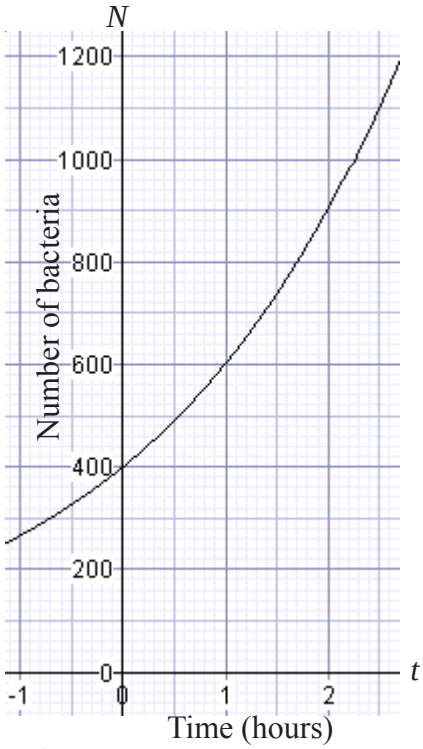
The sketch-graph shows a curve with equation $y = pq^x$.

The curve passes through the points (1, 3) and (4, 375).

Calculate the value of p and the value of q. $p = 0.6$ and $q = 5$

2) The graph shows the number of bacteria living in a petri dish.
The number N of bacteria at time t is given by the relation:

$N = a \times b^t$



The curve passes through the point (0, 400).

a) Use this information to show that $a = 400$.

$N = a \times b^t$
$400 = a \times b^0$
$400 = a \times 1$
$a = 400$

The curve also passes through (2, 900).

b) Use this information to find the value of b.

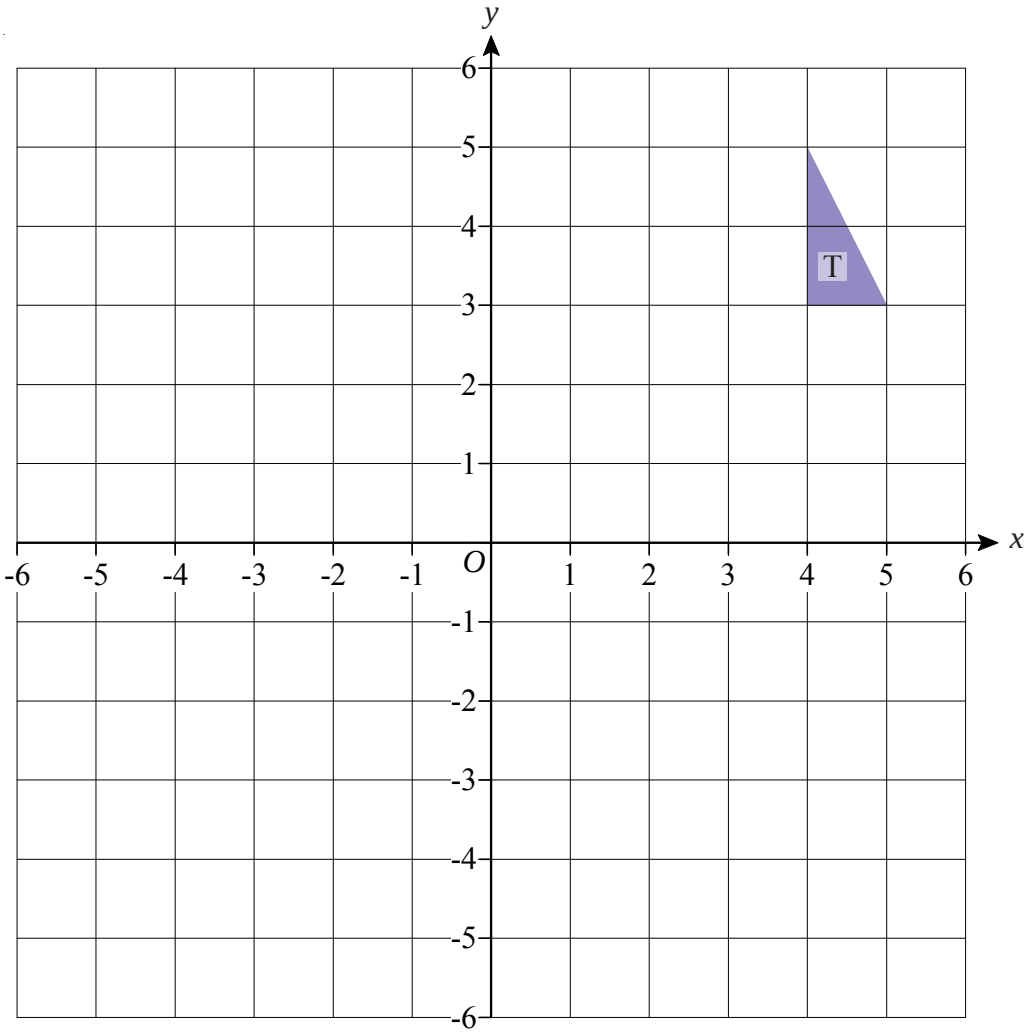
$N = 400 \times b^t$
$900 = 400 \times b^2$
$b^2 = \frac{900}{400}$
$b = \frac{30}{20}$
$b = 1.5$

c) Work out the number of bacteria in the dish at time $t = 3$. $N = 1350$

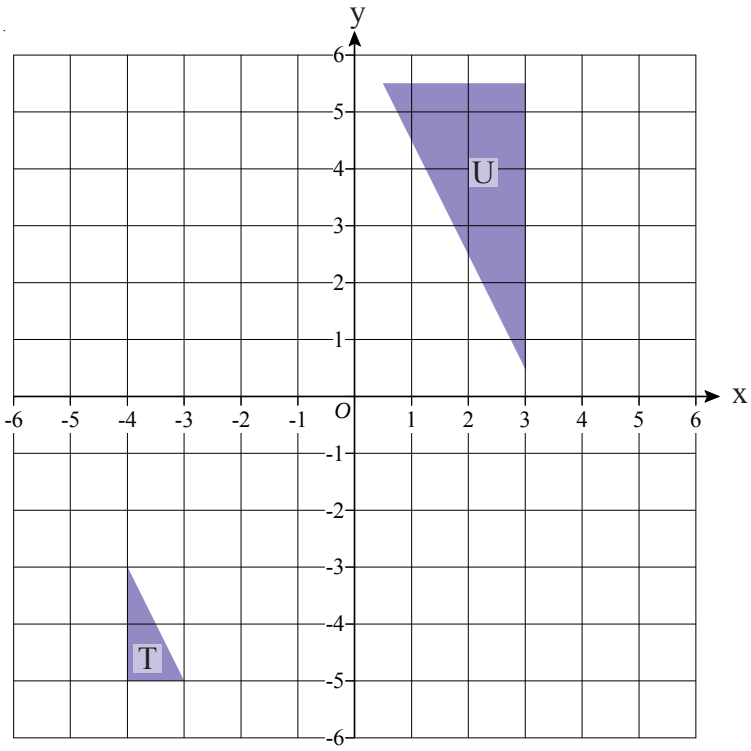
$N = 400 \times 1.5^t$
$N = 400 \times \left(\frac{3}{2}\right)^3$
$N = 400 \times \left(\frac{27}{8}\right)$
$N = 50 \times 27$
$N = 1350$

Enlargements by Negative Scale Factors

1) Enlarge triangle T by scale factor -2 using coordinates (2, 2) as the centre of enlargement.

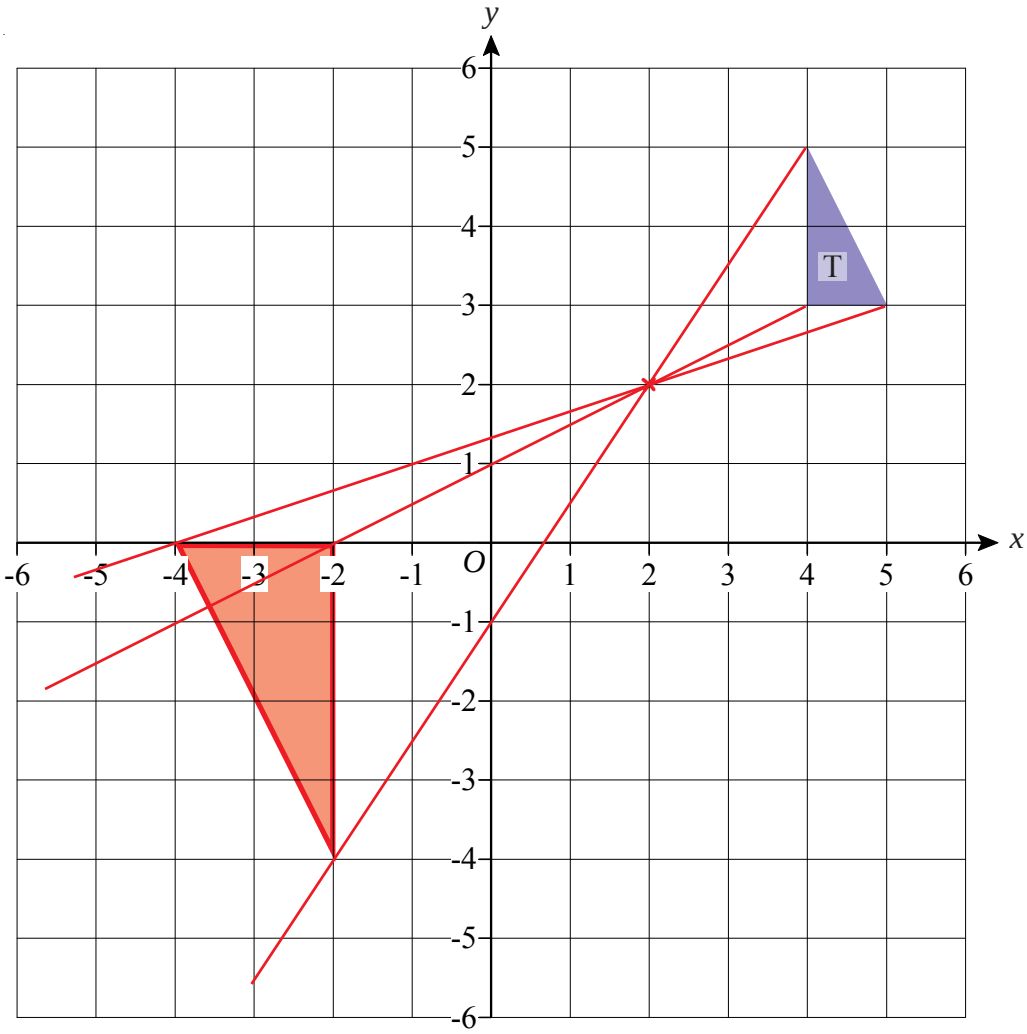


2) Describe fully the single transformation which maps triangle T to triangle U.

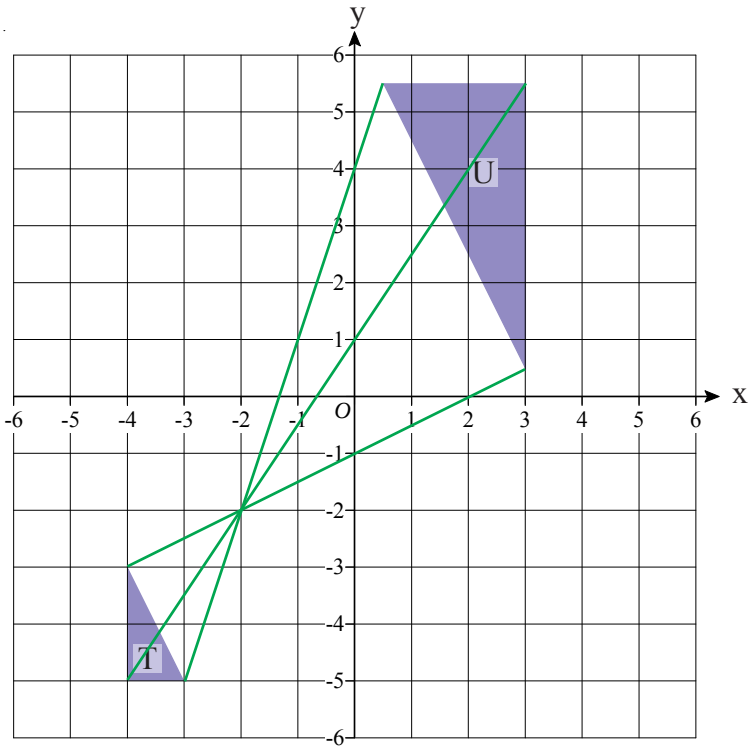


Enlargements by Negative Scale Factors

1) Enlarge triangle T by scale factor -2 using coordinates (2, 2) as the centre of enlargement.



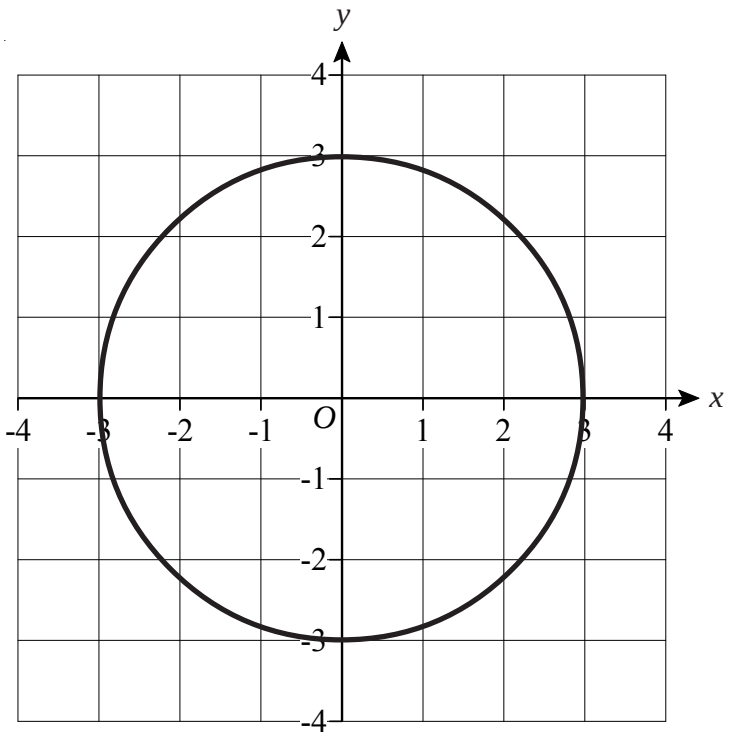
2) Describe fully the single transformation which maps triangle T to triangle U.



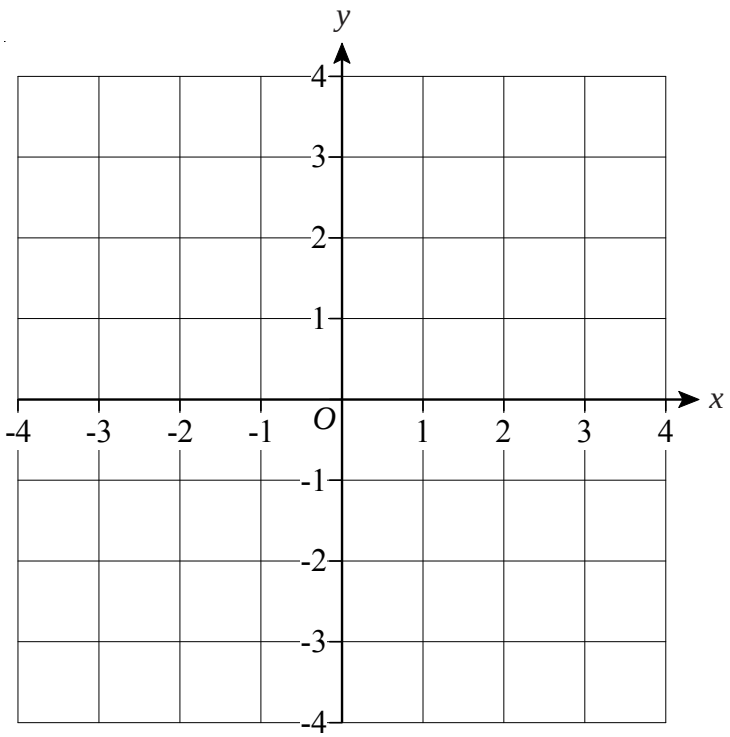
Enlargement with scale factor -2.5
Centre of enlargement at (-2, -2)

Equations of Circles

1) Find the equation of a circle with radius 3 and centre the origin.



2) a) Draw the graph of $x^2 + y^2 = 6.25$

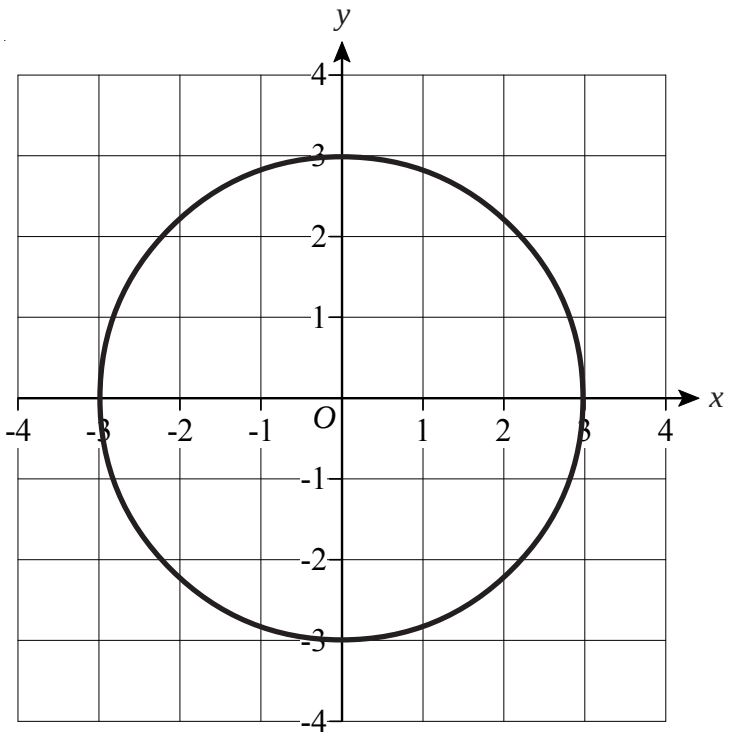


b) By drawing the line $x + y = 1.5$, solve the equations

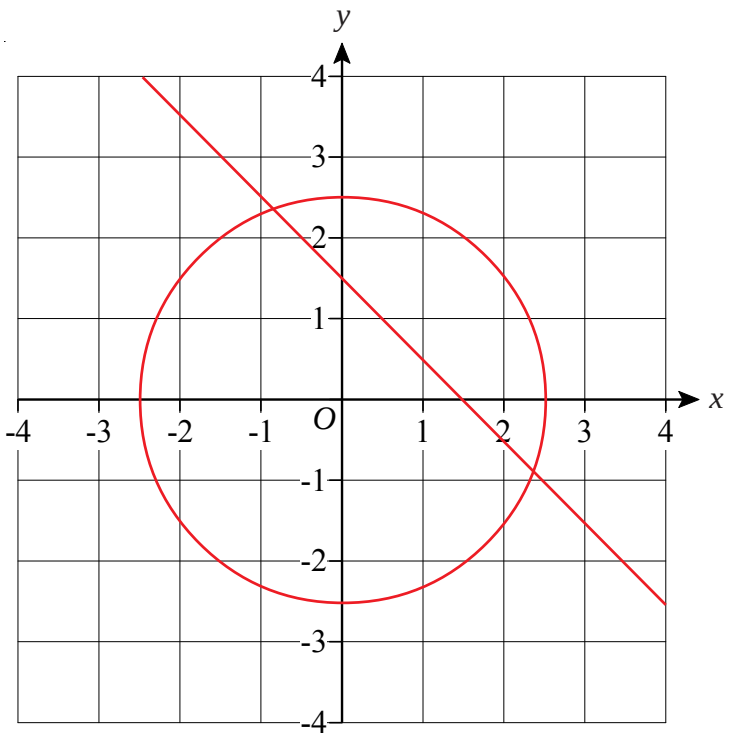
$$x^2 + y^2 = 6.25$$
$$x + y = 1.5$$

Equations of Circles

1) Find the equation of a circle with radius 3 and centre the origin. $x^2 + y^2 = 9$



2) a) Draw the graph of $x^2 + y^2 = 6.25$



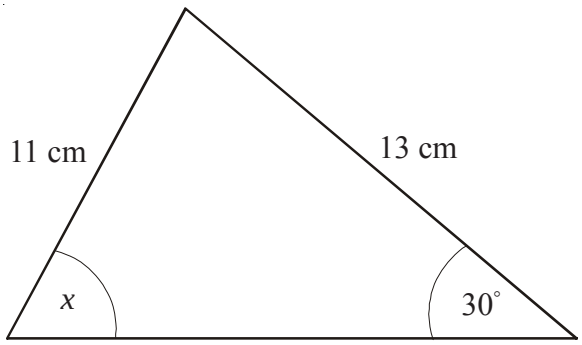
b) By drawing the line $x + y = 1.5$, solve the equations

$x^2 + y^2 = 6.25$ $\quad$ $x = 2.3$ and $y = -0.8$

$x + y = 1.5$ $\quad$ $x = -0.8$ and $y = 2.3$

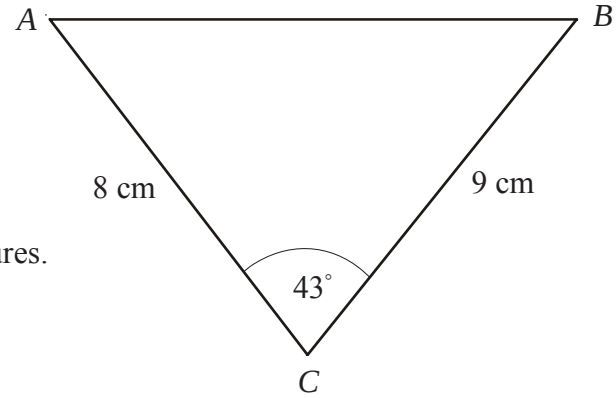
Sine and Cosine Rules

1) Work out the size of the angle marked x.
Give your answer correct to one decimal place.



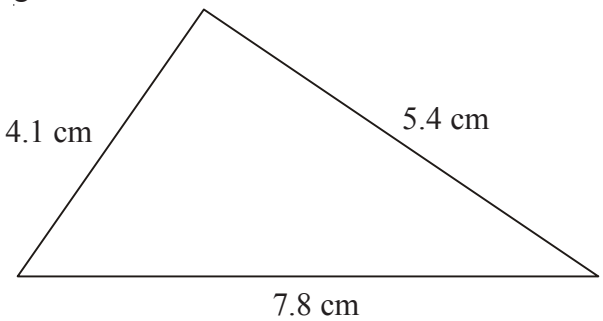
2) ABC is a triangle.
$AC = 8$ cm
$BC = 9$ cm
Angle $ACB = 43°$

Calculate the length of AB.
Give your answer correct to 3 significant figures.



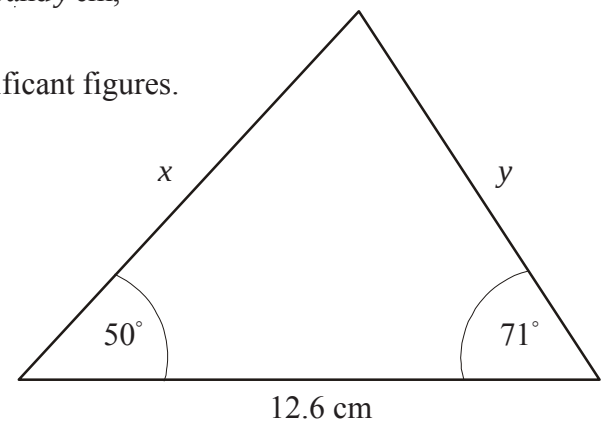
3) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

Calculate the size of the largest angle of the triangle.
Give your answer correct to 1 decimal place.



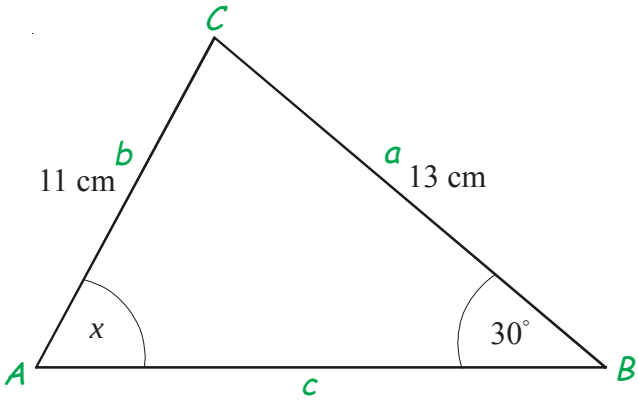
4) Find the missing lengths, x cm and y cm,
in this triangle.

