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- To improve our discs, year on year.

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

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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
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, 5, 6, 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).
   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
   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
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) $5^2 - 3^1$
   c) $1^2 + 2^2 + 3^2$

4) Find the value of
   a) $5^4 + 6^3$
   b) $3^4 \times 2^5$
   c) $9^3 - 6^1$

5) Find the value of
   $2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$
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
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

   $\begin{align*}
   9^2 & \quad \sqrt{9} & \quad 81 & \quad 5^3 \\
   2^5 & \quad 125 & \quad 32 & \quad 3
   \end{align*}$
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

   ![Matching cards](image)
1) Each of the grids below has a fraction written at the side of it.
a) Shade the grids to show these fractions.

\[
\begin{array}{ccc}
\frac{8}{12} & \frac{4}{6} & \frac{2}{3} \\
\end{array}
\]

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.

\[
\begin{array}{ccc}
\frac{2}{5} & \frac{4}{10} & \frac{8}{20} \\
\end{array}
\]

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.

\[
\frac{2}{5} = \frac{6}{\square} = \frac{30}{\square} = \frac{14}{\square}
\]

5) How do you know that \( \frac{3}{7} \) is not equivalent to \( \frac{25}{56} \)?
1) Each of the grids below has a fraction written at the side of it.
   a) Shade the grids to show these fractions.

   \[
   \frac{8}{12} \quad \frac{4}{6} \quad \frac{2}{3}
   \]

   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.

   \[
   \frac{2}{5} \quad \frac{4}{10} \quad \frac{8}{20}
   \]

   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.

   \[
   \frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}
   \]

4) Find the missing values in these equivalent fractions.

   \[
   \frac{2}{5} = \frac{6}{15} = \frac{12}{30} = \frac{14}{35}
   \]

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
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) \( \frac{72}{96} \)
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) \( \frac{14}{18} \) \( \frac{7}{9} \)
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) \( \frac{72}{96} \) \( \frac{3}{4} \)
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.
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) \( \frac{2}{3} \), \( \frac{8}{12} \), \( \frac{7}{12} \), \( \frac{7}{12} \), \( \frac{3}{4} \), \( \frac{9}{12} \), \( \frac{5}{6} \), \( \frac{10}{12} \), \( \frac{7}{12} \)

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

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

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.
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?

<table>
<thead>
<tr>
<th>20 exercise books</th>
<th>35 exercise books</th>
</tr>
</thead>
<tbody>
<tr>
<td>for £4.00</td>
<td>for £7.80</td>
</tr>
</tbody>
</table>

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.
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
      \[ \frac{400\text{ml of toothpaste}}{2} \times \frac{\text{£}1.00}{2} \]
   b) 600g of bananas for 70p or 200g of bananas for 22p
      \[ \frac{600\text{g of bananas}}{3} \times \frac{\text{£}66p}{3} \]
   c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50
      \[ \frac{1\text{ litre of paint}}{2} \times \frac{\£1.60}{5} \]
   d) 60 teabags for £1.62 or 40 teabags for £0.96
      \[ \frac{120\text{ teabags}}{3} \times \frac{\£3.24}{3} \]

2) Which of these is the best buy?

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.
   \[ \frac{\text{1 litre of paint}}{2} \times \£5.10 \]
   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’?
      \[ \£10.20 \]
      \[ \£9.58 \]
      \[ \£0.31 \]

4) Honey pots are sold in two sizes.
   A small pot costs 45p and weighs 450g.
   \[ 45 \div 450 = 0.1\text{p per g} \]
   A large pot costs 80p and weighs 850g.
   \[ 80 \div 850 = 0.09\text{p per g} \]
   Which pot of honey is better value for money?
   Large pot at 80p for 850g
   You must show all your working.
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?
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?
1) Work out:
   a) 10% of £170  £17
   b) 10% of £680  £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
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.
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.
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?
1) Write the following as percentages.
   a) 12 out of 50 \( \frac{12}{50} = 24\% \)
   b) 15 out of 25 \( \frac{15}{25} = 60\% \)
   c) 8 out of 10 \( \frac{8}{10} = 80\% \)
   d) 11 out of 20 \( \frac{11}{20} = 55\% \)
   e) 4 out of 5 \( \frac{4}{5} = 80\% \)
   f) 32 out of 40 \( \frac{32}{40} = 80\% \)
   g) 12 out of 80 \( \frac{12}{80} = 15\% \)
   h) 640 out of 800 \( \frac{640}{800} = 80\% \)
   i) 36 out of 60 \( \frac{36}{60} = 60\% \)

2) Tim got 17 out of 20 in a French test. Write 17 out of 20 as a percentage. \( \frac{17}{20} = 85\% \)

3) Write £19 as a percentage of £25 \( \frac{19}{25} = 76\% \)

4) Work out £14 as a percentage of £40 \( \frac{14}{40} = 35\% \)

5) A baker burnt 12 loaves out of the 200 loaves he baked. What percentage of the 200 loaves did he burn? \( \frac{12}{200} = 6\% \)

6) What is £380 as a percentage of £400? \( \frac{380}{400} = 95\% \)

7) What is £22 as a percentage of £40? \( \frac{22}{40} = 55\% \)

8) If there are 9 girls and 11 boys in a class, what percentage of the class are girls? \( \frac{9 + 11}{9 + 11} = 45\% \)
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?
1) Work out these amounts.
   a) \(\frac{3}{4} \text{ of £20} \) = £15
   b) \(\frac{2}{3} \text{ of } 60 \text{ kg} \) = 40 kg
   c) \(\frac{3}{8} \times 24 \) = 9
   d) \(150 \times \frac{2}{3} \) = 100
   e) \(\frac{2}{9} \text{ of } 180 \text{ cm} \) = 40 cm
   f) \(49 \times \frac{4}{7} \) = 28
   g) \(60 \times \frac{1}{4} \) = 15
   h) \(\frac{5}{8} \text{ of £48} \) = £30
   i) \(4000 \times \frac{7}{8} \) = 3500

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

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
inches

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

Page 56
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) \( 2 \frac{1}{6} + \frac{1}{2} = 3 \frac{2}{3} \)
   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. \( \frac{5}{11} \frac{12}{12} \)
   Give your answer as a mixed number.

\[
\begin{array}{c}
\hline
\text{In all the questions on this page, please give your answers in their simplest form.}
\end{array}
\]

Page 56
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) $\frac{2}{3} \times \frac{1}{1}$
   c) $\frac{3}{5} \times \frac{2}{3}$
   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) $3 \frac{2}{3} \div \frac{1}{5}$
   d) $4 \frac{1}{2} \div 1 \frac{1}{2}$
In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:
   a) \( \frac{1}{2} \times \frac{1}{2} = \frac{1}{4} \)
   b) \( \frac{2}{3} \times \frac{1}{3} = \frac{2}{9} \)
   c) \( \frac{3}{5} \times \frac{2}{7} = \frac{6}{35} \)
   d) \( \frac{4}{7} \times \frac{5}{9} = \frac{20}{63} \)

2) Work out the following:
   a) \( \frac{1}{2} \times \frac{2}{3} = \frac{1}{3} \)
   b) \( \frac{3}{4} \times \frac{8}{11} = \frac{6}{11} \)
   c) \( \frac{2}{9} \times \frac{3}{4} = \frac{1}{6} \)
   d) \( \frac{4}{5} \times \frac{1}{12} = \frac{1}{15} \)

3) Work out the following:
   a) \( 1 \frac{1}{2} \times \frac{1}{3} = 1 \frac{1}{2} \)
   b) \( \frac{2}{3} \times 2 \frac{2}{5} = 1 \frac{3}{5} \)
   c) \( 3 \frac{1}{2} \times 1 \frac{1}{2} = 5 \frac{1}{4} \)
   d) \( 1 \frac{2}{7} \times 3 \frac{1}{3} = 4 \frac{2}{7} \)

4) Work out the following:
   a) \( \frac{2}{5} \div \frac{3}{4} = \frac{8}{15} \)
   b) \( \frac{1}{7} \div \frac{3}{5} = \frac{5}{21} \)
   c) \( \frac{4}{9} \div \frac{1}{2} = \frac{8}{9} \)
   d) \( \frac{3}{10} \div \frac{5}{9} = \frac{27}{50} \)

5) Work out the following:
   a) \( \frac{1}{2} \div \frac{1}{3} = 1 \frac{1}{2} \)
   b) \( \frac{3}{7} \div \frac{4}{7} = \frac{3}{4} \)
   c) \( \frac{1}{9} \div \frac{2}{3} = \frac{1}{6} \)
   d) \( \frac{2}{5} \div \frac{3}{10} = 1 \frac{1}{3} \)

6) Work out the following:
   a) \( \frac{1}{3} \div \frac{1}{4} = 5 \frac{1}{3} \)
   b) \( \frac{3}{5} \div 2 \frac{2}{3} = \frac{9}{40} \)
   c) \( 3 \frac{2}{3} \div \frac{1}{5} = 3 \frac{1}{18} \)
   d) \( 4 \frac{1}{2} \div 1 \frac{1}{2} = 3 \)
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) \( \frac{5}{8} \)
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) \(\frac{1}{3}\) 0.3
9) \(\frac{1}{8}\) 0.125
10) \(\frac{5}{8}\) 0.625
Work out the following. *Note* 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) $27 + 3 + 6$
7) $(9 + 2) \times 2 + 5$
8) $4 \times (1 + 4) - 6$
9) $6 \times 4 - 3 \times 5$
10) $\frac{9 + 3}{4 + 2}$
11) $\frac{23 + 9}{7 - 3}$
12) $\frac{7 - 2^2}{4^2 - 15}$
13) $\frac{5^2 + 3}{2 \times 7}$
14) $\frac{5 \times 6 - 4}{13}$
15) $\frac{8 \times 2 - 4}{3 + 1^2}$
16) $\frac{12 - 3 \times 2}{14 \div 7}$
17) $\frac{20 - 3^2}{10 - (5 + 4)}$
18) $\frac{3 + 9 \times 8}{1 + 6 \times 4}$
Work out the following. \(=\) for all questions.

1) \(6 \times 5 + 2 = 32\)
2) \(2 + 6 \times 5 = 32\)
3) \(35 - 4 \times 3 = 23\)
4) \(48 \div (14 - 2) = 4\)
5) \(27 \div (3 + 6) = 3\)
6) \(27 \div 3 + 6 = 15\)
7) \((9 + 2) \times 2 + 5 = 27\)
8) \(4 \times (1 + 4) - 6 = 14\)
9) \(6 \times 4 - 3 \times 5 = 9\)
10) \(\frac{9 + 3}{4 + 2} = 2\)
11) \(\frac{23 + 9}{7 - 3} = 8\)
12) \(\frac{7 - 2^2}{4^2 - 15} = 3\)
13) \(\frac{5^2 + 3}{2 \times 7} = 2\)
14) \(\frac{5 \times 6 - 4}{13} = 2\)
15) \(\frac{8 \times 2 - 4}{3 + 1^2} = 3\)
16) \(\frac{12 - 3 \times 2}{14 \div 7} = 3\)
17) \(\frac{20 - 3^3}{10 - (5 + 4)} = 11\)
18) \(\frac{3 + 9 \times 8}{1 + 6 \times 4} = 3\)
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?
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
How much does he pay? £119.80
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 : $ 
   b) $4 : 9 = $ : 27 
   c) $ : 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?
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.

<table>
<thead>
<tr>
<th>Pancakes</th>
<th>Ingredients to make 8 pancakes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250 ml milk</td>
</tr>
<tr>
<td></td>
<td>1 egg</td>
</tr>
<tr>
<td></td>
<td>140 g flour</td>
</tr>
<tr>
<td></td>
<td>5 g butter</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Fish pie for 6 people</th>
<th>180 g flour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>240 g fish</td>
</tr>
<tr>
<td></td>
<td>80 g butter</td>
</tr>
<tr>
<td></td>
<td>4 eggs</td>
</tr>
<tr>
<td></td>
<td>180 ml milk</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Pineapple sorbet for 6 people</th>
<th>800 g of pineapple</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 egg whites</td>
</tr>
<tr>
<td></td>
<td>½ lemon</td>
</tr>
<tr>
<td></td>
<td>100 g caster sugar</td>
</tr>
</tbody>
</table>

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.
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**
1) Use your calculator to work out

\[
23.7 \times 14.2
\]

\[
8.4 \times 3.2
\]

Write down all the figures on your calculator display.

2) Use your calculator to work out

\[
\sqrt{21.4}
\]

\[
5.7 - 2.35
\]

Write down all the figures on your calculator display.

3) Work out

\[
\frac{5.8 + 4.65}{3.1^2 + 1.62}
\]

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.
1) Use your calculator to work out

\[ \frac{23.7 \times 14.2}{8.4 \times 3.2} = 336.54 \quad 12.52008929 \]

Write down all the figures on your calculator display.

2) Use your calculator to work out

\[ \sqrt{21.4} - 5.7 - 2.35 = 4.626013402 \quad 1.380899523 \]

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

\[ \frac{9.2 \times 16.3}{9.4 - 5.71} = \frac{149.96}{3.69} = 40.6395664 \]

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

5) Use your calculator to work out

\[ \frac{3}{2.1 + 3.45} = \frac{3}{5.55} = 0.5405405405 \]

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

6) Use your calculator to work out

\[ \frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}} = \frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}} = \frac{81}{2.393741841} = 33.83823544 \]

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

7) Use a calculator to work out

\[ \sqrt{\frac{22.4 \times 13.9}{3.6}} \quad \sqrt{\frac{311.36}{3.6}} = 9.299940263 \]

Write down all the figures on your calculator display.
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.
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? \(€402.50 \quad 350 \times 1.15 = 402.50\)

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

b) Work out the cost of the camera in pounds. \(€100 \quad 115 \div 1.15 = 100\)

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

\[77 \div 1.40 = 55 \quad 59.99 - 55.00 = 4.99\]

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

\[86 \div 2.10 = 40.95 \quad 56 \div 1.40 = 40\]

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. Paris

eg Suppose Tony changes £100.
In London he would get \(100 \times 1.14 = €114\)
In Paris he would get \(100 \div 0.86 = €116.28\)

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

\[1.98 \div 3 = 0.66 \quad 5 \times 0.66 = 3.30 \quad 4.88 - 3.30 = 1.58 \quad 1.58 \div 2 = 0.79\]
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.
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

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

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%
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.
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 \( s \).
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 \( s \).
1) Line $PQ$ is parallel to line $RS$.
   If angle $PQR$ is equal to $36^\circ$
   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 $HGC$
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. \( \text{Alternate angles are equal} \)

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 \( ACB \) \( 79° \) \( \text{DCE is straight line} \)
      \( 180° - 68° - 33° = 79° \)

3) a) Find the size of angle \( DBF \) \( 54° \)
     b) Find the size of angle \( HGC \) \( 136° \)
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 \(y\).
1) \(AB\) is parallel to \(CD\).

(i) Write down the value of \(y\).  \(59^\circ\)

(ii) Give a reason for your answer.  \textit{Alternate angles are equal}

2) \(PQ\) is parallel to \(RS\).

\(OSQ\) and \(ORP\) are straight lines.

a) (i) Write down the value of \(x\).  \(110^\circ\)

(ii) Give a reason for your answer.  \textit{Corresponding angles are equal}

b) Work out the value of \(y\).  \(30^\circ\)
1) \[ \text{ANB is parallel to CMD.} \]
\[ \text{LNM is a straight line.} \]
\[ \text{Angle } LMD = 67^\circ \]
(i) Work out the size of the angle marked \( y \).
(ii) Give reasons for your answer.

\[ a \]

2) \[ ANB \text{ is parallel to CMD.} \]
\[ LNM \text{ is a straight line.} \]
\[ \text{Angle } LMD = 67^\circ \]
(i) Work out the size of the angle marked \( y \).
(ii) Give reasons for your answer.

3) \[ ABCD \text{ is a rhombus.} \]
\[ BCE \text{ is an isosceles triangle.} \]
\[ ABE \text{ is a straight line.} \]

Work out the size of angle \( DCA \).
1) 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.
$\text{Angle } LNB = 67°$
(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°**
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 $d$. 
1) Work out the size of angle $a$. \[44^\circ\]

2) Work out the size of angle $b$. \[100^\circ\]

3) Work out the size of angle $c$. \[122^\circ\]

4) Work out the size of angle $d$. \[85^\circ\]
1) \(ABC\) is a triangle.
   a) Find the size of angle \(A\).
   
   b) Triangle \(ABC\) is equilateral. 
       Explain why.

2) \(BCD\) is a triangle.
   \(ABC\) is a straight line.
   Angle \(CBD = 70^\circ\).
   \(BD = CD\).
   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.

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.
1) \(ABC\) is a triangle.
   a) Find the size of angle \(A\). \[180 - 60 - 60\]
   Angle \(A\) is \(60^\circ\)
   b) Triangle \(ABC\) is equilateral.
      Explain why.
      Triangle \(ABC\) is equilateral because all three angles are \(60^\circ\).

2) \(BCD\) is a triangle.
   \(ABC\) is a straight line.
   Angle \(CBD\) = \(70^\circ\).
   \(BD = CD\).
   a) (i) Work out the value of \(x\).
      \[180 - 70\]
      \(x = 110^\circ\)
      (ii) Give a reason for your answer.
      Angles on a straight line add up to \(180^\circ\).
   b) (i) Work out the value of \(y\).
      \[180 - 70 - 70\]
      \(y = 40^\circ\)
      (ii) Give reasons for your answer.
      Base angles of an isosceles triangle are equal.
      \(180^\circ\) 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 \(x\).
      \(x = 60^\circ\)
      (ii) Give a reason for your answer.
      The triangle in the diagram is equilateral.
   b) (i) Work out the value of \(y\).
      \(y = 150^\circ\)
      (ii) Explain your answer.
      Angle \(y\) is made up of the angle in the square and the angle in the equilateral triangle. This is \(90^\circ + 60^\circ = 150^\circ\).
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° 360 ÷ 10
      Interior angle = 144° 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
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 $PQRPSE$ are regular pentagons.

$AES$ is an equilateral triangle.

Work out the size of angle $DEP$. 
1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle \( a \). \( 150^\circ \)

2) The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle \( x \). \( 105^\circ \)

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

Work out the size of angle \( DEP \). \( 84^\circ \)
1) Find the areas of the following shapes.

a)  

b)  

\[ \pi \times (3cm)^2 \]

c)  

\[ \pi \times (7m)^2 \]

2) Work out the areas of the following shapes.

a)  

\[ \frac{1}{2} \pi \times (12\text{ mm})^2 \]

b)  

\[ \frac{1}{2} \pi \times (10\text{ cm})^2 \]

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 m².

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.

\[ \pi \times (60\text{ cm})^2 \]

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

\[ \pi \times (30\text{ cm})^2 \]

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.
Take \( \pi \) to be 3.142 for all questions.

1) Find the areas of the following shapes.

a) \[ 3.142 \times 3^2 = 28.278 \text{ cm}^2 \]

b) \[ 3.142 \times 7^2 = 153.958 \text{ m}^2 \]

c) \[ 3.142 \times 4^2 = 50.272 \text{ cm}^2 \]

2) Work out the areas of the following shapes.

a) \[ 3.142 \times 6^2 = 113.112 \]

\[ 113.112 \div 2 = 56.556 \text{ mm}^2 \]

b) \[ 3.142 \times 10^2 = 314.2 \]

\[ 314.2 \div 4 = 78.55 \text{ cm}^2 \]

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.
\[ 3.142 \times 60^2 = 11311.2 \text{ cm}^2 \]

b) Work out the area of the base of the table.
\[ 3.142 \times 15^2 = 706.95 \text{ cm}^2 \]

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. \( 287 \text{ cm}^2 \)

\[ 221 + 66.37475 = 287.37475 \]
1) Find the circumference of the following shapes.

a) \( 3 \text{ cm} \)

b) \( 5 \text{ m} \)

c) \( 8 \text{ cm} \)

2) Work out the perimeter of the following shapes.

a) \( 12 \text{ mm} \)

b) \( 10 \text{ cm} \)

3) The \textbf{radius} of the top of a circular table is 60 cm.
The table also has a circular base with \textbf{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.
Take $\pi$ to be 3.142 for all questions.

1) Find the circumference of the following shapes.

   a) $C = 18.852$ cm
   b) $C = 31.42$ m
   c) $C = 25.136$ cm

   

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

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

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

\[
\text{Area of circle} = 75 \\
\text{Area of square} = 144
\]

Work out the difference between the area of the circle and the area of the square if you take \( \pi \) to be 3. 
\( \text{69 cm}^2 \) difference

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

3) A circle has a radius of 7 cm.

Work out the area of the circle. 
\( 154 \text{ cm}^2 \)
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.
1) The radius of a circle is 10 cm.

\[ \text{Work out the area of this circle.} \]

\[ \text{Take } \pi \text{ to be 3.14} \]

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.

\[ \text{Work out the area of the path.} \]

\[ \text{Give your answer correct to 3 significant figures.} \]

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

a) Work out the circumference of the CD.

\[ \text{Give your answer correct to 3 significant figures.} \]

\[ \text{CDs of this size are cut from rectangular sheets of plastic.} \]
\[ \text{Each sheet is 1 metre long and 50 cm wide.} \]

b) Work out the greatest number of CDs which can be cut from one rectangular sheet.
1) The radius of a circle is 10 cm.

\[
\text{Area of circle} = \pi r^2 = 3.14 \times 10^2 = 314 \text{ cm}^2
\]

Take \( \pi \) 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.

\[
\text{Area of path} = \pi (R^2 - r^2) = \pi (6^2 - 5^2) = 40.8 \text{ m}^2
\]

Give your answer correct to 3 significant figures.

\[153.958 \approx 113.112\]

3) The diagram shows a CD which has a radius of 6 cm.
   a) Work out the circumference of the CD. \(37.7 \text{ cm}\)

   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. \(32\)
1) Find the areas of these two triangles.

a) 

![Triangle 1](image1)

Area: \( \frac{1}{2} \times 10 \, \text{cm} \times 12 \, \text{cm} \)

b) 

![Triangle 2](image2)

Area: \( \frac{1}{2} \times 7 \, \text{cm} \times 9 \, \text{cm} \)

2) The area of this triangle is 70 cm\(^2\).

Find its height, \( h \).

![Triangle 3](image3)

Area: \( \frac{1}{2} \times 14 \, \text{cm} \times h \) = 70 cm\(^2\)

3) Find the area of the parallelogram.

![Parallelogram](image4)

Area: \( 13 \, \text{cm} \times 6 \, \text{cm} \)

4) Find the area of these two trapeziums.

a) 

![Trapezium 1](image5)

Area of trapezium = \( \frac{1}{2} (a + b)h \) where \( a = 4 \, \text{cm}, b = 5 \, \text{cm} \), and \( h = 6 \, \text{cm} \)

b) 

![Trapezium 2](image6)

Area of trapezium = \( \frac{1}{2} (a + b)h \) where \( a = 10 \, \text{cm}, b = 5 \, \text{cm} \), and \( h = 15 \, \text{cm} \)
1) Find the areas of these two triangles.
   a) \[ \text{Area} = 60 \text{ cm}^2 \]
   b) \[ \text{Area} = 31.5 \text{ cm}^2 \]

2) The area of this triangle is 70 cm\(^2\).
   Find its height, \( h \).
   \[ h = 10 \text{ cm} \]

3) Find the area of the parallelogram.
   \[ \text{Area} = 78 \text{ cm}^2 \]

4) Find the area of these two trapeziums.
   a) \[ \text{Area} = 25 \text{ cm}^2 \]
   b) \[ \text{Area} = 100 \text{ cm}^2 \]

Area of trapezium = \[ \frac{1}{2} (a + b)h \]
1) Find the area of each shape.
   a)
   
   b)
   
   c)
   
   d)

2) Find the shaded area of each shape.
   a)
   
   b)
   
   c)
   
   d)
1) Find the area of each shape.

a) \[ \text{Area} = 52 \text{ cm}^2 \]

b) \[ \text{Area} = 150 \text{ cm}^2 \]

c) \[ \text{Area} = 72 \text{ m}^2 \]

d) \[ \text{Area} = 24 \text{ mm}^2 \]

2) Find the shaded area of each shape.

a) \[ \text{Area} = 54 \text{ cm}^2 \] \quad (60 \ - \ 6)

b) \[ \text{Area} = 56 \text{ cm}^2 \] \quad (84 \ - \ 28)

c) \[ \text{Area} = 48 \text{ mm}^2 \] \quad (60 \ - \ 4 \ - \ 8)

d) \[ \text{Area} = 66 \text{ m}^2 \] \quad (132 \ - \ 66)
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.
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)
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.
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.
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.
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).
1) a) Translate triangle T by vector \[ \begin{pmatrix} -4 \\ 2 \end{pmatrix} \] and label it U.

b) Translate triangle T by vector \[ \begin{pmatrix} 3 \\ -2 \end{pmatrix} \] 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.
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.
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.
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.
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.
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)
1) a) Rotate the shaded shape 90° clockwise about the point O.

b) Describe fully the single transformation that will map shape S onto shape T.
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 \[ \begin{pmatrix} 4 \\ -1 \end{pmatrix} \]
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.
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
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.
1) Describe fully the single transformation that maps triangle A onto triangle B.

Triangle T has been drawn on the grid.
Rotate triangle T 180° about the point (1, 0)
Label the new triangle A.
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.
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.
Describe fully the single transformation which maps shape S onto shape T.

Enlargement scale factor 2 with (1, 0) as the centre of enlargement.

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 $180^\circ$ about the point (0, 0)

b) Translate triangle P by the vector \[ \begin{pmatrix} 3 \\ -1 \end{pmatrix} \]
   Label the new triangle R.
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 $O$. 
1) Reflect the shaded shape in the line $y = x$.

b) On the grid, enlarge the shaded shape by a scale factor of 3, centre $O$. 
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.
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 \( \begin{pmatrix} -6 \\ -2 \end{pmatrix} \)
1) 

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

b) Rotate the shape 90° clockwise, centre $O$. 
1) a) On the grid, enlarge the shape with scale factor $\frac{1}{2}$, centre $Q$.

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

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

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)**

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)**

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)**

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)**
1) Measure the following angles:

- $\angle ABC = 60^\circ$
- $\angle PQR = 127^\circ$
- $\angle XYZ = 275^\circ$

2) Draw the following angles:

- a) Angle $ABC = 60^\circ$
- b) Angle $PQR = 127^\circ$
- c) Angle $XYZ = 275^\circ$
1) Measure the following angles:

- Angle \( a \) = 45°
- Angle \( b \) = 113°
- Angle \( c \) = 54°
- Angle \( d \) = 117°
- Angle \( e \) = 225°
- Angle \( f \) = 331°

2) Draw the following angles:

a) Angle \( ABC = 60° \)

b) Angle \( PQR = 127° \)

c) Angle \( XYZ = 275° \)
1) The diagram shows a sketch of triangle $ABC$.

\[ BC = 7.4 \text{ cm} \]
\[ AC = 8.5 \text{ cm} \]
\[ \text{Angle } C = 38^\circ \]

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 $PQR$.

a) Use ruler and compasses to make an accurate drawing of triangle $PQR$.

b) Measure angle $P$. 
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. \[ \text{Angle } A = 59^\circ \]

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.

   \[ \text{Angle } P = 43^\circ \]
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.
The diagram shows a prism drawn on an isometric grid.

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.

```
  +-------+-------+
  |       |       |
  +-------+-------+
  |       |       |
  +-------+-------+
```
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.
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.
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.
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.
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.
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.
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 dot, A. Mark them with As. One other vertex will meet the dot B. Mark it with B.

a) 

b) 

1) Sketch nets of these solids.

   a) 
   b) 

2) 

   Cube
   Cuboid
   Right-angled triangular prism
   Triangular prism

3) The two nets, below, are folded to make cubes.
   Two other vertices will meet at the dot, A. Mark them with As.
   One other vertex will meet at the dot B. Mark it with B.

   a) 
   b)
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.
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.
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.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>cat</td>
<td>cat</td>
<td>hamster</td>
<td>cat</td>
</tr>
<tr>
<td>mouse</td>
<td>hamster</td>
<td>cat</td>
<td>dog</td>
</tr>
<tr>
<td>dog</td>
<td>dog</td>
<td>snake</td>
<td>hamster</td>
</tr>
<tr>
<td>cat</td>
<td>cat</td>
<td>hamster</td>
<td>dog</td>
</tr>
<tr>
<td>cat</td>
<td>hamster</td>
<td>snake</td>
<td>cat</td>
</tr>
</tbody>
</table>

Design and complete a suitable data collection sheet that Emma could have used to collect and show this information.
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.

<table>
<thead>
<tr>
<th>Type of programme</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soap opera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reality TV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Films</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Situation comedy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Documentary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Favourite pet</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>HHTT</td>
<td>8</td>
</tr>
<tr>
<td>Hamster</td>
<td>HHT</td>
<td>5</td>
</tr>
<tr>
<td>Mouse</td>
<td>H</td>
<td>1</td>
</tr>
<tr>
<td>Dog</td>
<td>HHH</td>
<td>4</td>
</tr>
<tr>
<td>Snake</td>
<td>H</td>
<td>2</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th></th>
<th>Still</th>
<th>Sparkling</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>26</td>
<td></td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>20</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>16</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th></th>
<th>French</th>
<th>German</th>
<th>Spanish</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>18</td>
<td></td>
<td>90</td>
</tr>
</tbody>
</table>

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.
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:

<table>
<thead>
<tr>
<th></th>
<th>Still</th>
<th>Sparkling</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>26</td>
<td>21</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>20</td>
<td>10</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>41</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th></th>
<th>French</th>
<th>German</th>
<th>Spanish</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>6</td>
<td>11</td>
<td>23</td>
<td>40</td>
</tr>
<tr>
<td>Male</td>
<td>14</td>
<td>7</td>
<td>29</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>18</td>
<td>52</td>
<td>90</td>
</tr>
</tbody>
</table>

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
1) Patrick asked some of his colleagues which was their favourite holiday destination. The table shows the results.

<table>
<thead>
<tr>
<th>City</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alicante</td>
<td>8</td>
</tr>
<tr>
<td>Paris</td>
<td>7</td>
</tr>
<tr>
<td>Ibiza</td>
<td>15</td>
</tr>
<tr>
<td>St Lucia</td>
<td>1</td>
</tr>
<tr>
<td>Biarritz</td>
<td>9</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Region</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern England</td>
<td>9</td>
</tr>
<tr>
<td>London</td>
<td>23</td>
</tr>
<tr>
<td>Midlands</td>
<td>16</td>
</tr>
<tr>
<td>Northern England</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
</tr>
</tbody>
</table>

Draw a pie chart to illustrate the information.

3) Sophie represents her monthly expenses using a pie chart. Numbers from her table have been rubbed out by mistake. Use the pie chart to complete the table.

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothes</td>
<td>£35</td>
<td></td>
</tr>
<tr>
<td>Eating out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Make up</td>
<td>£17</td>
<td>34°</td>
</tr>
<tr>
<td>Magazines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Books</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>£180</td>
<td></td>
</tr>
</tbody>
</table>
1) Patrick asked some of his colleagues which was their favourite holiday destination. The table shows the results.

<table>
<thead>
<tr>
<th>City</th>
<th>Frequency</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alicante</td>
<td>8 × 9</td>
<td>72°</td>
</tr>
<tr>
<td>Paris</td>
<td>7 × 9</td>
<td>63°</td>
</tr>
<tr>
<td>Ibiza</td>
<td>15 × 9</td>
<td>135°</td>
</tr>
<tr>
<td>St Lucia</td>
<td>1 × 9</td>
<td>9°</td>
</tr>
<tr>
<td>Biarritz</td>
<td>9 × 9</td>
<td>81°</td>
</tr>
</tbody>
</table>

Draw a pie chart to illustrate the information.

\[
\frac{360}{40} = 9
\]

2) Brian asked 60 people which region their favourite rugby team came from. The table shows the results.

<table>
<thead>
<tr>
<th>Region</th>
<th>Frequency</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern England</td>
<td>9 × 6</td>
<td>54°</td>
</tr>
<tr>
<td>London</td>
<td>23 × 6</td>
<td>138°</td>
</tr>
<tr>
<td>Midlands</td>
<td>16 × 6</td>
<td>96°</td>
</tr>
<tr>
<td>Northern England</td>
<td>12 × 6</td>
<td>72°</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>360°</td>
</tr>
</tbody>
</table>

Draw a pie chart to illustrate the information.

\[
\frac{360}{60} = 6
\]

3) Sophie represents her monthly expenses using a pie chart. Numbers from her table have been rubbed out by mistake. Use the pie chart to complete the table.

<table>
<thead>
<tr>
<th></th>
<th>Angle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td>£35</td>
<td>70°</td>
</tr>
<tr>
<td>Eating out</td>
<td>£73</td>
<td>146°</td>
</tr>
<tr>
<td>Make up</td>
<td>£17</td>
<td>34°</td>
</tr>
<tr>
<td>Magazines</td>
<td>£20</td>
<td>40°</td>
</tr>
<tr>
<td>Books</td>
<td>£35</td>
<td>70°</td>
</tr>
<tr>
<td>Total</td>
<td>£180</td>
<td>360°</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Maths</th>
<th>22</th>
<th>8</th>
<th>17</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>30</td>
<td>12</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>4</th>
<th>2</th>
<th>5</th>
<th>1</th>
<th>9</th>
<th>6</th>
<th>8</th>
<th>7</th>
<th>10</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hours sleep</td>
<td>14</td>
<td>13</td>
<td>12.5</td>
<td>15</td>
<td>10</td>
<td>12.5</td>
<td>10.8</td>
<td>12</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

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.
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.

<table>
<thead>
<tr>
<th>Maths</th>
<th>22</th>
<th>8</th>
<th>17</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>30</td>
<td>12</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>4</th>
<th>2</th>
<th>5</th>
<th>1</th>
<th>9</th>
<th>6</th>
<th>8</th>
<th>7</th>
<th>10</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hours sleep</td>
<td>14</td>
<td>13</td>
<td>12.5</td>
<td>15</td>
<td>10</td>
<td>12.5</td>
<td>10.8</td>
<td>12</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

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.**
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.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>15</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (Minutes)</td>
<td>21</td>
<td>15</td>
</tr>
</tbody>
</table>

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.
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.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>15</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (Minutes)</td>
<td>21</td>
<td>15</td>
</tr>
</tbody>
</table>

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.**
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.


b) Estimate the time it takes Henry to read it.
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**


b) Estimate the time it takes Henry to read it. **7 hours** (your answer will depend on your line of best fit)
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.
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)
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.

<table>
<thead>
<tr>
<th>Time $(t)$ in min</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; t \leq 5$</td>
<td>3</td>
</tr>
<tr>
<td>$5 &lt; t \leq 10$</td>
<td>4</td>
</tr>
<tr>
<td>$10 &lt; t \leq 15$</td>
<td>5</td>
</tr>
<tr>
<td>$15 &lt; t \leq 20$</td>
<td>7</td>
</tr>
<tr>
<td>$20 &lt; t \leq 25$</td>
<td>5</td>
</tr>
</tbody>
</table>

a) Draw a frequency diagram to show this information.

b) Draw a frequency polygon to show this information.
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.

<table>
<thead>
<tr>
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<tr>
<td>$0 &lt; t \leq 5$</td>
<td>3</td>
</tr>
<tr>
<td>$5 &lt; t \leq 10$</td>
<td>4</td>
</tr>
<tr>
<td>$10 &lt; t \leq 15$</td>
<td>5</td>
</tr>
<tr>
<td>$15 &lt; t \leq 20$</td>
<td>7</td>
</tr>
<tr>
<td>$20 &lt; t \leq 25$</td>
<td>5</td>
</tr>
</tbody>
</table>

a) Draw a frequency diagram to show this information.

[Bar chart showing frequency distribution with categories and corresponding frequencies]

b) Draw a frequency polygon to show this information.

[Line graph showing frequency distribution with categories and corresponding frequencies]
1) 60 students take a Maths test. The test is marked out of 50.

This table shows information about students’ marks.

<table>
<thead>
<tr>
<th>Maths mark</th>
<th>0 - 10</th>
<th>11 - 20</th>
<th>21 - 30</th>
<th>31 - 40</th>
<th>41 - 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>3</td>
<td>13</td>
<td>18</td>
<td>19</td>
<td>7</td>
</tr>
</tbody>
</table>

On the grid, draw a frequency polygon to show this information.
1) 60 students take a Maths test.
   The test is marked out of 50.

This table shows information about students’ marks.

<table>
<thead>
<tr>
<th>Maths mark</th>
<th>0 - 10</th>
<th>11 - 20</th>
<th>21 - 30</th>
<th>31 - 40</th>
<th>41 - 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>3</td>
<td>13</td>
<td>18</td>
<td>19</td>
<td>7</td>
</tr>
</tbody>
</table>

On the grid, draw a frequency polygon to show this information.
1) 30 students took a test.

The table shows information about how many marks they gained in the test.

<table>
<thead>
<tr>
<th>Marks ((m))</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0 &lt; m \leq 10)</td>
<td>4</td>
</tr>
<tr>
<td>(10 &lt; m \leq 20)</td>
<td>8</td>
</tr>
<tr>
<td>(20 &lt; m \leq 30)</td>
<td>9</td>
</tr>
<tr>
<td>(30 &lt; m \leq 40)</td>
<td>6</td>
</tr>
<tr>
<td>(40 &lt; m \leq 50)</td>
<td>3</td>
</tr>
</tbody>
</table>

On the grid, draw a frequency polygon for this information.
1) 30 students took a test.
   The table shows information about how many marks they gained in the test.

<table>
<thead>
<tr>
<th>Marks (m)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; m &lt; 10</td>
<td>5</td>
</tr>
<tr>
<td>10 &lt; m &lt; 20</td>
<td>15</td>
</tr>
<tr>
<td>20 &lt; m &lt; 30</td>
<td>25</td>
</tr>
<tr>
<td>30 &lt; m &lt; 40</td>
<td>35</td>
</tr>
<tr>
<td>40 &lt; m &lt; 50</td>
<td>45</td>
</tr>
</tbody>
</table>

On the grid, draw a frequency polygon for this information.
1) The table shows some information about the ages, in years, of 60 people.

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 9</td>
<td>5</td>
</tr>
<tr>
<td>10 to 19</td>
<td>14</td>
</tr>
<tr>
<td>20 to 29</td>
<td>12</td>
</tr>
<tr>
<td>30 to 39</td>
<td>9</td>
</tr>
<tr>
<td>40 to 49</td>
<td>7</td>
</tr>
<tr>
<td>50 to 59</td>
<td>3</td>
</tr>
<tr>
<td>60 to 69</td>
<td>10</td>
</tr>
</tbody>
</table>

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.
1) The table shows some information about the ages, in years, of 60 people.

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 9</td>
<td>4.5</td>
</tr>
<tr>
<td>10 to 19</td>
<td>14.5</td>
</tr>
<tr>
<td>20 to 29</td>
<td>24.5</td>
</tr>
<tr>
<td>30 to 39</td>
<td>34.5</td>
</tr>
<tr>
<td>40 to 49</td>
<td>44.5</td>
</tr>
<tr>
<td>50 to 59</td>
<td>54.5</td>
</tr>
<tr>
<td>60 to 69</td>
<td>64.5</td>
</tr>
</tbody>
</table>

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.
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.

\[
\begin{array}{c|ccc}
  & 0 & 10 & 20 \\
 0 & 5 & 7 & 9 \\
1 & 0 & 0 & 5 \\
2 & 8 & 8 & 8 \\
3 & 5 & 7 & 7 \\
\end{array}
\]

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.
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, 67, 72, 73, 73, 77, 79

Draw a stem and leaf diagram to show this information.

\[
\begin{array}{c|c}
3 & 9 \\
4 & 4 5 9 \\
5 & 0 1 5 \\
6 & 2 4 4 7 \\
7 & 2 3 3 7 9 \\
\end{array}
\]

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, 170, 170, 173, 173, 177, 182

Draw a stem and leaf diagram to show this information.

\[
\begin{array}{c|c}
15 & 6 9 \\
16 & 1 2 3 8 9 9 \\
17 & 0 0 3 3 7 \\
18 & 2 \\
\end{array}
\]

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.

\[
\begin{array}{c|c}
0 & 5 7 9 \\
1 & 0 0 5 8 8 \\
2 & 0 2 3 5 7 \\
3 & 2 5 \\
\end{array}
\]

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
1) Here are the ages, in years, of 15 office workers.

<table>
<thead>
<tr>
<th>34</th>
<th>54</th>
<th>42</th>
<th>27</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>31</td>
<td>41</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>44</td>
<td>29</td>
<td>45</td>
<td>45</td>
<td>53</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>1</th>
<th>1</th>
<th>1</th>
<th>3</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

Find the median.

Key 3|6 means 36 mm

3) Here are the ages, in years, of 16 people.

<table>
<thead>
<tr>
<th>36</th>
<th>47</th>
<th>18</th>
<th>22</th>
<th>36</th>
<th>28</th>
<th>45</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>27</td>
<td>41</td>
<td>16</td>
<td>36</td>
<td>48</td>
<td>28</td>
<td>21</td>
</tr>
</tbody>
</table>

a) Draw an ordered stem and leaf diagram to show this information. You must include a key.

Key:

b) Find the median age.
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.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3 7 9</td>
</tr>
<tr>
<td>3</td>
<td>1 4 5 6</td>
</tr>
<tr>
<td>4</td>
<td>1 2 4 5 5</td>
</tr>
<tr>
<td>5</td>
<td>0 3 4</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 1 3 5</td>
</tr>
<tr>
<td>2</td>
<td>3 4 5 9 9</td>
</tr>
<tr>
<td>3</td>
<td>0 2 3 3 5 7 8</td>
</tr>
<tr>
<td>4</td>
<td>1 2 4 8 9</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6 8</td>
</tr>
<tr>
<td>2</td>
<td>1 2 7 8 8</td>
</tr>
<tr>
<td>3</td>
<td>0 6 6 6 8</td>
</tr>
<tr>
<td>4</td>
<td>1 5 7 8</td>
</tr>
</tbody>
</table>

Key:  1|6  means 16 yrs old

b) Find the median age.  33 years old
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:
1) Here are the weights in grams, to the nearest gram, of 15 eggs.

\[
\begin{array}{cccccccc}
34 & 45 & 42 & 54 & 50 \\
37 & 61 & 44 & 56 & 52 \\
63 & 57 & 51 & 37 & 64 \\
\end{array}
\]

Draw an ordered stem and leaf diagram to show this information. You must include a key.

\[
\begin{array}{cccc}
3 & 4 & 7 & 7 \\
4 & 2 & 4 & 5 \\
5 & 0 & 1 & 2 & 4 & 6 & 7 \\
6 & 1 & 3 & 4 \\
\end{array}
\]

Key: \(3|4\) means 34 g

2) Here are the weights, in grams, of 16 eggs.

\[
\begin{array}{cccccccccccccccc}
46 & 44 & 50 & 52 & 45 & 60 & 54 & 61 \\
59 & 55 & 56 & 47 & 53 & 61 & 57 & 58 \\
\end{array}
\]

Draw an ordered stem and leaf diagram to show this information. You must include a key.

\[
\begin{array}{cccc}
4 & 4 & 5 & 6 & 7 \\
5 & 0 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\
6 & 0 & 1 & 1 \\
\end{array}
\]

Key: \(4|4\) means 44 g

3) Sue plays golf. Here are 15 of her scores.

\[
\begin{array}{cccccccccccc}
68 & 75 & 81 & 85 & 79 \\
81 & 90 & 76 & 92 & 83 \\
72 & 82 & 81 & 77 & 72 \\
\end{array}
\]

Draw an ordered stem and leaf diagram to show this information. You must include a key.

\[
\begin{array}{cccc}
6 & 6 & 8 \\
7 & 2 & 2 & 5 & 6 & 7 & 9 \\
8 & 1 & 1 & 1 & 2 & 3 & 5 \\
9 & 0 & 2 \\
\end{array}
\]

Key: \(6|8\) means a score of 68
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?
1) A blue dice and a red dice are rolled.
   a) How many different outcomes are possible? 36
   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? 32

4) A dice is rolled and a coin is flipped. 1H, 2H, 3H, 4H, 5H, 6H
   List all the possible outcomes. 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) 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.

<table>
<thead>
<tr>
<th>Food</th>
<th>Curry</th>
<th>Sausages</th>
<th>Fish</th>
<th>Casserole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.36</td>
<td>0.41</td>
<td>0.09</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Type of book</th>
<th>Novel</th>
<th>Drama</th>
<th>Biography</th>
<th>Romance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.24</td>
<td>0.16</td>
<td>( x )</td>
<td>( x )</td>
</tr>
</tbody>
</table>

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.
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.

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<td>Probability</td>
<td>0.36</td>
<td>0.41</td>
<td>0.14</td>
<td>0.09</td>
</tr>
</tbody>
</table>

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.

<table>
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<tr>
<th>Type of book</th>
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<td>Probability</td>
<td>0.24</td>
<td>0.16</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

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
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, giving all answers to 1 decimal place:
   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?
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 £971.26 £97.13
   h) 10% of £12.82 £1.28
   i) 10% of £6.50 £0.65
   j) 10% of £12.20 £1.22
   k) 10% of £530 £53
   l) 10% of £68 £6.80
   m) 10% of £350 £35
   n) 10% of £46 £4.60
   o) 10% of £971.26 £97.13
   p) 10% of £12.82 £1.28
   q) 10% of £6.50 £0.65
   r) 10% of £12.20 £1.22
   s) 10% of £530 £53
   t) 10% of £68 £6.80
   u) 10% of £350 £35
   v) 10% of £46 £4.60
   w) 10% of £971.26 £97.13
   x) 10% of £12.82 £1.28
   y) 10% of £6.50 £0.65
   z) 10% of £12.20 £1.22
   \( \text{Maths} \quad 64.3\% \)
   \( \text{Sci} \quad 63.9\% \)

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**
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 17\(\frac{1}{2}\)%.
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 17\(\frac{1}{2}\)%.
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.
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%
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.
1) Increase:
   a) 500 by 10% 500 + 50 550
   b) 320 by 10% 320 + 32 352

2) Decrease:
   a) 400 by 10% 400 - 40 360
   b) 380 by 10% 380 - 38 342

3) The price of a laptop is increased by 15%. The old price of the laptop was £300.
   Work out the new price. £345

4) The price of a £6800 car is reduced by 10%.
   What is the new price? £6 120

5) Increase:
   a) 65 by 12% 72.8
   b) 120 by 23% 147.6

6) Decrease:
   a) 42 by 15% 35.7
   b) 79 by 12% 69.52

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

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

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

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
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.

5) 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?
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

<table>
<thead>
<tr>
<th>Sa</th>
<th>Ta</th>
<th>Da</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

£28 ÷ 35 = £0.80
Tammy: 12 × £0.80 = £9.60

35 shares
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 \(y\).
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 \(y = 3\)

   \[
   75 = 3 \times 5 \times 5 \\
   75 = 3 \times 5^2 
   \]
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.
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. \(42 = 2 \times 3 \times 7 \quad 63 = 3 \times 3 \times 7\)
(ii) Work out the Highest Common Factor of 42 and 63. 21
(iii) Work out the Lowest Common Multiple of 42 and 63. 126
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.
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. \(2 \times 2 \times 2 \times 3 \times 3 \times 11 \times 11\)

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. \(60\)
1) Using the information that $4.7 \times 34 = 159.8$

   write down the value of
   
   a) $47 \times 34$
   b) $4.7 \times 3.4$
   c) $159.8 \div 47$

2) Using the information that $324 \times 48 = 15552$

   write down the value of
   
   a) $3.24 \times 4.8$
   b) $0.324 \times 0.48$
   c) $15552 \div 4.8$

3) Using the information that $73 \times 234 = 17082$

   write down the value of
   
   a) $730 \times 234$
   b) $73 \times 2.34$

4) Using the information that $27 \times 5.6 = 151.2$

   write down the value of
   
   a) $27 \times 56$
   b) $2.7 \times 0.56$
   c) $151.2 \div 56$

5) Using the information that $719 \times 35 = 25165$

   write down the value of
   
   a) $71.9 \times 3.5$
   b) $0.719 \times 0.35$
   c) $25165 \div 7.19$
1) Using the information that
\[4.7 \times 34 = 159.8\]
write down the value of
a) \[47 \times 34\] 1598
b) \[4.7 \times 3.4\] 15.98
c) \[159.8 \div 47\] 3.4

2) Using the information that
\[324 \times 48 = 15552\]
write down the value of
a) \[3.24 \times 4.8\] 15.552
b) \[0.324 \times 0.48\] 0.15552
c) \[15552 \div 4.8\] 3240

3) Using the information that
\[73 \times 234 = 17082\]
write down the value of
a) \[730 \times 234\] 170820
b) \[73 \times 2.34\] 170.82

4) Using the information that
\[27 \times 5.6 = 151.2\]
write down the value of
a) \[27 \times 56\] 1512
b) \[2.7 \times 0.56\] 1.512
c) \[151.2 \div 56\] 2.7

5) Using the information that
\[719 \times 35 = 25165\]
write down the value of
a) \[71.9 \times 3.5\] 251.65
b) \[0.719 \times 0.35\] 0.25165
c) \[25165 \div 7.19\] 3500
1) Use the information that \(13 \times 17 = 221\) to write down the value of
   (i) \(1.3 \times 1.7\)
   (ii) \(221 \div 1.7\)

2) Use the information that \(253 \times 48 = 12144\) to write down the value of
   (i) \(2.53 \times 4.8\)
   (ii) \(2530 \times 480\)
   (iii) \(0.253 \times 4800\)
   (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) \(273 \times 28\)
   (ii) \(2.73 \times 280\)
   (iii) \(0.273 \times 28\)
   (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) \(9.76 \times 37\)
   (ii) \(9760 \times 3700\)
   (iii) \(0.0976 \times 3.7\)
   (iv) \(36.112 \div 3.7\)
   (v) \(361120 \div 9.76\)
1) Use the information that $13 \times 17 = 221$

to write down the value of

(i) $1.3 \times 1.7 \quad 2.21$

(ii) $221 \div 1.7 \quad 130$

2) Use the information that $253 \times 48 = 12144$

to write down the value of

(i) $2.53 \times 4.8 \quad 12.144$

(ii) $2530 \times 480 \quad 1214400$

(iii) $0.253 \times 4800 \quad 1214.4$

(iv) $12144 \div 25.3 \quad 480$

(v) $12144 \div 0.48 \quad 25300$

3) Use the information that $27.3 \times 2.8 = 76.44$

to write down the value of

(i) $273 \times 28 \quad 7644$

(ii) $2.73 \times 280 \quad 764.4$

(iii) $0.273 \times 28 \quad 76.44$

(iv) $76.44 \div 28 \quad 2.73$

(v) $7.644 \div 2.73 \quad 2.8$

4) Use the information that $97.6 \times 370 = 36112$

to write down the value of

(i) $9.76 \times 37 \quad 361.12$

(ii) $9760 \times 3700 \quad 36112000$

(iii) $0.0976 \times 3.7 \quad 0.36112$

(iv) $36.112 \div 3.7 \quad 9.76$

(v) $361120 \div 9.76 \quad 37000$
1) Write each recurring decimal as an exact fraction, in its lowest terms.

a) \(0.\overline{5}\)

b) \(0.\overline{7}\)

c) \(0.\overline{4}\)

d) \(0.2\overline{4}\)

e) \(0.7\overline{5}\)

f) \(0.8\overline{2}\)

g) \(0.6\overline{17}\)

h) \(0.2\overline{16}\)

i) \(0.7\overline{14}\)

j) \(0.3\overline{24}\)

k) \(0.72\overline{357}\)

l) \(0.6\overline{5214}\)
1) Write each recurring decimal as an exact fraction, in its lowest terms.

a) \(0.\overline{5}\)  \(\frac{5}{9}\)

b) \(0.\overline{7}\)  \(\frac{7}{9}\)

c) \(0.\overline{4}\)  \(\frac{4}{9}\)

d) \(0.\overline{24}\)  \(\frac{24}{99}\)

e) \(0.\overline{75}\)  \(\frac{75}{99}\)

f) \(0.\overline{82}\)  \(\frac{82}{99}\)

g) \(0.6\overline{17}\)  \(\frac{617}{999}\)

h) \(0.2\overline{16}\)  \(\frac{216}{999}\)

i) \(0.\overline{714}\)  \(\frac{714}{999}\)

j) \(0.\overline{324}\)  \(\frac{324}{999}\)

k) \(0.7\overline{2357}\)  \(\frac{72357}{99999}\)

l) \(0.6\overline{5214}\)  \(\frac{65214}{99999}\)
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) $2 - 7 \quad -5$
   b) $4 - 6 \quad -2$
   c) $1 - 8 \quad -7$
   d) $0 - 4 \quad -4$

2) Work out the following:
   a) $-3 + 2 \quad -1$
   b) $-7 + 5 \quad -2$
   c) $-3 + 8 \quad 5$
   d) $-9 + 11 \quad 2$

3) Work out the following:
   a) $-1 - 3 \quad -4$
   b) $-4 - 5 \quad -9$
   c) $-7 - 8 \quad -15$
   d) $-2 - 12 \quad -14$

4) Work out the following:
   a) $6 - -3 \quad 9$
   b) $-3 - -5 \quad 2$
   c) $-9 - -2 \quad -7$
   d) $1 - -13 \quad 14$

5) Work out the following:
   a) $-3 \times 4 \quad -12$
   b) $5 \times -2 \quad -10$
   c) $-4 \times -5 \quad 20$
   d) $-6 \times -3 \quad 18$

6) Work out the following:
   a) $12 \div -4 \quad -3$
   b) $-20 \div -2 \quad 10$
   c) $-15 \div 3 \quad -5$
   d) $-100 \div -5 \quad 20
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) \(2.6202 \div 0.11\)
1) Work out the following:
   a) \(1 \div 0.1\) \(\Rightarrow 10\)
   b) \(1 \div 0.2\) \(\Rightarrow 5\)
   c) \(1 \div 0.5\) \(\Rightarrow 2\)