Give your answers to 3 significant figures.



Sine and Cosine Rules

1) Work out the size of the angle marked x. 36.2°
Give your answer correct to one decimal place.



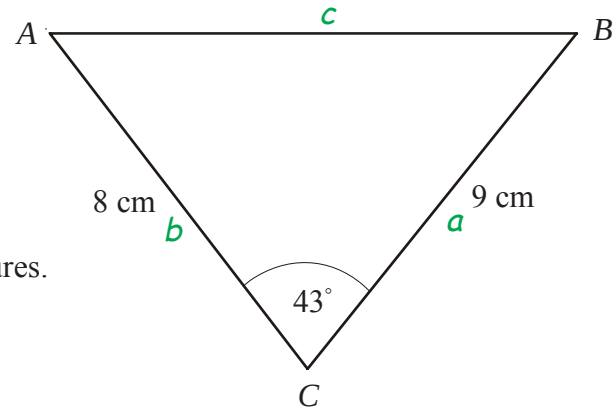
$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\frac{\sin A}{13} = \frac{\sin 30}{11}$$

$$\sin A = \frac{13 \times \sin 30}{11}$$

2) ABC is a triangle.
$AC = 8$ cm
$BC = 9$ cm
Angle $ACB = 43°$

Calculate the length of AB. 6.30 cm
Give your answer correct to 3 significant figures.

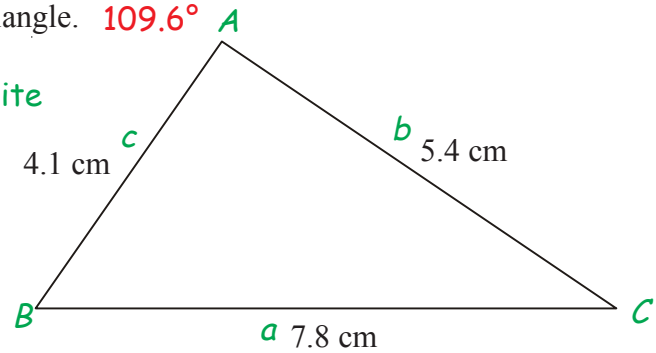


$c^2 = a^2 + b^2 - 2ab \cos C$
$c^2 = 9^2 + 8^2 - 2 \times 9 \times 8 \times \cos 43$
$c^2 = 39.6851$

3) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

Calculate the size of the largest angle of the triangle. 109.6°
Give your answer correct to 1 decimal place.

A is the largest angle because it is opposite the largest side.

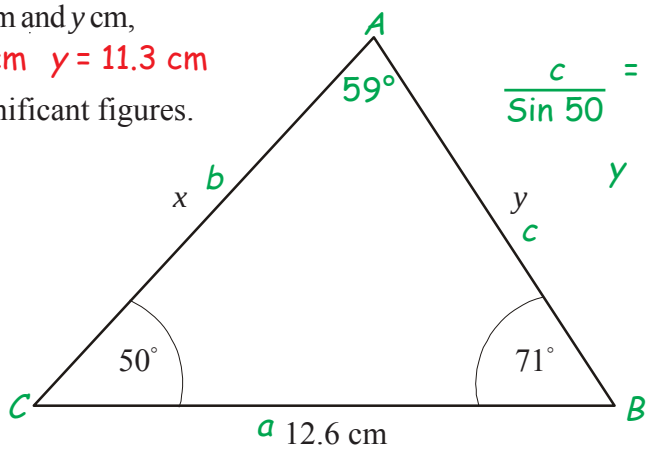


$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos A = \frac{5.4^2 + 4.1^2 - 7.8^2}{2 \times 5.4 \times 4.1}$$

4) Find the missing lengths, x cm and y cm, in this triangle. $x = 13.9$ cm $y = 11.3$ cm

Give your answers to 3 significant figures.



$$\frac{b}{\sin 71} = \frac{12.6}{\sin 59}$$

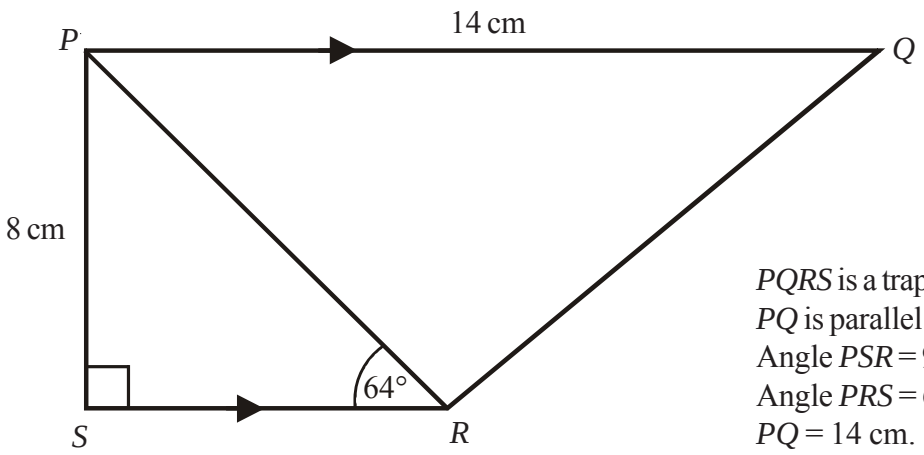
$$x = \frac{12.6 \times \sin 71}{\sin 59}$$

$$\frac{c}{\sin 50} = \frac{12.6}{\sin 59}$$

$$y = \frac{12.6 \times \sin 50}{\sin 59}$$

Sine and Cosine Rules

1)

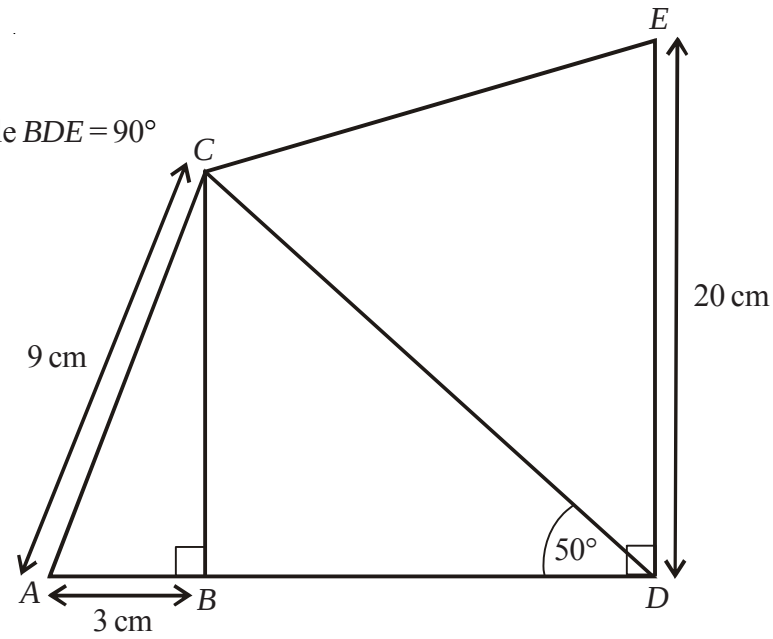


PQRS is a trapezium.
PQ is parallel to *SR*.
Angle *PSR* = 90°
Angle *PRS* = 64°
PQ = 14 cm.
PS = 8 cm.

a) Work out the length of *PR*.
Give your answer correct to 3 significant figures.

b) Work out the length of *QR*.
Give your answer correct to 3 significant figures.

2) *AC* = 9 cm
AB = 3 cm
DE = 20 cm
Angle *ABC* = angle *CBD* = angle *BDE* = 90°

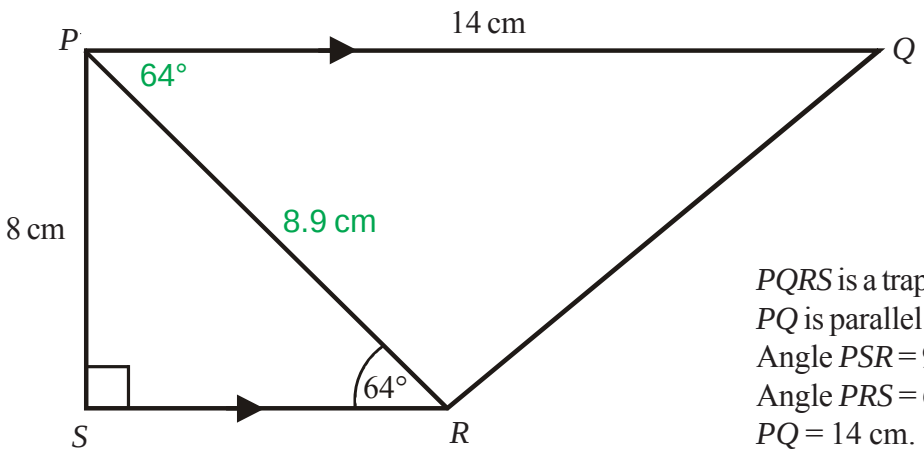


a) Calculate the length of *CD*.
Give your answer to 3 significant figures.

b) Calculate the length of *CE*.
Give your answer to 3 significant figures.

Sine and Cosine Rules

1)

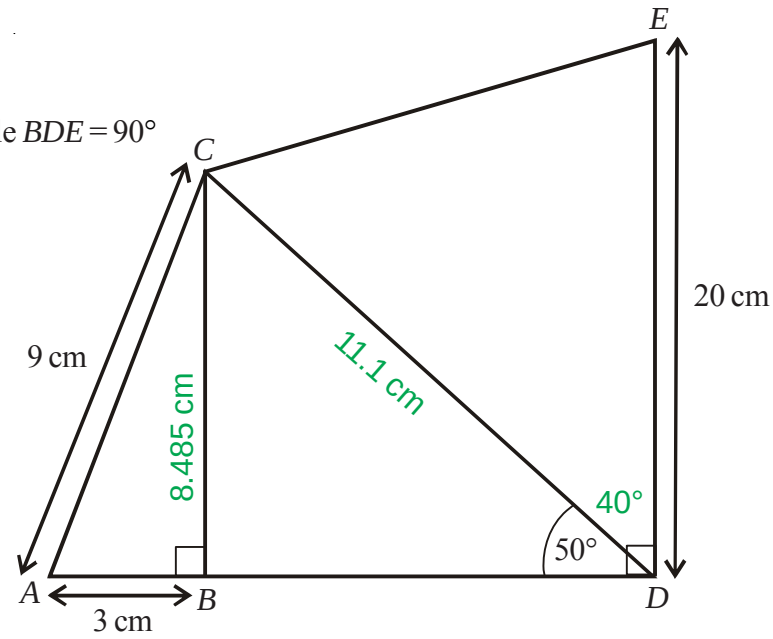


PQRS is a trapezium.
PQ is parallel to *SR*.
Angle *PSR* = 90°
Angle *PRS* = 64°
PQ = 14 cm.
PS = 8 cm.

a) Work out the length of *PR*. 8.90 cm
Give your answer correct to 3 significant figures.

b) Work out the length of *QR*. 12.9 cm
Give your answer correct to 3 significant figures.

2) *AC* = 9 cm
AB = 3 cm
DE = 20 cm
Angle *ABC* = angle *CBD* = angle *BDE* = 90°



a) Calculate the length of *CD*. 11.1 cm
Give your answer to 3 significant figures.

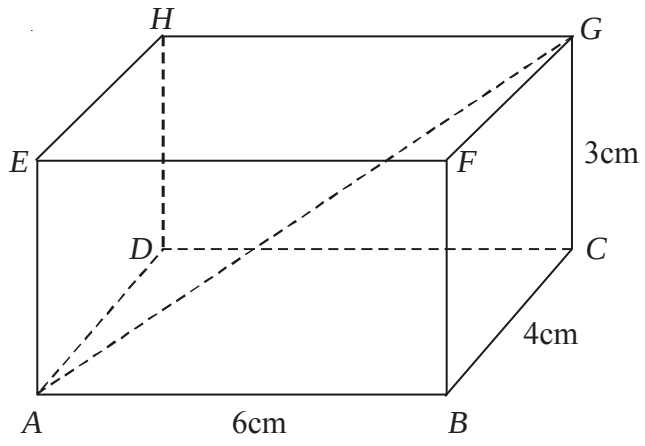
b) Calculate the length of *CE*. 13.5 cm
Give your answer to 3 significant figures.

Pythagoras in 3D

1) The diagram shows a box in the shape of a cuboid.
$AB = 6$cm, $BC = 4$cm, $CG = 3$cm

A string runs diagonally across the box from A to G.

Calculate the length of the string AG.
Give your answer correct to 3 significant figures.

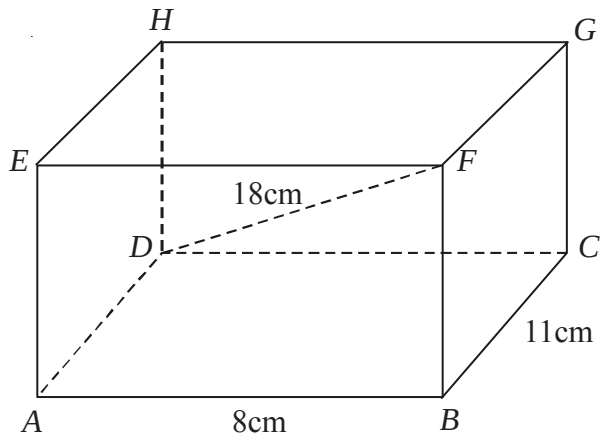


---

2) The diagram shows a box in the shape of a cuboid.
$AB = 8$cm, $BC = 11$cm

A string runs diagonally across the box from D to F and is 18cm long.

Calculate the length AE.
Give your answer correct to 3 significant figures.

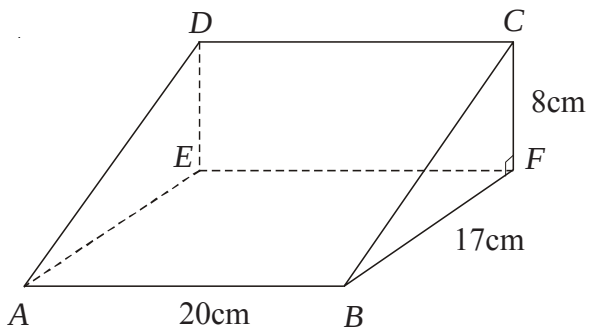


---

3) The diagram shows a wedge in the shape of a prism.
Angle BFC is a right angle.

String runs diagonally across the wedge from A to C.

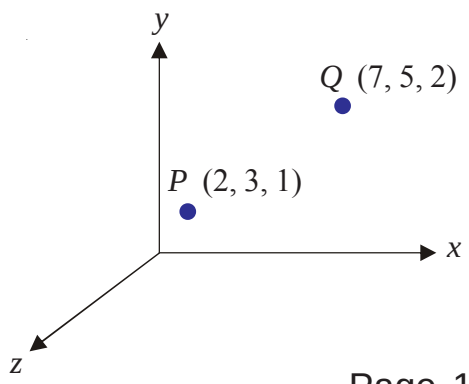
Calculate the length AC
Give your answer correct to 3 significant figures.



---

4) Two points, P and Q, lie on coordinate axes.

Find the distance PQ to 1 decimal place.



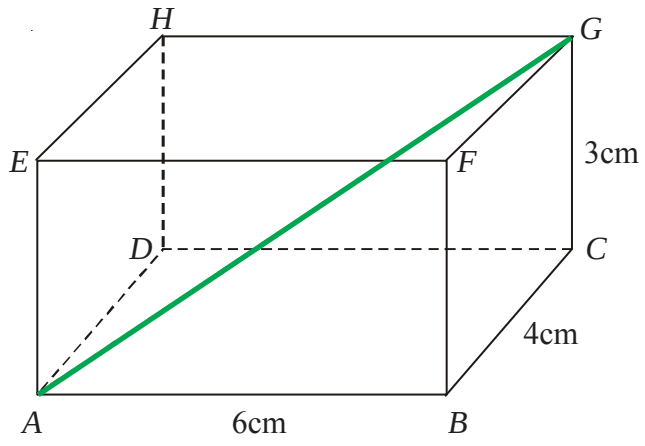
Pythagoras in 3D

1) The diagram shows a box in the shape of a cuboid.
$AB = 6$cm, $BC = 4$cm, $CG = 3$cm

A string runs diagonally across the box from A to G.

Calculate the length of the string AG.
Give your answer correct to 3 significant figures. 7.81 cm

$AG = \sqrt{6^2 + 4^2 + 3^2}$

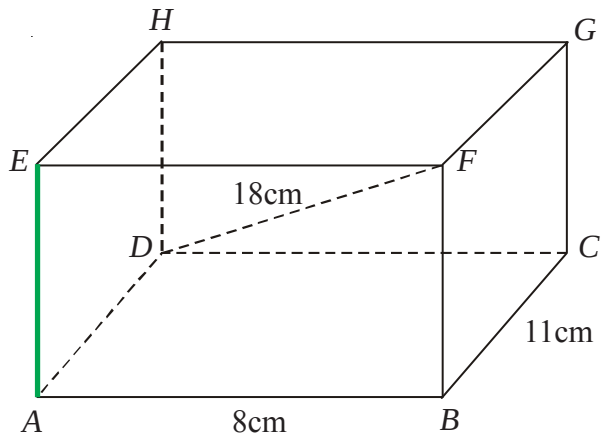


2) The diagram shows a box in the shape of a cuboid.
$AB = 8$cm, $BC = 11$cm

A string runs diagonally across the box from D to F and is 18cm long.

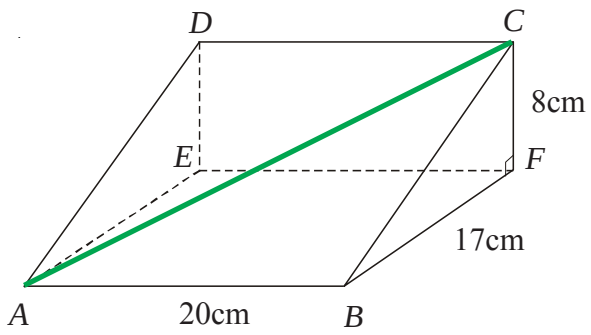
Calculate the length AE. 11.8 cm
Give your answer correct to 3 significant figures.

$AE = \sqrt{18^2 - 11^2 - 8^2}$



3) The diagram shows a wedge in the shape of a prism.
Angle BFC is a right angle.

String runs diagonally across the wedge from A to C.
$AC = \sqrt{20^2 + 17^2 + 8^2}$
Calculate the length AC 27.4 cm
Give your answer correct to 3 significant figures.



4) Two points, P and Q, lie on coordinate axes.

Find the distance PQ to 1 decimal place. 5.5

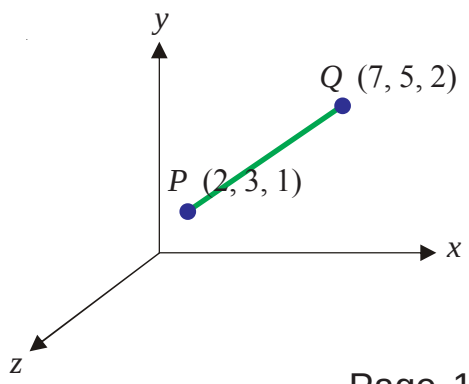
$D^2 = x^2 + y^2 + z^2$

$Q\,(7, 5, 2)$ $P\,(2, 3, 1)$

$D^2 = (7 - 2)^2 + (5 - 3)^2 + (2 - 1)^2$

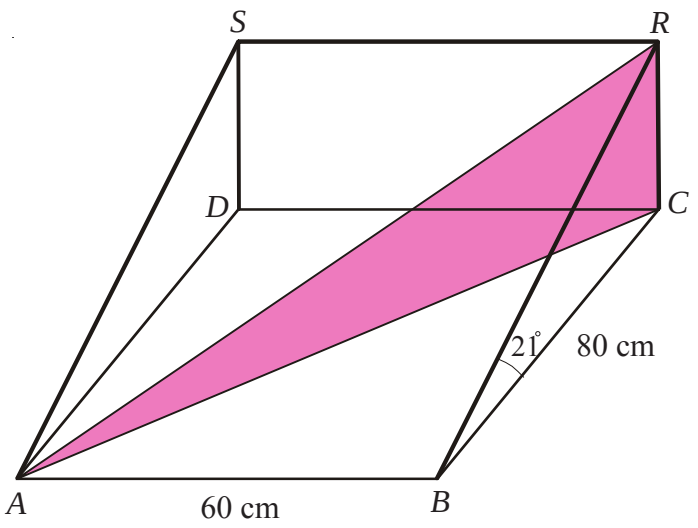
$D^2 = 5^2 + 2^2 + 1^2$

$D = \sqrt{30}$



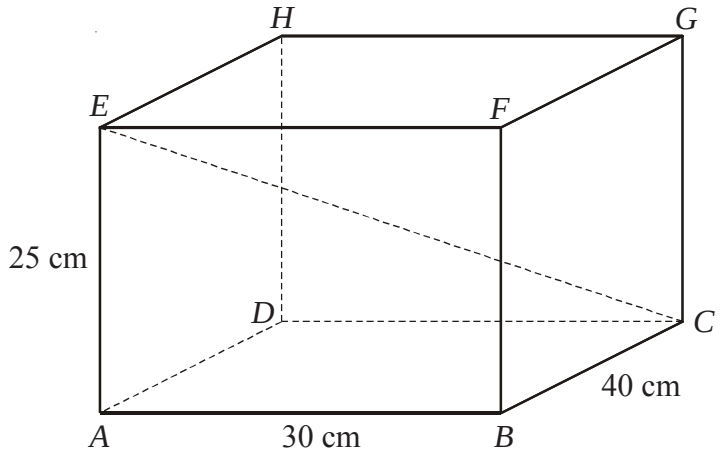
Trigonometry in 3D

1) The diagram shows a wedge.
The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
The sloping face *ABRS* makes an angle of 21° to the horizontal.



Calculate the angle that *AR* makes with the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place.

2) The diagram shows a box in the shape of a cuboid.
A string runs diagonally across the box from *C* to *E*.

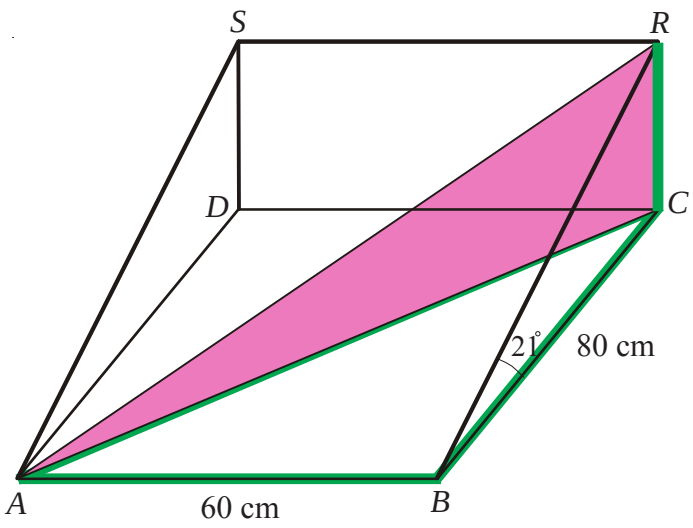


a) Work out the length of the string *CE*.
Give your answer correct to 1 decimal place.

b) Work out the angle between the string *CE* and the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place.

Trigonometry in 3D

1) The diagram shows a wedge.
The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
The sloping face *ABRS* makes an angle of 21° to the horizontal.



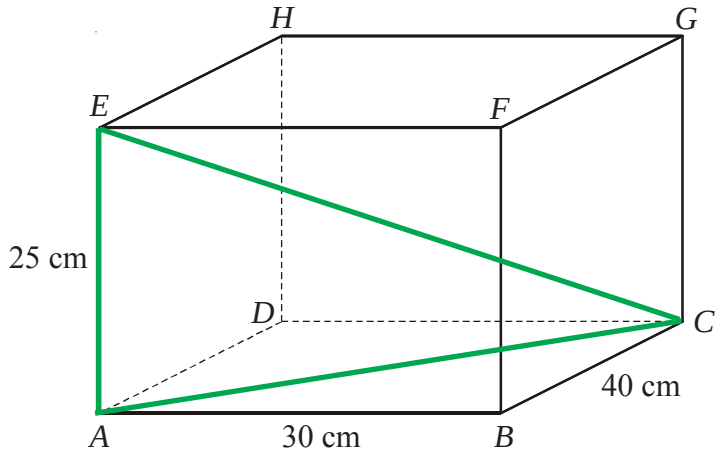
Step 1:
Find *AC* using Pythagoras in triangle *ABC*.
Answer: *AC* = 100 cm

Step 2:
Find *CR* using Tan 21 in triangle *BCR*.
Answer: *CR* = 30.71 cm

Step 3:
Find angle *RAC* using Tan in triangle *RAC*.
Answer: Angle *RAC* = 17.1°

Calculate the angle that *AR* makes with the horizontal plane *ABCD*. 17.1°
Give your answer correct to 1 decimal place.