2) Work out the following:
   a) \(2 \div 0.2\) \(\Rightarrow 10\)
   b) \(5 \div 0.1\) \(\Rightarrow 50\)
   c) \(8 \div 0.5\) \(\Rightarrow 16\)

3) Work out the following:
   a) \(6 \div 0.3\) \(\Rightarrow 20\)
   b) \(24 \div 0.8\) \(\Rightarrow 30\)
   c) \(7.2 \div 0.9\) \(\Rightarrow 8\)

4) Work out the following:
   a) \(5 \div 0.25\) \(\Rightarrow 20\)
   b) \(8 \div 0.25\) \(\Rightarrow 32\)
   c) \(20 \div 0.25\) \(\Rightarrow 80\)

5) Work out the following:
   a) \(4.08 \div 0.12\) \(\Rightarrow 34\)
   b) \(7.13 \div 0.23\) \(\Rightarrow 31\)
   c) \(44.94 \div 0.14\) \(\Rightarrow 321\)

6) Work out the following:
   a) \(61.6 \div 0.55\) \(\Rightarrow 112\)
   b) \(5.166 \div 0.42\) \(\Rightarrow 12.3\)
   c) \(2.6202 \div 0.11\) \(\Rightarrow 23.82\)
1) Round the following numbers to 1 significant figure:
   a) 428
   b) 783
   c) 5608
   d) 3521
   e) 21999
   f) 793041

2) Round the following numbers to 2 significant figures:
   a) 846
   b) 2647
   c) 3552
   d) 46817
   e) 89711
   f) 195084

3) Round the following numbers to 3 significant figures:
   a) 91249
   b) 64182
   c) 223058
   d) 389512
   e) 7761223
   f) 4997124

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
1) Round the following numbers to 1 significant figure:
   a) $428 \quad 400$
   b) $783 \quad 800$
   c) $5608 \quad 6000$
   d) $3521 \quad 4000$
   e) $21999 \quad 20000$
   f) $793041 \quad 800000$

2) Round the following numbers to 2 significant figures:
   a) $846 \quad 850$
   b) $2647 \quad 2600$
   c) $3552 \quad 3600$
   d) $46817 \quad 47000$
   e) $89711 \quad 90000$
   f) $195084 \quad 200000$

3) Round the following numbers to 3 significant figures:
   a) $91249 \quad 91200$
   b) $64182 \quad 64200$
   c) $223058 \quad 223000$
   d) $389512 \quad 390000$
   e) $7761223 \quad 7760000$
   f) $4997124 \quad 5000000$

4) Work out the following and give your answer to 3 significant figures:
   a) $216 \times 348 \quad 75200$
   b) $7721 \times 609 \quad 4700000$
   c) $8714 \times 2198 \quad 192000000$

5) Round the following numbers to 1 significant figure:
   a) $0.00618 \quad 0.006$
   b) $0.00482 \quad 0.005$
   c) $0.00006492 \quad 0.00006$
   d) $0.004981 \quad 0.005$

6) Round the following numbers to 2 significant figures:
   a) $0.035812 \quad 0.036$
   b) $0.00082477 \quad 0.00082$
   c) $0.0038611 \quad 0.0039$
   d) $0.00037211 \quad 0.000037$

7) Round the following numbers to 3 significant figures:
   a) $0.00143229 \quad 0.00143$
   b) $0.000721981 \quad 0.000722$
   c) $0.0000044251 \quad 0.00000443$
   d) $0.000668821 \quad 0.000669$

8) Round the following numbers to 3 significant figures:
   a) $47.84122 \quad 47.8$
   b) $9.778112 \quad 9.78$
   c) $12.35913 \quad 12.4$

9) Work out the following and give your answer to 3 significant figures:
   a) $15 \div 0.38 \quad 39.5$
   b) $0.31 \div 0.16 \quad 1.94$
   c) $208 \times 366 \quad 76100$
1) Work out an estimate for \(\frac{304 \times 9.96}{0.51}\)

2) Work out an estimate for \(\frac{6.7 \times 192}{0.051}\)

3) Work out an estimate for \(\frac{32 \times 4.92}{0.21}\)

4) Work out an estimate for \(\frac{3880}{236 \times 4.85}\)

5) Work out an estimate for \(\frac{7.18 \times 19.7}{0.47}\)
1) Work out an estimate for \( \frac{304 \times 9.96}{0.51} \)  
   \[ \frac{300 \times 10}{0.5} \]  
   6000

2) Work out an estimate for \( \frac{6.7 \times 192}{0.051} \)  
   \[ \frac{7 \times 200}{0.05} \]  
   28000

3) Work out an estimate for \( \frac{32 \times 4.92}{0.21} \)  
   \[ \frac{30 \times 5}{0.2} \]  
   750

4) Work out an estimate for \( \frac{3880}{236 \times 4.85} \)  
   \[ \frac{4000}{200 \times 5} \]  
   4

5) Work out an estimate for \( \frac{7.18 \times 19.7}{0.47} \)  
   \[ \frac{7 \times 20}{0.5} \]  
   280
1) Work out an estimate for the value of

a) $\frac{547}{4.8 \times 9.7}$

b) $\frac{69 \times 398}{207}$

c) $\frac{7.5 \times 2.79}{2.71 + 3.19}$

d) $\frac{409 \times 5.814}{0.19}$

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

$\frac{613 \times 968}{379 \times 256}$
1) Work out an estimate for the value of

a) \[
\frac{547}{4.8 \times 9.7} \approx \frac{500}{5 \times 10} = 10
\]

b) \[
\frac{69 \times 398}{207} \approx \frac{70 \times 400}{200} = 140
\]

c) \[
\frac{7.5 \times 2.79}{2.71 + 3.19} \approx \frac{8 \times 3}{3 + 3} = 4
\]

d) \[
\frac{409 \times 5.814}{0.19} \approx \frac{400 \times 6}{0.2} = 12000
\]

2) a) Work out an estimate for

\[
\frac{19.6 \times 31.7}{7.9 \times 5.2} \approx \frac{20 \times 30}{8 \times 5} = 15
\]

b) Use your answer to part (a) to find an estimate for

\[
\frac{196 \times 317}{79 \times 52} \approx \frac{20 \times 30}{8 \times 5} = 15
\]

3) a) Work out an estimate for

\[
\frac{6.13 \times 9.68}{3.79 \times 2.56} \approx \frac{6 \times 10}{4 \times 3} = 5
\]

b) Use your answer to part (a) to find an estimate for

\[
\frac{613 \times 968}{379 \times 256} \approx \frac{6 \times 10}{4 \times 3} = 5
\]
### 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) \( 4x^2y + x^3y \)
   d) \( 3xy^2 - 2xy^2 \)
   e) \( 2x^2y^3 + 4x^3y^3 - 3x^3y^3 \)
   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) \( 3t \times 2t \)
   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) \( 2x^3y^3 \times 5x^3y^2 \)
   e) \( tu^2 \times t^2u \times 4tu \)

8) Simplify the following
   a) \( x^5 + x \)
   b) \( y^4 + y^3 \)
   c) \( g^8 + g^5 \)

9) Simplify the following
   a) \( \frac{x^6 \times x^3}{x^4} \)
   b) \( \frac{x^3 \times x^4}{x^2 \times x} \)
   c) \( \frac{(x + 5)^4}{(x + 5)^2} \)

10) Simplify the following
    a) \( 20x^6 \div 5x^2 \)
    b) \( \frac{14x^7}{2x^2} \)
    c) \( \frac{8x \times 2x^3}{4x^2} \)
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) \( 4x^2y + x^3y \)  \( 5x^2y \)
   d) \( 3xy^2 - 2x^2y \)  \( xy^2 \)
   e) \( 2x^3y^3 + 4x^2y^3 - 3x^2y^3 \)  \( 3x^2y^3 \)
   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) \( 3t \times 2t \)  \( 6t^3 \)
   d) \( 4y^3 \times 3y^3 \)  \( 12y^6 \)
   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) \( 2x^3y^3 \times 5x^2y^3 \)  \( 10x^5y^6 \)
   e) \( tu^2 \times r^2u \times 4tu \)  \( 4t^4u^4 \)

8) Simplify the following
   a) \( x^5 + x \)  \( x^4 \)
   b) \( y^4 + y^3 \)  \( y \)
   c) \( g^8 + g^5 \)  \( g^3 \)

9) Simplify the following
   a) \( \frac{x^6 \times x^3}{x^4} \)  \( x^5 \)
   b) \( \frac{x^3 \times x^4}{x^2 \times x} \)  \( x^4 \)
   c) \( \frac{(x + 5)^6}{(x + 5)^5} \)  \( (x + 5)^3 \)

10) Simplify the following
    a) \( 20x^6 \div 5x^2 \)  \( 4x^4 \)
    b) \( \frac{14x^7}{2x^2} \)  \( 7x^5 \)
    c) \( \frac{8x \times 2x^3}{4x^2} \)  \( 4x^2 \)
1) a) Simplify \(4p \times 6q\)
   
   b) Simplify \(d \times d \times d \times d\)
   
   c) Simplify \(t^6 + t^4\)

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 \(3x^2 \times 4x^3y^4\)

5) Simplify \(4x + 3y - 2x + 6y\)

6) a) Simplify \(t^4 \times t^6\)
   
   b) Simplify \(a \times a \times a\)

7) a) Simplify \(x^6 \times x^2\)
   
   b) Simplify \(10x^2y^4 + 2xy^2\)

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 \(\frac{3x^2y \times 4xy^3}{2xy^2}\)

15) a) Simplify \(3d + e - d + 4e\)
    
    b) Simplify \(3x^2 - x^2\)
    
    c) Simplify \(5t + 8d - 2t - 3d\)
    
    d) Simplify \(\frac{(3x + 1)^3}{(3x + 1)}\)
1) a) Simplify $4p \times 6q \quad 24pq$
   b) Simplify $d \times d \times d \times d \quad d^4$
   c) Simplify $t^4 \times t^4 \quad t^8$

2) a) Simplify $4a + 3c - 2a + c \quad 2a + 4c$
   b) Simplify $2x - 6c - x + 2c \quad x - 4c$

3) a) Simplify $5xt + 2xt - 4xt \quad 3xt$
   b) Simplify $4x + 3y - 2x + 4y \quad 2x + 7y$
   c) Simplify $m \times m \times m \quad m^3$
   d) Simplify $3n \times 2t \quad 6nt$

4) Simplify $3x^2 \times 4x^3y^4 \quad 12x^7y^4$

5) Simplify $4x + 3y - 2x + 6y \quad 2x + 9y$

6) a) Simplify $t^4 \times t^6 \quad t^9$
   b) Simplify $a \times a \times a \quad a^3$

7) a) Simplify $x^6 \times x^2 \quad x^8$
   b) Simplify $10x^3y^4 + 2xy^2 \quad 5xy^2$

8) a) Simplify $3a + 5c - a + 3c \quad 2a + 8c$
   b) Simplify $x^3 \times x^4 \quad x^7$
   c) Simplify $4x^3y^4 \times 5xy^2 \quad 20x^3y^6$

9) Simplify $6x + 8y + 2x - 10y \quad 8x - 2y$

10) a) Simplify $x \times x \times x \times x \quad x^4$
    b) Simplify $2x \times 3y \quad 6xy$

11) a) Simplify $pq + 2pq \quad 3pq$
    b) Simplify $5x + 3y - x - 4y \quad 4x - y$

12) a) Simplify $6a + 5b - 3b + a \quad 7a + 2b$
    b) Simplify $x^4 + x^4 \quad 2x^4$

13) a) Simplify $x + y + x + y + x \quad 3x + 2y$
    b) Simplify $t^2 + t^2 + t^2 \quad 3t^2$

14) a) Simplify $a^3 \times a^3 \quad a^6$
    b) Simplify $\frac{3x^3y^4 \times 4xy^3}{2xy^2} \quad 6x^2y^2$

15) a) Simplify $3d + e - d + 4e \quad 2d + 5e$
    b) Simplify $3x^2 - x^2 \quad 2x^2$
    c) Simplify $5t + 8d - 2t - 3d \quad 3t + 5d$
    d) Simplify $\frac{(3x + 1)^3}{(3x + 1)} \quad (3x + 1)^2$
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) $2(5p - q) - (p - 3q)$
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) \(2(5p - q) - (p - 3q)\) \(9p + q\)
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) \((3x - 2y)(x - 5y)\)
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) \((3x - 2y)(x - 5y)\) \(3x^2 - 17xy + 10y^2\)
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) $2r^2 + 10tu$
   c) $6x^2 - 8xy$
   d) $3x^2y^2 + 9xy$
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) \(3x^2y^2 + 9xy\) \(3xy(xy + 3)\)
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 $2x - 3 = 17$
   $\Rightarrow x = 10$

2) Solve $3x + 2 = 14$
   $\Rightarrow x = 4$

3) Solve $5x - 7 = 33$
   $\Rightarrow x = 8$

4) Solve $4x + 7 = 19$
   $\Rightarrow x = 3$

5) Solve $x + x + x + x = 20$
   $\Rightarrow x = 5$

6) Solve $x + 3x = 24$
   $\Rightarrow x = 6$

7) Solve $2(x + 3) = 8$
   $\Rightarrow x = 1$

8) Solve $2(3x - 4) = 22$
   $\Rightarrow x = 5$

9) Solve $5(t - 1) = 20$
   $\Rightarrow t = 5$

10) Solve $3(2x + 5) = 36$
    $\Rightarrow x = 3.5$

11) Solve $2x + 7 = x + 11$
    $\Rightarrow x = 4$

12) Solve $5y - 2 = 3y + 10$
    $\Rightarrow y = 6$

13) Solve $2x + 1 = 5x - 20$
    $\Rightarrow x = 7$

14) Solve $p - 3 = 3p - 11$
    $\Rightarrow p = 4$

15) Solve $2d + 5 = 20 - 3d$
    $\Rightarrow d = 3$

16) Solve $4 - e = 2e - 8$
    $\Rightarrow e = 4$

17) Solve $2(x + 3) = x + 9$
    $\Rightarrow x = 3$

18) Solve $x - 7 = 3(2x - 4)$
    $\Rightarrow x = 1$

19) Solve $5(x + 3) = 2(x + 6)$
    $\Rightarrow x = -1$

20) Solve $4(2y + 1) = 2(12 - y)$
    $\Rightarrow y = 2$

21) Solve $7 - 3x = 2(x + 1)$
    $\Rightarrow x = 1$

22) Solve $\frac{x}{2} = 5$
    $\Rightarrow x = 10$

23) Solve $\frac{x}{5} = 6$
    $\Rightarrow x = 30$

24) Solve $\frac{2x}{3} = 4$
    $\Rightarrow x = 6$

25) Solve $\frac{5x}{2} = 15$
    $\Rightarrow x = 6$

26) Solve $\frac{x - 2}{3} = 1$
    $\Rightarrow x = 5$

27) Solve $\frac{x + 5}{2} = 7$
    $\Rightarrow x = 9$

28) Solve $\frac{2x + 1}{4} = 2$
    $\Rightarrow x = 3.5$

29) Solve $\frac{5x - 3}{3} = 4$
    $\Rightarrow x = 3$

30) Solve $\frac{x + 2}{3} = x + 4$
    $\Rightarrow x = -5$

31) Solve $\frac{3x - 1}{4} = 2x - 3$
    $\Rightarrow x = 2.2$

32) Solve $\frac{4x + 3}{5} = \frac{2x - 1}{2}$
    $\Rightarrow x = 5.5$
1) The width of a rectangle is \( x \) centimetres.
The length of the rectangle is \((x + 5)\) centimetres.

\[ x + 5 \]
\[ x \]

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) 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.
1) The width of a rectangle is \( x \) centimetres.
The length of the rectangle is \( (x + 5) \) centimetres.

\[
\begin{align*}
 x + 5 \\
\end{align*}
\]

\[
\begin{align*}
 x \\
\end{align*}
\]

\[
\begin{align*}
 x + 5 \\
\end{align*}
\]

\[
\begin{align*}
P &= x + 5 + x + x + 5 + x \\
P &= 4x + 10
\end{align*}
\]

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) The sizes of the angles, in degrees, of the quadrilateral are

\[
\begin{align*}
x + 10 \\
2x \\
x + 80 \\
x + 30
\end{align*}
\]

\[
\text{Angles of a quadrilateral add up to } 360^\circ
\]

\[
\begin{align*}
x + 80 + x + 10 + 2x + x + 30 &= 360 \\
5x + 120 &= 360
\end{align*}
\]

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°

\[
\begin{align*}
5x &= 240 \\
x &= 48
\end{align*}
\]

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
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 \(x\).
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 \( x \). \( x = 3.5 \text{ cm} \)

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 \( x \). \( x = 5 \text{ cm} \)
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 $APB$. 
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.

   b) Given that $y$ equals 145 degrees
   
      (i) Work out the value of $x$.  $35^\circ$

      (ii) Work out the size of the largest angle in triangle $APB$.  $85^\circ$
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.
1) Make \(c\) the subject of the formula.

\[
a = b + cd \quad c = \frac{a - b}{d}
\]

2) Make \(t\) the subject of the formula.

\[
u = v + 2t \quad t = \frac{u - v}{2}
\]

3) Make \(n\) the subject of the formula.

\[
M = 3n + 5 \quad n = \frac{M - 5}{3}
\]

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.

\[
t = \frac{r - 5s}{3}
\]

b) Make \(s\) the subject of the formula.

\[
s = \frac{r - 3t}{5}
\]

6) Rearrange \(y = 3x + 1\) to make \(x\) the subject.

\[
x = \frac{y - 1}{3}
\]

7) Rearrange \(y = \frac{1}{2}x + 2\) to make \(x\) the subject.

\[
x = 2(y - 2) \quad \text{or} \quad x = 2y - 4
\]

8) Rearrange \(y = \frac{1}{3}x + 1\) to make \(x\) the subject.

\[
x = 3(y - 1) \quad \text{or} \quad x = 3y - 3
\]
1) Represent this inequality on the number line

\[-3 < x < 2\]

2) Represent this inequality on the number line

\[-1 \leq x < 5\]

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

\[-2 < y \leq 5\]

6) If \(x\) is an integer, write down all the possible values of

\[-9 < x < -5\]
1) Represent this inequality on the number line

\[-3 < x \leq 2\]

2) Represent this inequality on the number line

\[-1 \leq x < 5\]

3) Write down the inequality shown

\[-4 < x \leq 4\]

4) Write down the inequality shown

\[-5 \leq x < 3\]

5) If \(y\) is an integer, write down all the possible values of

\[-2 < y \leq 5\]

\[-1, 0, 1, 2, 3, 4, 5\]

6) If \(x\) is an integer, write down all the possible values of

\[-9 < x < -5\]

\[-8, -7, -6\]
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.
   \( x = \ldots, y = \ldots \)
   and
   \( x = \ldots, y = \ldots \)
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.
   \(x = \ldots\ldots\,, y = \ldots\ldots\)
   and
   \(x = \ldots\ldots\,, y = \ldots\ldots\)
   other pairs of values are possible.
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 \(6y \geq y + 10\)

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 \(\frac{29 - x}{3} = x + 5\)

11) Solve \(3x - 10 = x + 30\)

12) Solve the inequality \(3x - 2 > x + 7\)

13) Solve the inequality \(\frac{2x}{3} < 10\)
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 \(t\)
\[t = 6 \text{ (or -6)}\]

4) Solve \(3(x + 2) = 8\)
\[x = \frac{2}{3}\]

5) Solve the inequality \(6y \geq y + 10\)
\[y \geq 2\]

6) Solve \(4(2x - 3) = 5x + 7\)
\[x = 6\frac{1}{3}\]

7) \(h = 5t^2 + 3\)
Work out the value of \(t\) when \(h = 48\)
\[t = 3 \text{ or -3}\]

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 \(\frac{2x}{3} < 10\)
\[x < 15\]
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.
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.

\[ \begin{array}{c|c|c|c}
\text{trial} & \text{value} & \text{result} & \text{status} \\
\hline
x = 3 & 3^3 - 3 = 24 & \text{too low} \\
x = 4 & 4^3 - 4 = 60 & \text{too high} \\
x = 3.1 & 3.1^3 - 3.1 = 26.691 & \text{too low} \\
x = 3.2 & 3.2^3 - 3.2 = 29.568 & \text{too high} \\
\end{array} \]
Therefore, \( x = 3.2 \) to 1 decimal place.

\[ \begin{array}{c|c|c}
\text{trial} & \text{value} & \text{result} \\
\hline
x = 3 & 3^3 - x = 29 \\
x = 4 & 4^3 - x = 29 \\
\end{array} \]

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.

\[ \begin{array}{c|c|c|c}
\text{trial} & \text{value} & \text{result} & \text{status} \\
\hline
x = 3 & 3^3 - 4 \times 3 = 15 & \text{too low} \\
x = 4 & 4^3 - 4 \times 4 = 48 & \text{too high} \\
x = 3.4 & 3.4^3 - 4 \times 3.4 = 25.704 & \text{too high} \\
x = 3.3 & 3.3^3 - 4 \times 3.3 = 22.737 & \text{too low} \\
\end{array} \]
Therefore, \( x = 3.4 \) to 1 decimal place.

\[ \begin{array}{c|c|c}
\text{trial} & \text{value} & \text{result} \\
\hline
x = 3 & x^3 - 4x = 25 \\
x = 4 & x^3 - 4x = 25 \\
\end{array} \]

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.

\[ \begin{array}{c|c|c|c}
\text{trial} & \text{value} & \text{result} & \text{status} \\
\hline
x = 4 & 4^3 - 2 \times 4 = 56 & \text{too low} \\
x = 5 & 5^3 - 2 \times 5 = 115 & \text{too high} \\
x = 4.2 & 4.2^3 - 2 \times 4.2 = 65.688 & \text{too low} \\
x = 4.3 & 4.3^3 - 2 \times 4.3 = 70.907 & \text{too high} \\
\end{array} \]
Therefore, \( x = 4.2 \) to 1 decimal place.

\[ \begin{array}{c|c|c}
\text{trial} & \text{value} & \text{result} \\
\hline
x = 4 & x^3 - 2x = 68 \\
x = 5 & x^3 - 2x = 68 \\
\end{array} \]

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.

\[ \begin{array}{c|c|c|c}
\text{trial} & \text{value} & \text{result} & \text{status} \\
\hline
x = 3 & 3^3 + 4 \times 3 = 39 & \text{too low} \\
x = 4 & 4^3 + 4 \times 4 = 80 & \text{too low} \\
x = 5 & 5^3 + 4 \times 5 = 145 & \text{too high} \\
x = 4.2 & 4.2^3 + 4 \times 4.2 = 90.888 & \text{too low} \\
x = 4.3 & 4.3^3 + 4 \times 4.3 = 96.707 & \text{too low} \\
x = 4.4 & 4.4^3 + 4 \times 4.4 = 102.784 & \text{too low} \\
x = 4.35 & 4.35^3 + 4 \times 4.35 = 99.712875 & \text{too low} \\
\end{array} \]
Therefore, \( x = 4.4 \) to 1 decimal place.
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) $3^2 \times 3^8$
   b) $3^{10} \div 3^3$

3) Simplify
   a) $k^5 \times k^2$
   b) $x^4 \div x^2$
   c) $k^{11} \div k^6$
   d) $(k^3)^2$

4) Simplify
   eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$
   a) $(2xy^3)^3$
   b) $(2x^3y^2)^3$
   c) $(4xy^3)^2$
   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) $2^{x+2y}$
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) $3^2 \times 3^8 = 3^{11}$
   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) $\frac{k^{11}}{k^6} = k^5$
   d) $(k^3)^2 = k^{16}$

4) Simplify
   eg. $(2xy^3)^4 = 2^4x^4y^{12} \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$
   a) $(2xy^3)^3 = 8x^3y^{15}$
   b) $(2x^3y^2)^3 = 8x^6y^6$
   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) $2^{x+2y} = ab^2$
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 $3x^2 \times 4x^3y^4$

3) a) Simplify $t^4 \times t^5$
   b) Simplify $x^8 \div x^5$
   c) Simplify $(c^d)^3$

4) a) Simplify $x^6 \times x^2$
   b) Simplify $\frac{x^8}{x^3}$
   c) Simplify $(2t)^3$
   d) Simplify $3x^2y \times 4x^3y^4$

5) a) Simplify $x^3 \times x^4$
   b) Simplify $t^7 \div t^5$
   c) Simplify $4x^3y^4 \times 3xy^2$

6) a) Simplify $x \times x \times x \times x$
   b) Simplify $2x \times 3y$
1) a) Simplify $d \times d \times d \times d \quad d^4$
   b) Simplify $t \times t^2 \quad t^3$
   c) Simplify $m^5 \div m^3 \quad m^2$

2) a) Simplify $(2x^2)^3 \quad 8x^6$
   b) Simplify $3x^2 \times 4x^5y^4 \quad 12x^7y^4$

3) a) Simplify $t^4 \times t^5 \quad t^9$
   b) Simplify $x^8 \div x^5 \quad x^3$
   c) Simplify $(c^4)^3 \quad c^{12}$

4) a) Simplify $x^6 \times x^2 \quad x^8$
   b) Simplify $\frac{x^8}{x^3} \quad x^5$
   c) Simplify $(2t)^3 \quad 8t^3$
   d) Simplify $3x^2y \times 4x^5y^4 \quad 12x^7y^5$

5) a) Simplify $x^3 \times x^4 \quad x^7$
   b) Simplify $t^7 \div t^3 \quad t^4$
   c) Simplify $4x^3y^4 \times 3xy^2 \quad 12x^3y^6$

6) a) Simplify $x \times x \times x \times x \quad x^4$
   b) Simplify $2x \times 3y \quad 6xy$
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.
1) Here are the first five terms of an arithmetic sequence.

\[ 1 \quad 3 \quad 5 \quad 7 \quad 9 \]

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.

\[ 6 \quad 10 \quad 14 \quad 18 \quad 22 \]

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.

\[ 1 \quad 4 \quad 7 \quad 10 \quad 13 \]

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.

\[ 7 \quad 12 \quad 17 \quad 22 \quad 27 \]

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.

\[ 8 \quad 6 \quad 4 \quad 2 \quad 0 \]

Find, in terms of \( n \), an expression for the \( n \)th term of this sequence.

\[ -2n + 10 \]
1) Here are the first four terms of an arithmetic sequence.

4 7 10 13

Find an expression, in terms of $n$, for the $n$th term of the sequence.

2) The $n$th 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 $n$th term of this sequence.

b) An expression for the $n$th 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 $n$th 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.
1) Here are the first four terms of an arithmetic sequence.

\[ 4 \quad 7 \quad 10 \quad 13 \]

Find an expression, in terms of \( n \), for the \( n \)th term of the sequence. \[ 3n + 1 \]

2) The \( n \)th 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.

\[ 2 \quad 7 \quad 12 \quad 17 \quad 22 \]

a) Find, in terms of \( n \), an expression for the \( n \)th term of this sequence. \[ 5n - 3 \]

b) An expression for the \( n \)th 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 \( n \)th 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? \[ \text{No} \]

Give reasons for your answer.

\[ 2n^2 = 400 \]

\[ n^2 = \frac{400}{2} = 200 \]

200 isn’t a square number
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.