2) The diagram shows a box in the shape of a cuboid.
A string runs diagonally across the box from *C* to *E*.



a) Work out the length of the string *CE*. 55.9 cm $CE = \sqrt{30^2 + 40^2 + 25^2}$
Give your answer correct to 1 decimal place.

b) Work out the angle between the string *CE* and the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place. 26.6°

In triangle *CAE* we have *CE* = 55.9 cm and *AE* = 25 cm.
It has a right angle at *A*.
Use Sin to find the required angle.

Areas of Triangles Using ½*ab*Sin*C*

1)

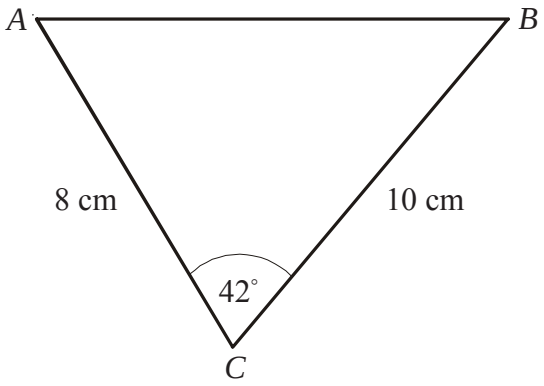


Diagram **NOT** accurately drawn.

ABC is a triangle.
AC = 8 cm.
BC = 10 cm
Angle *ACB* = 42°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

2)

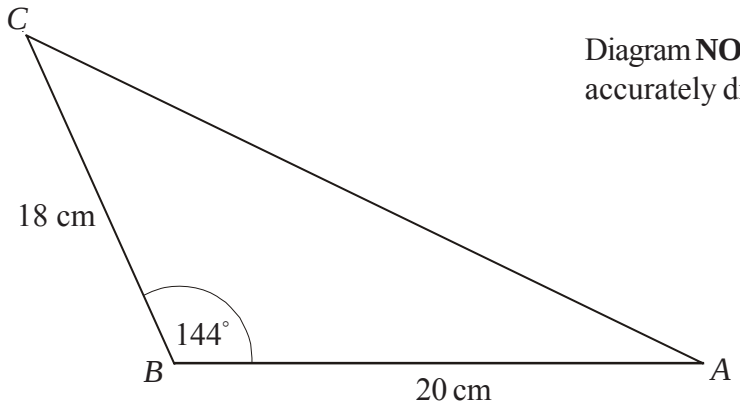


Diagram **NOT** accurately drawn.

ABC is a triangle.
AB = 20 cm.
BC = 18 cm
Angle *ABC* = 144°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

3)

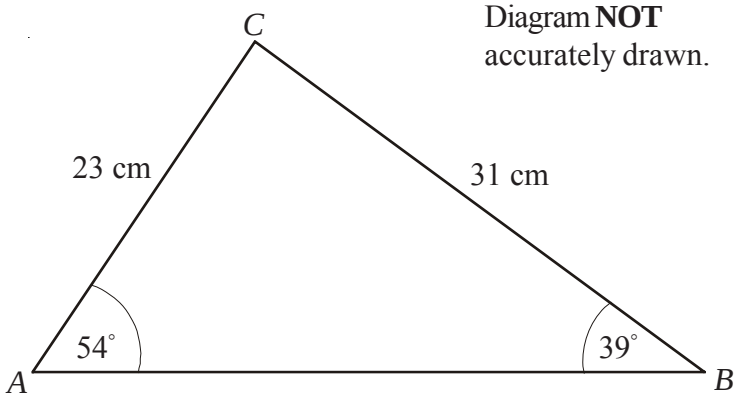


Diagram **NOT** accurately drawn.

ABC is a triangle.
AC = 23 cm.
BC = 31 cm
Angle *BAC* = 54°
Angle *ABC* = 39°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

Areas of Triangles Using ½*ab*Sin*C*

1)

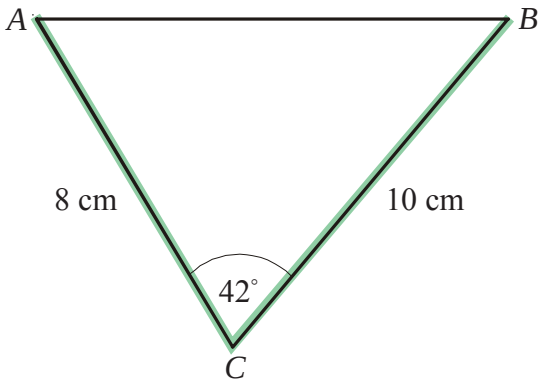


Diagram **NOT** accurately drawn.

$A = \frac{1}{2}ab\sin C$

ABC is a triangle.
AC = 8 cm.
BC = 10 cm
Angle *ACB* = 42°

Calculate the area of triangle *ABC*. 26.8 cm²
Give your answer correct to 3 significant figures.

2)

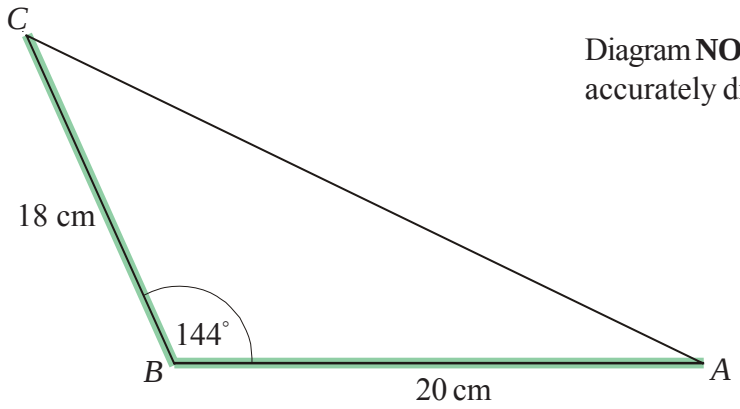


Diagram **NOT** accurately drawn.

$A = \frac{1}{2}ab\sin C$

ABC is a triangle.
AB = 20 cm.
BC = 18 cm
Angle *ABC* = 144°

Calculate the area of triangle *ABC*. 106 cm²
Give your answer correct to 3 significant figures.

3)

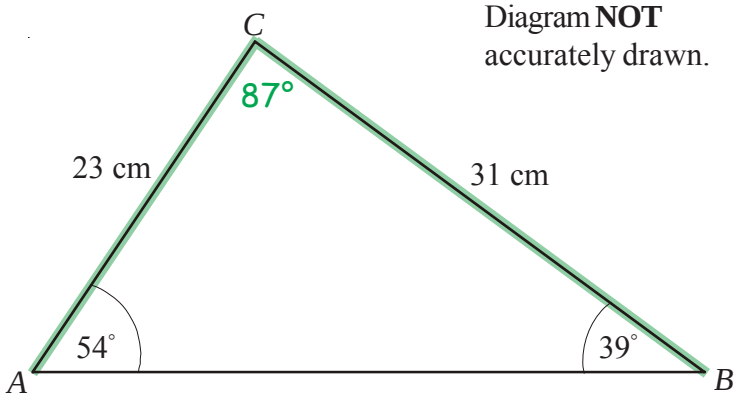


Diagram **NOT** accurately drawn.

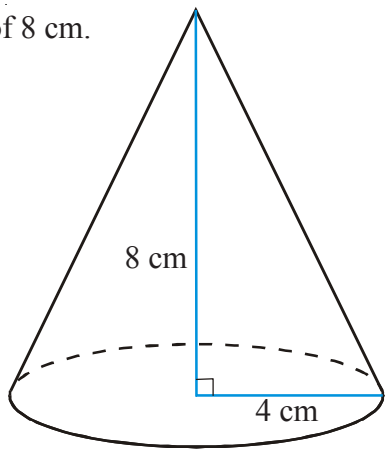
$A = \frac{1}{2}ab\sin C$

ABC is a triangle.
AC = 23 cm.
BC = 31 cm
Angle *BAC* = 54°
Angle *ABC* = 39°

Calculate the area of triangle *ABC*. 356 cm²
Give your answer correct to 3 significant figures.

Cones and Spheres

1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

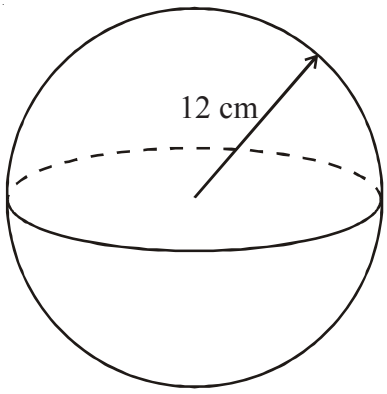


a) Calculate the volume of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

b) Use Pythagoras' Theorem to find the slant height of the cone.
Give your answer correct to 1 decimal place.

c) Find the curved surface area of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

2) A sphere has a radius of 12cm.

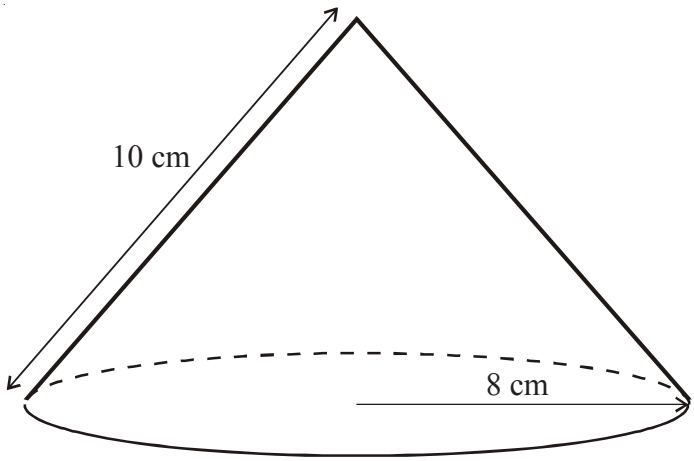


a) Calculate the volume of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

b) Find the curved surface area of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

3) A cone has a base radius of 8 cm and a slant height of 10 cm.

Calculate the volume of the cone.
Leave your answer in terms of π.

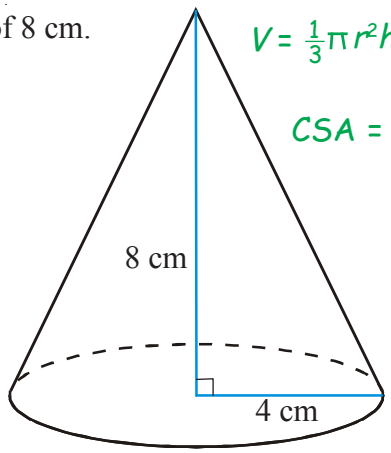


Cones and Spheres

1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

$V = \frac{1}{3}\pi r^2 h$

$CSA = \pi r l$



a) Calculate the volume of the cone. 134 cm^3
Take π to be 3.142.
Give your answer correct to 3 significant figures.

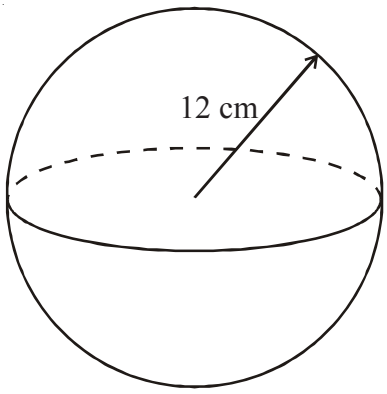
b) Use Pythagoras' Theorem to find the slant height of the cone. 8.9 cm
Give your answer correct to 1 decimal place.

c) Find the curved surface area of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures. 112 cm^2

2) A sphere has a radius of 12cm.

$V = \frac{4}{3}\pi r^3$

$CSA = 4\pi r^2$

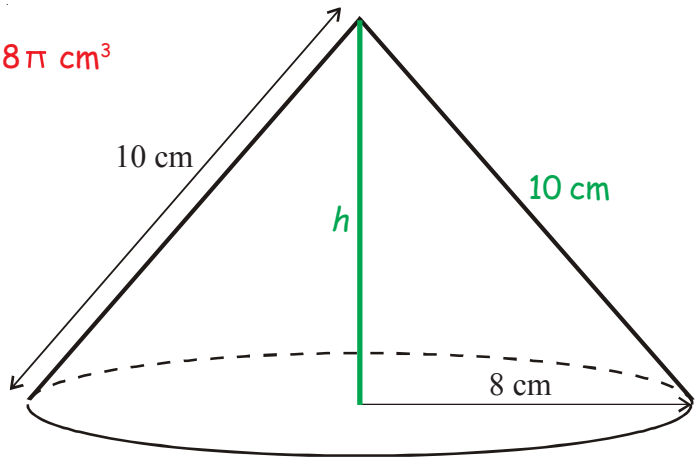


a) Calculate the volume of the sphere. 7240 cm^3
Take π to be 3.142.
Give your answer correct to 3 significant figures.

b) Find the curved surface area of the sphere. 1810 cm^2
Take π to be 3.142.
Give your answer correct to 3 significant figures.

3) A cone has a base radius of 8 cm and a slant height of 10 cm.

Calculate the volume of the cone. 128π cm^3
Leave your answer in terms of π.



Find height using Pythagoras

$10^2 = 100$

$8^2 = 64$ -

36

$\sqrt{36} = 6$

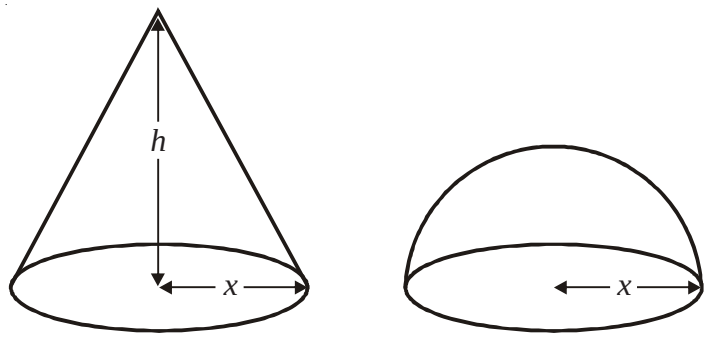
$V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \pi \times 8^2 \times 6$

$= 128\pi$

Cones and Spheres

1)

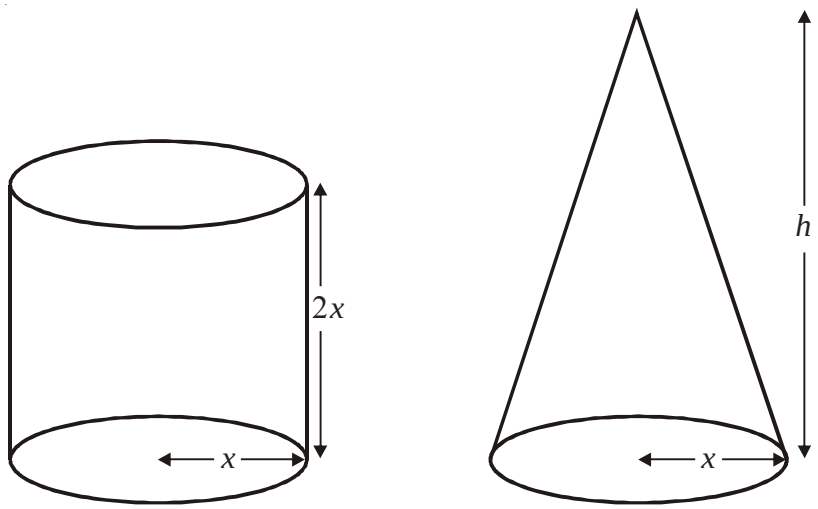


The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x.

2)



A cylinder has base radius x cm and height $2x$ cm.

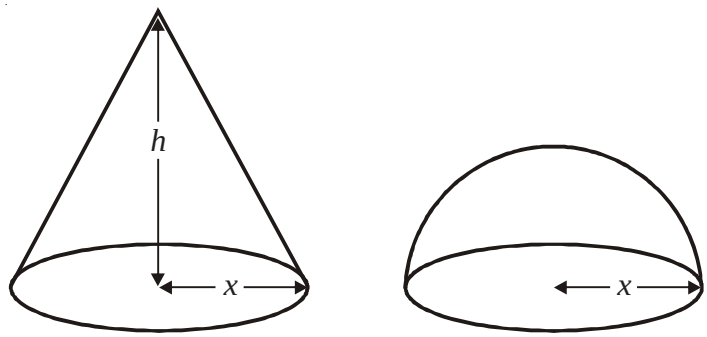
A cone has base radius x cm and height h cm.

The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x.
Give your answer in its simplest form.

Cones and Spheres

1)

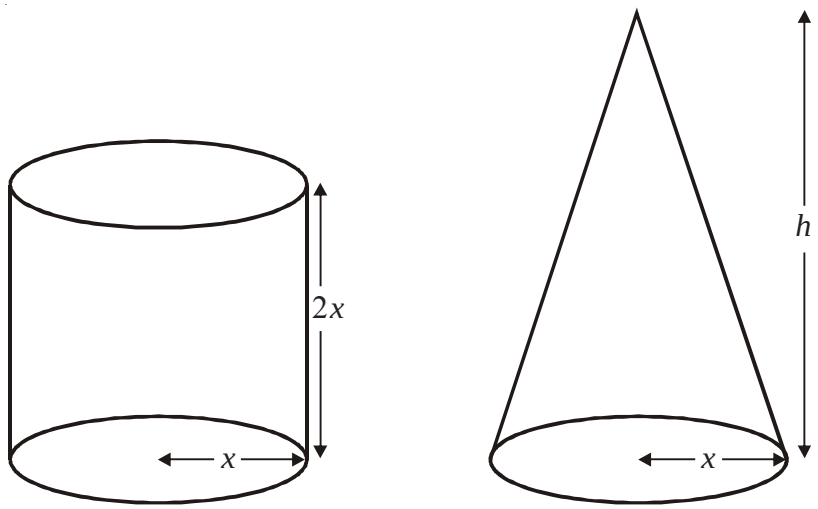


The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x. $h = \sqrt{3}\,x$ or $h = x\sqrt{3}$

2)



A cylinder has base radius x cm and height $2x$ cm.

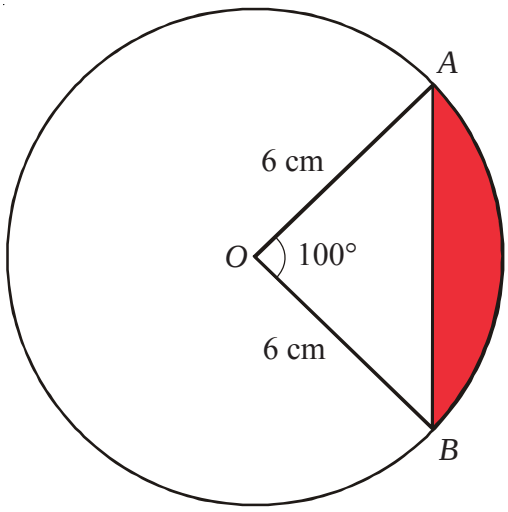
A cone has base radius x cm and height h cm.

The volume of the cylinder and the volume of the cone are equal.

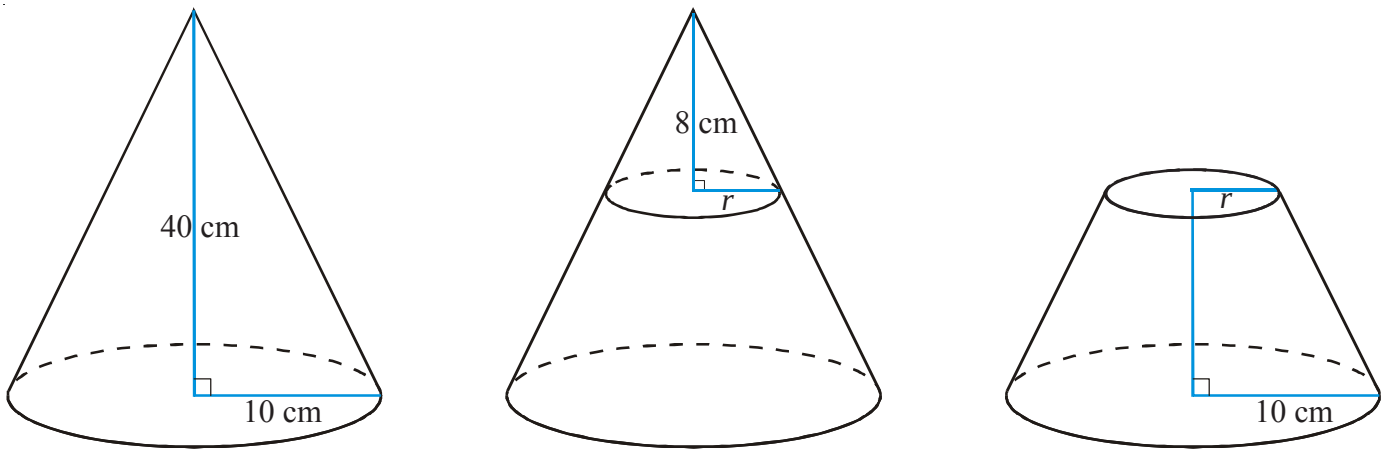
Find h in terms of x. $h = 6x$
Give your answer in its simplest form.

Segments and Frustums

1) Find the area of the segment shaded in the diagram below.
Take π to be 3.142.
Give your answer to 3 significant figures.



2) The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.



Taking π to be 3.142

a) Work out the radius r of the base of the smaller cone.

Calculate, to the nearest cm^3

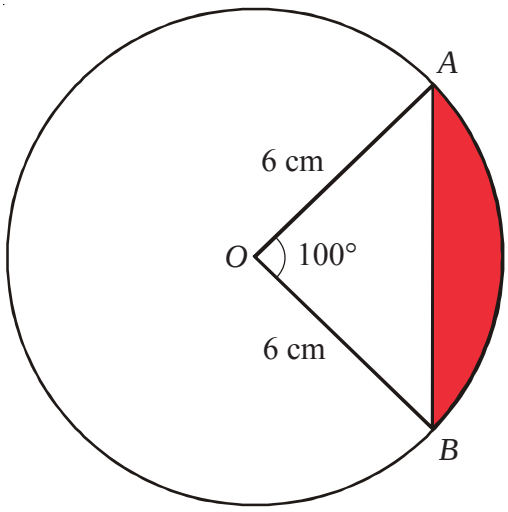
b) The volume of the larger cone.

c) The volume of the smaller cone.

d) The volume of the frustum.

Segments and Frustums

1) Find the area of the segment shaded in the diagram below. 13.7 cm²
Take π to be 3.142.
Give your answer to 3 significant figures.



Area of sector *AOB*

$\frac{100}{360} \times 3.142 \times 6^2 = 31.42$

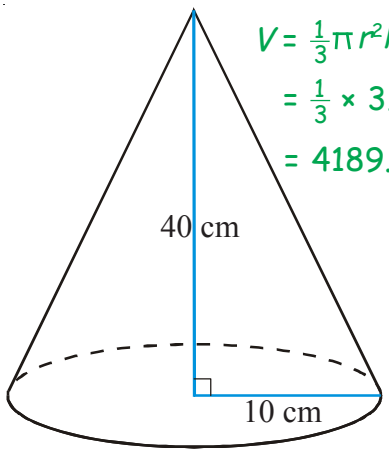
Area of triangle *AOB*

$\frac{1}{2} \times 6 \times 6 \times \sin 100 = 17.73$

Area of shaded segment

$31.42 - 17.73 = 13.7$ to 3 sig figs.

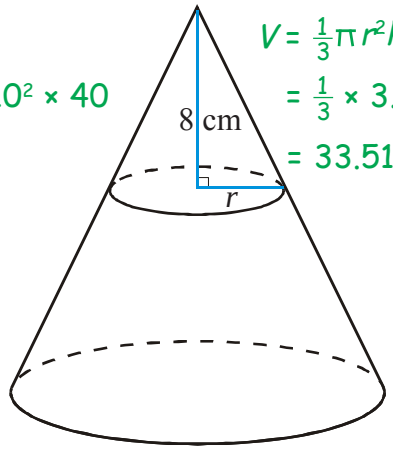
2) The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.



$V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times 3.142 \times 10^2 \times 40$

$= 4189.\dot{3}$



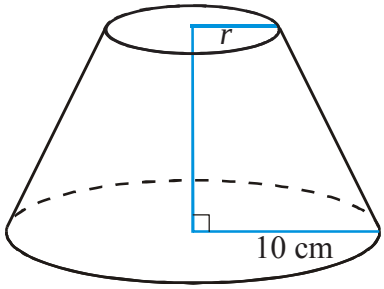
$V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times 3.142 \times 2^2 \times 8$

$= 33.51$

$V = 4189.33 - 33.51$

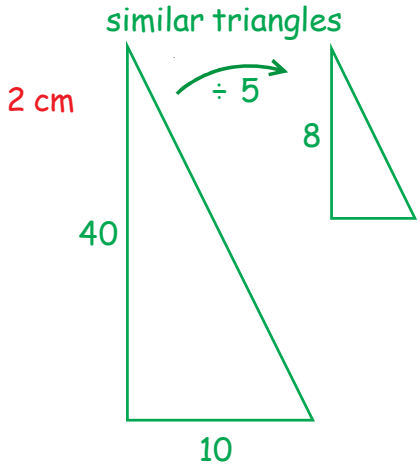
$= 4155.82$



Taking π to be 3.142

a) Work out the radius *r* of the base of the smaller cone. 2 cm

similar triangles



Calculate, to the nearest cm³

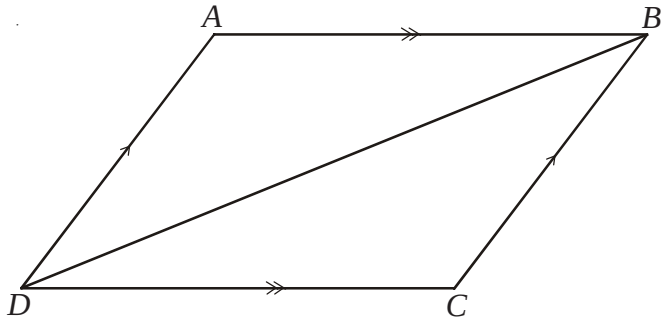
b) The volume of the larger cone. 4189cm³

c) The volume of the smaller cone. 34cm³

d) The volume of the frustum. 4156cm³

Congruent Triangles

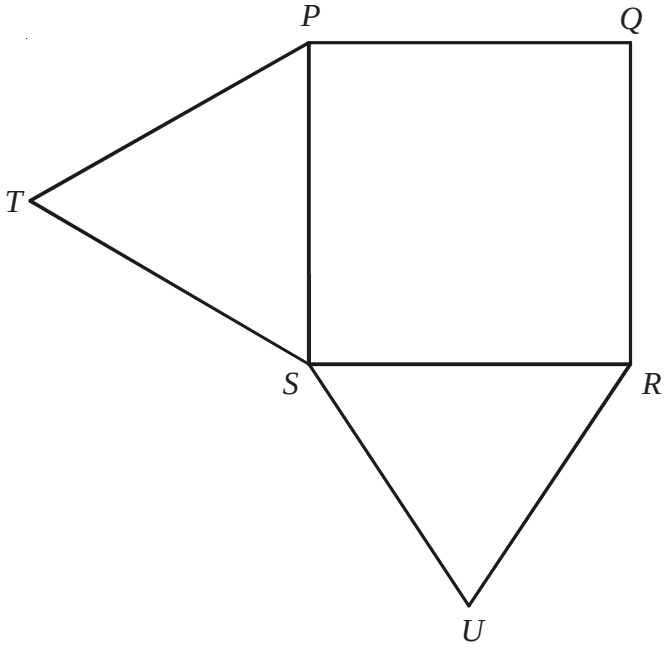
1) *ABCD* is a quadrilateral.



AB is parallel to *DC*.
DA is parallel to *CB*.

Prove that triangle *ABD* is congruent to triangle *CDB*.

2)



PQRS is a square.
PTS and *SUR* are equilateral triangles.

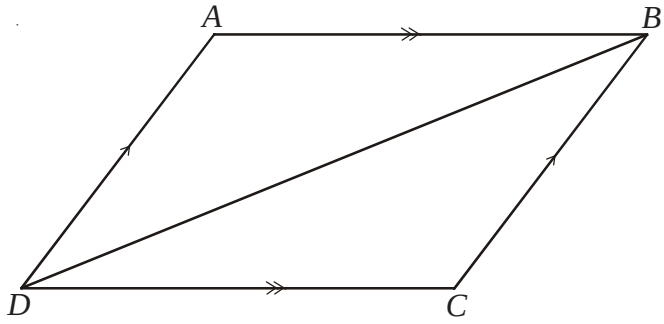
a) Prove that triangle *USP* is congruent to triangle *TSR*.

X is the point such that *RUXT* is a parallelogram.

b) Prove that $UP = UX$

Congruent Triangles

1) *ABCD* is a quadrilateral.

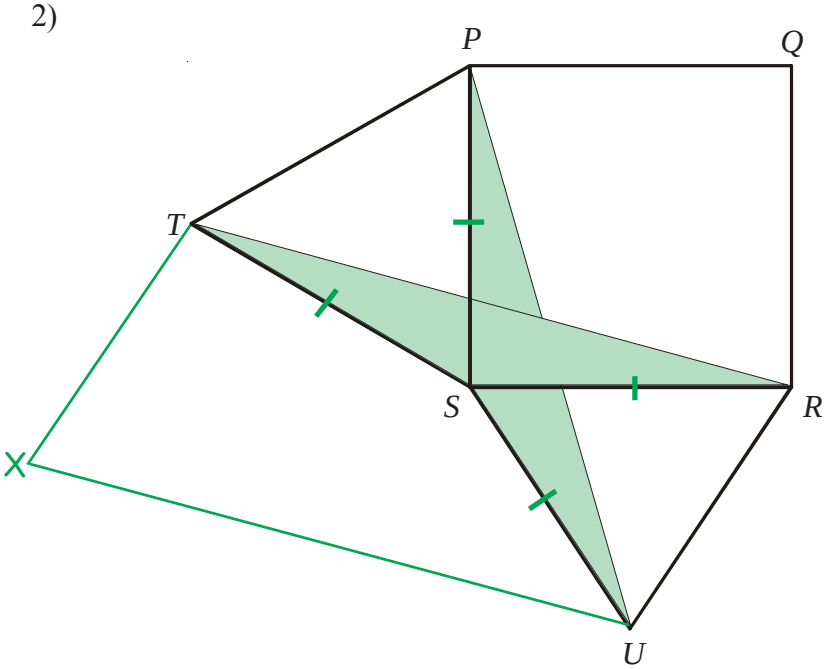


AB is parallel to *DC*.
DA is parallel to *CB*.

Prove that triangle *ABD* is congruent to triangle *CDB*.

AB = *CD* (opp. sides of parallelogram are equal)
AD = *CB* (opp. sides of parallelogram are equal)
DB is a shared side.
Therefore *ABD* is congruent to *CDB* (SSS)

2)



PQRS is a square.
PTS and *SUR* are equilateral triangles.

US = *TS*
SP = *SR*
Angle *USP* = 60° + 90° = 150°
Angle *TSR* = 60° + 90° = 150°
USP is congruent to *TSR* (SAS)

a) Prove that triangle *USP* is congruent to triangle *TSR*.

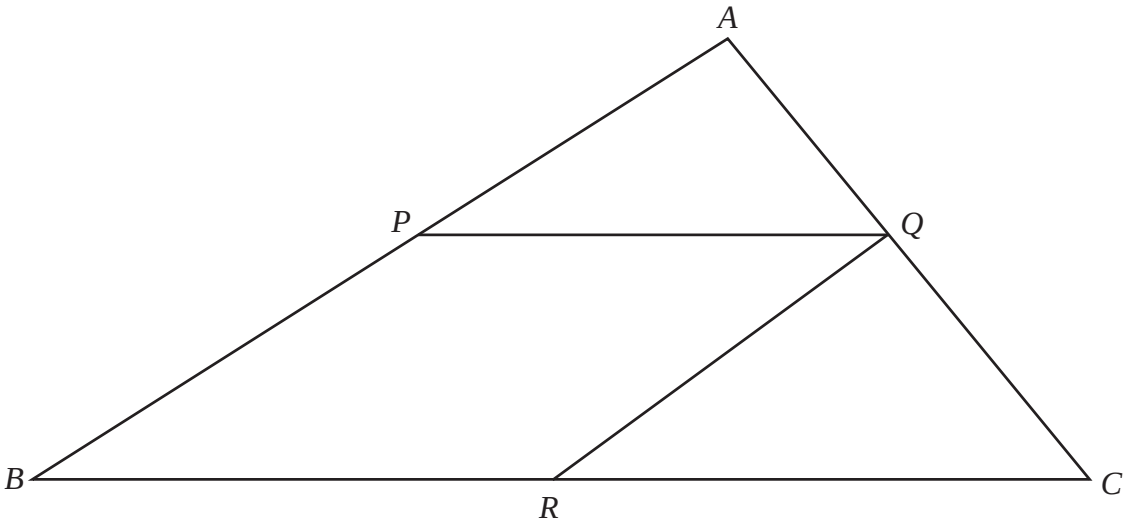
X is the point such that *RUXT* is a parallelogram.

b) Prove that *UP* = *UX*

UP = *RT* (corresponding sides of congruent triangles)
RT = *UX* (opp. sides of parallelogram are equal)
Therefore *UP* = *UX*

Congruent Triangles

1)

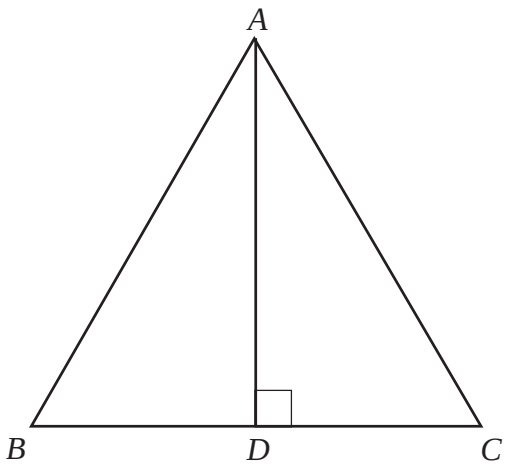


The diagram shows a triangle *ABC*.

PQRB is a parallelogram where
P is the midpoint of *AB*,
Q is the midpoint of *AC*,
and *R* is the midpoint of *BC*.

Prove that triangle *APQ* and triangle *QRC* are congruent.
You must give reasons for each stage of your proof.

2)



ABC is an equilateral triangle.

D lies on *BC*.

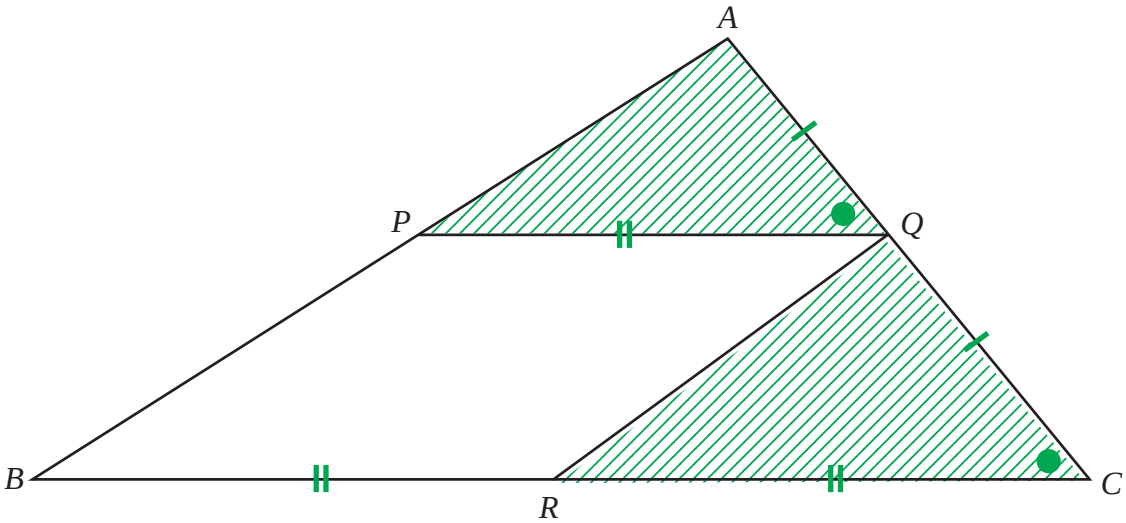
AD is perpendicular to *BC*.

a) Prove that triangle *ADC* is congruent to triangle *ADB*.

b) Hence, prove that $BD = \frac{1}{2}AB$

Congruent Triangles

1)



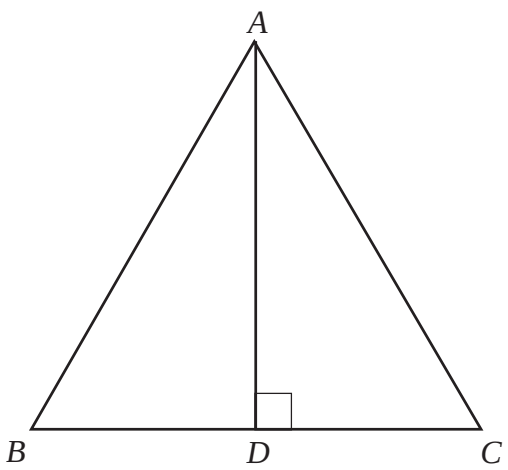
The diagram shows a triangle *ABC*.

PQRB is a parallelogram where
P is the midpoint of *AB*,
Q is the midpoint of *AC*,
and *R* is the midpoint of *BC*.

Prove that triangle *APQ* and triangle *QRC* are congruent.
You must give reasons for each stage of your proof.

AQ = *QC* (*Q* is midpoint of *AC*)
Angle *AQP* = angle *QCR* (corresponding angles)
PQ = *BR* (opposite sides of parallelogram)
BR = *RC* (*R* is midpoint of *BC*)
∴ *PQ* = *RC*
∴ *APQ* is congruent to *QRC* (SAS)

2)



ABC is an equilateral triangle.

D lies on *BC*.

AD is perpendicular to *BC*.

Angle *ADB* = angle *ADC* = 90° (*AD* is perp. to *BC*)
AB = *AC* (equilateral triangle)
AD is a side in triangles *ADC* and *ADB*
∴ Triangle *ADC* is congruent to triangle *ADB* (RHS)

a) Prove that triangle *ADC* is congruent to triangle *ADB*.

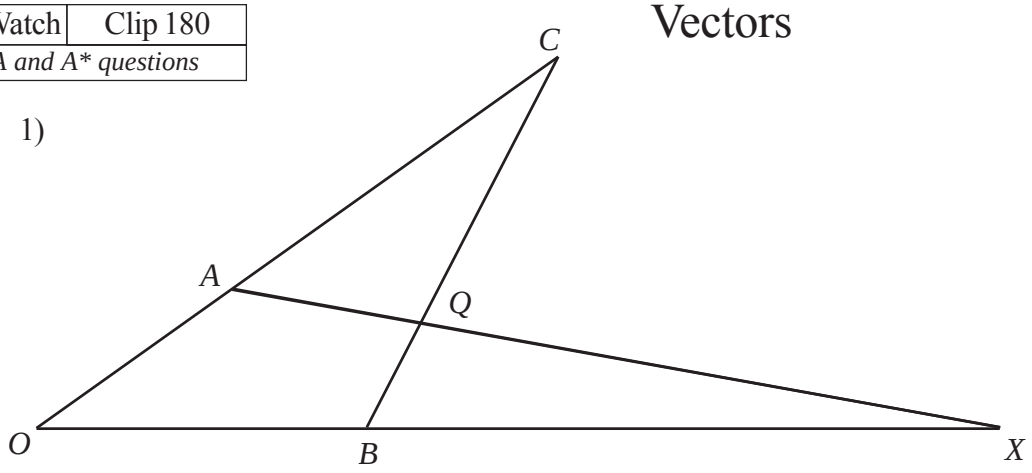
ADC is congruent to *ADB*
∴ *BD* = *DC*

b) Hence, prove that $BD = \frac{1}{2}AB$

$BD = \frac{1}{2}BC$
BC = *AB* (equilateral triangles)
∴ $BD = \frac{1}{2}AB$

Vectors

1)



In the diagram,

$\overrightarrow{OA} = 4\mathbf{a}$ and $\overrightarrow{OB} = 4\mathbf{b}$

OAC, *OBX* and *BQC* are all straight lines.

$AC = 2OA$ and $BQ : QC = 1 : 3$

a) Find, in terms of **a** and **b**, the vectors which represent

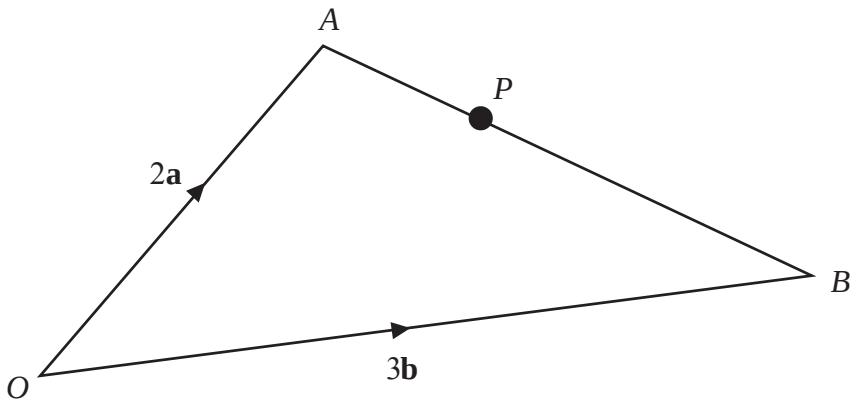
(i) $\overrightarrow{BC}$

(ii) $\overrightarrow{AQ}$

Given that $\overrightarrow{BX} = 8\mathbf{b}$

b) Show that *AQX* is a straight line.

2)



OAB is a triangle.

$\overrightarrow{OA} = 2\mathbf{a}$

$\overrightarrow{OB} = 3\mathbf{b}$

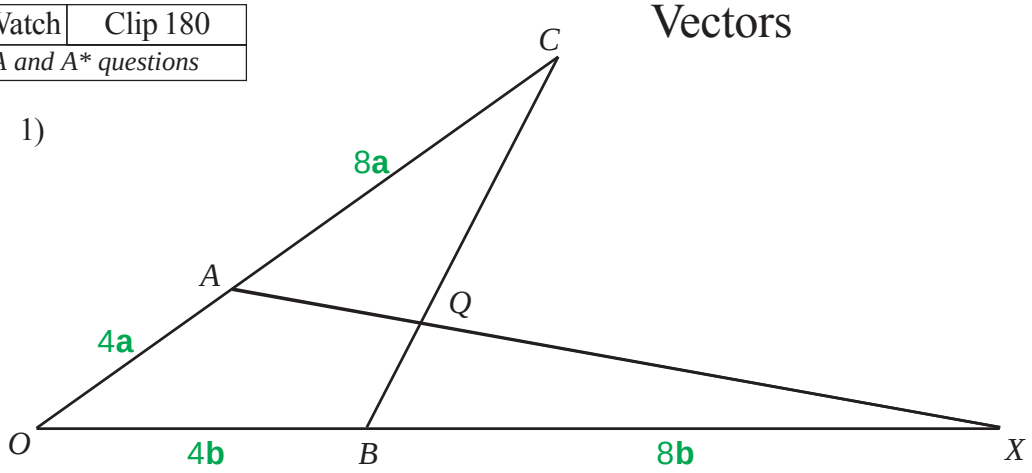
a) Find $\overrightarrow{AB}$ in terms of **a** and **b**.

P is a point on *AB* such that $AP : PB = 2 : 3$

b) Show that $\overrightarrow{OP}$ is parallel to the vector $\mathbf{a} + \mathbf{b}$.

Vectors

1)



In the diagram,

$\overrightarrow{OA} = 4\mathbf{a}$ and $\overrightarrow{OB} = 4\mathbf{b}$

OAC, *OBX* and *BQC* are all straight lines.

$AC = 2OA$ and $BQ : QC = 1 : 3$

a) Find, in terms of **a** and **b**, the vectors which represent

(i) $\overrightarrow{BC}$ $12\mathbf{a} - 4\mathbf{b}$ or $-4\mathbf{b} + 12\mathbf{a}$

(ii) $\overrightarrow{AQ}$ $3\mathbf{b} - \mathbf{a}$ or $-\mathbf{a} + 3\mathbf{b}$

Given that $\overrightarrow{BX} = 8\mathbf{b}$

b) Show that *AQX* is a straight line.

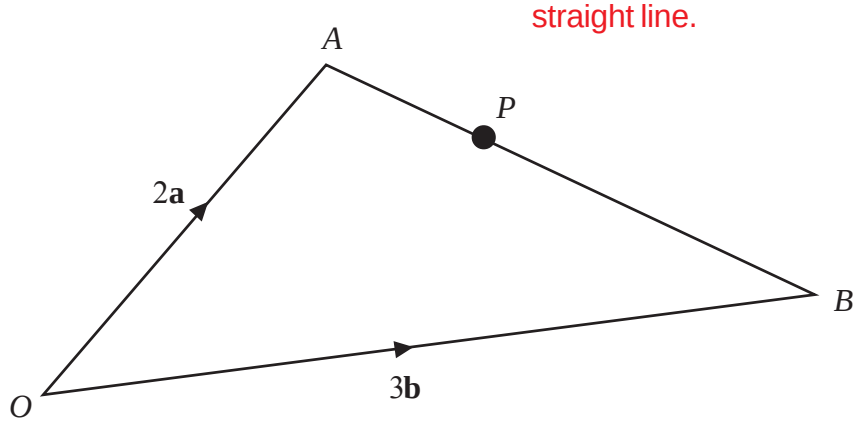
$\overrightarrow{AQ} = -\mathbf{a} + 12\mathbf{b}$

$\overrightarrow{AX} = -4\mathbf{a} + 12\mathbf{b}$

$\overrightarrow{AX} = 4\overrightarrow{AQ}$

Because *AX* and *AQ* both start from the same point, *AQX* is a straight line.

2)



OAB is a triangle.

$\overrightarrow{OA} = 2\mathbf{a}$

$\overrightarrow{OB} = 3\mathbf{b}$

a) Find $\overrightarrow{AB}$ in terms of **a** and **b**.

$3\mathbf{b} - 2\mathbf{a}$ or $-2\mathbf{a} + 3\mathbf{b}$

P is a point on *AB* such that $AP : PB = 2 : 3$

b) Show that $\overrightarrow{OP}$ is parallel to the vector $\mathbf{a} + \mathbf{b}$.

$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$

$\overrightarrow{AP} = \frac{2}{5}AB$

$\overrightarrow{OP} = 2\mathbf{a} + \frac{2}{5}(3\mathbf{b} - 2\mathbf{a})$

$\overrightarrow{OP} = 2\mathbf{a} + \frac{6}{5}\mathbf{b} - \frac{4}{5}\mathbf{a}$

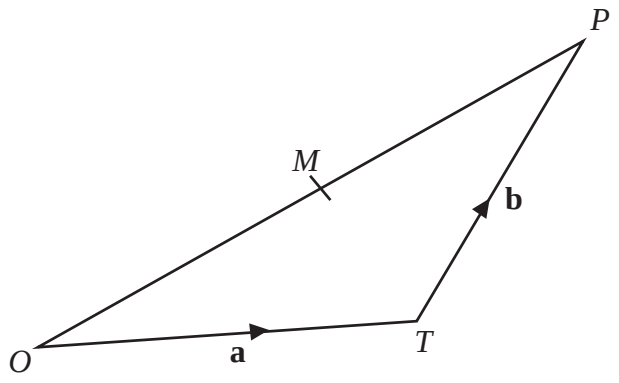
$\overrightarrow{OP} = \frac{6}{5}\mathbf{a} + \frac{6}{5}\mathbf{b}$

$\overrightarrow{OP} = \frac{6}{5}(\mathbf{a} + \mathbf{b})$

So $\overrightarrow{OP}$ is parallel to vector $\mathbf{a} + \mathbf{b}$

Vectors

1)



OPT is a triangle.
M is the midpoint of *OP*.

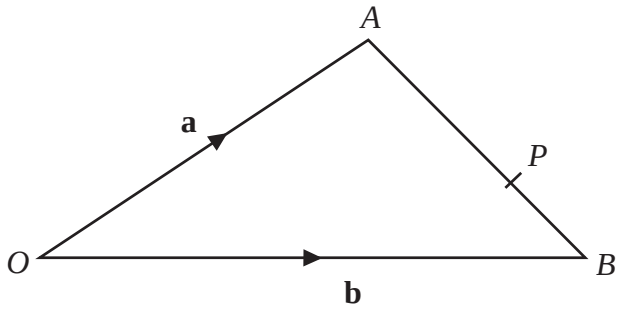
$\overrightarrow{OT} = \mathbf{a}$

$\overrightarrow{TP} = \mathbf{b}$

a) Express $\overrightarrow{OM}$ in terms of **a** and **b**.

b) Express $\overrightarrow{TM}$ in terms of **a** and **b**.
Give your answer in its simplest form.