<table>
<thead>
<tr>
<th>Line Number</th>
<th>$1^2 + 3^2$</th>
<th>$2 \times 2^2 + 2$</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>34</td>
<td>34</td>
<td></td>
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<td>4</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   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 $999^2 + 1001^2$
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.

<table>
<thead>
<tr>
<th>Line Number</th>
<th>( 1^2 + 3^2 )</th>
<th>( 2 \times 2^2 + 2 )</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>( 2^2 + 4^2 )</td>
<td>( 2 \times 3^2 + 2 )</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>( 3^2 + 5^2 )</td>
<td>( 2 \times 4^2 + 2 )</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>( 4^2 + 6^2 )</td>
<td>( 2 \times 5^2 + 2 )</td>
<td>52</td>
</tr>
<tr>
<td>5</td>
<td>( 5^2 + 7^2 )</td>
<td>( 2 \times 6^2 + 2 )</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>( 6^2 + 8^2 )</td>
<td>( 2 \times 7^2 + 2 )</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>( 7^2 + 9^2 )</td>
<td>( 2 \times 8^2 + 2 )</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>( 8^2 + 10^2 )</td>
<td>( 2 \times 9^2 + 2 )</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>( 9^2 + 11^2 )</td>
<td>( 2 \times 10^2 + 2 )</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>( 10^2 + 12^2 )</td>
<td>( 2 \times 11^2 + 2 )</td>
<td>244</td>
</tr>
</tbody>
</table>

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

\[ 2 \times 1000^2 + 2 \]
\[ 2 \times 1000000 + 2 \]
\[ 2000000 + 2 \]
\[ 2000002 \]
1) a) Complete the table of values for \( y = 4x - 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-10</td>
<td>-2</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 \( y = 2x + 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of \( y = 2x + 2 \).
1) a) Complete the table of values for \( y = 4x - 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-10</td>
<td>-6</td>
<td>-2</td>
<td>2</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

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 \( y = 2x + 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of \( y = 2x + 2 \).
1) On the grid, draw the graph of \( y = 2x - 4 \)

2) a) Complete the table of values for \( 3x + 2y = 6 \)

<table>
<thead>
<tr>
<th></th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( y )</td>
<td>4.5</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>-1.5</td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of \( 3x + 2y = 6 \)

c) Find the gradient of the graph of \( 3x + 2y = 6 \).
1) On the grid, draw the graph of \( y = 2x - 4 \)

2) a) Complete the table of values for \( 3x + 2y = 6 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>6</td>
<td>4.5</td>
<td>3</td>
<td>1.5</td>
<td>0</td>
<td>-1.5</td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of \( 3x + 2y = 6 \)

c) Find the gradient of the graph of \( 3x + 2y = 6 \).  Gradient is \(-1.5\)
1) a) Complete the table of values for \( y = 2x - 3 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 \( y = 2 - x \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Using the axes on the right, again, draw the graph of \( y = 2 - x \)

3) a) Complete the table of values for \( y = \frac{1}{2}x - 1 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Draw the graph of \( y = \frac{1}{2}x - 1 \)

c) Use your graph to find the value of \( y \) when \( x = 3.5 \)
1) a) Complete the table of values for $y = 2x - 3$

<table>
<thead>
<tr>
<th>$x$</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>-5</td>
<td>-3</td>
<td>-1</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

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 $y = 2 - x$

<table>
<thead>
<tr>
<th>$x$</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
</tr>
</tbody>
</table>

b) Using the axes on the right, again, draw the graph of $y = 2 - x$

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

<table>
<thead>
<tr>
<th>$x$</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>$-1\frac{1}{2}$</td>
<td>-1</td>
<td>$-\frac{1}{2}$</td>
<td>0</td>
<td>$\frac{1}{2}$</td>
<td>1</td>
</tr>
</tbody>
</table>

b) Draw the graph of $y = \frac{1}{2}x - 1$

c) Use your graph to find the value of $y$ when $x = 3.5$ \[ x = 0.75 \]
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.
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 $C$: $y = -x$
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 \( y = 7 - x \)
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 \( y = 6 - x \)

\[ x = 2 \text{ and } y = 4 \]

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 \( y = 7 - x \)

\[ x = 2 \text{ and } y = 5 \]
1) Complete the table of values for $y = x^2 - 4x + 3$

<table>
<thead>
<tr>
<th>$x$</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the grid, draw the graph of $y = x^2 - 4x + 3$
1) Complete the table of values for \( y = x^2 - 4x + 3 \)

<table>
<thead>
<tr>
<th>x</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

On the grid, draw the graph of \( y = x^2 - 4x + 3 \)
1) a) Complete the table of values for \( y = x^2 - 3x - 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y  )</td>
<td>2</td>
<td>-2</td>
<td>-4</td>
<td>-2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of \( y = x^2 - 3x - 2 \)

c) Use your graph to estimate the values of \( x \) when \( y = -1 \)
1) a) Complete the table of values for \( y = x^2 - 3x - 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y  )</td>
<td>8</td>
<td>2</td>
<td>-2</td>
<td>-4</td>
<td>-2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of \( y = x^2 - 3x - 2 \)

![Graph of \( y = x^2 - 3x - 2 \)](image)

c) Use your graph to estimate the values of \( x \) when \( y = -1 \). \( x = -0.3 \) and \( x = 3.3 \)
1) a) Complete the table of values for \( y = x^2 + x - 4 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>8</td>
<td>-2</td>
<td>-4</td>
<td></td>
<td>2</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of \( y = x^2 + x - 4 \)
1) a) Complete the table of values for $y = x^2 + x - 4$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$-4$</th>
<th>$-3$</th>
<th>$-2$</th>
<th>$-1$</th>
<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
<th>$3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>$8$</td>
<td>$2$</td>
<td>$-2$</td>
<td>$-4$</td>
<td>$-4$</td>
<td>$-2$</td>
<td>$2$</td>
<td>$8$</td>
</tr>
</tbody>
</table>

b) On the grid, draw the graph of $y = x^2 + x - 4$
1)  a) Complete the table of values for \( y = 2x^2 - 3x \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>14</td>
<td>0</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 \( y = x^2 - 2x \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>8</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 \( x^2 - 2x = 2.5 \)
1) a) Complete the table of values for \( y = 2x^2 - 3x \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>14</td>
<td>5</td>
<td>0</td>
<td>-1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

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 \( y = x^2 - 2x \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

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 \( x = 2.9 \)
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

\[
\begin{align*}
y &= x^2 - 5x - 3 \\
y &= x - 4
\end{align*}
\]
1) The diagram shows the graph of $y = x^2 - 5x - 3$

a) Use the graph to find estimates for the solutions of
   (i) $x^2 - 5x - 3 = 0 \quad x = -0.5$ and $5.5$
   (ii) $x^2 - 5x - 3 = 6 \quad x = -1.4$ and $6.4$

b) Use the graph to find estimates for the solutions of the simultaneous equations

\[
\begin{align*}
y &= x^2 - 5x - 3 \\ y &= x - 4
\end{align*}
\]
\[
\begin{align*}
x &= 0.2 & \quad x &= 5.8 \\ y &= -3.8 & \quad y &= 1.8
\end{align*}
\]
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.
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**
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.
1) Find the length of side $a$. $18.4\, \text{cm}$
Give your answer to 1 decimal place.

2) Find the length of side $b$. $9.4\, \text{cm}$
Give your answer to 1 decimal place.

3) Find the length of side $c$. $8.3\, \text{cm}$
Give your answer to 1 decimal place.

4) Find the length of side $d$. $6.2\, \text{cm}$
Give your answer to 1 decimal place.

5) Find the length of the diagonal of this rectangle.
Give your answer to 1 decimal place. $18.4\, \text{cm}$ $9\, \text{cm}$
1) Find the length of side $AC$. Give your answer to 1 decimal place.

$$A \quad 12\text{cm}\quad 7\text{cm}\quad C$$

2) Find the length of side $QR$. Give your answer to 1 decimal place.

$$Q \quad 4.8\text{cm} \quad P$$

3) Find the length of side $SU$. Give your answer to 1 decimal place.

$$T \quad 23\text{cm} \quad S$$

4) Below is a picture of a doorway. Find the size of the diagonal of the doorway. Give your answer to 1 decimal place.

$$\text{2.1m} \quad 0.8\text{m}$$

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.

$$\text{50m} \quad 60\text{m}$$

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.
1) Find the length of side $AC$. Give your answer to 1 decimal place.

$$12^2 = 144$$
$$7^2 = 49$$
$$\sqrt{193} = 13.9$$

2) Find the length of side $QR$ Give your answer to 1 decimal place.

$$7.6^2 = 57.76$$
$$4.8^2 = 23.04$$
$$\sqrt{34.72} = 5.9$$

3) Find the length of side $SU$ Give your answer to 1 decimal place.

$$23^2 = 529$$
$$14^2 = 196$$
$$\sqrt{333} = 18.2$$

4) Below is a picture of a doorway. Find the size of the diagonal of the doorway. Give your answer to 1 decimal place.

$$2.1^2 = 4.41$$
$$0.8^2 = 0.64$$
$$\sqrt{5.05} = 2.2$$

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? $B$ to $C$ to $D$ or straight across the field from $B$ to $D$. Give your answer to the nearest metre.

$$B$ to $C$ to $D$:
$$60^2 + 50^2 = 110^2$$
$$\sqrt{6100} = 78$$

$$B$ to $D$:
$$60^2 = 3600$$
$$50^2 = 2500$$
$$110^2 = 6100$$
$$\sqrt{110^2} = 110$$

$$110 - 78 = 32$$

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.

No. The diagonal is only 18.8cm.
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.
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

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
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.
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, 6 cm and 7 cm. Find the total surface area of the cuboid. **344 cm^2**

3) A cuboid has sides of length 12 cm, 4.5 cm and 6 cm. Find the total surface area of the cuboid. **306 cm^2**
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.
1) Find the surface area of this triangular prism. \(84 \text{ cm}^2\) \(6 + 6 + 30 + 24 + 18\)

2) Find the surface area of this triangular prism. \(660 \text{ cm}^2\) \(60 + 60 + 195 + 195 + 150\)

3) With the aid of Pythagoras’ Theorem, find the surface area of this triangular prism. Give your answer correct to 2 significant figures. \(120 \text{ cm}^2\) \(5.29 + 5.29 + 42.78 + 21.39 + 47.43\)
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 \( \pi \) 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.
1) The diagram shows a cuboid.

Work out the volume of the cuboid.

\[ V = 22500 \text{ cm}^3 \]

2) Calculate the volume of this triangular prism.

\[ V = 54 \text{ cm}^3 \]

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 \( \pi \) to be 3.142

Work out the volume of the puck.

Give your answer correct to 3 significant figures.

\[ V = 113 \text{ cm}^3 \]

4) A cuboid has:
   - a volume of 80 cm\(^3\)
   - a length of 5 cm
   - a width of 2 cm

Work out the height of the cuboid.

\[ H = 8 \text{ cm} \]

5) Work out the maximum number of boxes which can fit in the carton.

160 boxes will fit.

\[ 1600000 \div 10000 = 160 \]
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 $\pi$ 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. \(180 \text{ cm}^3\)

2) A solid cylinder has a radius of 5 cm and a height of 10 cm.
   Work out the volume of the cylinder. \(786 \text{ cm}^3\)
   Take \(\pi\) 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. \(1200 \text{ cm}^3\)
   You must state your units.
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 \(AB\).
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
1) Triangle $ABC$ is similar to triangle $ADE$.

$AC = 15\, \text{cm}$.

$CE = 6\, \text{cm}$.

$BC = 12.5\, \text{cm}$.

Work out the length of $DE$.

2) $ABC$ and $AED$ are straight lines.

$EB$ is parallel to $DC$.

Angle $ACD = 90^\circ$

$AB = 10\, \text{cm}$

$BC = 5\, \text{cm}$

$EB = 6\, \text{cm}$

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 $ACD = 90^\circ$

   $AB = 10$ 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$^2$
1) The diagram shows two quadrilaterals that are mathematically **similar**.

![Diagram](image)

- **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 \(VU\).

![Diagram](image)

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 \(ED\).
1) The diagram shows two quadrilaterals that are mathematically similar.

![Diagram with measurements]

a) Calculate the length of $AB$ 28 cm  \( AB = PQ \times 3.5 \)
b) Calculate the length of $PS$ 6 cm  \( PS = AD \div 3.5 \)

2) $SV$ is parallel to $TU$.

$RST$ and $RVU$ are straight lines.

$RS = 9$ cm, $ST = 3$ cm, $TU = 7$ cm, $RV = 6$ cm

Calculate the length of $VU$. 2 cm

$RU = 1.333333 \times 6$
$RU = 8$
$VU = RU - RV$
$VU = 8 - 6$

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

a) Calculate the length of $CD$. 12.5 cm
b) Calculate the length of $ED$. 6.6 cm
1) Change 9 m² into cm²
2) How many square metres are there in 5 square kilometres?
3) Change 4 cm² into mm²
4) Convert 6.5 m² into mm²
5) Change 2 m³ into cm³
6) How many cubic millimetres are there in 3 cubic centimetres?
7) Change 7 m³ into mm³
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?
1) Change 9 m$^2$ into cm$^2$  $\quad 90000$ cm$^2$

2) How many square metres are there in 5 square kilometres?  $\quad 5000000$ m$^2$

3) Change 4 cm$^2$ into mm$^2$  $\quad 400$ mm$^2$

4) Convert 6.5 m$^2$ into mm$^2$  $\quad 6500000$ mm$^2$

5) Change 2 m$^3$ into cm$^3$  $\quad 20000000$ cm$^3$

6) How many cubic millimetres are there in 3 cubic centimetres?  $\quad 3000$ mm$^3$

7) Change 7 m$^3$ into mm$^3$  $\quad 7000000000$ 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?  $\quad 625$

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?  $\quad 135$
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.
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 cm²
      7.5 × 7.5
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?
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. 
\[ S = \frac{D}{T} \]
\[ S = \frac{200}{21.4} \]
\[ S = 9.3 \text{ m/s} \]

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. 
\[ S = \frac{D}{T} \]
\[ S = \frac{310}{5} \]
\[ S = 62 \text{ mph} \]

3) A plane flies 1440 miles at a speed of 240 mph. 
How long does it take? 
\[ T = \frac{D}{S} \]
\[ T = \frac{1440}{240} \]
\[ T = 6 \text{ hours} \]

4) A marathon runner runs at 7.6 mph for three and a half hours. 
How many miles has he run? 
\[ D = S \times T \]
\[ D = 7.6 \times 3.5 \]
\[ D = 26.6 \text{ miles} \]

5) A car takes 15 minutes to travel 24 miles. 
Find its speed in mph. 
\[ S = \frac{D}{T} \]
\[ S = \frac{24}{0.25} \]
\[ S = 96 \text{ mph} \]

6) A cyclist takes 10 minutes to travel 2.4 miles. 
Calculate the average speed in mph. 
\[ S = \frac{D}{T} \]
\[ S = \frac{2.4}{0.16} \]
\[ S = 14.4 \text{ mph} \]

7) An ice hockey puck has a volume of 113 cm³. 
It is made out of rubber with a density of 1.5 grams per cm³. 
Work out the mass of the ice hockey puck. 
\[ M = D \times V \]
\[ M = 1.5 \times 113 \]
\[ M = 169.5 \text{ g} \]

8) An apple has a mass of 160 g and a volume of 100 cm³. 
Find its density in g/cm³. 
\[ D = \frac{M}{V} \]
\[ D = \frac{160}{100} \]
\[ D = 1.6 \text{ g/cm³} \]

9) A steel ball has a volume of 1500 cm³. 
The density of the ball is 95 g/cm³. 
Find the mass of the ball in kg. 
\[ M = D \times V \]
\[ M = 95 \times 1500 \]
\[ M = 142 500 \]
\[ M = 142.5 \text{ kg} \]

10) The mass of a bar of chocolate is 1800 g. 
The density of the chocolate is 9 g/cm³. 
What is the volume of the bar of chocolate? 
\[ V = \frac{M}{D} \]
\[ V = \frac{1800}{9} \]
\[ V = 200 \text{ cm³} \]
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.

![Cylinder Diagram]

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 cm³

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/cm³.

Calculate the mass of the prism. Give your answer in kilograms.
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 cm³

      The cylinder is made of wood.
      The density of the wood is 0.7 grams per cm³

   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/cm³.

   Calculate the mass of the prism.  4.8 kg
      \[ \text{mass} = \text{density} \times \text{volume} \]
      \[ \text{mass} = 4 \times 1200 \]
      \[ \text{mass} = 4800 \text{ g} \]
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.
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.
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.
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.
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.
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.
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.
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.
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 $B$. 
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 $B$. 
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 $ABCD$. 

\begin{figure}
\centering
\begin{tikzpicture}
\draw[thick] (0,0) -- (4,0) -- (4,2) -- (0,2) -- cycle;
\draw (0,0) node[below] {$D$} -- (4,0) node[below] {$C$} -- (4,2) node[above] {$B$} -- (0,2) node[above] {$A$} -- cycle;
\end{tikzpicture}
\end{figure}
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 \( ABCD \).
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 \( 160^\circ \) 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 \( 050^\circ \)
   The bearing of boat \( R \) from boat \( Q \) is \( 320^\circ \)

   In the space above, draw an accurate diagram to show the position of boat \( R \).
   Mark the position of boat \( R \) with a cross (\( \times \)). Label it \( R \).
1) The diagram shows the position of two telephone masts, $A$ and $B$, on a map.

a) Measure the bearing of $B$ from $A$. $059^\circ$

Another mast $C$ is on a bearing of $160^\circ$ 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 $050^\circ$
The bearing of boat $R$ from boat $Q$ is $320^\circ$

In the space above, draw an accurate diagram to show the position of boat $R$. Mark the position of boat $R$ with a cross ($\times$). Label it $R$. 
1) School $B$ is due east of school $A$. 
   $C$ is another school. 
   The bearing of $C$ from $A$ is $065^\circ$. 
   The bearing of $C$ from $B$ is $313^\circ$. 

   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 $320^\circ$ 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.*
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.
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.

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
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<tr>
<td>2</td>
<td>17</td>
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<tr>
<td>3</td>
<td>10</td>
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<tr>
<td>4</td>
<td>24</td>
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<td>5</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
</tr>
</tbody>
</table>

   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?
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.

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</tr>
<tr>
<td>6</td>
<td>16</td>
</tr>
</tbody>
</table>

   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**
      \[\frac{18}{100} \times 250 = 45\]
1) Tom carried out a survey of the number of school dinners 34 students had in one week. The table shows this information.

<table>
<thead>
<tr>
<th>Number of school dinners</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Time (t minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; t ≤ 6</td>
<td>15</td>
</tr>
<tr>
<td>6 &lt; t ≤ 12</td>
<td>23</td>
</tr>
<tr>
<td>12 &lt; t ≤ 18</td>
<td>28</td>
</tr>
<tr>
<td>18 &lt; t ≤ 24</td>
<td>19</td>
</tr>
<tr>
<td>24 &lt; t ≤ 30</td>
<td>15</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Number of children</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>more than 4</td>
<td>0</td>
</tr>
</tbody>
</table>

a) Find the mode.

b) Calculate the mean to 1 decimal place.
1) Tom carried out a survey of the number of school dinners 34 students had in one week. The table shows this information.

<table>
<thead>
<tr>
<th>Number of school dinners</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Time (t minutes)</th>
<th>Frequency</th>
<th>Midpoint</th>
<th>MP × Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; t ≤ 6</td>
<td>15</td>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>6 &lt; t ≤ 12</td>
<td>23</td>
<td>9</td>
<td>207</td>
</tr>
<tr>
<td>12 &lt; t ≤ 18</td>
<td>28</td>
<td>15</td>
<td>420</td>
</tr>
<tr>
<td>18 &lt; t ≤ 24</td>
<td>19</td>
<td>21</td>
<td>399</td>
</tr>
<tr>
<td>24 &lt; t ≤ 30</td>
<td>15</td>
<td>27</td>
<td>405</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Number of children</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>more than 4</td>
<td>0</td>
</tr>
</tbody>
</table>

a) Find the mode. 0 children
b) Calculate the mean to 1 decimal place. 1.6 children
1) The table shows some information about the heights ($h$ cm) of 100 plants.

<table>
<thead>
<tr>
<th>Height ($h$ cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$120 &lt; h \leq 130$</td>
<td>9</td>
</tr>
<tr>
<td>$130 &lt; h \leq 140$</td>
<td>18</td>
</tr>
<tr>
<td>$140 &lt; h \leq 150$</td>
<td>27</td>
</tr>
<tr>
<td>$150 &lt; h \leq 160$</td>
<td>31</td>
</tr>
<tr>
<td>$160 &lt; h \leq 170$</td>
<td>15</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Number of books ($n$)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; n \leq 40$</td>
<td>2</td>
</tr>
<tr>
<td>$40 &lt; n \leq 80$</td>
<td>6</td>
</tr>
<tr>
<td>$80 &lt; n \leq 120$</td>
<td>13</td>
</tr>
<tr>
<td>$120 &lt; n \leq 160$</td>
<td>6</td>
</tr>
<tr>
<td>$160 &lt; n \leq 200$</td>
<td>3</td>
</tr>
</tbody>
</table>

Calculate an estimate for the mean number of books sold each week. Give your answer correct to 1 decimal place.
1) The table shows some information about the heights \((h \text{ cm})\) of 100 plants.

<table>
<thead>
<tr>
<th>Height ((h \text{ cm}))</th>
<th>Frequency</th>
<th>Midpoint</th>
<th>(\text{MP} \times \text{Frequency})</th>
</tr>
</thead>
<tbody>
<tr>
<td>(120 &lt; h \leq 130)</td>
<td>9</td>
<td>125</td>
<td>1125</td>
</tr>
<tr>
<td>(130 &lt; h \leq 140)</td>
<td>18</td>
<td>135</td>
<td>2430</td>
</tr>
<tr>
<td>(140 &lt; h \leq 150)</td>
<td>27</td>
<td>145</td>
<td>3915</td>
</tr>
<tr>
<td>(150 &lt; h \leq 160)</td>
<td>31</td>
<td>155</td>
<td>4805</td>
</tr>
<tr>
<td>(160 &lt; h \leq 170)</td>
<td>15</td>
<td>165</td>
<td>2475</td>
</tr>
</tbody>
</table>

a) Find the class interval in which the median lies. \(140 < h \leq 150\)

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.

<table>
<thead>
<tr>
<th>Number of books ((n))</th>
<th>Frequency</th>
<th>Midpoint</th>
<th>(\text{MP} \times \text{Frequency})</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0 &lt; n \leq 40)</td>
<td>2</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>(40 &lt; n \leq 80)</td>
<td>6</td>
<td>60</td>
<td>360</td>
</tr>
<tr>
<td>(80 &lt; n \leq 120)</td>
<td>13</td>
<td>100</td>
<td>1300</td>
</tr>
<tr>
<td>(120 &lt; n \leq 160)</td>
<td>6</td>
<td>140</td>
<td>840</td>
</tr>
<tr>
<td>(160 &lt; n \leq 200)</td>
<td>3</td>
<td>180</td>
<td>540</td>
</tr>
</tbody>
</table>

Calculate an estimate for the mean number of books sold each week. 102.7 books
Give your answer correct to 1 decimal place.
1) The number of pens in each pupil’s pencil case in a classroom has been counted. The results are displayed in a table.

<table>
<thead>
<tr>
<th>Number of pens</th>
<th>Number of pupils</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

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.

Thomas said that the mode is 7
Thomas is wrong.

a) Explain why.

b) Calculate the mean number of goals scored.

<table>
<thead>
<tr>
<th>Goals scored</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

3) Tina recorded how long, in minutes, she watched TV for each day during a month.

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.

<table>
<thead>
<tr>
<th>Time (t in minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 &lt; t ≤ 20</td>
<td>5</td>
</tr>
<tr>
<td>20 &lt; t ≤ 30</td>
<td>9</td>
</tr>
<tr>
<td>30 &lt; t ≤ 45</td>
<td>8</td>
</tr>
<tr>
<td>45 &lt; t ≤ 60</td>
<td>6</td>
</tr>
<tr>
<td>60 &lt; t ≤ 90</td>
<td>3</td>
</tr>
</tbody>
</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.

<table>
<thead>
<tr>
<th>Number of pens</th>
<th>Number of pupils</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4 × 4</td>
</tr>
<tr>
<td>1</td>
<td>6 × 6</td>
</tr>
<tr>
<td>2</td>
<td>7 × 2</td>
</tr>
<tr>
<td>3</td>
<td>5 × 3</td>
</tr>
<tr>
<td>4</td>
<td>3 × 4</td>
</tr>
<tr>
<td>5</td>
<td>1 × 5</td>
</tr>
</tbody>
</table>

- 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.

<table>
<thead>
<tr>
<th>Goals scored</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5 × 1</td>
</tr>
<tr>
<td>2</td>
<td>3 × 3</td>
</tr>
<tr>
<td>3</td>
<td>6 × 3</td>
</tr>
<tr>
<td>4</td>
<td>2 × 4</td>
</tr>
<tr>
<td>5</td>
<td>1 × 5</td>
</tr>
<tr>
<td>6</td>
<td>1 × 6</td>
</tr>
</tbody>
</table>

- a) Thomas said that the mode is 7. Thomas is wrong. **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.

<table>
<thead>
<tr>
<th>Time (t in minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 &lt; t ≤ 20</td>
<td>5</td>
</tr>
<tr>
<td>20 &lt; t ≤ 30</td>
<td>9</td>
</tr>
<tr>
<td>30 &lt; t ≤ 45</td>
<td>8</td>
</tr>
<tr>
<td>45 &lt; t ≤ 60</td>
<td>6</td>
</tr>
<tr>
<td>60 &lt; t ≤ 90</td>
<td>3</td>
</tr>
</tbody>
</table>

- a) Find the class interval in which the median lies. **30 < t ≤ 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**
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.
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?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

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?”

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Very good</th>
<th>Good</th>
</tr>
</thead>
</table>

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?”

<table>
<thead>
<tr>
<th>Very often</th>
<th>Not often</th>
</tr>
</thead>
</table>

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?**

<table>
<thead>
<tr>
<th>None</th>
<th>Once</th>
<th>Twice</th>
<th>More than twice</th>
</tr>
</thead>
</table>
1) Change the following to normal (or ordinary) numbers.
   a) $4.3 \times 10^4$
   c) $7.03 \times 10^3$
   e) $1.01 \times 10^4$
   b) $6.79 \times 10^6$
   d) $9.2 \times 10^2$
   f) $4 \times 10^5$

2) Change the following to normal (or ordinary) numbers.
   a) $4.3 \times 10^{-4}$
   c) $7.03 \times 10^{-3}$
   e) $1.01 \times 10^{-4}$
   b) $6.79 \times 10^{-6}$
   d) $9.2 \times 10^{-2}$
   f) $4 \times 10^{-5}$

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) $240 \times 0.0002$
   e) $\frac{8 \times 10^4}{4 \times 10^2}$
   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) $6 \times 4.1 \times 10^3$
1) Change the following to normal (or ordinary) numbers.
   a) $4.3 \times 10^4$  
      $43000$
   b) $6.79 \times 10^6$  
      $6790000$
   c) $7.03 \times 10^3$  
      $7030$
   d) $9.2 \times 10^2$  
      $920$
   e) $1.01 \times 10^4$  
      $10100$
   f) $4 \times 10^5$  
      $400000$

2) Change the following to normal (or ordinary) numbers.
   a) $4.3 \times 10^{-4}$  
      $0.00043$
   b) $6.79 \times 10^{-6}$  
      $0.00000679$
   c) $7.03 \times 10^{-3}$  
      $0.00703$
   d) $9.2 \times 10^{-2}$  
      $0.092$
   e) $1.01 \times 10^{-4}$  
      $0.000101$
   f) $4 \times 10^{-5}$  
      $0.00004$

3) Change the following to standard form.
   a) $360$  
      $3.6 \times 10^2$
   b) $8900$  
      $8.9 \times 10^3$
   c) $520000$  
      $5.2 \times 10^5$
   d) $60000$  
      $6 \times 10^4$
   e) $1003$  
      $1.003 \times 10^3$
   f) $6450000$  
      $6.45 \times 10^6$

4) Change the following to standard form.
   a) $0.071$  
      $7.1 \times 10^{-2}$
   b) $0.0008$  
      $8 \times 10^{-4}$
   c) $0.00076$  
      $7.6 \times 10^{-4}$
   d) $0.0928$  
      $9.28 \times 10^{-2}$
   e) $0.00009$  
      $9 \times 10^{-5}$
   f) $0.00000173$  
      $1.73 \times 10^{-6}$

5) Work out the following, giving your answer in standard form.
   a) $3000 \times 5000$  
      $15000000$  
      $1.5 \times 10^7$
   b) $240 \times 0.0002$  
      $0.048$  
      $4.8 \times 10^{-2}$
   c) $9 \times 1.1 \times 10^7$  
      $9.9 \times 10^7$
   d) $5 \times 4 \times 10^3$  
      $20 \times 10^3$  
      $2 \times 10^4$
   e) $8 \times 10^4$  
      $4 \times 10^2$  
      $2 \times 10^2$
   f) $9 \times 10^2 \times 2 \times 10^5$  
      $18 \times 10^3$  
      $1.8 \times 10^2$
   g) $7 \times 10^2 \times 3 \times 10^4$  
      $21 \times 10^2$  
      $2.1 \times 10^1$
   h) $2 \times 3.6 \times 10^{-5}$  
      $7.2 \times 10^{-5}$
   i) $6 \times 4.1 \times 10^3$  
      $24.6 \times 10^3$  
      $2.46 \times 10^4$
1) Work out the following, giving your answer in standard form.
   a) \((6 \times 10^2) \times (8 \times 10^4)\)
   b) \((2 \times 10^5) + (3 \times 10^6)\)
   c) \(\frac{3 \times 10^3}{6 \times 10^{-5}}\)
   d) \((9.2 \times 10^5) \div (2 \times 10^2)\)

2) A spaceship travelled for \(5 \times 10^3\) hours at a speed of \(9 \times 10^4\) km/h.
   a) Work out the distance travelled by the spaceship.
      Give your answer in standard form.
   Another spaceship travelled a distance of \(2 \times 10^7\) km, last month.
   This month it has travelled \(5 \times 10^6\) 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) \((7.5 \times 10^6) \times (1.9 \times 10^{-2})\)
   c) \(\frac{9.435 \times 10^5}{3.28 \times 10^3}\)
   d) \(\frac{5.98 \times 10^8}{6.14 \times 10^{-2}}\)

4) Work out the following, giving your answer in standard form correct to 3 significant figures.
   a) \(\frac{5.76 \times 10^7 + 3.89 \times 10^9}{7.18 \times 10^2}\)
   b) \(\frac{7.2 \times 10^{-2} - 5.4 \times 10^{-1}}{9.25 \times 10^{-7}}\)
   c) \(\frac{3 \times 10^8 \times 2 \times 10^7}{3 \times 10^8 + 2 \times 10^7}\)
   d) \(\frac{3 \times 3.2 \times 10^{12} \times 1.5 \times 10^{12}}{3.2 \times 10^{12} - 1.5 \times 10^{12}}\)

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.
1) Work out the following, giving your answer in standard form.
   
   a) \((6 \times 10^2) \times (8 \times 10^4)\) \(4.8 \times 10^7\)
   b) \((2 \times 10^5) + (3 \times 10^6)\) \(2.3 \times 10^6\)
   c) \(\frac{3 \times 10^3}{6 \times 10^{-5}}\) \(5 \times 10^7\)
   d) \((9.2 \times 10^5) \div (2 \times 10^2)\) \(4.6 \times 10^3\)

2) A spaceship travelled for \(5 \times 10^3\) hours at a speed of \(9 \times 10^4\) km/h.
   
   a) Work out the distance travelled by the spaceship.
   Give your answer in standard form. \(4.5 \times 10^8\) km
   
   Another spaceship travelled a distance of \(2 \times 10^7\) km, last month.
   This month it has travelled \(5 \times 10^6\) 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. \(25 000 000\) km

3) Work out the following, giving your answer in standard form, correct to 2 significant figures.
   
   a) \(2.6 \times 10^3 \times 4.3 \times 10^4\) \(1.1 \times 10^8\)
   b) \((7.5 \times 10^5) \times (1.9 \times 10^{-2})\) \(1.4 \times 10^4\)
   c) \(\frac{9.435 \times 10^5}{3.28 \times 10^1}\) \(2.9 \times 10^2\)
   d) \(\frac{5.98 \times 10^9}{6.14 \times 10^{-2}}\) \(9.7 \times 10^9\)

4) Work out the following, giving your answer in standard form, correct to 3 significant figures.
   
   a) \(\frac{5.76 \times 10^7 + 3.89 \times 10^9}{7.18 \times 10^2}\) \(5.50 \times 10^{10}\)
   b) \(\frac{7.2 \times 10^2 - 5.4 \times 10^{-1}}{9.25 \times 10^{-7}}\) \(-5.06 \times 10^5\)
   c) \(\frac{3 \times 10^8 \times 2 \times 10^7}{3 \times 10^8 + 2 \times 10^7}\) \(1.88 \times 10^7\)
   d) \(\frac{3 \times 3.2 \times 10^{12} - 1.5 \times 10^{12}}{3.2 \times 10^{12}}\) \(8.47 \times 10^{12}\)

5) A microsecond is 0.000 001 seconds.
   
   a) Write the number 0.000 001 in standard form. \(1 \times 10^{-6}\)
   
   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. \(1 \div (3 \times 10^{-6})\) \(3.33 \times 10^5\)

6) 340 000 tomato seeds weigh 1 gram.
   Each tomato seed weighs the same.
   
   a) Write the number 340 000 in standard form. \(3.4 \times 10^5\)
   
   b) Calculate the weight, in grams, of one tomato seed.
   Give your answer in standard form, correct to 2 significant figures. \(2.9 \times 10^{-6}\)
   
   \(1 \div (3.4 \times 10^5)\)
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
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%

\[
\frac{196 - 175}{175} \times 100 = 12\%
\]

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%

\[
\frac{1352 - 1014}{1352} \times 100 = 25\%
\]

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%

\[
\frac{32.50 - 29.25}{32.50} \times 100 = 10\%
\]

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%

\[
\frac{795 - 750}{750} \times 100 = 6\%
\]

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%

\[
\frac{300 000 - 270 000}{270 000} \times 100 = 11\%
\]

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
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?
1) Henry places £6000 in an account which pays 4.6% compound interest each year.
   Calculate the amount in his account after 2 years.  
   \[6000 \times 1.046^2 = \mathbf{6564.70}\]

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.  
   \[8600 \times 1.038^4 = \mathbf{9983.62}\]

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?  
   \[10000 \times 1.056^5 = \mathbf{13131.66}\]

4) Susan places £7900 in an account which pays 2.4% compound interest per year.
   How much interest does she earn in 3 years?  
   \[7900 \times 1.024^3 = 8482.56 \quad \mathbf{\text{£}}8482.56 - \mathbf{\text{£}}7900 = \mathbf{\text{£}}582.56\]

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?  
   \[23000 \times 1.06^5 = 30779.19 \quad \mathbf{\text{£}}30779.19 - \mathbf{\text{£}}23000 = \mathbf{\text{£}}7779.19\]

6) Laura buys a new car for £14600.
   The annual rate of depreciation is 23%.
   How much is the car worth after 3 years?  
   \[14600 \times 0.77^3 = \mathbf{6665.38}\]

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?  
   \[650 \times 0.35^2 = 79.63\]

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?  
   \[3500 \times 0.76^4 = \mathbf{1167.68}\]

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?  
   \[17000 \times 1.04^3 = \mathbf{19122.69}\]

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?  
    \[8900 \times 0.82^6 = \mathbf{2705.66}\]
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 commission 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.
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

\[(26 \div 80) \times 100 = 32.5\]

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

\[(6120 \div 85) \times 100 = 7200\]

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

\[(108.75 \div 87) \times 100 = 125\]

4) A salesman gets a basic wage of £160 per week plus a commission 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

\[640 - 160 = 480\]
\[(480 \div 30) \times 100 = 1600\]

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

\[(1976 \div 104) \times 100 = 1900\]

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

\[(960 \div 120) \times 100 = 800\]

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

\[(122.40 \div 4) \times 100 = 3060\]

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

\[(2932.80 \div 104) \times 100 = 2820\]
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  \(\frac{2}{3} + \frac{5}{6}\)
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.
1) Work out the value of \( 2 \frac{4}{5} - 1 \frac{3}{4} \cdot \frac{1}{20} \)
Give your answer as a fraction in its simplest form.

2) a) Work out \( \frac{3}{8} + \frac{1}{4} \cdot \frac{5}{8} \)
Give your answer in its simplest form.

b) Work out \( \frac{2}{3} \times \frac{4}{5} \cdot \frac{8}{15} \)

3) Work out the value of \( 3 \frac{1}{4} \times 2 \frac{2}{3} \cdot 8 \frac{2}{3} \)
Give your answer as a fraction in its simplest form.

4) a) Work out \( 2 \frac{17}{20} - 1 \frac{2}{5} \cdot \frac{9}{20} \)

b) Work out \( 2 \frac{2}{3} \times 1 \frac{3}{4} \cdot 4 \frac{2}{3} \)

5) a) Work out \( \frac{2}{3} + \frac{5}{6} \cdot \frac{4}{5} \)
Give your fraction in its simplest form.

b) Work out \( 2 \frac{1}{3} - 1 \frac{2}{5} \cdot 14 \frac{14}{15} \)

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
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.
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) \( 9x^2 - 9 = 7 \)
1) Factorise
   a) \( x^2 - 16 \) \((x - 4)(x + 4)\)
   c) \( y^2 - 9 \) \((y - 3)(y + 3)\)
   e) \( x^2 - \frac{1}{4} \) \((x - \frac{1}{2})(x + \frac{1}{2})\)

   b) \( a^2 - b^2 \) \((a - b)(a + b)\)
   d) \( x^2 - 1 \) \((x - 1)(x + 1)\)
   f) \( x^2 - \frac{1}{9} \) \((x - \frac{1}{3})(x + \frac{1}{3})\)

2) Factorise
   a) \( x^2 - 4y^2 \) \((x - 2y)(x + 2y)\)
   c) \( 9x^2 - 16y^2 \) \((3x - 4y)(3x + 4y)\)
   e) \( 4x^2 - 25y^2 \) \((2x - 5y)(2x + 5y)\)

   b) \( 9a^2 - b^2 \) \((3a - b)(3a + b)\)
   d) \( \frac{1}{4}x^2 - y^2 \) \((\frac{1}{2}x - y)(\frac{1}{2}x + y)\)
   f) \( x^2 - \frac{1}{9}y^2 \) \((x - \frac{1}{3}y)(x + \frac{1}{3}y)\)

3) Simplify
   a) \( \frac{y^2 - 4}{y + 2} \times \frac{5}{y + 5} \) \(\frac{5(y - 2)}{y + 5}\)
   \(\frac{(y - 2)(y + 2)}{y + 2} \times \frac{5}{y + 5}\)

   b) \( \frac{3}{2x + 1} \times \frac{4x^2 - 1}{x - 2} \) \(\frac{3(2x - 1)}{x - 2}\)
   \(\frac{3}{2x + 1} \times \frac{(2x - 1)(2x + 1)}{x - 2}\)

   c) \( \frac{12x^2 + 8x}{9x^2 - 4} \) \(\frac{4x}{3x - 2}\)
   \(\frac{4x(3x + 2)}{(3x - 2)(3x + 2)}\)

   d) \( \frac{25a^2 - 16b^2}{10ab - 8b^2} \) \(\frac{5a + 4b}{2b}\)
   \(\frac{(5a - 4b)(5a + 4b)}{2b(5a - 4b)}\)

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) \( 9x^2 - 9 = 7 \) \((3x - 4)(3x + 4) = 0\)
   \(x = 1\frac{1}{3}\), \(x = -1\frac{1}{3}\)
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
   \[4x + 3y = 6\]
   \[5x - 3y = 21\]
   \[x = 3 \text{ and } y = -2\]

2) Solve
   \[4x + 3y = 19\]
   \[3x - 5y = 7\]
   \[x = 4 \text{ and } y = 1\]

3) Solve
   \[3x + 5y = 13\]
   \[2x + 3y = 8\]
   \[x = 1 \text{ and } y = 2\]

4) Solve
   \[x + 4y = 5\]
   \[4x - 2y = 11\]
   \[x = 3 \text{ and } y = 0.5\]

5) Solve
   \[2a + b = 3\]
   \[4a - 5b = 20\]
   \[a = 2.5 \text{ and } b = -2\]

6) Solve
   \[5x + 3y = 4\]
   \[3x + 4y = 9\]
   \[x = -1 \text{ and } y = 3\]

7) Solve
   \[6x - 2y = 13\]
   \[2x + 3y = -3\]
   \[x = 1.5 \text{ and } y = -2\]

8) Solve
   \[3a - 2b = 14\]
   \[4a + 3b = 13\]
   \[a = 4 \text{ and } b = -1\]

9) Solve
   \[5x + 4y = 5\]
   \[2x + 7y = 29\]
   \[x = -3 \text{ and } y = 5\]

10) Solve
    \[6x - 4y = 39\]
    \[2x + y = 6\]
    \[x = 4.5 \text{ and } y = -3\]
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 $AB$. 
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 \( AB \). \( y = 2x - 1 \)
1) On the grid below, draw straight lines and use shading to show the region $R$ that satisfies the inequalities $x \geq 1$, $y \geq x$, $x + y \leq 7$.

2) On the grid below, draw straight lines and use shading to show the region $R$ that satisfies the inequalities $y \geq x + 1$, $y \leq 5$, $x \geq 1$. 
1) On the grid below, draw straight lines and use shading to show the region $R$ that satisfies the inequalities $x \geq 1$, $y \geq x$, $x + y \leq 7$

2) On the grid below, draw straight lines and use shading to show the region $R$ that satisfies the inequalities $y \geq x + 1$, $y \leq 5$, $x \geq 1$
1) a) Complete this table of values for 
\[ y = x^3 + x - 4 \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>(-14)</td>
<td>(-2)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 
\[ y = x^3 + 2x \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-12</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 
\[ y = 1 + \frac{1}{x} \]
1) a) Complete this table of values for 
\( y = x^3 + x - 4 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-14</td>
<td>-6</td>
<td>-4</td>
<td>-2</td>
<td>6</td>
</tr>
</tbody>
</table>

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 
\( y = x^3 + 2x \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-12</td>
<td>-3</td>
<td>0</td>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>

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.

\[ a) \quad y = 3x^3 \quad b) \quad y = -\frac{2}{x} \quad c) \quad y = 3x - 1 \quad d) \quad y = 2^x \]
\[ e) \quad y = 2x^2 + 1 \quad f) \quad y = \frac{2}{x} \quad g) \quad y = 5x - x^3 \quad h) \quad y = -2x^3 \]
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) $y = -2x^3$
1) ABC is a right-angled triangle.
   $AB = 50\,\text{cm}$.
   Angle $ABC = 24^\circ$
   Work out the length of $BC$.
   Give your answer correct to 1 decimal place.

2) ABC is a right-angled triangle.
   $AB = 23\,\text{cm}$.
   Angle $BCA = 20^\circ$
   Work out the length of $AC$.
   Give your answer correct to 1 decimal place.

3) ABC is a right-angled triangle.
   $AC = 16\,\text{cm}$.
   Angle $CAB = 65^\circ$
   Work out the length of $BC$.
   Give your answer correct to 1 decimal place.

4) ABC is a right-angled triangle.
   $AB = 13\,\text{cm}$.
   $AC = 21\,\text{cm}$.
   Work out the size of angle $x$.
   Give your answer correct to 1 decimal place.

5) ABC is a right-angled triangle.
   $AB = 18\,\text{cm}$.
   $AC = 7\,\text{cm}$.
   Work out the size of angle $ABC$.
   Give your answer correct to 1 decimal place.
1) \(ABC\) is a right-angled triangle.
\(AB = 50\) cm.
Angle \(ABC = 24^\circ\)
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 \(BCA = 20^\circ\)
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 \(CAB = 65^\circ\)
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 \(x^\circ\). \(51.8^\circ\)
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 \(ABC\). \(22.9^\circ\)
Give your answer correct to 1 decimal place.
1) \(PQR\) is a right-angled triangle.
\(PR = 11\) cm.
\(QR = 4.5\) cm
Angle \(PRQ = 90^\circ\)

Work out the value of \(x\).
Give your answer correct to 1 decimal place.

2) \(AC = 14\) cm.
Angle \(ABC = 90^\circ\)
Angle \(ACB = 34^\circ\)

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 \(PRQ = 90^\circ\)

Work out the value of \(x\).
Give your answer correct to 1 decimal place.

4) \(AB = 23\) cm.
Angle \(ABC = 90^\circ\)
Angle \(ACB = 21^\circ\)

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.
1) \( \triangle PQR \) is a right-angled triangle.
\[ PR = 11 \text{ cm}, \quad QR = 4.5 \text{ cm} \]
\[ \text{Angle } \angle PRQ = 90^\circ \]

Work out the value of \( x \). \( 22.2^\circ \)
Give your answer correct to 1 decimal place.

2) \( AC = 14 \text{ cm} \).
\[ \text{Angle } \angle ABC = 90^\circ \]
\[ \text{Angle } \angle ACB = 34^\circ \]

Calculate the length of \( BC \). \( 11.6 \text{ cm} \)
Give your answer correct to 3 significant figures.

3) \( \triangle PQR \) is a right-angled triangle.
\[ PQ = 18 \text{ cm}, \quad QR = 8.4 \text{ cm} \]
\[ \text{Angle } \angle PRQ = 90^\circ \]

Work out the value of \( x \). \( 27.8^\circ \)
Give your answer correct to 1 decimal place.

4) \( AB = 23 \text{ cm} \).
\[ \text{Angle } \angle ABC = 90^\circ \]
\[ \text{Angle } \angle ACB = 21^\circ \]

Calculate the length of \( AC \). \( 64.2 \text{ cm} \)
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 \( x \). \( 27.9^\circ \)
Give your answer correct to 3 significant figures.
1) \( DEF \) is a right-angled triangle.
\( DE = 31 \text{ mm} \)
\( FE = 45 \text{ mm} \)
Calculate the size of angle \( y \).
Give your answer correct to one decimal place.

2) \( PQR \) is a right-angled triangle.
\( QR = 3 \text{ cm} \)
\( PR = 10 \text{ cm} \)
Work out the size of angle \( RQP \).
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.
   \(DE = 31\text{ mm}\)
   \(FE = 45\text{ mm}\)
   Calculate the size of angle \(y\). \(34.6^\circ\)
   Give your answer correct to one decimal place.

2) PQR is a right-angled triangle.
   \(QR = 3\text{ cm}\)
   \(PR = 10\text{ cm}\)
   Work out the size of angle \(RPQ\). \(16.7^\circ\)
   Give your answer correct to three significant figures.

3) a) Calculate the size of the angle marked \(x\). \(63.6^\circ\)
   Give your answer correct to one decimal place.

   b) Calculate the value of \(y\). \(9.6\text{ cm}\)
   Give your answer correct to one decimal place.
1) ABC is a right-angled triangle.
\( AC = 9.7 \text{ cm} \)
\( BC = 8.1 \text{ cm} \)
Calculate the size of the angle marked \( x \).
Give your answer correct to three significant figures.

2) ABC is a right-angled triangle.
\( AC = 15 \text{ m} \)
Angle \( CAB = 57^\circ \)
Calculate the length of \( AB \).
Give your answer correct to three significant figures.

3) ABC is a right-angled triangle.
\( AC = 9 \text{ m} \)
Angle \( CAB = 36^\circ \)
Calculate the length of \( AB \).
Give your answer correct to three significant figures.
1) \(ABC\) is a right-angled triangle.
\(AC = 9.7\) cm
\(BC = 8.1\) cm
Calculate the size of the angle marked \(x\).  \(33.4^\circ\)
Give your answer correct to three significant figures.

2) \(ABC\) is a right-angled triangle.
\(AC = 15\) m
Angle \(CAB = 57^\circ\)
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 \(CAB = 36^\circ\)
Calculate the length of \(AB\).  \(7.28\) m
Give your answer correct to three significant figures.
1) Calculate the length of $CD$.
Give your answer to 3 significant figures.

2) Work out the length of $PR$.
Give your answer correct to 3 significant figures.
1) \(AC = 9\) cm
\(AB = 3\) cm
\(DE = 20\) cm
Angle \(ABC = \angle CBD = \angle BDE = 90^\circ\)

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 \(PSR = 90^\circ\)
Angle \(PRS = 64^\circ\)
\(PQ = 14\) cm.
\(PS = 8\) cm.

Work out the length of \(PR\). 
\(8.90\) cm
Give your answer correct to 3 significant figures.
1) 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) 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.
1) 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) 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
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.
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. \((6, 4, 0)\)
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.
1) Triangle $ABC$ is similar to triangle $PQR$.

The area of triangle $ABC$ is $24$ cm$^2$.
Calculate the area of triangle $PQR$. \[54 \text{ cm}^2\]

2) Cylinder A is mathematically similar to cylinder B.

The volume of cylinder A is $240$ cm$^3$
Calculate the volume of cylinder B. \[468.75 \text{ cm}^3\]

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. \[21600 \text{ cm}^3\]
1) In the diagram, $A, B, C,$ and $D$ are points on the circumference of a circle, centre $O$.
Angle $BAD = 55^\circ$.
Angle $BOD = x^\circ$.
Angle $BCD = y^\circ$.

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 $ADO = 34^\circ$

a) Work out the size of angle $AOD$.

b) (i) Work out the size of angle $ABC$.
(ii) Give a reason for your answer.
1) In the diagram, $A$, $B$, $C$, and $D$ are points on the circumference of a circle, centre $O$.

Angle $BAD = 55^\circ$.

Angle $BOD = x^\circ$.

Angle $BCD = y^\circ$.

(a) (i) Work out the value of $x$. \(110^\circ\)

(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 $y$. \(125^\circ\)

(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 $ADO = 34^\circ$

(a) Work out the size of angle $AOD$. \(56^\circ\)

(b) (i) Work out the size of angle $ABC$. \(28^\circ\)

(ii) Give a reason for your answer.

*Angle at centre of circle is twice the angle on the circumference*
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 \(DOF = 120^\circ\).

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 \(DBE = 25^\circ\).

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.
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 \( ABC \). \( 90^\circ \)
(ii) Give a reason for your answer.
\( \text{Angle in a semi-circle is } 90^\circ \)

b) \( D, E \) and \( F \) are points on the circumference of a circle, centre \( O \).
Angle \( DOF = 120^\circ \).

b) (i) Work out the size of angle \( DEF \). \( 60^\circ \)
(ii) Give a reason for your answer.
\( \text{Angle at centre of circle is twice the angle on the circumference} \)

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 \( DBE = 25^\circ \).

a) Find the size of angle \( ABD \). \( 65^\circ \)
Give a reason for your answer.
\( \text{Radius meets a tangent at } 90^\circ \)

b) Find the size of angle \( DEB \). \( 65^\circ \)
Give a reason for your answer.
\( \text{Alternate segment theorem} \)
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°.

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°.

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°.
D is a point on AC such that angle BDA is a right angle.

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.

a) Find the size of angle ADC.

b) Find the size of angle ADB.

Angle CAD = 69°.

c) Is BD a diameter of the circle? You must explain your answer.
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 $ACB = 72^\circ$.

- a) i) Work out the size of angle $AOB$.  
  
  144°

- a) 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 $RPQ = 32^\circ$.

- a) i) Work out the size of angle $PQR$.  
  
  58°

- a) 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°

- b) 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 $BAC = 31^\circ$. $D$ is a point on $AC$ such that angle $BDA$ is a right angle.

- a) Work out the size of angle $BCA$.  
  
  59°

- a) 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 $BAC = 21^\circ$. Angle $EBC = 58^\circ$.

- a) Find the size of angle $ADC$.  
  
  58°

- b) Find the size of angle $ADB$.  
  
  37°

- Angle $CAD = 69^\circ$.

- c) Is $BD$ a diameter of the circle?  
  
  Yes  
  You must explain your answer.  
  