2)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

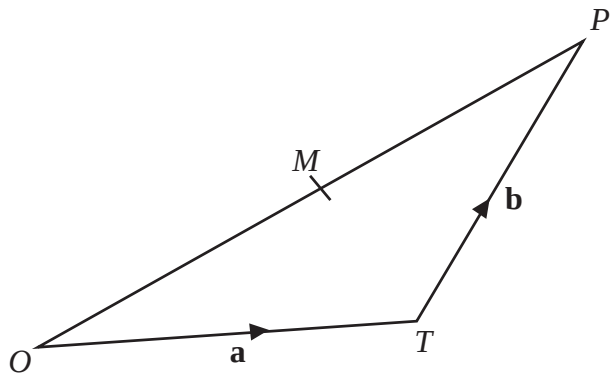
a) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**.

P is the point on *AB* so that $AP : PB = 2 : 1$

b) Find the vector $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.

Vectors

1)



OPT is a triangle.
M is the midpoint of *OP*.

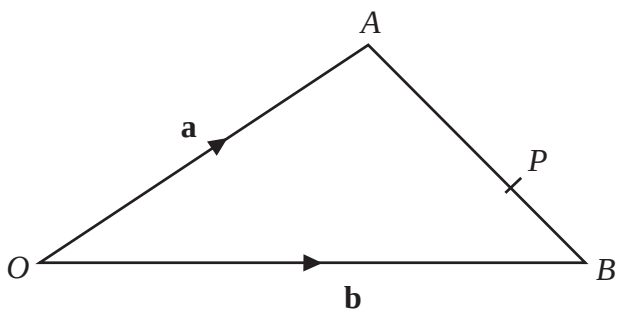
$\overrightarrow{OT} = \mathbf{a}$

$\overrightarrow{TP} = \mathbf{b}$

a) Express $\overrightarrow{OM}$ in terms of **a** and **b**. $\overrightarrow{OM} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

b) Express $\overrightarrow{TM}$ in terms of **a** and **b**. $\overrightarrow{TM} = \frac{1}{2}(\mathbf{b} - \mathbf{a})$
Give your answer in its simplest form.

2)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

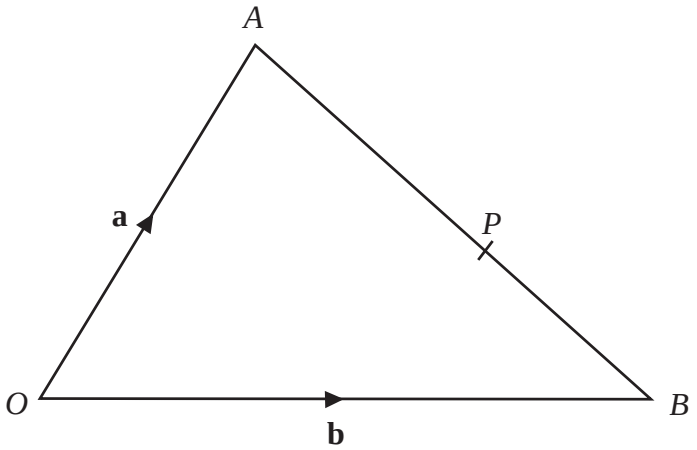
a) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**. $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

P is the point on *AB* so that $AP : PB = 2 : 1$

b) Find the vector $\overrightarrow{OP}$ in terms of **a** and **b**. $\overrightarrow{OP} = \frac{1}{3}(\mathbf{a} + 2\mathbf{b})$
Give your answer in its simplest form.

Vectors

1)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

a) Find the vector *AB* in terms of **a** and **b**.

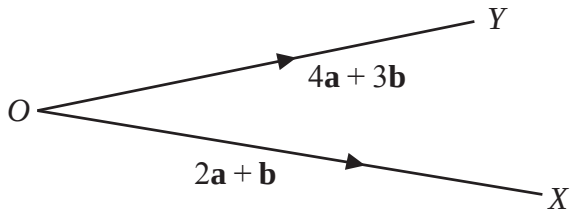
P is the point on *AB* so that $AP : PB = 3 : 2$

b) Show that $\overrightarrow{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$

2)

$OX = 2\mathbf{a} + \mathbf{b}$

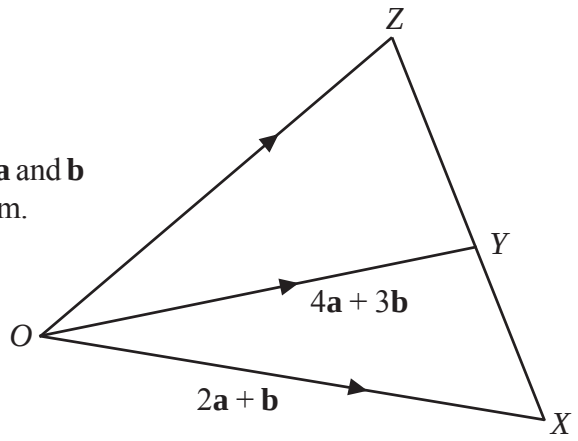
$OY = 4\mathbf{a} + 3\mathbf{b}$



a) Express the vector *XY* in terms of **a** and **b**
Give your answer in its simplest form.

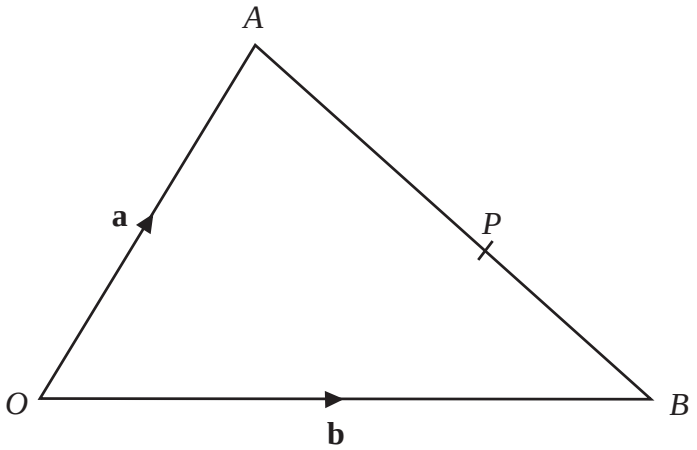
XYZ is a straight line.
$XY : YZ = 2 : 3$

b) Express the vector *OZ* in terms of **a** and **b**
Give your answer in its simplest form.



Vectors

1)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

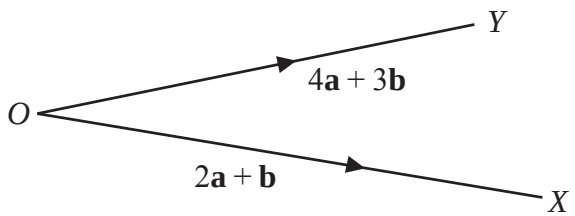
a) Find the vector *AB* in terms of **a** and **b**. $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

P is the point on *AB* so that $AP : PB = 3 : 2$

b) Show that $\overrightarrow{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$

$$\begin{aligned}\overrightarrow{OP} &= \overrightarrow{OA} + \overrightarrow{AP}\\ &= \overrightarrow{OA} + \tfrac{3}{5}\overrightarrow{AB}\\ &= \mathbf{a} + \tfrac{3}{5}(\mathbf{b} - \mathbf{a})\\ &= \mathbf{a} + \tfrac{3}{5}\mathbf{b} - \tfrac{3}{5}\mathbf{a}\\ &= \tfrac{2}{5}\mathbf{a} + \tfrac{3}{5}\mathbf{b}\\ &= \tfrac{1}{5}(2\mathbf{a} + 3\mathbf{b})\end{aligned}$$

2)



$OX = 2\mathbf{a} + \mathbf{b}$

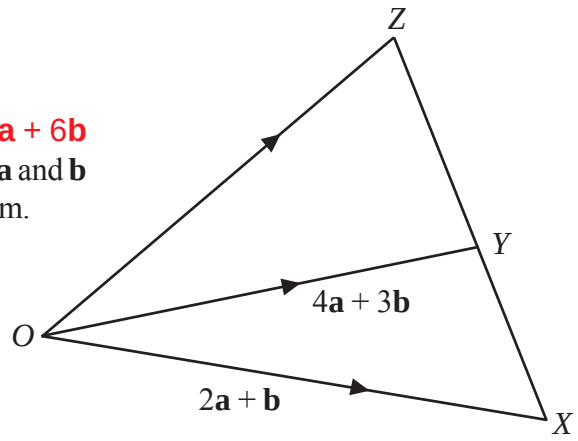
$OY = 4\mathbf{a} + 3\mathbf{b}$

a) Express the vector *XY* in terms of **a** and **b** $\overrightarrow{XY} = 2(\mathbf{a} + \mathbf{b})$
Give your answer in its simplest form.

XYZ is a straight line.
$XY : YZ = 2 : 3$

$\overrightarrow{OZ} = 7\mathbf{a} + 6\mathbf{b}$

b) Express the vector *OZ* in terms of **a** and **b**
Give your answer in its simplest form.



Vectors

1) The diagram shows a trapezium *PQRS*.
$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{QR} = \mathbf{b}$.
PS is three times the length of *QR*.

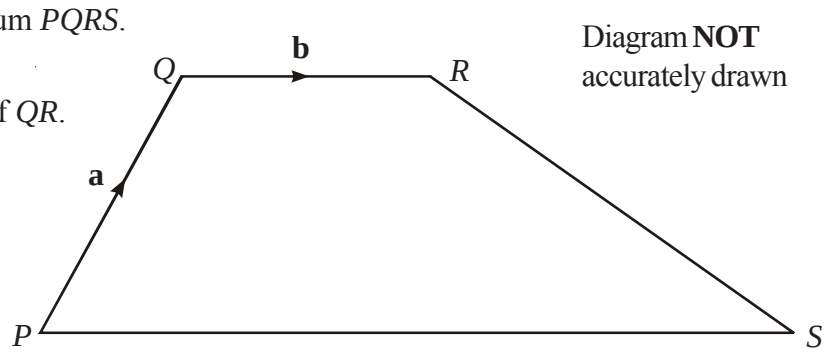


Diagram **NOT** accurately drawn

Find, in terms of **a** and **b**, expressions for

a) $\overrightarrow{QP}$ b) $\overrightarrow{PR}$ c) $\overrightarrow{PS}$ d) $\overrightarrow{QS}$

---

2) In triangle *ABC*, *P* and *Q* are the midpoints of *AB* and *AC*.

$\overrightarrow{AP} = \mathbf{p}$ and $\overrightarrow{AQ} = \mathbf{q}$.

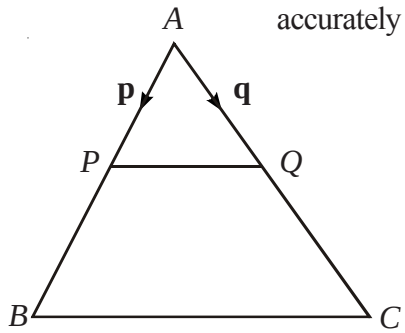


Diagram **NOT** accurately drawn

a) Find, in terms of **p** and **q**, expressions for

(i) $\overrightarrow{PQ}$ (ii) $\overrightarrow{AB}$ (iii) $\overrightarrow{AC}$ (iv) $\overrightarrow{BC}$

b) Use your results from (a) to prove that *PQ* is parallel to *BC*.

---

3)

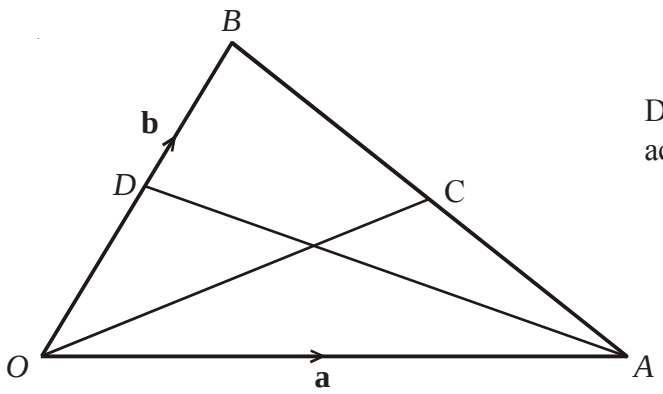


Diagram **NOT** accurately drawn

OAB is a triangle.
D is the midpoint of *OB*.
C is the midpoint of *AB*.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

(i) Find $\overrightarrow{OC}$ in terms of **a** and **b**.

(ii) Show that *DC* is parallel to *OA*.

Vectors

1) The diagram shows a trapezium *PQRS*.
$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{QR} = \mathbf{b}$.
PS is three times the length of *QR*.

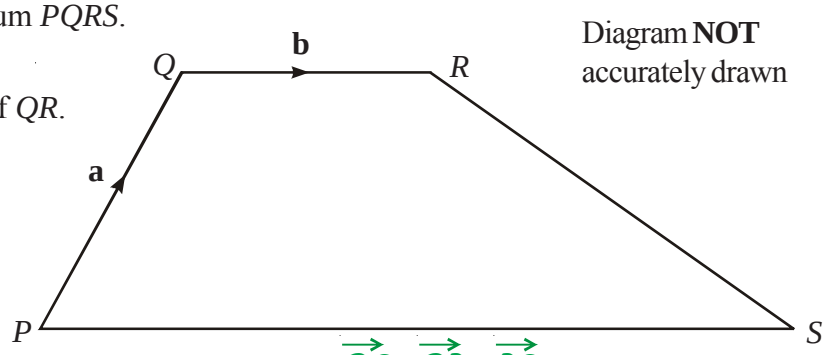


Diagram **NOT** accurately drawn

$\overrightarrow{QS} = \overrightarrow{QP} + \overrightarrow{PS}$
$= -\mathbf{a} + 3\mathbf{b}$

Find, in terms of **a** and **b**, expressions for

a) $\overrightarrow{QP} = -\mathbf{a}$ b) $\overrightarrow{PR} = \mathbf{a} + \mathbf{b}$ c) $\overrightarrow{PS} = 3\mathbf{b}$ d) $\overrightarrow{QS} = 3\mathbf{b} - \mathbf{a}$

---

2) In triangle *ABC*, *P* and *Q* are the midpoints of *AB* and *AC*.

$\overrightarrow{AP} = \mathbf{p}$ and $\overrightarrow{AQ} = \mathbf{q}$.

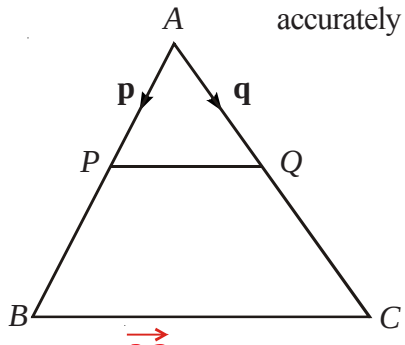


Diagram **NOT** accurately drawn

a) Find, in terms of **p** and **q**, expressions for

(i) $\overrightarrow{PQ}$ (ii) $\overrightarrow{AB}$ (iii) $\overrightarrow{AC}$ (iv) $\overrightarrow{BC}$

$\mathbf{q} - \mathbf{p}$ $2\mathbf{p}$ $2\mathbf{q}$ $2\mathbf{q} - 2\mathbf{p}$

b) Use your results from (a) to prove that *PQ* is parallel to *BC*.

$\overrightarrow{PQ} = \mathbf{q} - \mathbf{p}$
$\overrightarrow{BC} = 2\mathbf{q} - 2\mathbf{p}$
$= 2(\mathbf{q} - \mathbf{p})$

Therefore $\overrightarrow{PQ}$ is parallel to $\overrightarrow{BC}$

---

3)

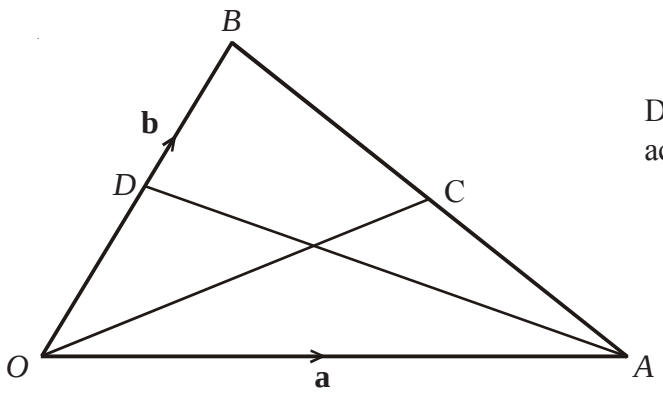


Diagram **NOT** accurately drawn

OAB is a triangle.
D is the midpoint of *OB*.
C is the midpoint of *AB*.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$
$\overrightarrow{AC} = \frac{1}{2}\overrightarrow{AB}$
$\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$
$\overrightarrow{OC} = \mathbf{a} + \frac{1}{2}(-\mathbf{a} + \mathbf{b})$
$\overrightarrow{OC} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

(i) Find $\overrightarrow{OC}$ in terms of **a** and **b**.
$\overrightarrow{OC} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

(ii) Show that *DC* is parallel to *OA*.

$\overrightarrow{DC} = \overrightarrow{DO} + \overrightarrow{OC}$
$= -\frac{1}{2}\mathbf{b} + \frac{1}{2}(\mathbf{a} + \mathbf{b})$
$= \frac{1}{2}\mathbf{a}$
$\overrightarrow{OA} = \mathbf{a}$ Therefore $\overrightarrow{DC}$ is parallel to $\overrightarrow{OA}$

Vectors

1)

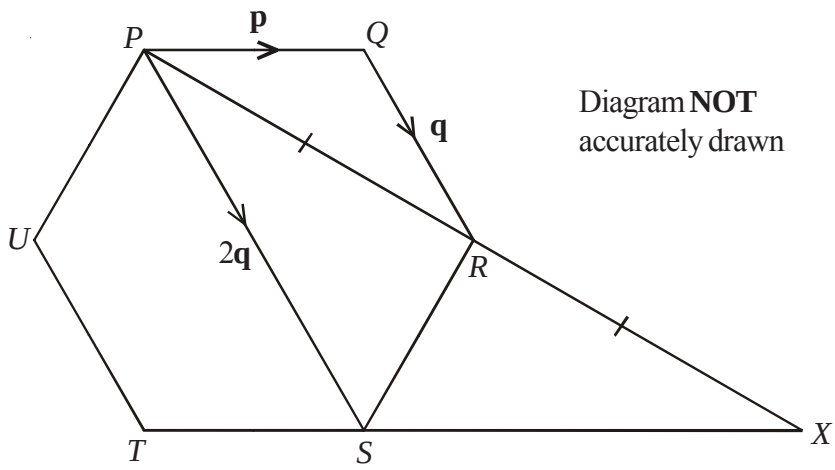


Diagram **NOT** accurately drawn

PQRSTU is a regular hexagon.

$\overrightarrow{PQ} = \mathbf{p}$ $\quad \overrightarrow{QR} = \mathbf{q}$ $\quad \overrightarrow{PS} = 2\mathbf{q}$

a) Find the vector *PR* in terms of **p** and **q**.

$\overrightarrow{PR} = \overrightarrow{RX}$

b) Prove that *PQ* is parallel to *SX*

---

2)

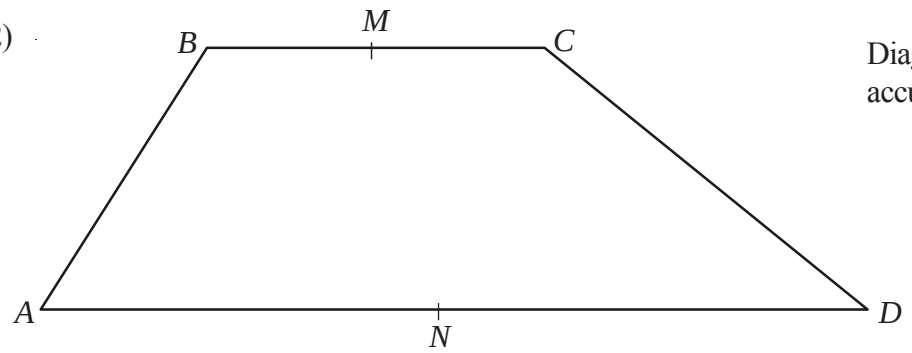


Diagram **NOT** accurately drawn

ABCD is a trapezium with *BC* parallel to *AD*.

$\overrightarrow{AB} = 3\mathbf{b}$ $\quad \overrightarrow{BC} = 3\mathbf{a}$ $\quad \overrightarrow{AD} = 9\mathbf{a}$

M is the midpoint of *BC* and *N* is the midpoint of *AD*.

a) Find the vector *MN* in terms of **a** and **b**.

X is the midpoint of *MN* and *Y* is the midpoint of *CD*.

b) Prove that *XY* is parallel to *AD*.

Vectors

1)

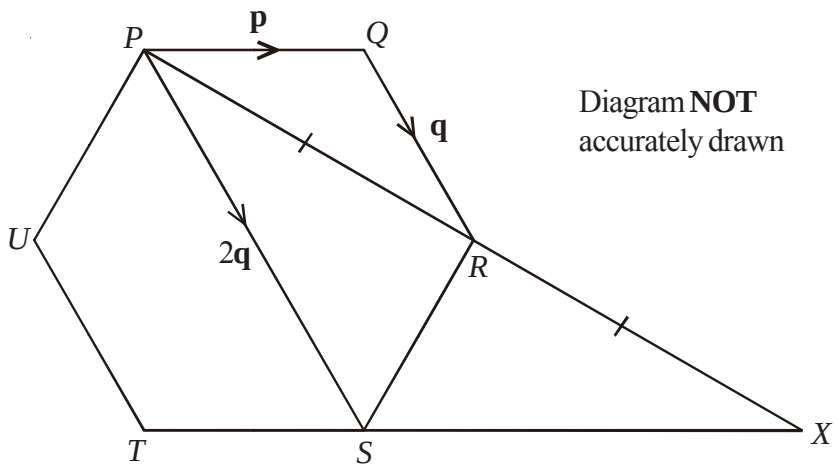


Diagram **NOT** accurately drawn

PQRSTU is a regular hexagon.

$\overrightarrow{PQ} = \mathbf{p}$ $\quad \overrightarrow{QR} = \mathbf{q}$ $\quad \overrightarrow{PS} = 2\mathbf{q}$

a) Find the vector *PR* in terms of **p** and **q**.

$\overrightarrow{PR} = \mathbf{p} + \mathbf{q}$

$\overrightarrow{PR} = \overrightarrow{RX}$

b) Prove that *PQ* is parallel to *SX*

$\overrightarrow{SX} = \overrightarrow{SP} + \overrightarrow{PX}$
$= \overrightarrow{SP} + 2\overrightarrow{PR}$
$= -2\mathbf{q} + 2(\mathbf{p} + \mathbf{q})$
$= -2\mathbf{q} + 2\mathbf{p} + 2\mathbf{q}$
$= 2\mathbf{p}$

$\overrightarrow{PQ} = \mathbf{p}$ Therefore $\overrightarrow{PQ}$ is parallel to $\overrightarrow{SX}$

---

2)

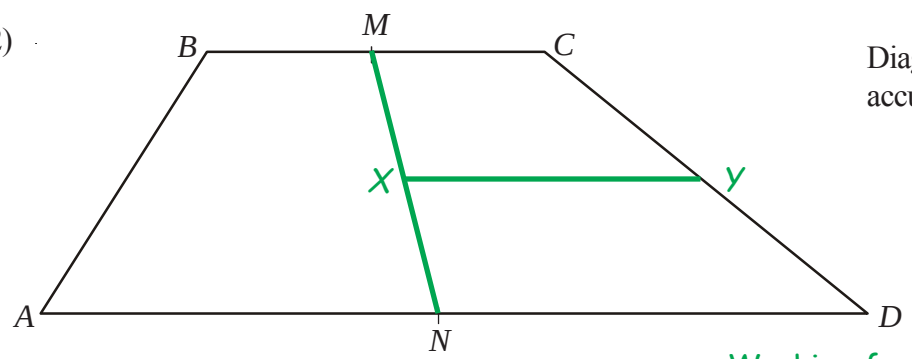


Diagram **NOT** accurately drawn

ABCD is a trapezium with *BC* parallel to *AD*.