  Angle $DAB = 69^\circ + 21^\circ = 90^\circ$  
  $BD$ subtends $90^\circ$ on the circumference. Therefore $BD$ is a diameter.
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) \( r = \) ____ \( s = \) ____
Circle Theorems

1) $a = 44^\circ$

2) $b = 23^\circ$

3) $c = 92^\circ$

4) $d = 23^\circ$

5) $e = 39^\circ$  $f = 56^\circ$

6) $g = 82^\circ$

7) $h = 90^\circ$

8) $i = 90^\circ$

9) $j = 36^\circ$  $k = 54^\circ$

10) $l = 50^\circ$  $m = 40^\circ$

11) $n = 36^\circ$  $p = 72^\circ$  $q = 6^\circ$

12) $r = 60^\circ$  $s = 54^\circ$
1) $a = \underline{\hspace{1cm}}$, $b = \underline{\hspace{1cm}}$

2) $c = \underline{\hspace{1cm}}$, $d = \underline{\hspace{1cm}}$

3) $e = \underline{\hspace{1cm}}$, $f = \underline{\hspace{1cm}}$

4) $g = \underline{\hspace{1cm}}$, $h = \underline{\hspace{1cm}}$

5) $i = \underline{\hspace{1cm}}$

6) $j = \underline{\hspace{1cm}}$

7) $k = \underline{\hspace{1cm}}$, $l = \underline{\hspace{1cm}}$, $m = \underline{\hspace{1cm}}$

8) $n = \underline{\hspace{1cm}}$, $p = \underline{\hspace{1cm}}$, $q = \underline{\hspace{1cm}}$

9) $r = \underline{\hspace{1cm}}$, $s = \underline{\hspace{1cm}}$

10) $t = \underline{\hspace{1cm}}$

11) $u = \underline{\hspace{1cm}}$

12) $v = \underline{\hspace{1cm}}$, $w = \underline{\hspace{1cm}}$
1) \(a = 71^\circ\) \(b = 92^\circ\)

2) \(c = 60^\circ\) \(d = 67^\circ\)

3) \(e = 98^\circ\) \(f = 55^\circ\)

4) \(g = 100^\circ\) \(h = 85^\circ\)

5) \(i = 39^\circ\)

6) \(j = 136^\circ\)

7) \(k = 56^\circ\) \(l = 68^\circ\) \(m = 45^\circ\)

8) \(n = 19^\circ\) \(p = 50^\circ\) \(q = 50^\circ\)

9) \(r = 23^\circ\) \(s = 93^\circ\)

10) \(t = 42^\circ\)

11) \(u = 5^\circ\)

12) \(v = 70^\circ\) \(w = 20^\circ\)
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) \( x = \)____ \( y = \)____ \( z = \)____
1) \( a = 64^\circ \)

2) \( b = 51^\circ \) \( c = 66^\circ \)

3) \( d = 92^\circ \) \( e = 28^\circ \)

4) \( f = 78^\circ \) \( g = 24^\circ \)

5) \( h = 50^\circ \) \( i = 65^\circ \)

6) \( j = 100^\circ \) \( k = 40^\circ \) \( l = 40^\circ \) \( m = 100^\circ \)

7) \( n = 81^\circ \)

8) \( p = 52^\circ \) \( q = 38^\circ \)

9) \( r = 50^\circ \) \( s = 70^\circ \) \( t = 20^\circ \)

10) \( u = 18^\circ \) \( v = 81^\circ \) \( w = 18^\circ \)

11) \( x = 68^\circ \) \( y = 22^\circ \) \( z = 56^\circ \)
1) The heights of 80 plants were measured and can be seen in the table, below.

<table>
<thead>
<tr>
<th>Height (h cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; h \leq 10$</td>
<td>2</td>
</tr>
<tr>
<td>$10 &lt; h \leq 20$</td>
<td>5</td>
</tr>
<tr>
<td>$20 &lt; h \leq 30$</td>
<td>19</td>
</tr>
<tr>
<td>$30 &lt; h \leq 40$</td>
<td>38</td>
</tr>
<tr>
<td>$40 &lt; h \leq 50$</td>
<td>13</td>
</tr>
<tr>
<td>$50 &lt; h \leq 60$</td>
<td>3</td>
</tr>
</tbody>
</table>

a) Complete the cumulative frequency table for the plants.

<table>
<thead>
<tr>
<th>Height (h cm)</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; h \leq 10$</td>
<td>2</td>
</tr>
<tr>
<td>$0 &lt; h \leq 20$</td>
<td></td>
</tr>
<tr>
<td>$0 &lt; h \leq 30$</td>
<td></td>
</tr>
<tr>
<td>$0 &lt; h \leq 40$</td>
<td></td>
</tr>
<tr>
<td>$0 &lt; h \leq 50$</td>
<td></td>
</tr>
<tr>
<td>$0 &lt; h \leq 60$</td>
<td></td>
</tr>
</tbody>
</table>

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.
1) The heights of 80 plants were measured and can be seen in the table, below.

<table>
<thead>
<tr>
<th>Height (h cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; h ≤ 10</td>
<td>2</td>
</tr>
<tr>
<td>10 &lt; h ≤ 20</td>
<td>5</td>
</tr>
<tr>
<td>20 &lt; h ≤ 30</td>
<td>19</td>
</tr>
<tr>
<td>30 &lt; h ≤ 40</td>
<td>38</td>
</tr>
<tr>
<td>40 &lt; h ≤ 50</td>
<td>13</td>
</tr>
<tr>
<td>50 &lt; h ≤ 60</td>
<td>3</td>
</tr>
</tbody>
</table>

- **Cumulative Frequency**

- **Height (h cm)**
- **Cumulative Frequency**
  - 0 < h ≤ 10: 2
  - 0 < h ≤ 20: 7
  - 0 < h ≤ 30: 26
  - 0 < h ≤ 40: 64
  - 0 < h ≤ 50: 77
  - 0 < h ≤ 60: 80

a) Complete the cumulative frequency table for the plants.

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. **11.3 cm**

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. **11.3 cm**

d) Use your graph to estimate how many plants had a height that was greater than 45cm. **80 – 72 = 8 plants**
1) The table shows information about the amount spent by 100 customers in a supermarket.

<table>
<thead>
<tr>
<th>Amount spent (£n)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; $n$ ≤ 20</td>
<td>17</td>
</tr>
<tr>
<td>20 &lt; $n$ ≤ 40</td>
<td>23</td>
</tr>
<tr>
<td>40 &lt; $n$ ≤ 60</td>
<td>36</td>
</tr>
<tr>
<td>60 &lt; $n$ ≤ 80</td>
<td>14</td>
</tr>
<tr>
<td>80 &lt; $n$ ≤ 100</td>
<td>8</td>
</tr>
<tr>
<td>100 &lt; $n$ ≤ 120</td>
<td>2</td>
</tr>
</tbody>
</table>

a) Complete the cumulative frequency table for this information.

<table>
<thead>
<tr>
<th>Amount spent (£n)</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; $n$ ≤ 20</td>
<td>17</td>
</tr>
<tr>
<td>0 &lt; $n$ ≤ 40</td>
<td>23 + 17 = 40</td>
</tr>
<tr>
<td>0 &lt; $n$ ≤ 60</td>
<td>36 + 23 = 59</td>
</tr>
<tr>
<td>0 &lt; $n$ ≤ 80</td>
<td>14 + 36 = 50</td>
</tr>
<tr>
<td>0 &lt; $n$ ≤ 100</td>
<td>8 + 14 = 22</td>
</tr>
<tr>
<td>0 &lt; $n$ ≤ 120</td>
<td>2 + 8 = 10</td>
</tr>
</tbody>
</table>

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.
1) The table shows information about the amount spent by 100 customers in a supermarket.

<table>
<thead>
<tr>
<th>Amount spent (£n)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; n ≤ 20</td>
<td>17</td>
</tr>
<tr>
<td>20 &lt; n ≤ 40</td>
<td>23</td>
</tr>
<tr>
<td>40 &lt; n ≤ 60</td>
<td>36</td>
</tr>
<tr>
<td>60 &lt; n ≤ 80</td>
<td>14</td>
</tr>
<tr>
<td>80 &lt; n ≤ 100</td>
<td>8</td>
</tr>
<tr>
<td>100 &lt; n ≤ 120</td>
<td>2</td>
</tr>
</tbody>
</table>

a) Complete the cumulative frequency table for this information.

<table>
<thead>
<tr>
<th>Amount spent (£n)</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; n ≤ 20</td>
<td>17</td>
</tr>
<tr>
<td>0 &lt; n ≤ 40</td>
<td>40</td>
</tr>
<tr>
<td>0 &lt; n ≤ 60</td>
<td>76</td>
</tr>
<tr>
<td>0 &lt; n ≤ 80</td>
<td>90</td>
</tr>
<tr>
<td>0 &lt; n ≤ 100</td>
<td>98</td>
</tr>
<tr>
<td>0 &lt; n ≤ 120</td>
<td>100</td>
</tr>
</tbody>
</table>

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**
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.

<table>
<thead>
<tr>
<th>Amount (£A) spent</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; A ≤ 100</td>
<td>12</td>
</tr>
<tr>
<td>0 &lt; A ≤ 150</td>
<td>26</td>
</tr>
<tr>
<td>0 &lt; A ≤ 200</td>
<td>42</td>
</tr>
<tr>
<td>0 &lt; A ≤ 250</td>
<td>64</td>
</tr>
<tr>
<td>0 &lt; A ≤ 300</td>
<td>93</td>
</tr>
<tr>
<td>0 &lt; A ≤ 350</td>
<td>112</td>
</tr>
<tr>
<td>0 &lt; A ≤ 400</td>
<td>120</td>
</tr>
</tbody>
</table>

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.
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.

<table>
<thead>
<tr>
<th>Amount (£A) spent</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; A ≤ 100</td>
<td>12</td>
</tr>
<tr>
<td>0 &lt; A ≤ 150</td>
<td>26</td>
</tr>
<tr>
<td>0 &lt; A ≤ 200</td>
<td>42</td>
</tr>
<tr>
<td>0 &lt; A ≤ 250</td>
<td>64</td>
</tr>
<tr>
<td>0 &lt; A ≤ 300</td>
<td>93</td>
</tr>
<tr>
<td>0 &lt; A ≤ 350</td>
<td>112</td>
</tr>
<tr>
<td>0 &lt; A ≤ 400</td>
<td>120</td>
</tr>
</tbody>
</table>

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
1) The table gives some information about the delay, in minutes, of 80 trains.
   
a) Complete the cumulative frequency table.

<table>
<thead>
<tr>
<th>Delay (n minutes)</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; n ≤ 20</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>20 &lt; n ≤ 30</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>30 &lt; n ≤ 40</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>40 &lt; n ≤ 50</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>50 &lt; n ≤ 60</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>

b) On the grid below, draw a cumulative frequency graph for your table.

![Cumulative Frequency Graph]

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.
1) The table gives some information about the delay, in minutes, of 80 trains.
   a) Complete the cumulative frequency table.

<table>
<thead>
<tr>
<th>Delay (n minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; n ≤ 20</td>
<td>16</td>
</tr>
<tr>
<td>20 &lt; n ≤ 30</td>
<td>27</td>
</tr>
<tr>
<td>30 &lt; n ≤ 40</td>
<td>22</td>
</tr>
<tr>
<td>40 &lt; n ≤ 50</td>
<td>10</td>
</tr>
<tr>
<td>50 &lt; n ≤ 60</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delay (n minutes)</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; n ≤ 20</td>
<td>16</td>
</tr>
<tr>
<td>0 &lt; n ≤ 30</td>
<td>43</td>
</tr>
<tr>
<td>0 &lt; n ≤ 40</td>
<td>65</td>
</tr>
<tr>
<td>0 &lt; n ≤ 50</td>
<td>75</td>
</tr>
<tr>
<td>0 &lt; n ≤ 60</td>
<td>80</td>
</tr>
</tbody>
</table>

   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
1) There are 100 teachers at Sam’s school.
   Sam found out the age of each teacher.
   The table gives information about her results.  
   a) Complete the cumulative frequency table

<table>
<thead>
<tr>
<th>Age (A years)</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 &lt; A ≤ 30</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>30 &lt; A ≤ 40</td>
<td>36</td>
<td>61</td>
</tr>
<tr>
<td>40 &lt; A ≤ 50</td>
<td>22</td>
<td>83</td>
</tr>
<tr>
<td>50 &lt; A ≤ 60</td>
<td>11</td>
<td>94</td>
</tr>
<tr>
<td>60 &lt; A ≤ 70</td>
<td>6</td>
<td>100</td>
</tr>
</tbody>
</table>

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.
1) There are 100 teachers at Sam’s school. Sam found out the age of each teacher. The table gives information about her results.  
   a) Complete the cumulative frequency table

<table>
<thead>
<tr>
<th>Age ($A$ years)</th>
<th>Frequency</th>
<th>Age ($A$ years)</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20 &lt; A \leq 30$</td>
<td>25</td>
<td>$20 &lt; A \leq 30$</td>
<td>25</td>
</tr>
<tr>
<td>$30 &lt; A \leq 40$</td>
<td>36</td>
<td>$20 &lt; A \leq 40$</td>
<td>61</td>
</tr>
<tr>
<td>$40 &lt; A \leq 50$</td>
<td>22</td>
<td>$20 &lt; A \leq 50$</td>
<td>83</td>
</tr>
<tr>
<td>$50 &lt; A \leq 60$</td>
<td>11</td>
<td>$20 &lt; A \leq 60$</td>
<td>94</td>
</tr>
<tr>
<td>$60 &lt; A \leq 70$</td>
<td>6</td>
<td>$20 &lt; A \leq 70$</td>
<td>100</td>
</tr>
</tbody>
</table>

   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**
1) This table shows information about the time, \( m \) minutes, it takes to show each of 120 films.

<table>
<thead>
<tr>
<th>Time (( m ) minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 70 &lt; m \leq 80 )</td>
<td>3</td>
</tr>
<tr>
<td>( 80 &lt; m \leq 90 )</td>
<td>13</td>
</tr>
<tr>
<td>( 90 &lt; m \leq 100 )</td>
<td>34</td>
</tr>
<tr>
<td>( 100 &lt; m \leq 110 )</td>
<td>32</td>
</tr>
<tr>
<td>( 110 &lt; m \leq 120 )</td>
<td>26</td>
</tr>
<tr>
<td>( 120 &lt; m \leq 130 )</td>
<td>12</td>
</tr>
</tbody>
</table>

a) Write down the modal class interval.

b) Complete this cumulative frequency table.

<table>
<thead>
<tr>
<th>Time (( m ) minutes)</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 70 &lt; m \leq 80 )</td>
<td>3</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 90 )</td>
<td>16</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 100 )</td>
<td>44</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 110 )</td>
<td>74</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 120 )</td>
<td>104</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 130 )</td>
<td>116</td>
</tr>
</tbody>
</table>

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.
1) This table shows information about the time, \( m \) minutes, it takes to show each of 120 films.

<table>
<thead>
<tr>
<th>Time (( m ) minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 70 &lt; m \leq 80 )</td>
<td>3</td>
</tr>
<tr>
<td>( 80 &lt; m \leq 90 )</td>
<td>13</td>
</tr>
<tr>
<td>( 90 &lt; m \leq 100 )</td>
<td>34</td>
</tr>
<tr>
<td>( 100 &lt; m \leq 110 )</td>
<td>32</td>
</tr>
<tr>
<td>( 110 &lt; m \leq 120 )</td>
<td>26</td>
</tr>
<tr>
<td>( 120 &lt; m \leq 130 )</td>
<td>12</td>
</tr>
</tbody>
</table>

a) Write down the modal class interval. \( 90 < m \leq 100 \)

b) Complete this cumulative frequency table.

<table>
<thead>
<tr>
<th>Time (( m ) minutes)</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 70 &lt; m \leq 80 )</td>
<td>3</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 90 )</td>
<td>16</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 100 )</td>
<td>50</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 110 )</td>
<td>82</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 120 )</td>
<td>108</td>
</tr>
<tr>
<td>( 70 &lt; m \leq 130 )</td>
<td>120</td>
</tr>
</tbody>
</table>

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
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.
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? 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.
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

<table>
<thead>
<tr>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest estimate</td>
</tr>
<tr>
<td>20 cm</td>
</tr>
<tr>
<td>Lower quartile</td>
</tr>
<tr>
<td>45 cm</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>62 cm</td>
</tr>
<tr>
<td>Upper quartile</td>
</tr>
<tr>
<td>75 cm</td>
</tr>
<tr>
<td>Highest estimate</td>
</tr>
<tr>
<td>95 cm</td>
</tr>
</tbody>
</table>

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.

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.
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

<table>
<thead>
<tr>
<th>Size of estimate in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest estimate</td>
<td>20 cm</td>
</tr>
<tr>
<td>Lower quartile</td>
<td>45 cm</td>
</tr>
<tr>
<td>Median</td>
<td>62 cm</td>
</tr>
<tr>
<td>Upper quartile</td>
<td>75 cm</td>
</tr>
<tr>
<td>Highest estimate</td>
<td>95 cm</td>
</tr>
</tbody>
</table>

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.
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
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**....
1) The incomplete box plot and table show some information about some marks.

<table>
<thead>
<tr>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest mark</td>
</tr>
<tr>
<td>Lower quartile</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Upper quartile</td>
</tr>
<tr>
<td>Highest mark</td>
</tr>
</tbody>
</table>

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.
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.

- **Height (cm)**: 10, 11, 12, 13, 14, 15, 16, 17

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.**
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.

   ![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.

   ![Probability Tree Diagram]

   b) Work out the probability that Terri takes exactly one pen of each colour from the box.
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.

   ![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.

   ![Probability Tree Diagram for Terri]

   b) Work out the probability that Terri takes exactly one pen of each colour from the box.

   \[\frac{10}{49} + \frac{10}{49} = \frac{20}{49}\]
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.
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.

   1st counter
   \[
   \begin{array}{c}
   \text{Red} \\
   \frac{3}{7} \\
   \frac{4}{7} \\
   \text{Blue}
   \end{array}
   \]

   2nd counter
   \[
   \begin{array}{c}
   \text{Red} \\
   \frac{3}{7} \\
   \frac{4}{7} \\
   \text{Blue}
   \end{array}
   \]

   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.

   1st game
   \[
   \begin{array}{c}
   \text{Win} \\
   0.2 \\
   \text{Draw} \\
   0.3 \\
   \text{Lose} \\
   0.5
   \end{array}
   \]

   2nd game
   \[
   \begin{array}{c}
   \text{Win} \\
   \ldots \cdot 0.2 \ldots \\
   \text{Draw} \\
   \ldots \cdot 0.3 \ldots \\
   \text{Lose} \\
   \ldots \cdot 0.5 \ldots 
   \end{array}
   \]

   b) Work out the probability that Jane will win both games. 0.04
1) Lucy throws a biased dice twice. Complete the probability tree diagram to show the outcomes. Label clearly the branches of the tree diagram.

1st Throw       2nd Throw

\[ \begin{array}{c}
\text{Six} \\
\frac{2}{6} \\
\text{Not} \\
\text{Six}
\end{array} \] 

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.

1st Ball       2nd Ball

\[ \begin{array}{c}
\text{Blue} \\
\text{Green} \\
\text{Blue} \\
\text{Green}
\end{array} \] 

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.
1) Lucy throws a biased dice twice. Complete the probability tree diagram to show the outcomes. Label clearly the branches of the tree diagram.

\[
\begin{array}{c}
\text{1st Throw} \\
\text{Six} \quad \frac{2}{6} \quad \text{six} \\
\quad \frac{4}{6} \quad \text{not six} \\
\text{Not} \\
\text{Six} \quad \frac{4}{6} \quad \text{not six} \\
\end{array}
\]

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.

\[
\begin{array}{c}
\text{1st Ball} \\
\text{Blue} \quad \frac{7}{10} \\
\quad \frac{3}{10} \\
\text{Green} \quad \frac{3}{10} \\
\end{array}
\]

\[
\begin{array}{c}
\text{2nd Ball} \\
\text{Blue} \quad \frac{7}{10} \times \frac{7}{10} \\
\text{Green} \quad \frac{7}{10} \times \frac{3}{10} \\
\text{Blue} \quad \frac{3}{10} \times \frac{7}{10} \\
\text{Green} \quad \frac{3}{10} \times \frac{3}{10} \\
\end{array}
\]

b) Work out the probability that Nathan will take two blue balls. \(\frac{49}{100} \times \frac{7}{10} = \frac{343}{1000}\)

c) Work out the probability that Nathan will take one of each coloured balls. \(\frac{42}{100} + \frac{21}{100} = \frac{63}{100}\)

d) Work out the probability that Nathan will take two balls of the same colour. \(\frac{58}{100} + \frac{9}{100} = \frac{67}{100}\)
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.
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. \( \frac{72}{156} \)
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?
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?
      \[
      \frac{42}{90}
      \]

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? \[\frac{30}{56}\]

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? \[\frac{108}{210}\]
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.
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. $\frac{64}{110}$
1) a) Convert the recurring decimal $0.\overline{36}$ to a fraction in its simplest form.

   b) Prove that the recurring decimal $0.\overline{72} = \frac{8}{11}$

2) a) Change $\frac{4}{9}$ to a decimal.

   b) Prove that the recurring decimal $0.\overline{57} = \frac{19}{33}$

3) a) Change $\frac{3}{11}$ to a decimal.

   b) Prove that the recurring decimal $0.\overline{45} = \frac{15}{33}$

4) a) Change $\frac{1}{6}$ to a decimal.

   b) Prove that the recurring decimal $0.\overline{135} = \frac{5}{37}$

5) a) Convert the recurring decimal $0.2\overline{61}$ to a fraction in its simplest form.

   b) Prove that the recurring decimal $0.2\overline{7} = \frac{5}{18}$

6) a) Convert the recurring decimal $5.\overline{2}$ to a fraction in its simplest form.

   b) Prove that the recurring decimal $0.1\overline{36} = \frac{3}{22}$
Recurring Decimals

1) a) Convert the recurring decimal \(0.\overline{36}\) to a fraction in its simplest form. \(\frac{4}{11}\)

\[100x = 36.\overline{36}\]
\[99x = 36\]
\[x = \frac{36}{99} = \frac{4}{11}\]

b) Prove that the recurring decimal \(0.\overline{72}\) = \(\frac{8}{11}\)

\[0.\overline{72} = 2 \times 0.\overline{36}\]
\[0.\overline{72} = 2 \times \frac{4}{11}\]
\[0.\overline{72} = \frac{8}{11}\]

2) a) Change \(\frac{4}{9}\) to a decimal. \(0.\overline{4}\)

\[0.\overline{4} = \frac{4}{9}\]

\[9\mid 4.00\]

b) Prove that the recurring decimal \(0.\overline{57}\) = \(\frac{19}{33}\)

\[x = 0.5757...\]
\[100x = 57.5757...\]
\[99x = 57\]
\[x = \frac{57}{99} = \frac{19}{33}\]

3) a) Change \(\frac{3}{11}\) to a decimal. \(0.2\overline{7}\)

b) Prove that the recurring decimal \(0.\overline{45}\) = \(\frac{15}{33}\)

\[x = 0.4545...\]
\[100x = 45.4545...\]
\[99x = 45\]
\[x = \frac{45}{99} = \frac{15}{33}\]

4) a) Change \(\frac{1}{6}\) to a decimal. \(0.1\overline{6}\)

\[0.1\overline{6} = \frac{1}{6} = \frac{1}{1000}\]

\[6\mid 1.000\]

b) Prove that the recurring decimal \(0.1\overline{35}\) = \(\frac{5}{37}\)

\[x = 0.135135...\]
\[1000x = 135.135135...\]
\[999x = 135\]
\[x = \frac{135}{999} = \frac{5}{37}\]

5) a) Convert the recurring decimal \(0.\overline{261}\) to a fraction in its simplest form. \(\frac{29}{111}\)

\[x = 0.2777...\]

\[0.261 = \frac{261}{999}\]

b) Prove that the recurring decimal \(0.\overline{27}\) = \(\frac{5}{18}\)

\[x = 0.2777...\]
\[100x = 27.777...\]
\[99x = 27.5\]
\[x = \frac{27.5}{99} = \frac{55}{198} = \frac{5}{18}\]

6) a) Convert the recurring decimal \(5.\overline{2}\) to a fraction in its simplest form. \(x = 5.222...\)

b) Prove that the recurring decimal \(0.\overline{136}\) = \(\frac{3}{22}\)

\[x = 0.13636...\]
\[100x = 13.63636...\]
\[99x = 13.5\]
\[x = \frac{13.5}{99} = \frac{27}{198} = \frac{3}{22}\]
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) \(t^6 \div t^3\)

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) \(8^{\frac{3}{2}}\)
   f) \(32^{\frac{2}{3}}\)
   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) \(2^x\)
   (iii) \(2^{x+2y}\)
1) Simplify the following:
   a) \( y^4 \times y^5 \) \( y^9 \)
   b) \( x^2 \times x^6 \) \( x^8 \)
   c) \((p^3)^5\) \( p^{15} \)
   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) \( \frac{t^4}{t^3} \) \( t \)

2) Work out the value of the following, leaving your answer in fraction form when necessary
   a) \( \frac{5^6}{1} \)
   b) \( \frac{4^{-2}}{16} \)
   c) \( \frac{5^{-3}}{125} \)
   d) \( 49^{\frac{1}{2}} \) \( 7 \)
   e) \( 8^{\frac{1}{3}} \) \( 2 \)
   f) \( 32^{\frac{1}{5}} \) \( 4 \)
   g) \( 16^{-\frac{1}{2}} \) \( \frac{1}{4} \)
   h) \( 27^{-\frac{1}{3}} \) \( \frac{1}{3} \)
   i) \( 64^{-\frac{3}{5}} \) \( \frac{1}{16} \)

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) \( a = 2^x, \quad b = 2^y \)
   Express in terms of \( a \) and \( b \)
   (i) \( 2^{x+y} \) \( ab \)
   (ii) \( 2^{2x} \) \( a^2 \)
   (iii) \( 2^{x+2y} \) \( ab^2 \)
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) \(\frac{(5 - \sqrt{5})(2 + 2\sqrt{5})}{\sqrt{20}}\)
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) $\frac{(5 - \sqrt{5})(2 + 2\sqrt{5})}{\sqrt{20}}$
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.
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 \( k \).
   \[
   h = 6 \text{ cm} \\
   h = 6 \text{ cm} \\
   h = 2\sqrt{3} \\
   h = 2\sqrt{3} \\
   \frac{h^2}{2} = 6^2 - (2\sqrt{3})^2 \\
   = 36 - 12 \\
   = 24 \\
   \frac{\text{Area}}{2} = \frac{2\sqrt{3} \times 2\sqrt{6}}{2} \\
   = 2\sqrt{3 \times 6} \\
   = 2\sqrt{18} \\
   = 2\sqrt{2 \times 9} \\
   = 2 \times 3 \\
   = 6 \\
   k = 6
   \]

3) a) Find the value of \( 64^{-\frac{2}{3}} \) \( \frac{1}{16} \)
   b) Given that \( \frac{8 - \sqrt{18}}{\sqrt{2}} = a + b\sqrt{2} \) \( a = -3 \) and \( b = 4 \)
      where \( a \) and \( b \) are integers,
      find the value of \( a \) and the value of \( b \).

4) Work out \( (2 + \sqrt{3})(2 - \sqrt{3}) \) \( 1 \)
   Give your answer in its simplest form.
1) Rationalise the denominator, simplifying where possible:

a) \( \frac{3}{\sqrt{2}} \)

b) \( \frac{2}{\sqrt{2}} \)

c) \( \frac{3\sqrt{2}}{\sqrt{7}} \)

d) \( \frac{\sqrt{5}}{\sqrt{10}} \)

e) \( \frac{1}{4\sqrt{8}} \)

f) \( \frac{\sqrt{15}}{\sqrt{3}} \)

g) \( \frac{1}{\sqrt{27}} \)

2) Rationalise the denominator of \( \frac{1}{\sqrt{3}} \)

3) Rationalise the denominator of \( \frac{1}{8\sqrt{8}} \) giving the answer in the form \( \frac{\sqrt{2}}{p} \)
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 \( \frac{\sqrt{2}}{p} \) \( \frac{\sqrt{2}}{32} \)
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, \( A \) \( \text{m}^2 \), of the sphere.

When \( A = 100, T = 30 \).

Find the value of \( T \) when \( A = 60 \).
Give your answer correct to 3 significant figures.
1) $M$ is directly proportional to $L^3$.

When $L = 2$, $M = 160$

Find the value of $M$ when $L = 3$  \[ M = 540 \]

2) $y$ is directly proportional to $x$.

When $x = 500$, $y = 10$

a) Find a formula for $y$ in terms of $x$.  \[ y = \frac{x}{50} \text{ or } y = 0.02x \]
b) Calculate the value of $y$ when $x = 350$  \[ y = 7 \]

3) $D$ is proportional to $S^2$.

$D = 900$ when $S = 20$

Calculate the value of $D$ when $S = 25$  \[ D = 1406.25 \]

4) $P$ is inversely proportional to $V$.

When $V = 8$, $P = 6$

a) Find a formula for $P$ in terms of $V$.  \[ P = \frac{48}{V} \]
b) Calculate the value of $P$ when $V = 2$  \[ 24 \]

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 $A = 60$.  \[ T = 23.2 \text{ secs} \]
Give your answer correct to 3 significant figures.
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 \( n \).
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. \( x = 70 \)

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. \( a = 6 \)
   c) Find the value of \( b \) when \( a \) is equal to 4. \( b = 12 \)

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 \( c > 0 \). \( z = 16 \ y^{0.5} \)
   You must find the values of \( c \) and \( n \).
   \( c = 16 \)
   \( n = -0.5 \)
1) Here is a rectangle.

\[ a = 8.4 \text{ cm correct to 1 decimal place.} \]
\[ b = 3.6 \text{ cm correct to 1 decimal place.} \]

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

\[ V = I R \]

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.
1) Here is a rectangle.

\[ a = 8.4 \text{ cm correct to 1 decimal place.} \]
\[ b = 3.6 \text{ cm correct to 1 decimal place.} \]

a) Calculate the upper bound of the area of the rectangle. \[ 8.45 \times 3.65 = 30.8425 \text{ cm}^2 \]
   Write down all the figures on your calculator.

b) Find the area of this rectangle correct to an appropriate number of significant figures. 
   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. \[ 221000 \text{ mm}^2 \]
   Give your answer correct to 3 significant figures.

b) Calculate the upper bound for the perimeter of the rectangle. \[ 2100 \text{ mm} \]

3) The voltage \( V \) of an electronic circuit is given by the formula

\[ V = I \cdot R \]

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 \( I \). \[ 17.38955823 \text{ amps} \]

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. \[ 8.75 \text{ miles per litre} \]
Give your answer correct to 2 decimal places.
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.
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.
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 \( \frac{A + B}{B + C} \).

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 \( ABC \).  
\( AB = 73 \text{mm} \) correct to 2 significant figures.  
\( BC = 80 \text{mm} \) correct to 1 significant figure.

a) Write the upper and lower bounds of both \( AB \) and \( BC \).  
\[ AB_{\text{upper}} = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]
\[ AB_{\text{lower}} = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]
\[ BC_{\text{upper}} = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]
\[ BC_{\text{lower}} = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]

b) Calculate the upper bound for the area of the triangle \( ABC \).  
..........................mm\(^2\)

Angle \( CAB = x^\circ \)

c) Calculate the lower bound for the value of \( \tan x^\circ \).
1) \( A = 11.3 \) correct to 1 decimal place  
\( B = 300 \) correct to 1 significant figure  
\( C = 9 \) correct to the nearest integer  

\[
\begin{array}{cccc}
11.3 & 11.25 & 300 & 250 \\
11.35 & 11.255 & 300.5 & 250.5 \\
9 & 8.5 & 9.5 & 9.495 \\
\end{array}
\]

a) Calculate the upper bound for \( A + B \).  
\[ 11.35 + 300 = 311.35 \]

b) Calculate the lower bound for \( B + C \).  
\[ 250 \div 9.5 = 26.3 \text{ (1 dp)} \]

c) Calculate the least possible value of \( AC \).  
\[ 11.25 \times 8.5 = 95.625 \]

d) Calculate the greatest possible value of \( \frac{A + B}{B + C} \).  
\[ \frac{11.35 + 300}{250 + 8.5} = 1.4 \text{ (1 dp)} \]

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  

\[
\begin{array}{cccc}
1.2 & 1.25 & 4.50 & 4.05 \\
1.15 & 1.155 & 4.495 & 3.95 \\
40 & 40.5 & 39.5 & 39.495 \\
\end{array}
\]

a) Calculate the lower bound for the value of \( g \).  
Give your answer correct to 3 decimal places.  
\[ 8.859 \]

b) Calculate the upper bound for the value of \( g \).  
Give your answer correct to 3 decimal places.  
\[ 10.711 \]

3) The diagram shows a triangle \( ABC \).

\( AB = 73 \text{mm} \) correct to 2 significant figures.  
\( BC = 80 \text{mm} \) correct to 1 significant figure.

a) Write the upper and lower bounds of both \( AB \) and \( BC \).

\[
\begin{array}{ccc}
AB_{upper} & = & 75 \\
AB_{lower} & = & 72 \\
BC_{upper} & = & 85 \\
BC_{lower} & = & 75 \\
\end{array}
\]

b) Calculate the upper bound for the area of the triangle \( ABC \).

\[
\frac{3123.75 \times \frac{2}{73.5} \times 85}{2} = 3123.75 \\
\]

Angle \( CAB = x^\circ \)  
\[ \tan x = \frac{BC}{AB} = \frac{75}{73.5} = 1.02 \text{ (2 dp)} \]

c) Calculate the lower bound for the value of \( \tan x^\circ \).  
\[ 1.02 \text{ (2 dp)} \]
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.
1) Solve the equation \( x^2 + 4x + 1 = 0 \)
Give your answers correct to 3 decimal places.
\[ x = -0.268 \quad \text{or} \quad x = -3.732 \]

2) Solve the equation \( x^2 + 8x + 6 = 0 \)
Give your answers correct to 3 significant figures.
\[ x = -0.838 \quad \text{or} \quad x = -7.16 \]

3) Solve the equation \( x^2 - 3x - 2 = 0 \)
Give your answers correct to 3 significant figures.
\[ x = -0.562 \quad \text{or} \quad x = 3.56 \]

4) Solve the equation \( x^2 - 7x + 2 = 0 \)
Give your answers correct to 3 significant figures.
\[ x = 0.298 \quad \text{or} \quad x = 6.70 \]

5) Solve the equation \( 2x^2 + 6x - 1 = 0 \)
Give your answers correct to 3 significant figures.
\[ x = -3.16 \quad \text{or} \quad x = 0.158 \]

6) Solve the equation \( 3x^2 - 2x - 20 = 0 \)
Give your answers correct to 3 significant figures.
\[ x = -2.27 \quad \text{or} \quad x = 2.94 \]

7) Solve the equation \( x^2 - 14x - 161.25 = 0 \)
\[ x = -7.5 \quad \text{or} \quad x = 21.5 \]

8) Solve the equation \( 17x^2 - 92x - 206 = 0 \)
Give your answers correct to 3 significant figures.
\[ x = -1.70 \quad \text{or} \quad x = 7.11 \]

9) \( x^2 + 10x = 300 \)
Find the positive value of \( x \).
Give your answer correct to 3 significant figures.
\[ x = 13.0 \]

10) \( (x + 2)(x - 3) = 1 \)
\[ x^2 - x - 7 = 0 \]
\[ x^2 - 3x + 2x - 6 = 1 \]
\[ x^2 - x - 6 = 1 \]

a) Show that \( x^2 - x - 7 = 0 \)
\[ x^2 - x - 7 = 0 \]

b) Solve the equation \( x^2 - x - 7 = 0 \)
Give your answers correct to 3 significant figures.
\[ x = -2.19 \quad \text{or} \quad x = 3.19 \]
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.

---

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.
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.

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

\[ x = \frac{4 \pm \sqrt{(-4)^2 - 4 \times 2 \times (-52)}}{2 \times 2} \]

\[ x = \frac{4 \pm \sqrt{432}}{4} \]

\[ x = 6.20 \text{ or } -4.20 \]

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.

\[ x = 6.36 \text{ cm} \]
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 cm².

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 cm².

Work out the length of the longest side of the shape.
Give your answer correct to 2 significant figures.
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 cm².

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 cm².

Work out the length of the longest side of the shape.
Give your answer correct to 2 significant figures.

\[x = -3.3\text{ or } 1.8\]

Using \(x = 1.8\) the longest side is given by \(2x + 5\)
\[2x + 5 = 8.6\text{ cm}\]
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 \( x \).

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 \( x \).

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 \( q \). \( p = 3 \) and \( q = -9 \)

b) Find the minimum value of \( x^2 + 6x \). \(-9\)

6) For all values of \( x \),

\[
x^2 - 8x - 5 = (x - p)^2 + q
\]

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 \( x \).

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 \( 10x - x^2 \). \(\frac{25}{2}\)

(ii) State the value of \( x \) for which this maximum value occurs. \( x = 5 \)
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.
1) Show algebraically that the sum of two consecutive numbers is always odd.
\[ n + (n + 1) \]
\[ 2n + 1 \]
\[ 2n \text{ is always even, so } 2n + 1 \text{ must always be odd.} \]

2) Show algebraically that the product of two even numbers is always a multiple of four.
\[ 2n \times 2m \]
\[ 4nm \]
\[ 4nm \text{ is always a multiple of four.} \]

3) Show algebraically that the square of an odd number is always odd.
\[ (2n + 1)^2 \]
\[ 4n^2 + 4n + 1 \]
\[ 2(2n^2 + 2n) + 1 \]
\[ 2(2n^2 + 2n) \text{ is always even, so } 2(2n^2 + 2n) + 1 \text{ must always be odd.} \]

4) Prove, using algebra, that the difference between the squares of any two consecutive even numbers is always a multiple of four.
\[ (2n + 2)^2 - (2n)^2 \]
\[ 4n^2 + 8n + 4 - 4n^2 \]
\[ 8n + 4 \]
\[ 4(2n + 1) \text{ which is always a multiple of four.} \]

5) \( n \) is an integer.
Prove that \((2n + 1)(n + 3) + (2n + 1)(n - 2)\) is not a multiple of 2.
\[ 2n^2 + 7n + 3 + 2n^2 - 3n - 2 \]
\[ 4n^2 + 4n + 1 \]
\[ 2(2n^2 + 2n) + 1 \]
\[ 2(2n^2 + 2n) \text{ is even, so } 2(2n^2 + 2n) + 1 \text{ must be odd (not a multiple of 2).} \]

6) Prove that \((4n + 1)^2 - (4n - 1)^2\) is a multiple of eight for all positive integer values of \( n \).
\[ (16n^2 + 8n + 1) - (16n^2 - 8n + 1) \]
\[ 16n^2 + 8n + 1 - 16n^2 + 8n - 1 \]
\[ 16n \]
\[ 8(2n) \text{ which is always a multiple of eight.} \]

7) Prove algebraically that the sum of the squares of any three consecutive even numbers is always a multiple of four.
\[ (2n)^2 + (2n + 2)^2 + (2n + 4)^2 \]
\[ 4n^2 + 4n^2 + 8n + 4 + 4n^2 + 16n + 16 \]
\[ 12n^2 + 24n + 20 \]
\[ 4(3n^2 + 6n + 5) \text{ which is always a multiple of four.} \]
1) Simplify fully

a) \( \frac{9x^2}{21x^3} \)

b) \( \frac{10xy^3}{5y^3} \)

c) \( \frac{18a^2b^2}{2ab^2} \)

d) \( \frac{4x^2 + 12x}{10x} \)

e) \( \frac{2a^2b - 14a^2b^3}{6a^2b^3} \)

f) \( \frac{5x^2y + 5xy^2}{10x^2y^2} \)

2) Simplify fully

a) \( \frac{x^2 + x}{x^2 + 6x + 5} \)

b) \( \frac{x^2 - 6x + 8}{2x^2 - 8x} \)

c) \( \frac{x^2 + 7x + 10}{x^2 + 5x} \)

3) a) Factorise \( 4x^2 - 12x + 9 \)

b) Simplify \( \frac{6x^2 - 7x - 3}{4x^2 - 12x + 9} \)
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) \[\frac{2a^2b - 14a^2b^3}{6a^2b^3} = \frac{1 - 7b^2}{3ab^2}\]
   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 \[\frac{6x^2 - 7x - 3}{4x^2 - 12x + 9} = \frac{3x + 1}{2x - 3}\]
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) \( \frac{x}{2x-1} + \frac{2}{x+2} = 1 \)
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 \( 3 \)
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) \[ k = \frac{l}{m-l} \]
   a) Make $l$ the subject of the formula.
   b) Make $m$ the subject of the formula.

5) \[ A = \frac{k(x+5)}{3} \]
   Make $x$ the subject of the formula.

6) \[ R = \frac{u+v^2}{u+v} \]
   Make $u$ the subject of the formula.

7) \[ \frac{3x+2}{5} = \frac{y}{10+y} \]
   Make $y$ the subject of the formula.

8) \[ \sqrt{\frac{a-3}{5}} = 4b \]
   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.
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.
   \[ A = \pi t + 5t \quad t = \frac{A}{\pi + 5} \]

3) Make $s$ the subject of the formula.
   \[ R - 2t = 3s + \pi s \]
   \[ R = 3s + \pi s + 2t \]

4) \[ k = \frac{l}{m - l} \]
   a) Make $l$ the subject of the formula.
      \[ l = \frac{km}{1 + k} \]
   b) Make $m$ the subject of the formula.
      \[ m = \frac{l + kl}{k} \]

5) \[ A = \frac{k(x + 5)}{3} \]
   Make $x$ the subject of the formula.
   \[ x = \frac{3A - 5k}{k} \]
   \[ 3A - 5k = kx \]

6) \[ R = \frac{u + v^2}{u + v} \]
   Make $u$ the subject of the formula.
   \[ u = \frac{\sqrt{v^2 - Rv}}{R - 1} \]
   \[ u(R - 1) = v^2 - Rv \]

7) \[ \frac{3x + 2}{5} = \frac{y}{10 + y} \]
   Make $y$ the subject of the formula.
   \[ y = \frac{30x + 20}{3 - 3x} \]
   \[ 30x + 20 = y(3 - 3x) \]

8) \[ \sqrt{\frac{a - 3}{5}} = 4b \]
   Rearrange this formula to give $a$ in terms of $b$.
   \[ a - 3 = 16b^2 \]
   \[ a = 80b^2 + 3 \]

9) \[ S = 2\pi d \sqrt{h^2 + d^2} \]
   Rearrange this formula to make $h$ the subject.
   \[ h = \sqrt{\frac{S^2}{4\pi^2d^2} - d^2} \]
   \[ \frac{S^2}{4\pi^2d^2} = h^2 + d^2 \]
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.
   \[ y = x \]
   \[ y = x^2 - 6 \]
   \[ x = 3 \text{ and } y = 3 \]
   \[ x = -2 \text{ and } y = -2 \]

2) Solve these simultaneous equations.
   \[ y = x^2 - 4 \]
   \[ y = 3x \]
   \[ x = 4 \text{ and } y = 12 \]
   \[ x = -1 \text{ and } y = -3 \]

3) Solve these simultaneous equations.
   \[ y = x^2 - x - 13 \]
   \[ y = x + 2 \]
   \[ x = 5 \text{ and } y = 7 \]
   \[ x = -3 \text{ and } y = -1 \]

4) Solve these simultaneous equations.
   \[ y = x^2 - 35 \]
   \[ x - y = 5 \]
   \[ x = 6 \text{ and } y = 1 \]
   \[ x = -5 \text{ and } y = -10 \]

5) Solve these simultaneous equations.
   \[ x^2 + y^2 = 26 \]
   \[ y + 6 = x \]
   \[ x = 5 \text{ and } y = -1 \]
   \[ x = 1 \text{ and } y = -5 \]

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.
   
   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
   
   \[ x^2 + y^2 = 25 \]
   \[ y = 3x - 9 \]
   \[ x = 1.4 \text{ and } y = -4.8 \]
   \[ x = 4 \text{ and } y = 3 \]
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.
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 \(AB\). 
\[ y = x + 2 \]
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 \( y = -f(x) \)
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.
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. \( y = f(x - 4) \)
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 \( y = f(x + 5) + 6 \)
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 \( y = f(x + 5) + 6 \). \((-2, 2)\)
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.
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) \( y = f(2x) \) \( \left(\frac{1}{2}, -1\right) \)

b) The curve \( y = x^2 \) has been translated to give the curve \( y = f(x) \).

Find \( f(x) \) in terms of \( x \). \( y = x^2 - 2x \)

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 \( (2, 3) \)
1) On the axes below, draw a sketch-graph to show \( y = \sin x \)

Given that \( \sin 30^\circ = 0.5 \), write down the value of:

(i) \( \sin 150^\circ \)

(ii) \( \sin 330^\circ \)

2) On the axes below, draw a sketch-graph to show \( y = \cos x \)

Given that \( \cos 60^\circ = 0.5 \), write down the value of:

(i) \( \cos 120^\circ \)

(ii) \( \cos 240^\circ \)
1) On the axes below, draw a sketch-graph to show $y = \sin x$

Given that $\sin 30^\circ = 0.5$, write down the value of:

(i) $\sin 150^\circ$ \quad 0.5

(ii) $\sin 330^\circ$ \quad -0.5

2) On the axes below, draw a sketch-graph to show $y = \cos x$

Given that $\cos 60^\circ = 0.5$, write down the value of:

(i) $\cos 120^\circ$ \quad -0.5

(ii) $\cos 240^\circ$ \quad -0.5
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 $0 \leq x \leq 360^\circ$.

   a) Use the graph to solve $\cos x = 0.75$ for $0 \leq x \leq 360^\circ$

   b) Use the graph to solve $\cos x = -0.75$ for $0 \leq x \leq 360^\circ$
1) On the axes below, draw a sketch-graph to show \( y = \tan x \)

![Graph of \( y = \tan x \)](image)

2) Here is the graph of the curve \( y = \cos x \) for \( 0 \leq x \leq 360^\circ \).

![Graph of \( y = \cos x \)](image)

a) Use the graph to solve \( \cos x = 0.75 \) for \( 0 \leq x \leq 360^\circ \). \( x = 42^\circ \) and \( 318^\circ \)

b) Use the graph to solve \( \cos x = -0.75 \) for \( 0 \leq x \leq 360^\circ \). \( x = 138^\circ \) and \( 222^\circ \)
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 \( y = \cos ax + b \), for values of \( x \) between 0° and 300°.

Work out the values of \( a \) and \( b \).
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 \( y = \cos ax + b \), for values of \( x \) between 0° and 300°.
Work out the values of \( a \) and \( b \). \( a = 2 \quad b = 3 \)
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 \(q\).

```
(1, 3)                     (4, 375)
```

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 \(t = 3\).
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 \( q \).

Using (1, 3)

\[ y = pq \]

Using (4, 375)

\[ y = pq^x \]

Using (1, 3)

\[ 3 = pq^1 \]

Replacing \( p \) with \( \frac{3}{q} \)

\[ 375 = pq^4 \]

Using (4, 375)

\[ 375 = \frac{3}{q} \times q^4 \]

\[ 375 = 3q^3 \]

\[ q^3 = 125 \]

\[ q = 5 \]

\[ p = \frac{3}{q} \]

\[ p = \frac{3}{5} \]

\[ p = 0.6 \text{ and } q = 5 \]

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 \( a = 400 \).

\[ 400 = a \times b^0 \]

\[ 400 = a \times 1 \]

\[ a = 400 \]

The curve also passes through (2, 900).

b) Use this information to find the value of \( b \).

\[ 900 = 400 \times b^2 \]

\[ b^2 = \frac{900}{400} \]

\[ b = \frac{30}{20} \]

\[ b = 1.5 \]

c) Work out the number of bacteria in the dish at time \( t = 3 \).

\[ N = 400 \times 1.5^t \]

\[ N = 400 \times \left( \frac{3}{2} \right)^3 \]

\[ N = 50 \times 27 \]

\[ N = 1350 \]
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.
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.
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 $x^2 + y^2 = 6.25$, $x + y = 1.5$
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 \( y = 2.3 \)
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 $ACB = 43^\circ$
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.
1) Work out the size of the angle marked $x$. Give your answer correct to one decimal place.

\[ x = 36.2^\circ \]

\[ \frac{\sin A}{a} = \frac{\sin B}{b} \]
\[ \frac{13}{11} = \frac{\sin 30}{11} \]
\[ \sin A = \frac{13 \times \sin 30}{11} \]

2) $ABC$ is a triangle.
$AC = 8\text{ cm}$
$BC = 9\text{ cm}$
Angle $ACB = 43^\circ$

Calculate the length of $AB$. Give your answer correct to 3 significant figures.

\[ \begin{align*}
    c^2 &= a^2 + b^2 - 2ab \cos C \\
    c^2 &= 9^2 + 8^2 - 2 \times 9 \times 8 \times \cos 43 \\
    c^2 &= 39.6851 \\
    c &= 6.30 \text{ cm}
\end{align*} \]

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.

$A$ is the largest angle because it is opposite the largest side.

\[ \begin{align*}
    \cos A &= \frac{b^2 + c^2 - a^2}{2bc} \\
    \cos A &= \frac{5.4^2 + 4.1^2 - 7.8^2}{2 \times 5.4 \times 4.1} \\
    A &= 109.6^\circ
\end{align*} \]

4) Find the missing lengths, $x$ cm and $y$ cm, in this triangle. Give your answers to 3 significant figures.

\[ \begin{align*}
    \frac{x}{\sin 71} &= \frac{12.6}{\sin 59} \\
    x &= \frac{12.6 \times \sin 71}{\sin 59} \\
    \frac{y}{\sin 50} &= \frac{12.6}{\sin 59} \\
    y &= \frac{12.6 \times \sin 50}{\sin 59}
\end{align*} \]
Sine and Cosine Rules

1) \( PQRS \) is a trapezium.
\( PQ \) is parallel to \( SR \).
\( \angle PSR = 90^\circ \)
\( \angle PRS = 64^\circ \)
\( PQ = 14 \text{ cm} \)
\( PS = 8 \text{ cm} \)

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) \( AC = 9 \text{ cm} \)
\( AB = 3 \text{ cm} \)
\( DE = 20 \text{ cm} \)
\( \angle ABC = \angle CBD = \angle BDE = 90^\circ \)

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 \( PSR = 90^\circ \)
Angle \( PRS = 64^\circ \)
\( PQ = 14 \text{ cm.} \)
\( PS = 8 \text{ cm.} \)

a) Work out the length of \( PR \). \( 8.90 \text{ cm} \)
Give your answer correct to 3 significant figures.

b) Work out the length of \( QR \). \( 12.9 \text{ cm} \)
Give your answer correct to 3 significant figures.

2) \( AC = 9 \text{ cm} \)
\( AB = 3 \text{ cm} \)
\( DE = 20 \text{ cm} \)
Angle \( ABC = \angle CBD = \angle BDE = 90^\circ \)

a) Calculate the length of \( CD \). \( 11.1 \text{ cm} \)
Give your answer to 3 significant figures.

b) Calculate the length of \( CE \). \( 13.5 \text{ cm} \)
Give your answer to 3 significant figures.
1) The diagram shows a box in the shape of a cuboid. 
\( AB = 6 \text{ cm}, \ BC = 4 \text{ cm}, \ CG = 3 \text{ cm} \)

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. 
\( AB = 8 \text{ cm}, \ BC = 11 \text{ cm} \)

A string runs diagonally across the box from \( D \) to \( F \) and is 18 cm 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.
1) The diagram shows a box in the shape of a cuboid. 
\[ AB = 6\text{cm}, \ BC = 4\text{cm}, \ CG = 3\text{cm} \]

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.

\[ AG = \sqrt{6^2 + 4^2 + 3^2} \]

\[ AG = 7.81\text{ cm} \]

2) The diagram shows a box in the shape of a cuboid. 
\[ AB = 8\text{cm}, \ BC = 11\text{cm} \]

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.

\[ AE = \sqrt{18^2 - 11^2 - 8^2} \]

\[ AE = 11.8\text{ cm} \]

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.

\[ AC = \sqrt{20^2 + 17^2 + 8^2} \]

\[ AC = 27.4\text{ cm} \]

4) Two points, \(P\) and \(Q\), lie on coordinate axes.

Find the distance \(PQ\) to 1 decimal place.

\[ D^2 = x^2 + y^2 + z^2 \]

\[ P (2, 3, 1) \quad Q (7, 5, 2) \]

\[ D^2 = (7 - 2)^2 + (5 - 3)^2 + (2 - 1)^2 \]

\[ D^2 = 5^2 + 2^2 + 1^2 \]

\[ D = \sqrt{30} \]

\[ D = 5.5 \]
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 $21^\circ$ 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.
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.

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.
1) \(ABC\) is a triangle. 
\(AC = 8\) cm. 
\(BC = 10\) cm. 
Angle \(ACB = 42^\circ\)

Calculate the area of triangle \(ABC\). 
Give your answer correct to 3 significant figures.

2) \(ABC\) is a triangle. 
\(AB = 20\) cm. 
\(BC = 18\) cm. 
Angle \(ABC = 144^\circ\)

Calculate the area of triangle \(ABC\). 
Give your answer correct to 3 significant figures.

3) \(ABC\) is a triangle. 
\(AC = 23\) cm. 
\(BC = 31\) cm. 
Angle \(BAC = 54^\circ\). 
Angle \(ABC = 39^\circ\)

Calculate the area of triangle \(ABC\). 
Give your answer correct to 3 significant figures.
1) \[ A = \frac{1}{2}ab\sin C \]\n
\[ \text{ABC is a triangle.} \]
\[ AC = 8 \text{ cm.} \]
\[ BC = 10 \text{ cm} \]
\[ \text{Angle } ACB = 42^\circ \]

Calculate the area of triangle ABC. 26.8 cm²
Give your answer correct to 3 significant figures.

2) \[ A = \frac{1}{2}ab\sin C \]\n
\[ \text{ABC is a triangle.} \]
\[ AB = 20 \text{ cm.} \]
\[ BC = 18 \text{ cm} \]
\[ \text{Angle } ABC = 144^\circ \]

Calculate the area of triangle ABC. 106 cm²
Give your answer correct to 3 significant figures.

3) \[ A = \frac{1}{2}ab\sin C \]\n
\[ \text{ABC is a triangle.} \]
\[ AC = 23 \text{ cm.} \]
\[ BC = 31 \text{ cm} \]
\[ \text{Angle } BAC = 54^\circ \]
\[ \text{Angle } ABC = 39^\circ \]

Calculate the area of triangle ABC. 356 cm²
Give your answer correct to 3 significant figures.
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 \( \pi \) 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 \( \pi \) to be 3.142.
      Give your answer correct to 3 significant figures.

2) A sphere has a radius of 12 cm.
   
   a) Calculate the volume of the sphere.
      Take \( \pi \) to be 3.142.
      Give your answer correct to 3 significant figures.
   
   b) Find the curved surface area of the sphere.
      Take \( \pi \) 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 \( \pi \).
3) A cone has a base radius of 8 cm and a slant height of 10 cm.

Calculate the volume of the cone. \(128\pi\) cm\(^3\)
Leave your answer in terms of \(\pi\).