$\overrightarrow{AB} = 3\mathbf{b}$ $\quad \overrightarrow{BC} = 3\mathbf{a}$ $\quad \overrightarrow{AD} = 9\mathbf{a}$

M is the midpoint of *BC* and *N* is the midpoint of *AD*.

a) Find the vector *MN* in terms of **a** and **b**.

$\overrightarrow{MN} = 3\mathbf{a} - 3\mathbf{b}$

X is the midpoint of *MN* and *Y* is the midpoint of *CD*.

b) Prove that *XY* is parallel to *AD*.

Working for part b)

$\overrightarrow{XY} = \overrightarrow{XN} + \overrightarrow{ND} + \overrightarrow{DY}$
$= \frac{1}{2}\overrightarrow{MN} + \overrightarrow{ND} + \overrightarrow{DY}$
$= \frac{1}{2}(3\mathbf{a} - 3\mathbf{b}) + 4\frac{1}{2}\mathbf{a} + \overrightarrow{DY}$
$= 6\mathbf{a} - 1\frac{1}{2}\mathbf{b} + \overrightarrow{DY}$

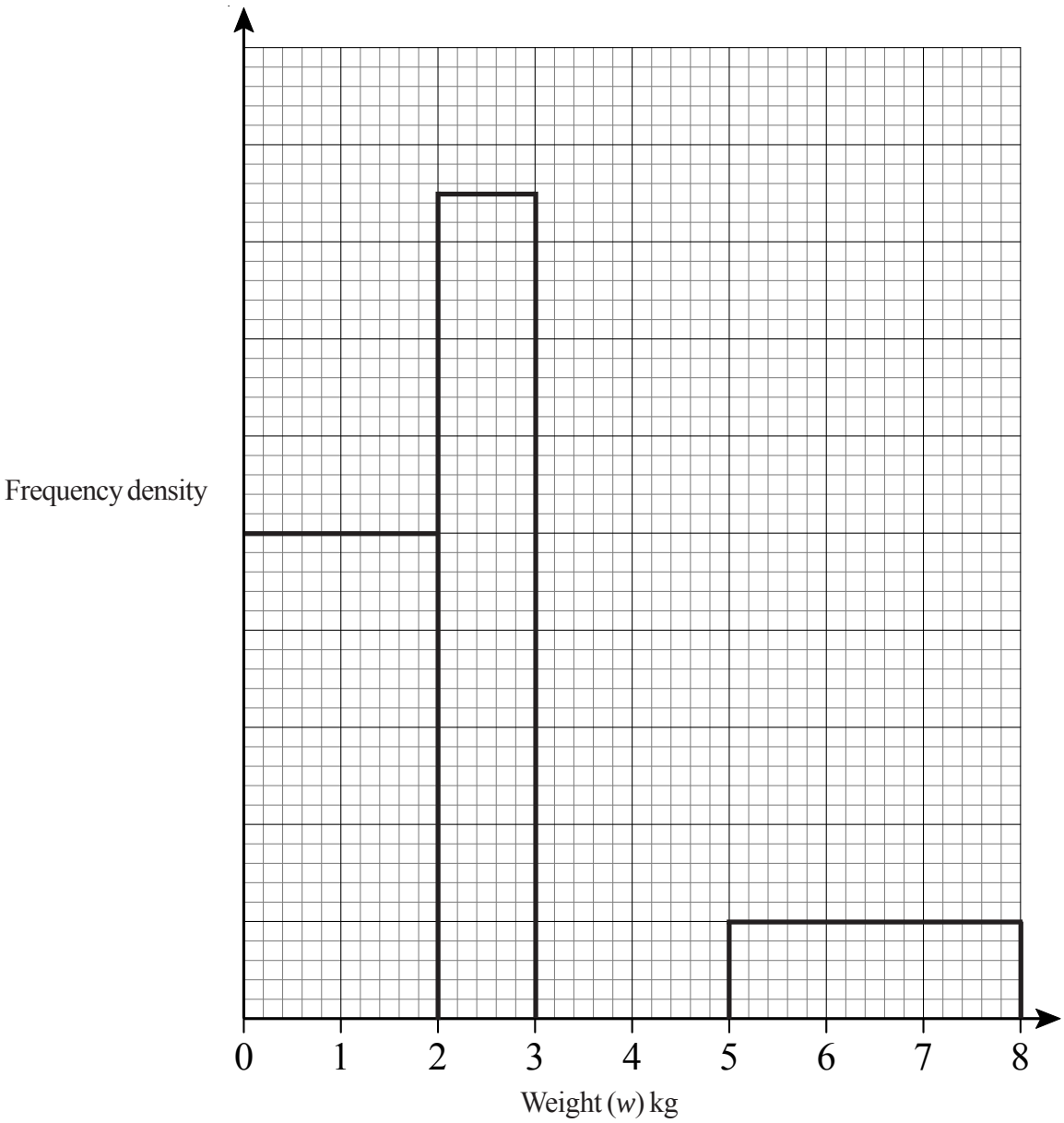
$\overrightarrow{DY} = \frac{1}{2}\overrightarrow{DC}$
$= \frac{1}{2}(\overrightarrow{DA} + \overrightarrow{AB} + \overrightarrow{BC})$
$= -4\frac{1}{2}\mathbf{a} + 1\frac{1}{2}\mathbf{b} + 1\frac{1}{2}\mathbf{a}$
$= 1\frac{1}{2}\mathbf{b} - 3\mathbf{a}$

$\overrightarrow{XY} = 6\mathbf{a} - 1\frac{1}{2}\mathbf{b} + 1\frac{1}{2}\mathbf{b} - 3\mathbf{a}$
$= 3\mathbf{a}$

Therefore $\overrightarrow{XY}$ is parallel to $\overrightarrow{AD}$

Histograms

1) The table and histogram give some information about the weights of parcels received at a post office during one Thursday.



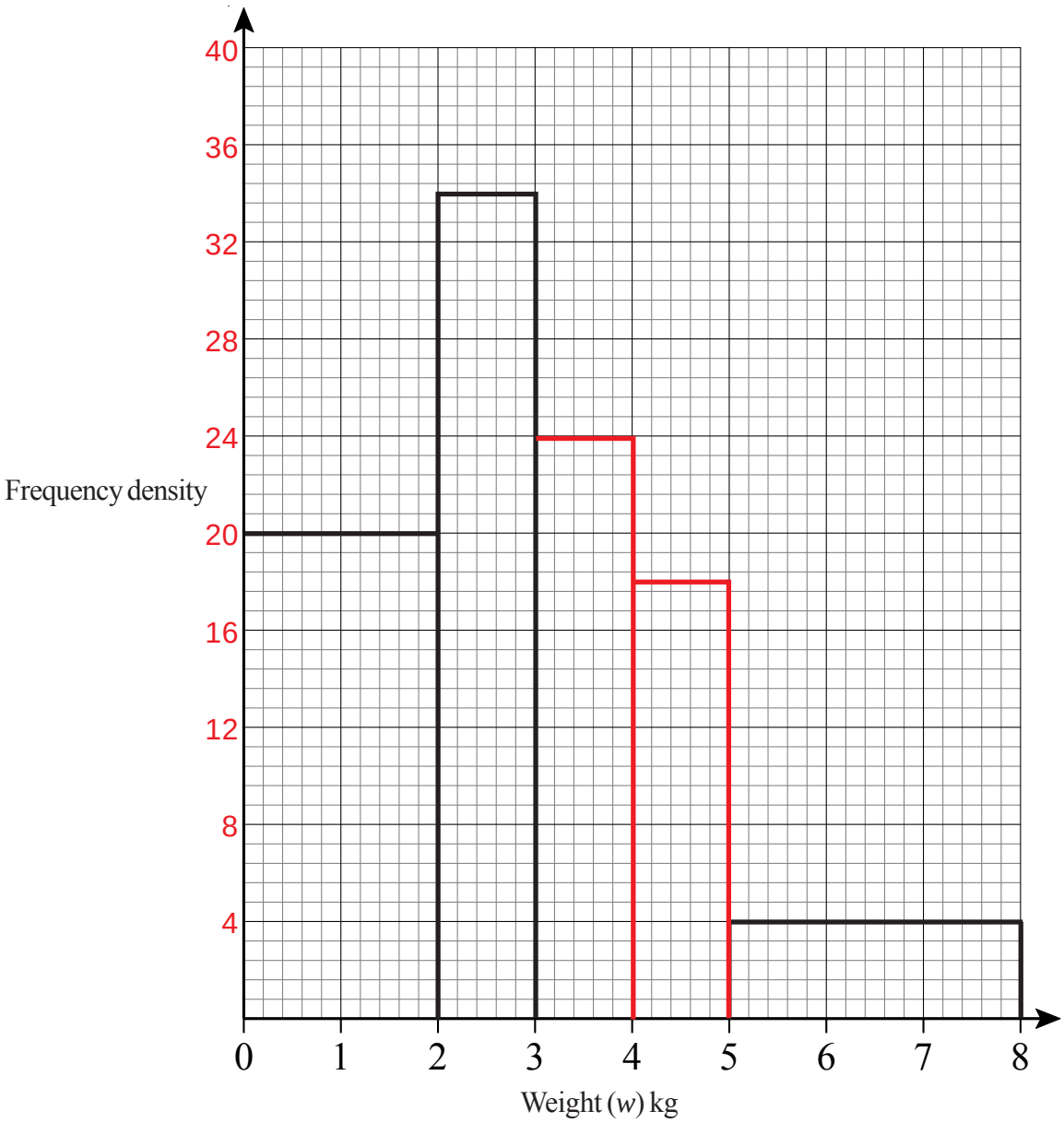
a) Use the histogram to complete the frequency table.

Weight (w) kg	Frequency
$0 < w \leqslant 2$	40
$2 < w \leqslant 3$	
$3 < w \leqslant 4$	24
$4 < w \leqslant 5$	18
$5 < w \leqslant 8$	

b) Use the table to complete the histogram.

Histograms

1) The table and histogram give some information about the weights of parcels received at a post office during one Thursday.



a) Use the histogram to complete the frequency table.

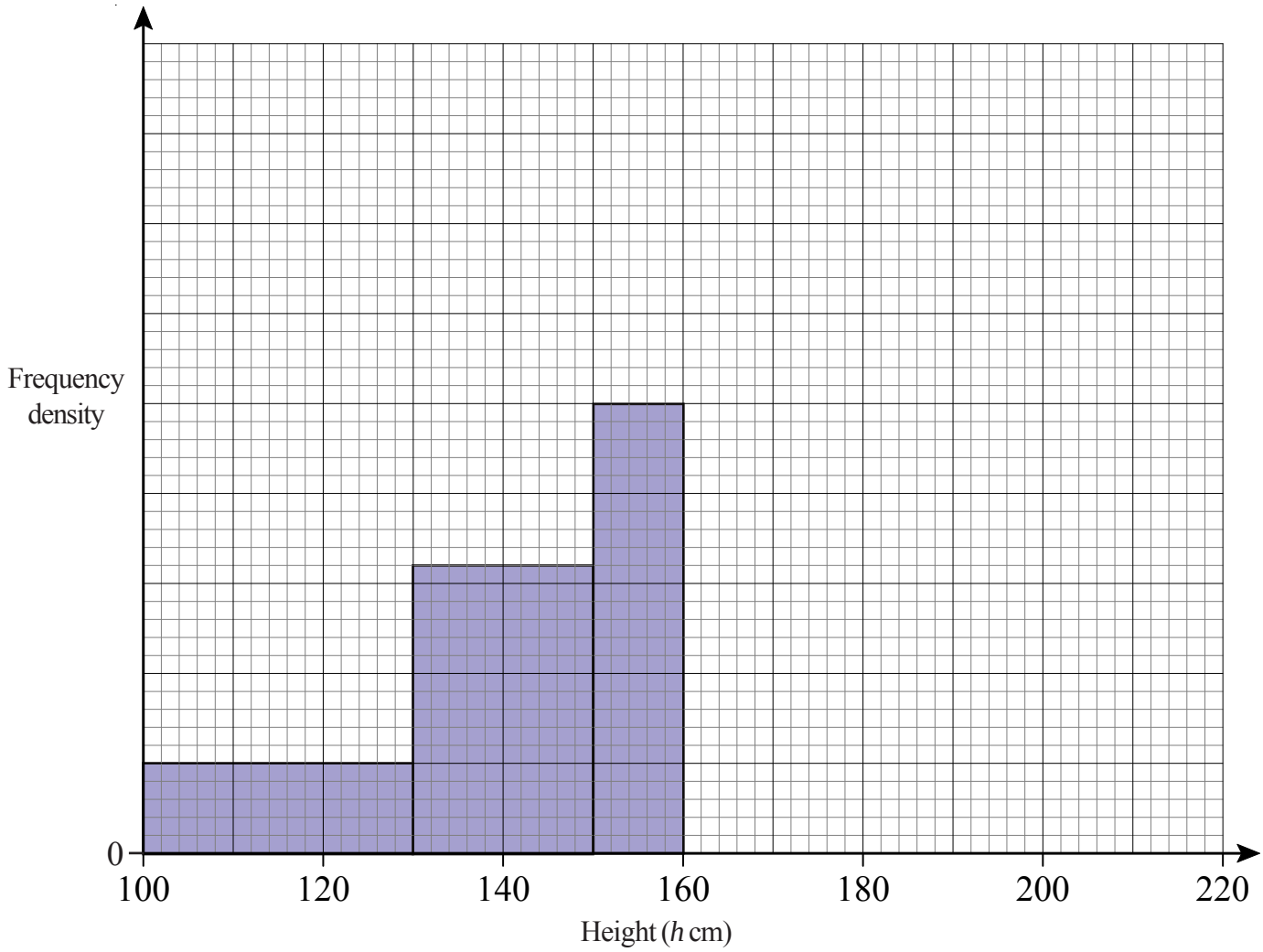
Weight (w) kg	Frequency
$0 < w \leqslant 2$	40
$2 < w \leqslant 3$	34
$3 < w \leqslant 4$	24
$4 < w \leqslant 5$	18
$5 < w \leqslant 8$	12

b) Use the table to complete the histogram.

Histograms

1) The incomplete table and histogram give some information about the heights (in cm) of some plants.

Height (h cm)	Frequency
$100 < h \leqslant 130$	30
$130 < h \leqslant 150$	
$150 < h \leqslant 160$	
$160 < h \leqslant 180$	40
$180 < h \leqslant 210$	18



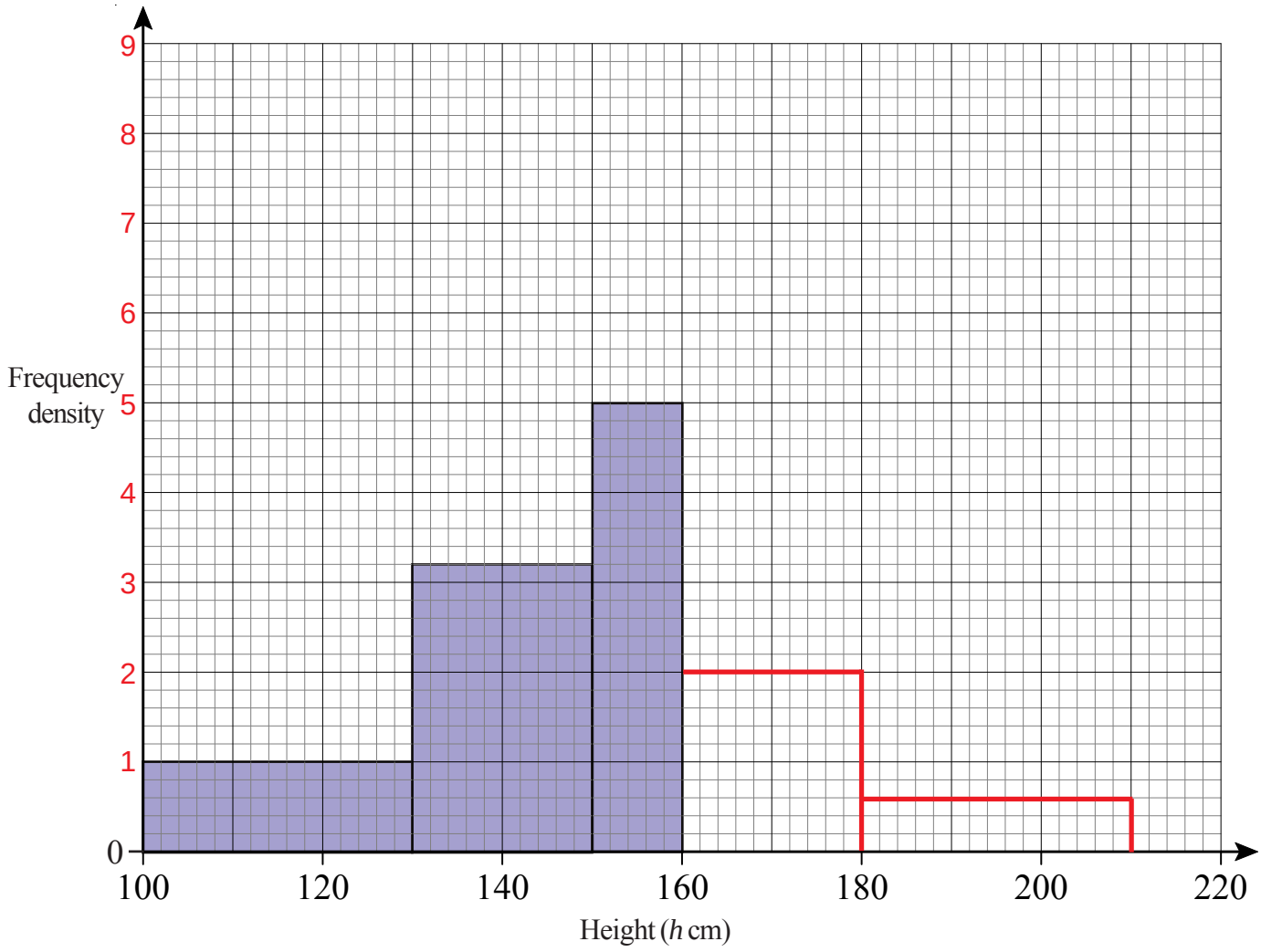
a) Use the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

1) The incomplete table and histogram give some information about the heights (in cm) of some plants.

Height (h cm)	Frequency
$100 < h \leqslant 130$	30
$130 < h \leqslant 150$	64
$150 < h \leqslant 160$	50
$160 < h \leqslant 180$	40
$180 < h \leqslant 210$	18



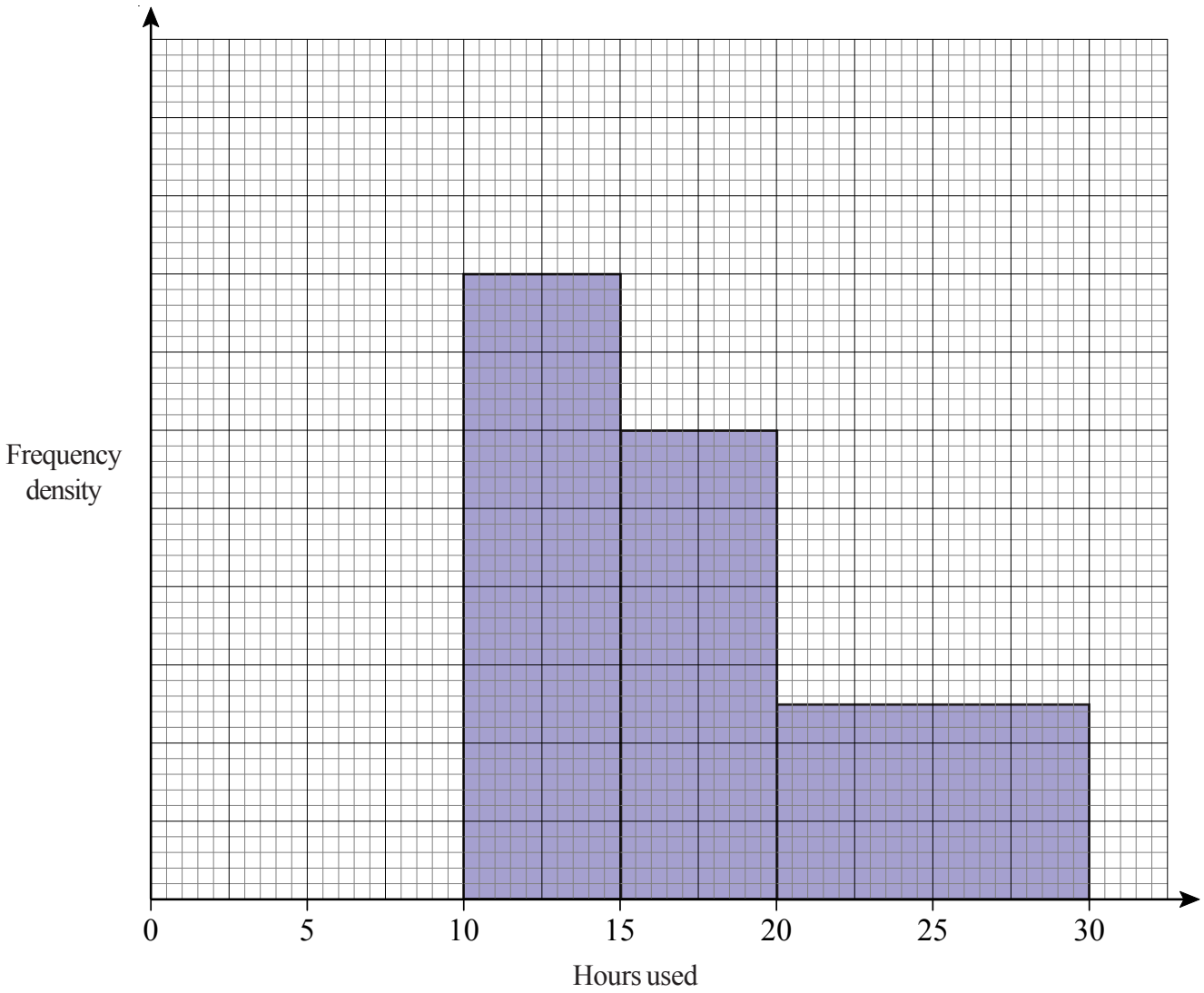
a) Use the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

1) Paul asked the students in his class how many hours they used the internet for last week.

The incomplete histogram was drawn using his results.



Eight students used the internet for between 10 and 15 hours.
Six students used it for between 0 and 10 hours.

a) Use this information to complete the histogram.

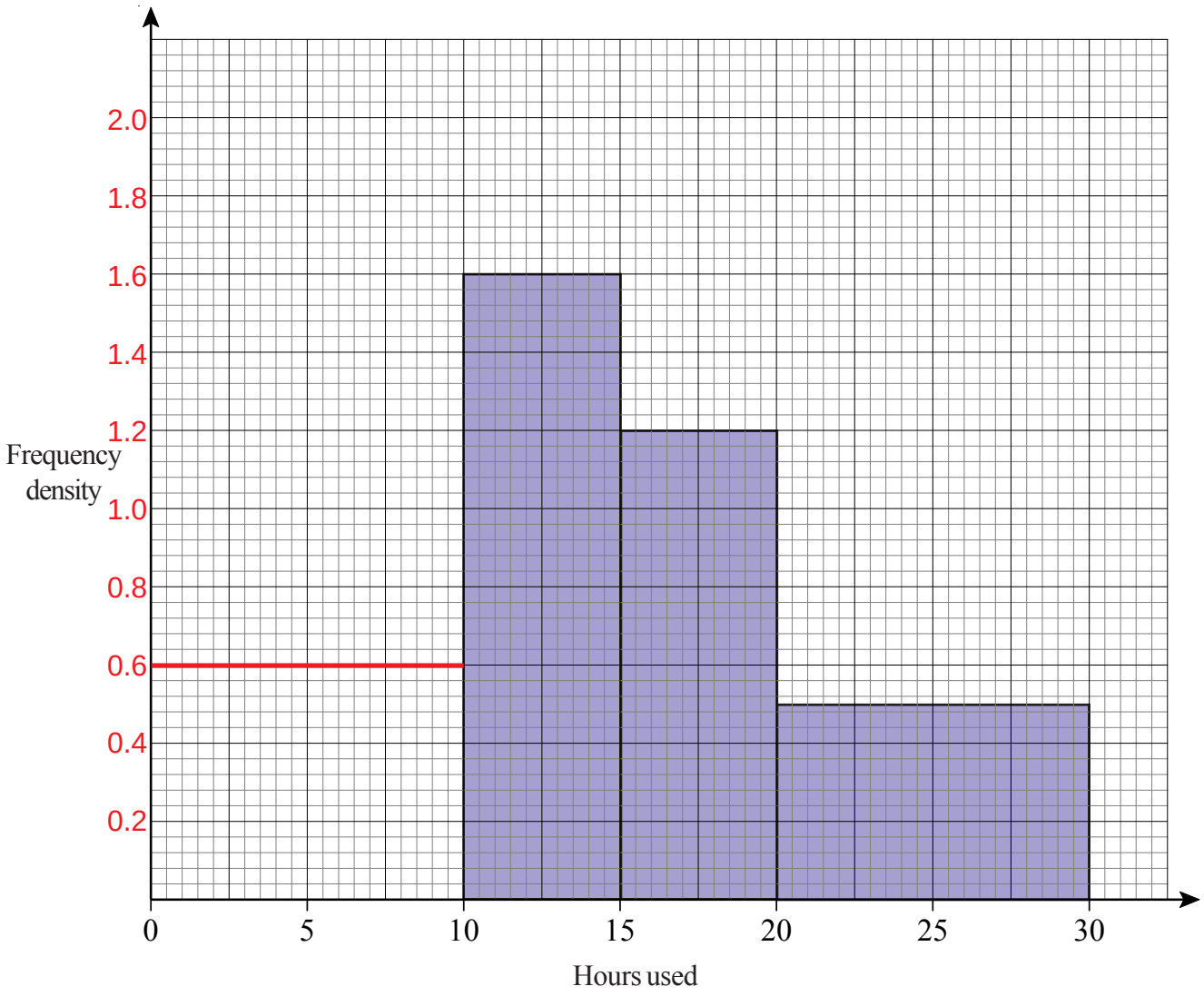
No students used the internet for more than 30 hours.

b) Work out how many students Paul asked.

Histograms

1) Paul asked the students in his class how many hours they used the internet for last week.

The incomplete histogram was drawn using his results.



Eight students used the internet for between 10 and 15 hours.
Six students used it for between 0 and 10 hours.

a) Use this information to complete the histogram.

No students used the internet for more than 30 hours.

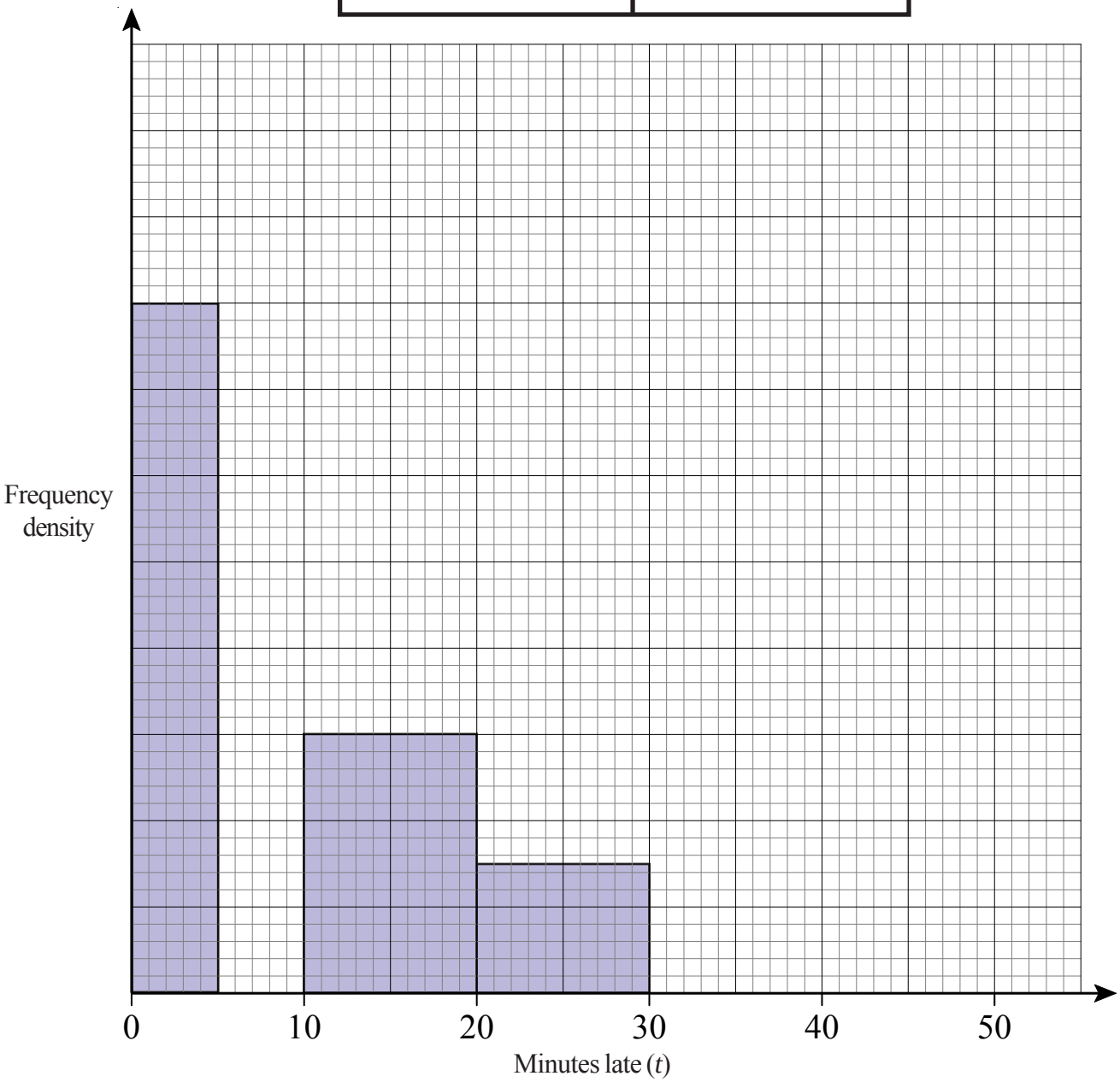
b) Work out how many students Paul asked.

6 + 8 + 6 + 5 = 25

Histograms

1) Some trains from Nottingham to Leeds were late.
The incomplete table and histogram give some information about how late the trains were.

Minutes late (t)	Frequency
$0 < t \leqslant 5$	16
$5 < t \leqslant 10$	10
$10 < t \leqslant 20$	
$20 < t \leqslant 30$	
$30 < t \leqslant 50$	8



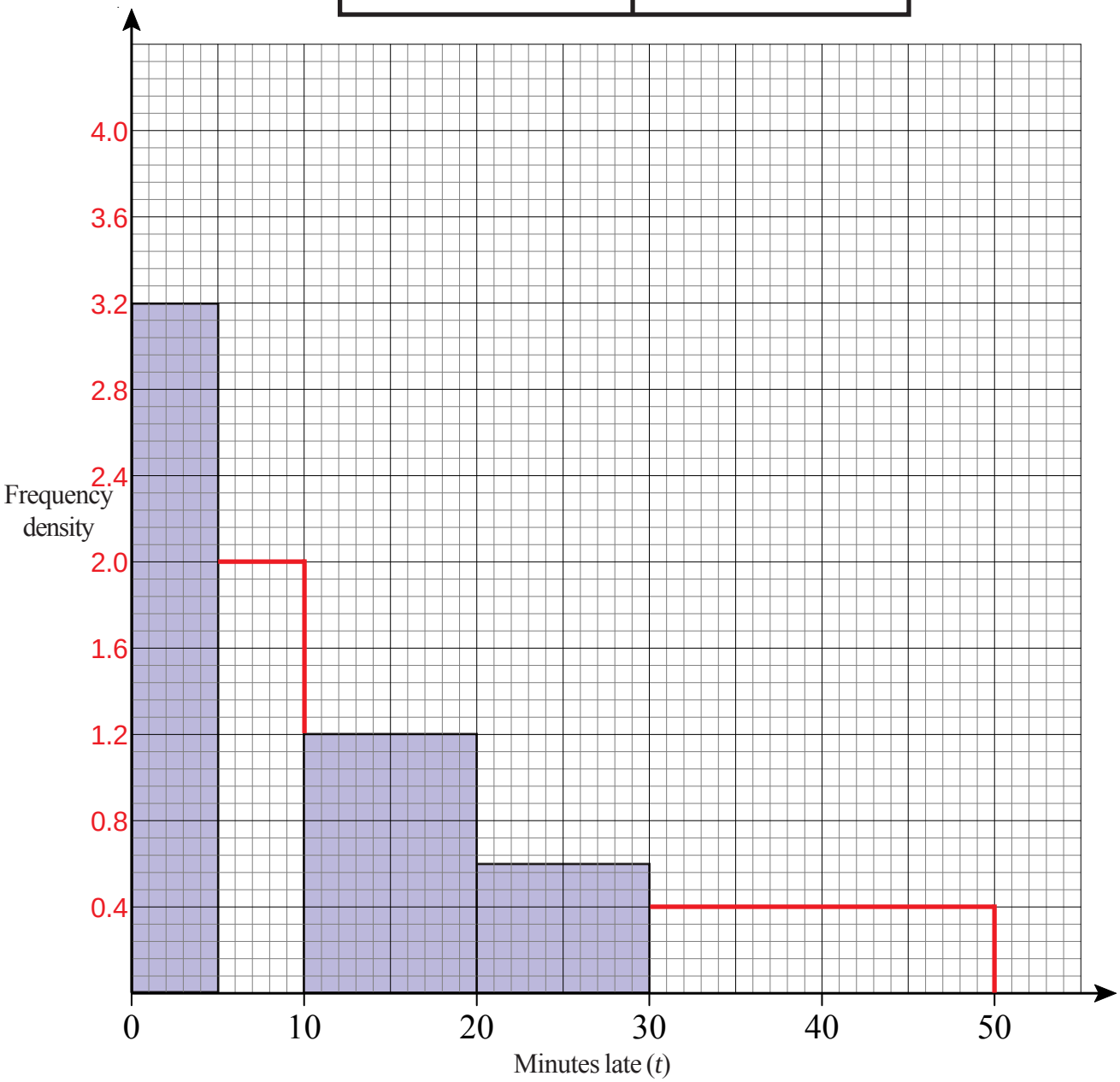
a) Use the information in the histogram to complete the table.

b) Use the information in the table to complete the histogram.

Histograms

1) Some trains from Nottingham to Leeds were late.
The incomplete table and histogram give some information about how late the trains were.

Minutes late (t)	Frequency
$0 < t \leqslant 5$	16
$5 < t \leqslant 10$	10
$10 < t \leqslant 20$	12
$20 < t \leqslant 30$	6
$30 < t \leqslant 50$	8



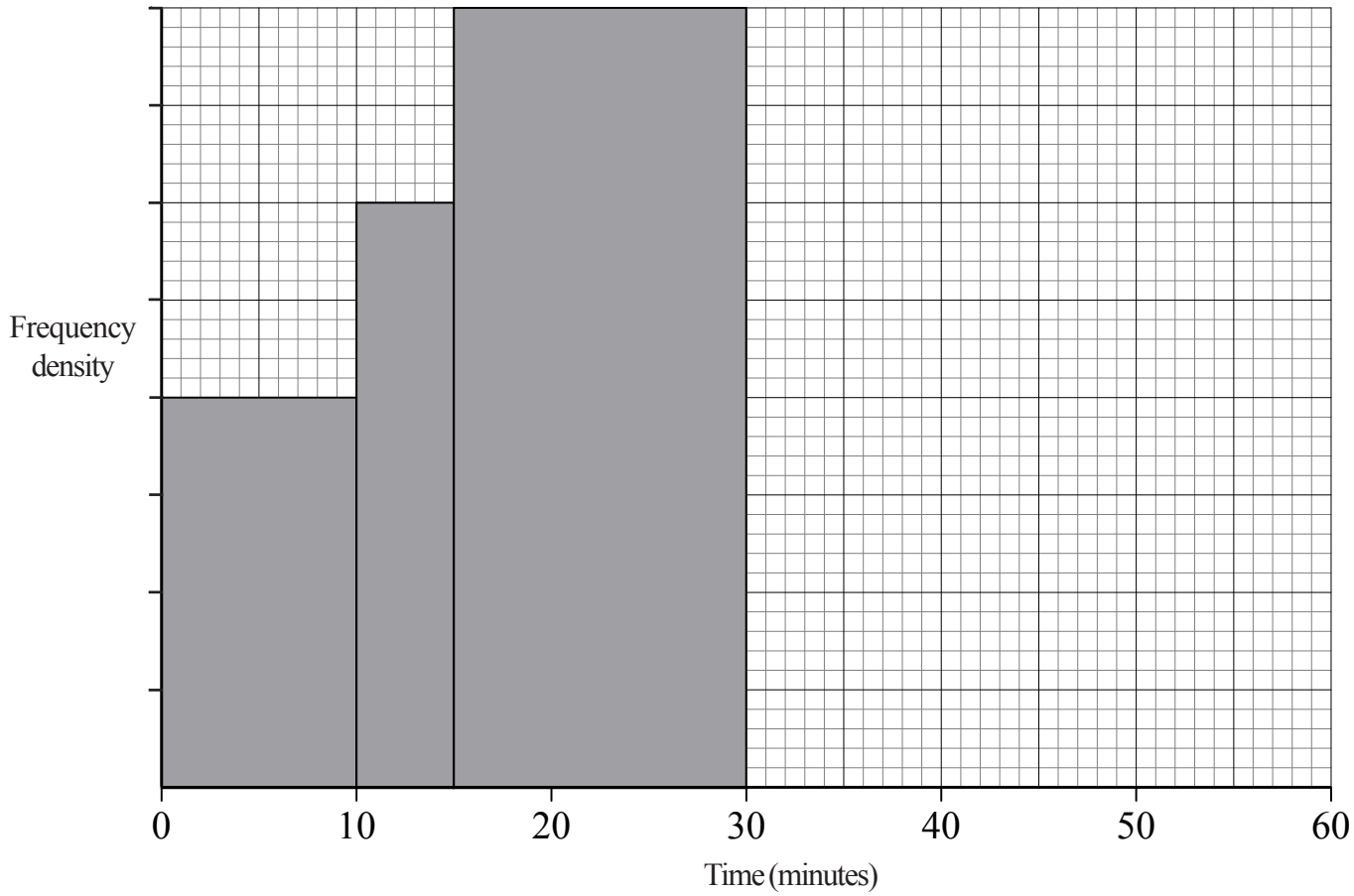
a) Use the information in the histogram to complete the table.

b) Use the information in the table to complete the histogram.

Histograms

1) The table and histogram give information about how long, in minutes, some students took to complete a set of homework.

Time (t) in minutes	Frequency
$0 < t \leqslant 10$	20
$10 < t \leqslant 15$	
$15 < t \leqslant 30$	
$30 < t \leqslant 50$	62
$50 < t \leqslant 60$	23



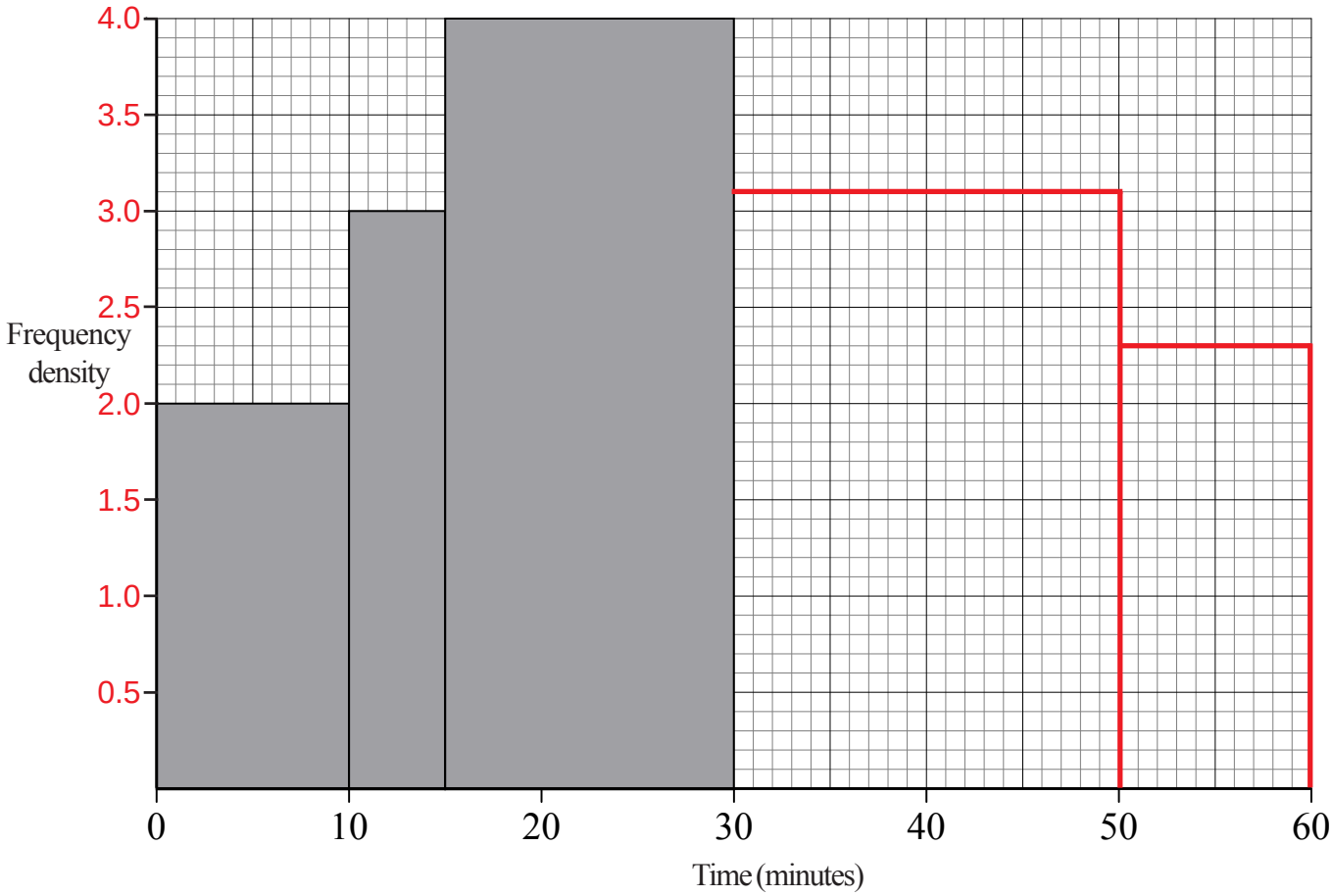
a) Use the information in the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

1) The table and histogram give information about how long, in minutes, some students took to complete a set of homework.

Time (t) in minutes	Frequency
$0 < t \leqslant 10$	20
$10 < t \leqslant 15$	15
$15 < t \leqslant 30$	60
$30 < t \leqslant 50$	62
$50 < t \leqslant 60$	23

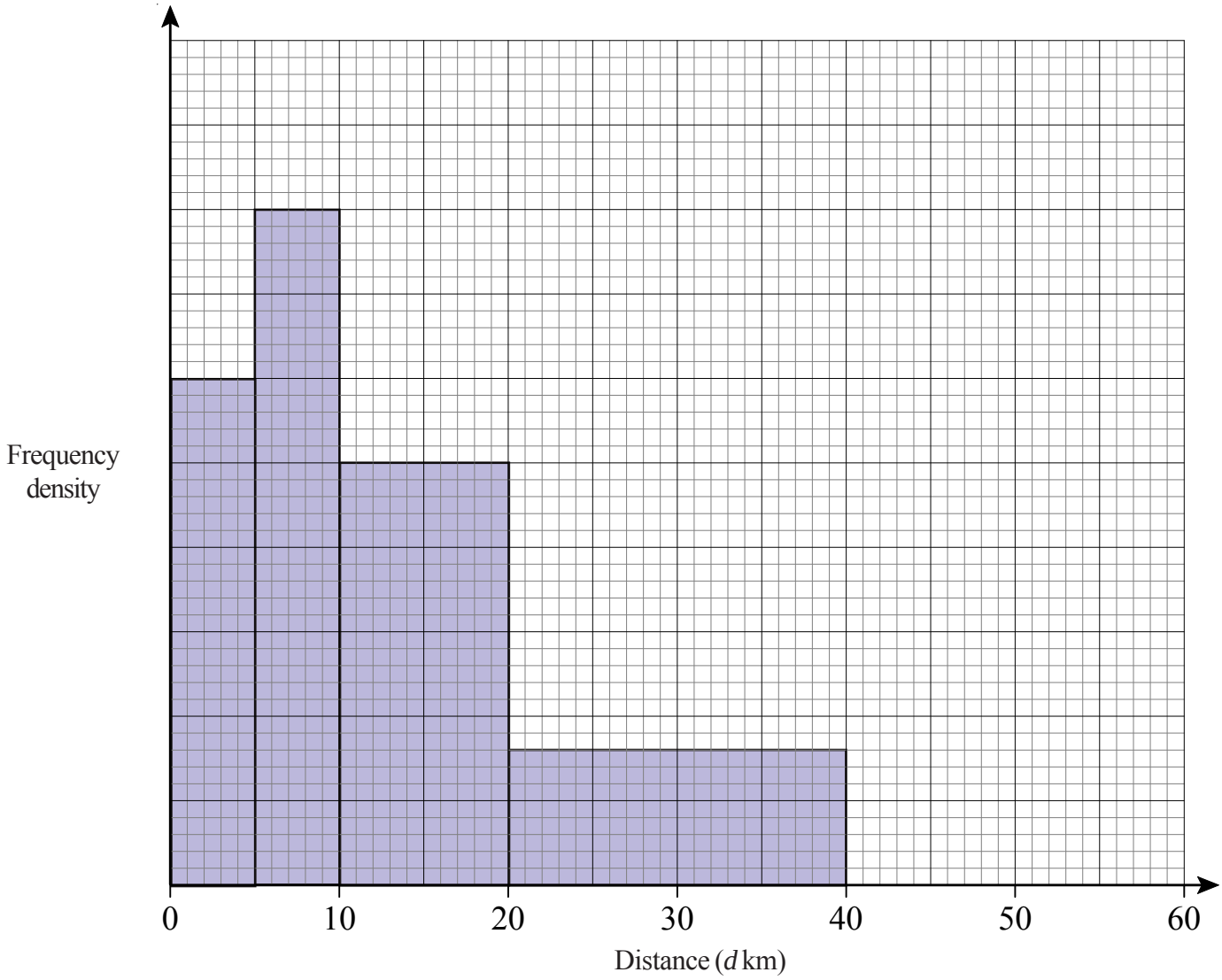


a) Use the information in the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

1) The incomplete histogram and table give some information about the distances some students travel to school.



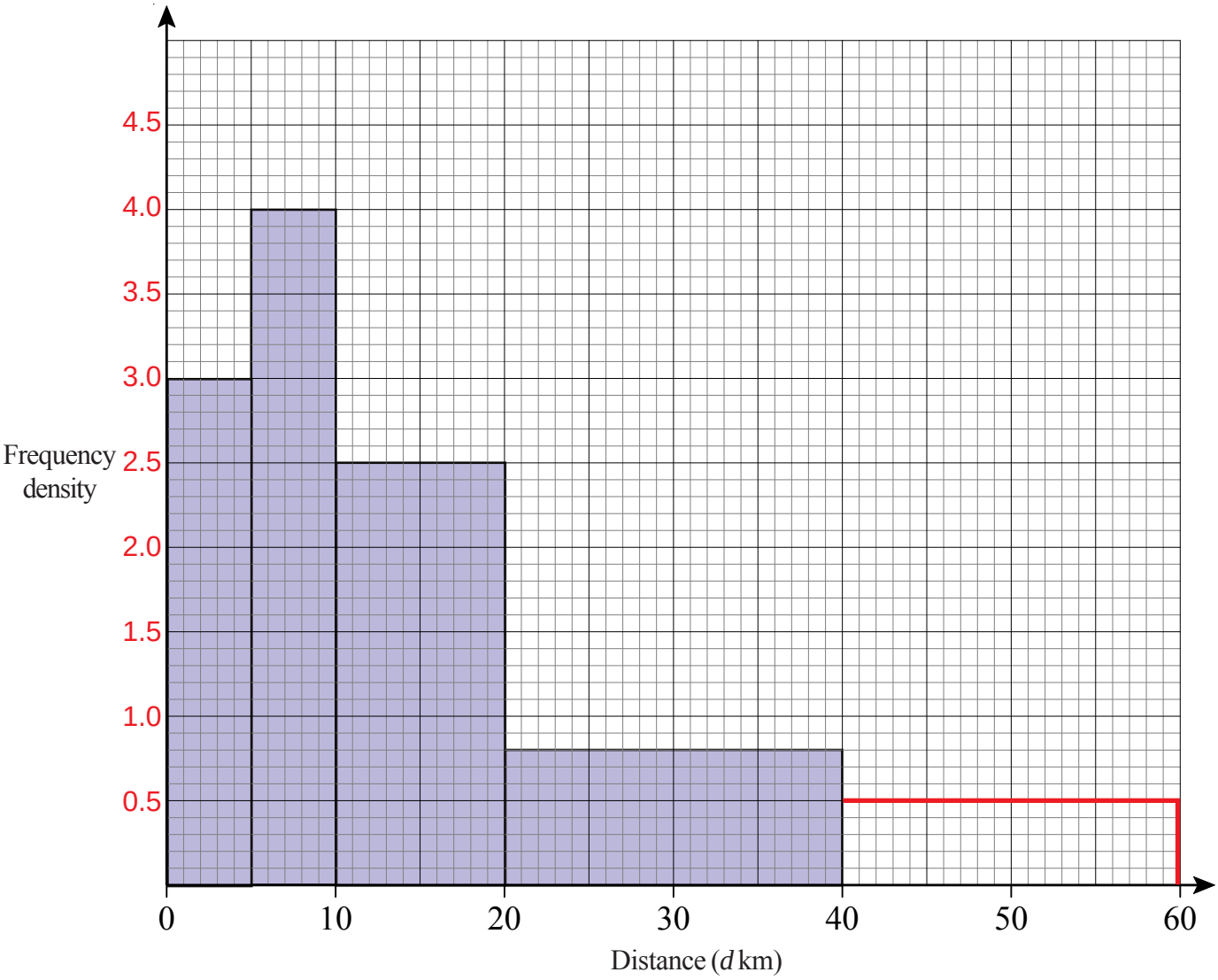
a) Use the information in the histogram to complete the frequency table.

Distance (d km)	Frequency
$0 < d \leqslant 5$	15
$5 < d \leqslant 10$	20
$10 < d \leqslant 20$	
$20 < d \leqslant 40$	
$40 < d \leqslant 60$	10

b) Use the information in the table to complete the histogram.

Histograms

1) The incomplete histogram and table give some information about the distances some students travel to school.



a) Use the information in the histogram to complete the frequency table.

Distance (d km)	Frequency
$0 < d \leqslant 5$	15
$5 < d \leqslant 10$	20
$10 < d \leqslant 20$	25
$20 < d \leqslant 40$	16
$40 < d \leqslant 60$	10

b) Use the information in the table to complete the histogram.

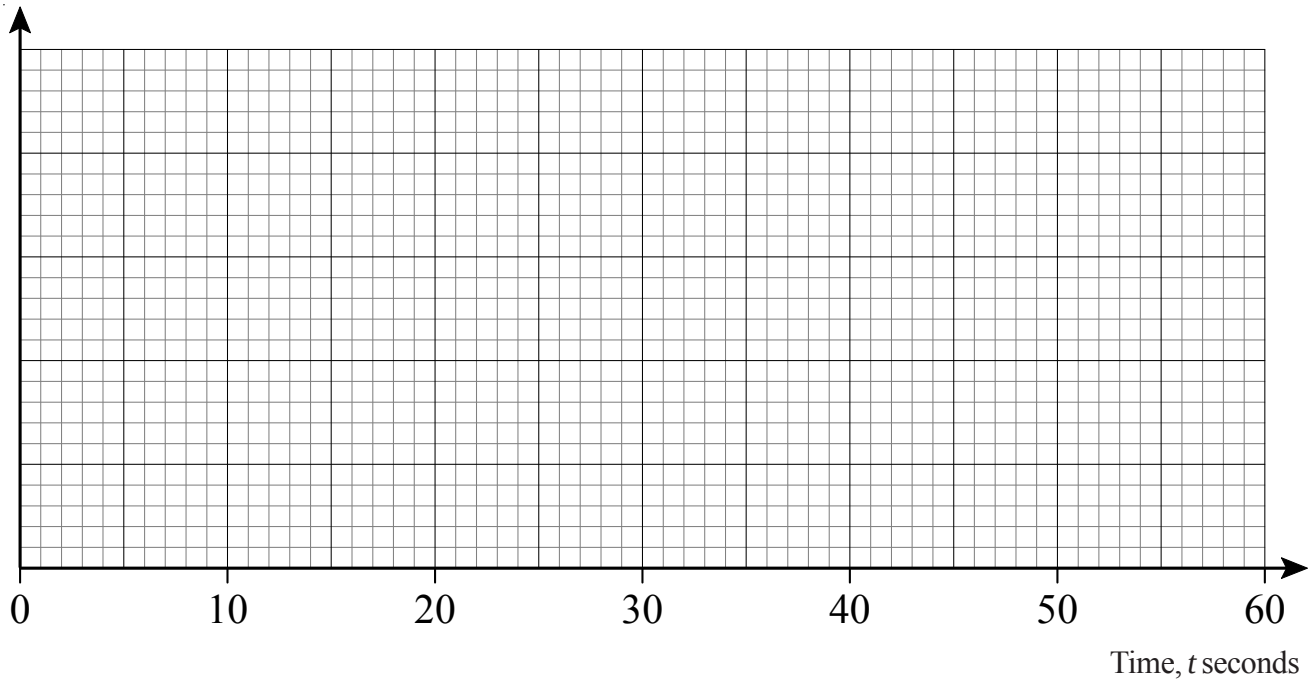
Histograms

1) There are 100 pupils in Year 11. The time taken by each pupil to answer a question was recorded. The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$
Number of pupils	6	19	25	36	14

Draw a histogram to illustrate the distribution on the graph paper below.

Time taken to answer in seconds

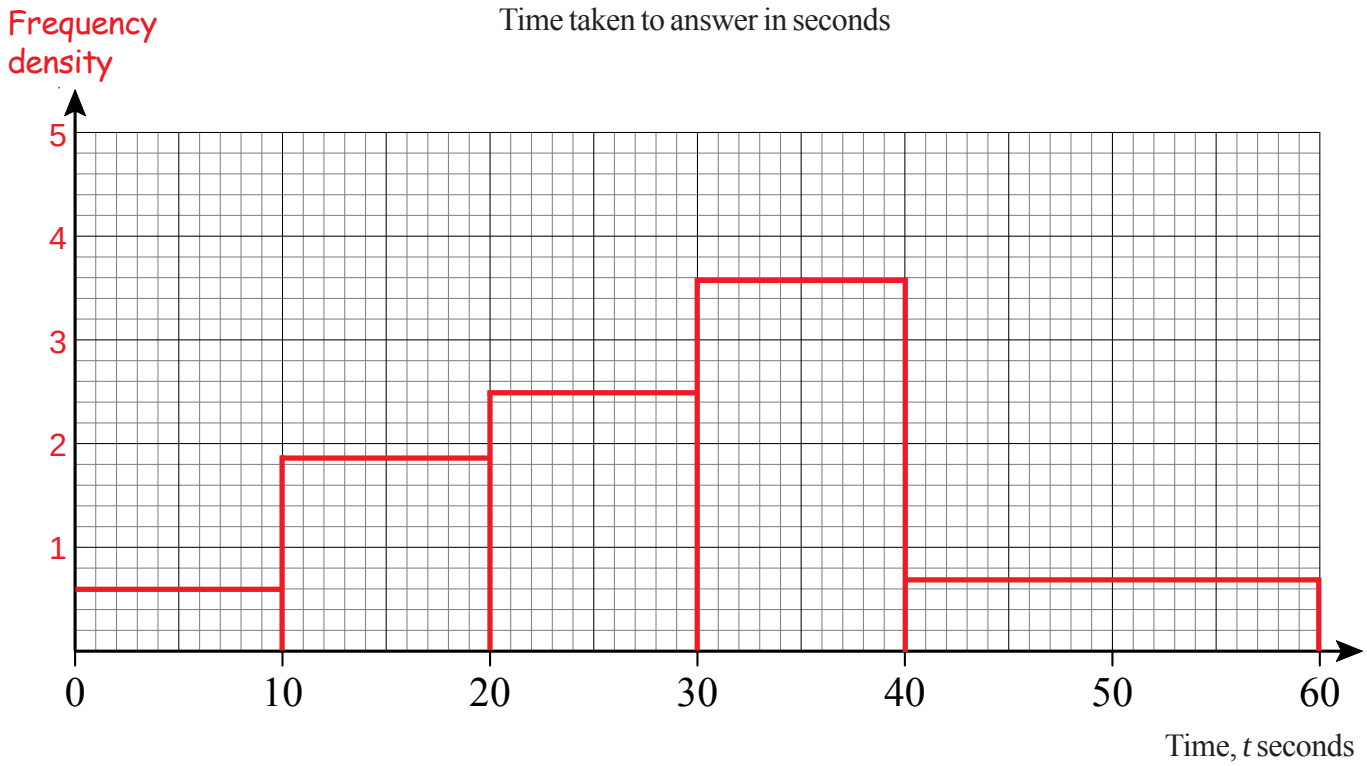


Histograms

1) There are 100 pupils in Year 11. The time taken by each pupil to answer a question was recorded. The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$
Number of pupils	6	19	25	36	14

Draw a histogram to illustrate the distribution on the graph paper below.

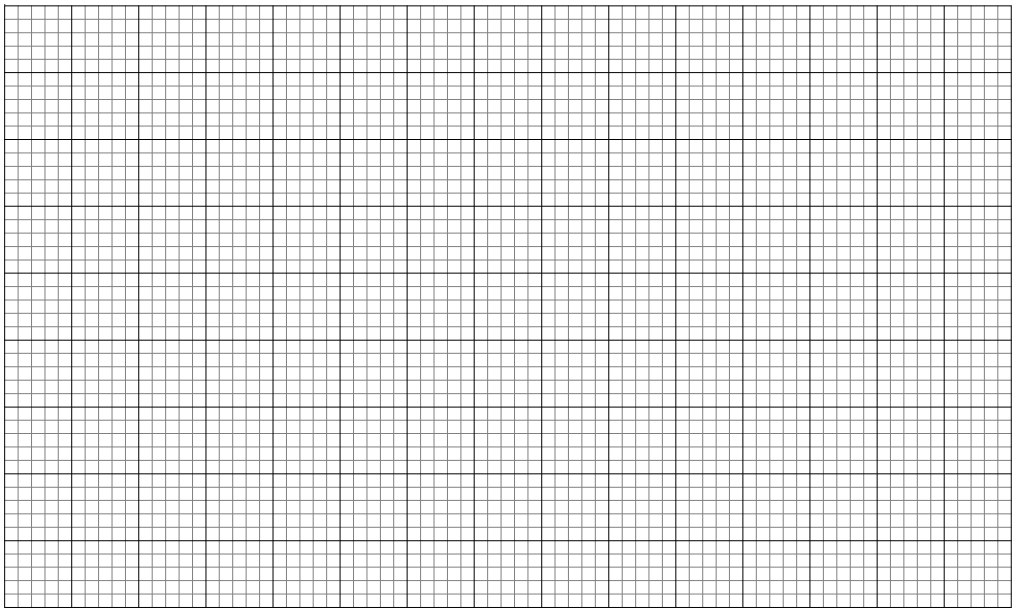


Histograms

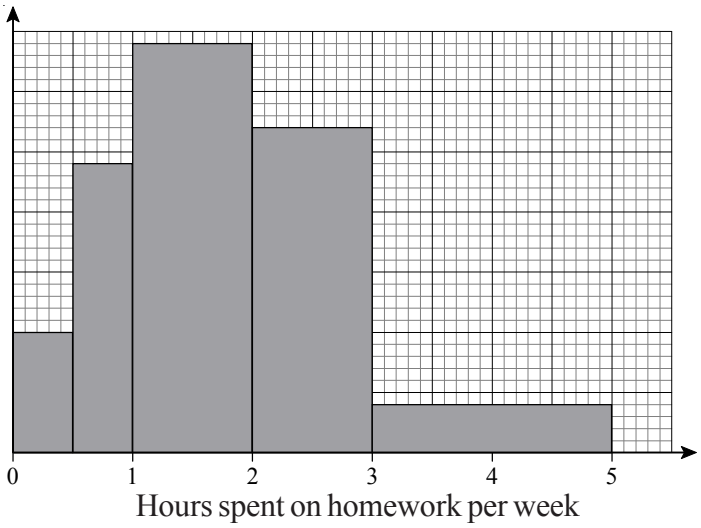
1) The table gives information about the heights, in centimetres, of some 18 year old students.

Use the table to draw a histogram.

Height (h cm)	Frequency
$135 < h \leqslant 145$	12
$145 < h \leqslant 165$	46
$165 < h \leqslant 180$	45
$180 < h \leqslant 190$	25
$190 < h \leqslant 195$	4



2) The histogram shows the amount of time, in hours, that students spend on their homework per week.



Use the histogram to complete the table.

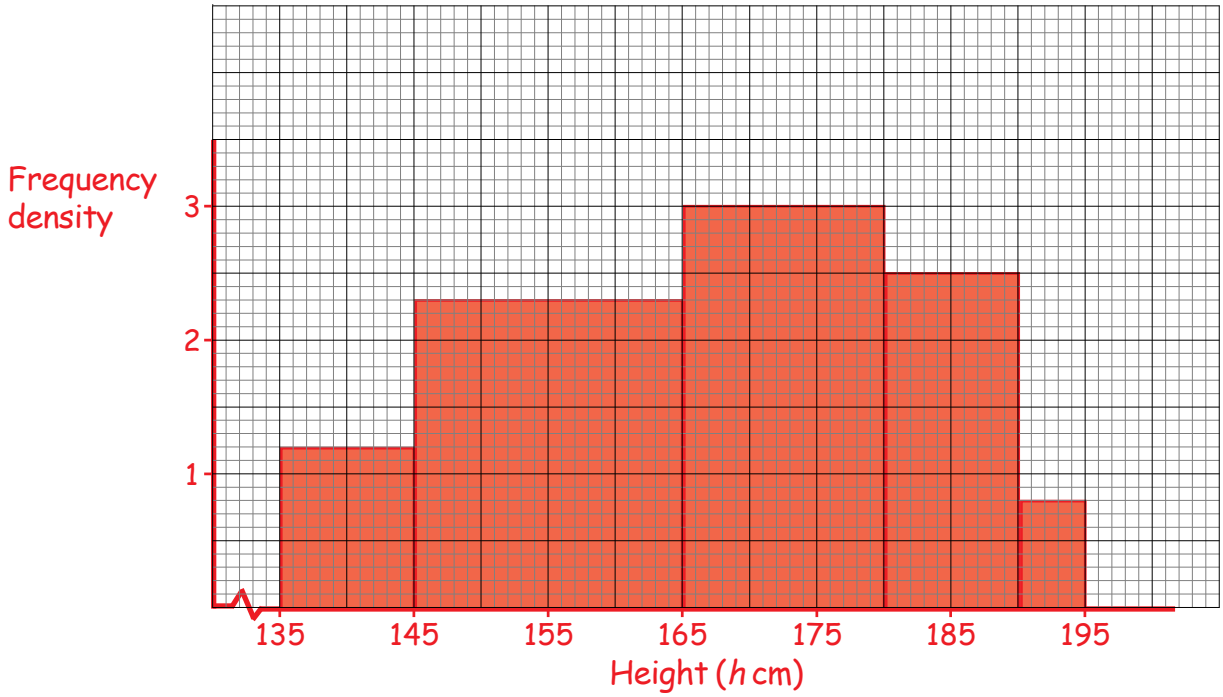
Time (t hours)	Frequency
$0 < t \leqslant ½$	
$½ < t \leqslant 1$	
$1 < t \leqslant 2$	
$2 < t \leqslant 3$	27
$3 < t \leqslant 5$	

Histograms

1) The table gives information about the heights, in centimetres, of some 18 year old students.

Use the table to draw a histogram.

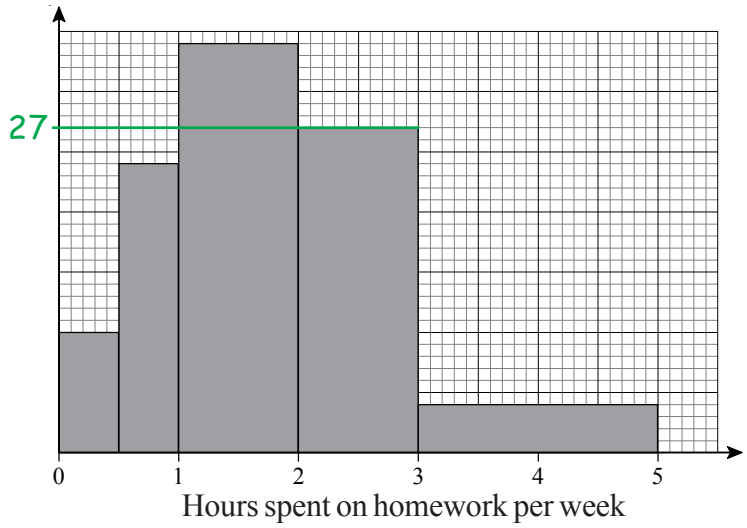
Height (h cm)	Frequency
$135 < h \leqslant 145$	12
$145 < h \leqslant 165$	46
$165 < h \leqslant 180$	45
$180 < h \leqslant 190$	25
$190 < h \leqslant 195$	4



2) The histogram shows the amount of time, in hours, that students spend on their homework per week.

$$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$$

From the numbers in the table:
Frequency density $= \frac{27}{1} = 27$



Use the histogram to complete the table.

Time (t hours)	Frequency
$0 < t \leqslant ½$	5
$½ < t \leqslant 1$	12
$1 < t \leqslant 2$	34
$2 < t \leqslant 3$	27
$3 < t \leqslant 5$	8

Probability 'And' & 'Or' Questions

1) Jordan designs a game for a school fair.
He has two 8-sided spinners.
The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour.

2) The probability that it will snow in Paris on Christmas day is 0.06.

a) Work out the probability that it will snow in Paris on **both** Christmas day 2015 **and** Christmas day 2016.

b) Work out the probability that it will snow in Paris on **either** Christmas Day 2015 **or** Christmas Day 2016, but **not** on both.

3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
Natalie takes a bead at random from the bag, records its colour and replaces it.
She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are the same colour.

Probability 'And' & 'Or' Questions

1) Jordan designs a game for a school fair.
He has two 8-sided spinners.
The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour. $\frac{18}{64}$ or $\frac{9}{32}$

Blue and Blue: $\frac{3}{8} \times \frac{2}{8} = \frac{6}{64}$

White and White: $\frac{3}{8} \times \frac{4}{8} = \frac{12}{64}$

Blue and Blue OR White and White

$\frac{6}{64} + \frac{12}{64} = \frac{18}{64}$

2) The probability that it will snow in Paris on Christmas day is 0.06.

a) Work out the probability that it will snow in Paris on **both** Christmas day 2015 **and** Christmas day 2016. 0.0036 0.06×0.06

b) Work out the probability that it will snow in Paris on **either** Christmas Day 2015 **or** Christmas Day 2016, but **not** on both. 0.1128

$\underset{\text{snow}}{0.06} \times \underset{\text{not snow}}{0.94} + \underset{\text{not snow}}{0.94} \times \underset{\text{snow}}{0.06}$

3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
Natalie takes a bead at random from the bag, records its colour and replaces it.
She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are the same colour. $\frac{660}{1000}$ (or any equivalent fraction)

P(two same colour) = 1 - P(BBB) - P(YYY) - P(RRR) - P(BYR) - P(BRY) - P(YBR) - P(YRB) - P(RBY) - P(RYB)

$\frac{8}{1000}$ $\frac{125}{1000}$ $\frac{27}{1000}$ $\frac{30}{1000}$ $\frac{30}{1000}$ $\frac{30}{1000}$ $\frac{30}{1000}$ $\frac{30}{1000}$ $\frac{30}{1000}$

$= 1 - \frac{340}{1000}$

Stratified Sampling

1) Ellen wants to do a survey with Years 9, 10 and 11 at her school.
The table shows the number of students in each of these year groups.

Year 11	Year 10	Year 9
750	700	900

Ellen takes a sample of 50 students stratified by year group.

Work out the number of students from Year 10 in the sample.

2) The table shows information about the year groups of 1000 students in a school.

Year group	7	8	9	10	11	12	13
Number in year	157	180	166	140	132	114	111

Tony takes a sample of 50 of these students, stratified by year group.

Calculate the number of Year 8 students he should have in his sample.

3) The table shows information about Ben's collection of 652 coins.

Country	France	Spain	Germany	Italy	Total
Number of coins	240	182	133	97	652

Ben takes a sample of 50 coins stratified by country.

Work out the number of coins from Italy in this sample.

4)

	Male	**Female**
Lower sixth	399	602
Upper sixth	252	198

The table gives information about the number of students in the two years of a sixth form.

Amy wants to interview some of these students.
She takes a random sample of 70 students stratified by year and by gender.

Work out the number of students in the sample who are male and in the lower sixth.

Stratified Sampling

1) Ellen wants to do a survey with Years 9, 10 and 11 at her school.
The table shows the number of students in each of these year groups.

Year 11	Year 10	Year 9
750	700	900

Ellen takes a sample of 50 students stratified by year group.

Work out the number of students from Year 10 in the sample. 15 students

2) The table shows information about the year groups of 1000 students in a school.

Year group	7	8	9	10	11	12	13
Number in year	157	180	166	140	132	114	111

Tony takes a sample of 50 of these students, stratified by year group.

Calculate the number of Year 8 students he should have in his sample. 9 students

3) The table shows information about Ben's collection of 652 coins.

Country	France	Spain	Germany	Italy	Total
Number of coins	240	182	133	97	652

Ben takes a sample of 50 coins stratified by country.

Work out the number of coins from Italy in this sample. 7 coins

4)

	Male	**Female**
Lower sixth	399	602
Upper sixth	252	198

The table gives information about the number of students in the two years of a sixth form.

Amy wants to interview some of these students.
She takes a random sample of 70 students stratified by year and by gender.

Work out the number of students in the sample who are male and in the lower sixth. 19 students

Stratified Sampling

1) The table below shows the number of employees in each section of a company.

Department	**Managerial**	**Sales**	**Technical**	**Production**
Number of employees	18	45	288	549

A survey on job satisfaction is to be carried out.

a) Explain why a simple random sample of employees is unsuitable.

b) A stratified random sample of 100 is used. Complete the table below to show how many employees from each department will be included.

Department	**Managerial**	**Sales**	**Technical**	**Production**
Number of employees in sample				

2) MathsWatch High-School has 798 pupils.
The size of each year group is shown below.

Year Group	**Boys**	**Girls**
7	77	72
8	74	79
9	72	74
10	93	107
11	85	65

The headteacher wants to find out the opinions of the pupils on changing the timing of the school day. A stratified sample of 80 pupils is taken.

a) Complete the table below to show the numbers of pupils to be sampled.

Year Group	**Boys in Sample**	**Girls in Sample**
7		
8		
9		
10		
11		

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

Year Group	**Boys in Sample who answered YES**	**Girls in Sample who answered YES**
7	2	3
8	3	5
9	2	1
10	1	4
11	0	1

b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question.

Stratified Sampling

1) The table below shows the number of employees in each section of a company.

Department	Managerial	Sales	Technical	Production
Number of employees	18	45	288	549

= 900 employees

A survey on job satisfaction is to be carried out.

a) Explain why a simple random sample of employees is unsuitable.
The numbers in each department are very different - it might not be fair.

b) A stratified random sample of 100 is used. Complete the table below to show how many employees from each department will be included.

Department	Managerial	Sales	Technical	Production
Number of employees in sample	2	5	32	61

$\frac{100}{900} \times 18$ $\frac{100}{900} \times 45$ $\frac{100}{900} \times 288$ $\frac{100}{900} \times 549$

2) MathsWatch High-School has 798 pupils.
The size of each year group is shown below.

Year Group	Boys	Girls
7	77	72
8	74	79
9	72	74
10	93	107
11	85	65

The headteacher wants to find out the opinions of the pupils on changing the timing of the school day. A stratified sample of 80 pupils is taken.

a) Complete the table below to show the numbers of pupils to be sampled.

Year Group	Boys in Sample	Girls in Sample
7	$\frac{80}{798} \times 77$ 8	$\frac{80}{798} \times 72$ 7
8	$\frac{80}{798} \times 74$ 7	$\frac{80}{798} \times 79$ 8
9	$\frac{80}{798} \times 72$ 7	$\frac{80}{798} \times 74$ 7
10	$\frac{80}{798} \times 93$ 9	$\frac{80}{798} \times 107$ 11
11	$\frac{80}{798} \times 85$ 9	$\frac{80}{798} \times 65$ 7

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

Year Group	Boys in Sample who answered YES	Girls in Sample who answered YES
7	2	3
8	3	5
9	2	1
10	1	4
11	0	1
	8	14

8 + 14 = 22 answered YES

$\frac{22}{80} \times 100 = 27.5$

b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question. 27.5%