Find height using Pythagoras
\[
\begin{align*}
10^2 &= 100 \\
8^2 &= 64 \\
\sqrt{36} &= 6
\end{align*}
\]

\[
V = \frac{1}{3}\pi r^2 h
= \frac{1}{3} \times \pi \times 8^2 \times 6
= 128\pi
\]
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.
1) Find the area of the segment shaded in the diagram below. Take \( \pi \) to be 3.142. Give your answer to 3 significant figures.

\[
\text{Area of segment} = \pi r^2 \left( \frac{\theta}{360} \right) - \frac{1}{2} \times 6 \times 6 \times \sin \left( \frac{100^\circ}{2} \right)
\]

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.

a) Work out the radius \( r \) of the base of the smaller cone.

Calculate, to the nearest cm³
b) The volume of the larger cone.

c) The volume of the smaller cone.

d) The volume of the frustum.
1) Find the area of the segment shaded in the diagram below. 13.7 cm²
Take \( \pi \) to be 3.142.
Give your answer to 3 significant figures.

![Diagram of a circle with a sector AOB and a triangle AOB.](image)

- Area of sector AOB: \( \frac{100 \times 3.142 \times 6^2}{360} = 31.42 \)
- 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.

![Diagram of a cone with a smaller cone removed.](image)

- Volume of the larger cone: \( \frac{1}{3} \pi r^2 h = \frac{1}{3} \times 3.142 \times 10^2 \times 40 = 4189.3 \) cm³
- Volume of the smaller cone: \( \frac{1}{3} \pi r^2 h = \frac{1}{3} \times 3.142 \times 2^2 \times 8 = 33.51 \) cm³
- Volume of the frustum: \( 4189.33 - 33.51 = 4155.82 \) cm³

Taking \( \pi \) to be 3.142

- a) Work out the radius \( r \) of the base of the smaller cone.
- Calculate, to the nearest cm³
- b) The volume of the larger cone. 4189 cm³
- c) The volume of the smaller cone. 34 cm³
- d) The volume of the frustum. 4156 cm³
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 $UP = UX$
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.

a) Prove that triangle \(USP\) is congruent to triangle \(TSR\).

\(US = TS\)
\(SP = SR\)
Angle \(USP = 60^\circ + 90^\circ = 150^\circ\)
Angle \(TSR = 60^\circ + 90^\circ = 150^\circ\)
\(USP\) is congruent to \(TSR\) (SAS)

\(X\) 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 \(UP = UX\)
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 $BD = \frac{1}{2} AB$
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 $AQP = angle \ QCR \ (corresponding \ angles)$
- $PQ = BR \ (opposite \ sides \ of \ parallelogram)$
- $BR = RC \ (R \ is \ midpoint \ of \ BC)$
- $\therefore \ PQ = RC$
- $\therefore \ APQ \ is \ congruent \ to \ QRC \ (SAS)$

2) $ABC$ is an equilateral triangle. 

$D$ lies on $BC$. 

$AD$ is perpendicular to $BC$. 

$AB = AC \ (equilateral \ triangle)$

$AD$ is a side in triangles $ADC$ and $ADB$.

$\therefore \ Triangle \ ADC \ is \ congruent \ to \ triangle \ ADB \ (RHS)$

a) Prove that triangle $ADC$ is congruent to triangle $ADB$. 

$\therefore \ AD$ is a side in triangles $ADC$ and $ADB$.

$\therefore \ Triangle \ ADC \ is \ congruent \ to \ triangle \ ADB$

$BD = \frac{1}{2} BC \ (equilateral \ triangles)$

$\therefore \ BD = \frac{1}{2} AB$
1) 

In the diagram,

\[ \overrightarrow{OA} = 4\mathbf{a} \text{ and } \overrightarrow{OB} = 4\mathbf{b} \]

OAC, OBX and BQC are all straight lines.

\[ AC = 2OA \text{ and } BQ : QC = 1 : 3 \]

a) Find, in terms of \( \mathbf{a} \) and \( \mathbf{b} \), the vectors which represent

(i) \( \overrightarrow{BC} \)

(ii) \( \overrightarrow{AQ} \)

Given that \( \overrightarrow{BX} = 8\mathbf{b} \)

b) Show that \( \overrightarrow{AQX} \) is a straight line.

2) 

\[ OAB \text{ is a triangle.} \]

\[ \overrightarrow{OA} = 2\mathbf{a} \]

\[ \overrightarrow{OB} = 3\mathbf{b} \]

a) Find \( \overrightarrow{AB} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

\( P \) is a point on \( AB \) such that \( AP : PB = 2 : 3 \)

b) Show that \( \overrightarrow{OP} \) is parallel to the vector \( \mathbf{a} + \mathbf{b} \).
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 \( \mathbf{a} \) and \( \mathbf{b} \), 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.

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 \( \mathbf{a} \) and \( \mathbf{b} \). \( 3\mathbf{b} - 2\mathbf{a} \) 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 \( \mathbf{a} + \mathbf{b} \).
1) \( OPT \) is a triangle.
\( M \) is the midpoint of \( OP \).
\[ \overrightarrow{OT} = a \]
\[ \overrightarrow{TP} = b \]
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.
\[ \overrightarrow{OA} = a, \quad \overrightarrow{OB} = b \]
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.
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 \(\mathbf{a}\) and \(\mathbf{b}\). 
\[\overrightarrow{OM} = \frac{1}{2}(\mathbf{a} + \mathbf{b})\]

b) Express \(\overrightarrow{TM}\) in terms of \(\mathbf{a}\) and \(\mathbf{b}\). 
Give your answer in its simplest form.
\[\overrightarrow{TM} = \frac{1}{2}(\mathbf{b} - \mathbf{a})\]

2) \(OAB\) is a triangle. 
\[\overrightarrow{OA} = \mathbf{a}, \quad \overrightarrow{OB} = \mathbf{b}\]

a) Find the vector \(\overrightarrow{AB}\) in terms of \(\mathbf{a}\) and \(\mathbf{b}\). 
\[\overrightarrow{AB} = \mathbf{b} - \mathbf{a}\]

\(P\) is the point on \(AB\) so that \(AP : PB = 2 : 1\)

b) Find the vector \(\overrightarrow{OP}\) in terms of \(\mathbf{a}\) and \(\mathbf{b}\). 
Give your answer in its simplest form.
\[\overrightarrow{OP} = \frac{1}{3}(\mathbf{a} + 2\mathbf{b})\]
1) $\overrightarrow{OAB}$ is a triangle.

$\overrightarrow{OA} = \mathbf{a}, \quad \overrightarrow{OB} = \mathbf{b}$

a) Find the vector $\overrightarrow{AB}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

$P$ 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) $\overrightarrow{OX} = 2\mathbf{a} + \mathbf{b}$

$\overrightarrow{OY} = 4\mathbf{a} + 3\mathbf{b}$

a) Express the vector $\overrightarrow{XY}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

Give your answer in its simplest form.

$\overrightarrow{XYZ}$ is a straight line.

$XY : YZ = 2 : 3$

b) Express the vector $\overrightarrow{OZ}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

Give your answer in its simplest form.
1) \( \overrightarrow{OAB} \) is a triangle.

\( \overrightarrow{OA} = \mathbf{a}, \overrightarrow{OB} = \mathbf{b} \)

a) Find the vector \( \overrightarrow{AB} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

\( \overrightarrow{AB} = \mathbf{b} - \mathbf{a} \)

\( P \) is the point on \( AB \) so that \( AP : PB = 3 : 2 \)

b) Show that \( \overrightarrow{OP} = \frac{1}{5} (2\mathbf{a} + 3\mathbf{b}) \)

2) \( \overrightarrow{OX} = 2\mathbf{a} + \mathbf{b} \)

\( \overrightarrow{OY} = 4\mathbf{a} + 3\mathbf{b} \)

a) Express the vector \( \overrightarrow{XY} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

Give your answer in its simplest form.

\( \overrightarrow{XY} = 2(\mathbf{a} + \mathbf{b}) \)

\( XYZ \) is a straight line.

\( XY : YZ = 2 : 3 \)

b) Express the vector \( \overrightarrow{OZ} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

Give your answer in its simplest form.

\( \overrightarrow{OZ} = 7\mathbf{a} + 6\mathbf{b} \)
1) The diagram shows a trapezium $PQRS$. 
\[ PQ = a \quad \text{and} \quad QR = b. \]
$PS$ is three times the length of $QR$.

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 $AC$.

$\overrightarrow{AP} = p$ and $\overrightarrow{AQ} = q$.

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) $OAB$ is a triangle.

$D$ is the midpoint of $OB$.

$C$ is the midpoint of $AB$.

$\overrightarrow{OA} = a$ and $\overrightarrow{OB} = b$.

(i) Find $\overrightarrow{OC}$ in terms of $a$ and $b$.

(ii) Show that $DC$ is parallel to $OA$. 
1) The diagram shows a trapezium $PQRS$. 
$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{QR} = \mathbf{b}$.
$PS$ is three times the length of $QR$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, expressions for

a) $\overrightarrow{QP}$  

b) $\overrightarrow{PR}$  

c) $\overrightarrow{PS}$  

d) $\overrightarrow{QS}$

$\overrightarrow{QS} = \overrightarrow{QP} + \overrightarrow{PS} = -\mathbf{a} + 3\mathbf{b}$

2) In triangle $ABC$, $P$ and $Q$ are the midpoints of $AB$ and $AC$.

$\overrightarrow{AP} = \mathbf{p}$ and $\overrightarrow{AQ} = \mathbf{q}$.

a) Find, in terms of $\mathbf{p}$ and $\mathbf{q}$, 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) $OAB$ 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 $\mathbf{a}$ and $\mathbf{b}$.

$\overrightarrow{OC} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

(ii) Show that $DC$ is parallel to $OA$.

$\overrightarrow{DC} = \frac{1}{2}\overrightarrow{OA} + \frac{1}{2}\overrightarrow{AB}$

$= -\frac{1}{2}\mathbf{b} + \frac{1}{2}(\mathbf{a} + \mathbf{b})$

$= \frac{1}{2}\mathbf{a}$

Therefore $\overrightarrow{DC}$ is parallel to $\overrightarrow{OA}$
1) **PQRSTU** is a regular hexagon.

\[ \overrightarrow{PQ} = p \quad \overrightarrow{QR} = q \quad \overrightarrow{PS} = 2q \]

a) Find the vector \( \overrightarrow{PR} \) in terms of \( p \) and \( q \).

\[ \overrightarrow{PR} = \overrightarrow{RX} \]

b) Prove that \( \overrightarrow{PQ} \) is parallel to \( \overrightarrow{SX} \)

2) **ABCD** is a trapezium with \( BC \) parallel to \( AD \).

\[ \overrightarrow{AB} = 3\, b \quad \overrightarrow{BC} = 3\, a \quad \overrightarrow{AD} = 9\, a \]

M is the midpoint of \( BC \) and \( N \) is the midpoint of \( AD \).

a) Find the vector \( \overrightarrow{MN} \) in terms of \( a \) and \( b \).

\( X \) is the midpoint of \( MN \) and \( Y \) is the midpoint of \( CD \).

b) Prove that \( \overrightarrow{XY} \) is parallel to \( \overrightarrow{AD} \).
1) \[ PQSTU \] is a regular hexagon.
\[ \overrightarrow{PQ} = p \quad \overrightarrow{QR} = q \quad \overrightarrow{PS} = 2q \]

a) Find the vector \( \overrightarrow{PR} \) in terms of \( p \) and \( q \).
\[ \overrightarrow{PR} = \overrightarrow{RX} \]

b) Prove that \( PQ \) is parallel to \( SX \)

\[ \overrightarrow{PR} = p + q \]
\[ \overrightarrow{SR} = \overrightarrow{SP} + 2\overrightarrow{PR} = -2q + 2(p + q) = 2p \]

Therefore \( \overrightarrow{PQ} \) is parallel to \( \overrightarrow{SX} \)

2) \[ ABCD \] is a trapezium with \( BC \) parallel to \( AD \).
\[ \overrightarrow{AB} = 3b \quad \overrightarrow{BC} = 3a \quad \overrightarrow{AD} = 9a \]

M is the midpoint of \( BC \) and \( N \) is the midpoint of \( AD \).
a) Find the vector \( MN \) in terms of \( a \) and \( b \).
\[ \overrightarrow{MN} = 3a - 3b \]

\( X \) is the midpoint of \( MN \) and \( Y \) is the midpoint of \( CD \).
b) Prove that \( XY \) is parallel to \( AD \).

Working for part b)
\[ \overrightarrow{XY} = \overrightarrow{XN} + \overrightarrow{NB} + \overrightarrow{DY} \]
\[ = \frac{1}{2}\overrightarrow{MN} + \overrightarrow{NB} + \overrightarrow{DY} \]
\[ = \frac{1}{2}(3a - 3b) + 4\frac{1}{3}a + \overrightarrow{DY} \]
\[ = 6a - 1\frac{1}{3}b + \overrightarrow{DY} \]
\[ \overrightarrow{DY} = \frac{1}{3}\overrightarrow{DC} \]
\[ = \frac{1}{3}(\overrightarrow{DA} + \overrightarrow{AB} + \overrightarrow{BC}) \]
\[ = -4\frac{1}{3}a + 1\frac{1}{3}b + 1\frac{1}{3}a \]
\[ = 1\frac{1}{3}b - 3a \]
\[ \overrightarrow{XY} = 6a - 1\frac{1}{3}b + 1\frac{1}{3}b - 3a \]
\[ = 3a \]
Therefore \( \overrightarrow{XY} \) is parallel to \( \overrightarrow{AD} \)
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.

<table>
<thead>
<tr>
<th>Weight ((w)) kg</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0 &lt; w \leq 2)</td>
<td>40</td>
</tr>
<tr>
<td>(2 &lt; w \leq 3)</td>
<td></td>
</tr>
<tr>
<td>(3 &lt; w \leq 4)</td>
<td>24</td>
</tr>
<tr>
<td>(4 &lt; w \leq 5)</td>
<td>18</td>
</tr>
<tr>
<td>(5 &lt; w \leq 8)</td>
<td></td>
</tr>
</tbody>
</table>

b) Use the table to complete the histogram.
1) The table and histogram give some information about the weights of parcels received at a post office during one Thursday.

<table>
<thead>
<tr>
<th>Weight (w) kg</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; w ≤ 2</td>
<td>40</td>
</tr>
<tr>
<td>2 &lt; w ≤ 3</td>
<td>34</td>
</tr>
<tr>
<td>3 &lt; w ≤ 4</td>
<td>24</td>
</tr>
<tr>
<td>4 &lt; w ≤ 5</td>
<td>18</td>
</tr>
<tr>
<td>5 &lt; w ≤ 8</td>
<td>12</td>
</tr>
</tbody>
</table>

a) Use the histogram to complete the frequency table.

b) Use the table to complete the histogram.
1) The incomplete table and histogram give some information about the heights (in cm) of some plants.

<table>
<thead>
<tr>
<th>Height ($h$ cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100 &lt; h \leq 130$</td>
<td>30</td>
</tr>
<tr>
<td>$130 &lt; h \leq 150$</td>
<td></td>
</tr>
<tr>
<td>$150 &lt; h \leq 160$</td>
<td></td>
</tr>
<tr>
<td>$160 &lt; h \leq 180$</td>
<td>40</td>
</tr>
<tr>
<td>$180 &lt; h \leq 210$</td>
<td>18</td>
</tr>
</tbody>
</table>

a) Use the histogram to complete the table.

b) Use the table to complete the histogram.
1) The incomplete table and histogram give some information about the heights (in cm) of some plants.

<table>
<thead>
<tr>
<th>Height ($h$ cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100 &lt; h \leq 130$</td>
<td>30</td>
</tr>
<tr>
<td>$130 &lt; h \leq 150$</td>
<td>64</td>
</tr>
<tr>
<td>$150 &lt; h \leq 160$</td>
<td>50</td>
</tr>
<tr>
<td>$160 &lt; h \leq 180$</td>
<td>40</td>
</tr>
<tr>
<td>$180 &lt; h \leq 210$</td>
<td>18</td>
</tr>
</tbody>
</table>

a) Use the histogram to complete the table.

b) Use the table to complete the histogram.
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.
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.

\[6 + 8 + 6 + 5 = 25\]
1) Some trains from Nottingham to Leeds were late. The incomplete table and histogram give some information about how late the trains were.

<table>
<thead>
<tr>
<th>Minutes late (t)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; t \leq 5$</td>
<td>16</td>
</tr>
<tr>
<td>$5 &lt; t \leq 10$</td>
<td>10</td>
</tr>
<tr>
<td>$10 &lt; t \leq 20$</td>
<td></td>
</tr>
<tr>
<td>$20 &lt; t \leq 30$</td>
<td></td>
</tr>
<tr>
<td>$30 &lt; t \leq 50$</td>
<td>8</td>
</tr>
</tbody>
</table>

a) Use the information in the histogram to complete the table.

b) Use the information in the table to complete the histogram.
1. Some trains from Nottingham to Leeds were late. The incomplete table and histogram give some information about how late the trains were.

<table>
<thead>
<tr>
<th>Minutes late ($t$)</th>
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<tbody>
<tr>
<td>$0 &lt; t \leq 5$</td>
<td>16</td>
</tr>
<tr>
<td>$5 &lt; t \leq 10$</td>
<td>10</td>
</tr>
<tr>
<td>$10 &lt; t \leq 20$</td>
<td>12</td>
</tr>
<tr>
<td>$20 &lt; t \leq 30$</td>
<td>6</td>
</tr>
<tr>
<td>$30 &lt; t \leq 50$</td>
<td>8</td>
</tr>
</tbody>
</table>

a) Use the information in the histogram to complete the table.

b) Use the information in the table to complete the histogram.
1) The table and histogram give information about how long, in minutes, some students took to complete a set of homework.

<table>
<thead>
<tr>
<th>Time ($t$) in minutes</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; t \leq 10$</td>
<td>20</td>
</tr>
<tr>
<td>$10 &lt; t \leq 15$</td>
<td></td>
</tr>
<tr>
<td>$15 &lt; t \leq 30$</td>
<td></td>
</tr>
<tr>
<td>$30 &lt; t \leq 50$</td>
<td>62</td>
</tr>
<tr>
<td>$50 &lt; t \leq 60$</td>
<td>23</td>
</tr>
</tbody>
</table>

a) Use the information in the histogram to complete the table.

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1) The table and histogram give information about how long, in minutes, some students took to complete a set of homework.

<table>
<thead>
<tr>
<th>Time (t) in minutes</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; t ≤ 10</td>
<td>20</td>
</tr>
<tr>
<td>10 &lt; t ≤ 15</td>
<td>15</td>
</tr>
<tr>
<td>15 &lt; t ≤ 30</td>
<td>60</td>
</tr>
<tr>
<td>30 &lt; t ≤ 50</td>
<td>62</td>
</tr>
<tr>
<td>50 &lt; t ≤ 60</td>
<td>23</td>
</tr>
</tbody>
</table>

a) Use the information in the histogram to complete the table.

b) Use the table to complete the histogram.
1) The incomplete histogram and table give some information about the distances some students travel to school.

![Histogram](image)

a) Use the information in the histogram to complete the frequency table.

<table>
<thead>
<tr>
<th>Distance ((d \text{ km}))</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0 &lt; d \leq 5)</td>
<td>15</td>
</tr>
<tr>
<td>(5 &lt; d \leq 10)</td>
<td>20</td>
</tr>
<tr>
<td>(10 &lt; d \leq 20)</td>
<td></td>
</tr>
<tr>
<td>(20 &lt; d \leq 40)</td>
<td></td>
</tr>
<tr>
<td>(40 &lt; d \leq 60)</td>
<td>10</td>
</tr>
</tbody>
</table>

b) Use the information in the table to complete the histogram.
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.

<table>
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<td>5 &lt; d ≤ 10</td>
<td>20</td>
</tr>
<tr>
<td>10 &lt; d ≤ 20</td>
<td>25</td>
</tr>
<tr>
<td>20 &lt; d ≤ 40</td>
<td>16</td>
</tr>
<tr>
<td>40 &lt; d ≤ 60</td>
<td>10</td>
</tr>
</tbody>
</table>

b) Use the information in the table to complete the histogram.
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.

<table>
<thead>
<tr>
<th>Time, $t$ seconds</th>
<th>0 &lt; $t$ \leq 10</th>
<th>10 &lt; $t$ \leq 20</th>
<th>20 &lt; $t$ \leq 30</th>
<th>30 &lt; $t$ \leq 40</th>
<th>40 &lt; $t$ \leq 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pupils</td>
<td>6</td>
<td>19</td>
<td>25</td>
<td>36</td>
<td>14</td>
</tr>
</tbody>
</table>

Draw a histogram to illustrate the distribution on the graph paper below.
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.

<table>
<thead>
<tr>
<th>Time, $t$ seconds</th>
<th>$0 &lt; t \leq 10$</th>
<th>$10 &lt; t \leq 20$</th>
<th>$20 &lt; t \leq 30$</th>
<th>$30 &lt; t \leq 40$</th>
<th>$40 &lt; t \leq 60$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pupils</td>
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<td>19</td>
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<td>36</td>
<td>14</td>
</tr>
</tbody>
</table>

Draw a histogram to illustrate the distribution on the graph paper below.
1) The table gives information about the heights, in centimetres, of some 18 year old students.

Use the table to draw a histogram.

<table>
<thead>
<tr>
<th>Height (h cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>135 &lt; h ≤ 145</td>
<td>12</td>
</tr>
<tr>
<td>145 &lt; h ≤ 165</td>
<td>46</td>
</tr>
<tr>
<td>165 &lt; h ≤ 180</td>
<td>45</td>
</tr>
<tr>
<td>180 &lt; h ≤ 190</td>
<td>25</td>
</tr>
<tr>
<td>190 &lt; h ≤ 195</td>
<td>4</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Time (t hours)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; t ≤ ½</td>
<td></td>
</tr>
<tr>
<td>½ &lt; t ≤ 1</td>
<td></td>
</tr>
<tr>
<td>1 &lt; t ≤ 2</td>
<td></td>
</tr>
<tr>
<td>2 &lt; t ≤ 3</td>
<td>27</td>
</tr>
<tr>
<td>3 &lt; t ≤ 5</td>
<td></td>
</tr>
</tbody>
</table>
1) The table gives information about the heights, in centimetres, of some 18 year old students. Use the table to draw a histogram.

<table>
<thead>
<tr>
<th>Height (h cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$135 &lt; h &lt; 145$</td>
<td>12</td>
</tr>
<tr>
<td>$145 &lt; h &lt; 165$</td>
<td>46</td>
</tr>
<tr>
<td>$165 &lt; h &lt; 180$</td>
<td>45</td>
</tr>
<tr>
<td>$180 &lt; h &lt; 190$</td>
<td>25</td>
</tr>
<tr>
<td>$190 &lt; h &lt; 195$</td>
<td>4</td>
</tr>
</tbody>
</table>

2) The histogram shows the amount of time, in hours, that students spend on their homework per week.

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.

<table>
<thead>
<tr>
<th>Time (t hours)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; t &lt; \frac{1}{2}$</td>
<td>5</td>
</tr>
<tr>
<td>$\frac{1}{2} &lt; t &lt; 1$</td>
<td>12</td>
</tr>
<tr>
<td>$1 &lt; t &lt; 2$</td>
<td>34</td>
</tr>
<tr>
<td>$2 &lt; t &lt; 3$</td>
<td>27</td>
</tr>
<tr>
<td>$3 &lt; t &lt; 5$</td>
<td>8</td>
</tr>
</tbody>
</table>
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.
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: \( \frac{3}{8} \times \frac{2}{8} = \frac{6}{64} \)
- Blue and Blue OR White and White: \( \frac{6}{64} + \frac{12}{64} = \frac{18}{64} \)
- White and White: \( \frac{3}{8} \times \frac{4}{8} = \frac{12}{64} \)

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
   - 0.06 × 0.94 + 0.94 × 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)

\[
P(\text{two same colour}) = 1 - P(\text{BBB}) - P(\text{YYY}) - P(\text{RRR}) - P(\text{BYR}) - P(\text{BRY}) - P(\text{YBR}) - P(\text{YRB}) - P(\text{RYB}) - P(\text{RYR})
\]

\[
= 1 - \frac{8}{1000} - \frac{125}{1000} - \frac{27}{1000} - \frac{30}{1000} - \frac{30}{1000} - \frac{30}{1000} - \frac{30}{1000} - \frac{30}{1000} - \frac{30}{1000}
\]

\[
= 1 - \frac{340}{1000}
\]
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.

<table>
<thead>
<tr>
<th>Year group</th>
<th>Number in year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 11</td>
<td>750</td>
</tr>
<tr>
<td>Year 10</td>
<td>700</td>
</tr>
<tr>
<td>Year 9</td>
<td>900</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Year group</th>
<th>Number in year</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>157</td>
</tr>
<tr>
<td>8</td>
<td>180</td>
</tr>
<tr>
<td>9</td>
<td>166</td>
</tr>
<tr>
<td>10</td>
<td>140</td>
</tr>
<tr>
<td>11</td>
<td>132</td>
</tr>
<tr>
<td>12</td>
<td>114</td>
</tr>
<tr>
<td>13</td>
<td>111</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of coins</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>240</td>
</tr>
<tr>
<td>Spain</td>
<td>182</td>
</tr>
<tr>
<td>Germany</td>
<td>133</td>
</tr>
<tr>
<td>Italy</td>
<td>97</td>
</tr>
<tr>
<td>Total</td>
<td>652</td>
</tr>
</tbody>
</table>

Ben takes a sample of 50 coins stratified by country.

Work out the number of coins from Italy in this sample.

4) The table gives information about the number of students in the two years of a sixth form.

<table>
<thead>
<tr>
<th>Year group</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower sixth</td>
<td>399</td>
<td>602</td>
</tr>
<tr>
<td>Upper sixth</td>
<td>252</td>
<td>198</td>
</tr>
</tbody>
</table>

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.
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.

<table>
<thead>
<tr>
<th>Year 11</th>
<th>Year 10</th>
<th>Year 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>750</td>
<td>700</td>
<td>900</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Year group</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number in year</td>
<td>157</td>
<td>180</td>
<td>166</td>
<td>140</td>
<td>132</td>
<td>114</td>
<td>111</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Country</th>
<th>France</th>
<th>Spain</th>
<th>Germany</th>
<th>Italy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of coins</td>
<td>240</td>
<td>182</td>
<td>133</td>
<td>97</td>
<td>652</td>
</tr>
</tbody>
</table>

Ben takes a sample of 50 coins stratified by country.

Work out the number of coins from Italy in this sample. **7 coins**

4) The table gives information about the number of students in the two years of a sixth form.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower sixth</td>
<td>399</td>
<td>602</td>
</tr>
<tr>
<td>Upper sixth</td>
<td>252</td>
<td>198</td>
</tr>
</tbody>
</table>

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**
1) The table below shows the number of employees in each section of a company.

<table>
<thead>
<tr>
<th>Department</th>
<th>Managerial</th>
<th>Sales</th>
<th>Technical</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>18</td>
<td>45</td>
<td>288</td>
<td>549</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Department</th>
<th>Managerial</th>
<th>Sales</th>
<th>Technical</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees in sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) MathsWatch High-School has 798 pupils. The size of each year group is shown below.

<table>
<thead>
<tr>
<th>Year Group</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>77</td>
<td>72</td>
</tr>
<tr>
<td>8</td>
<td>74</td>
<td>79</td>
</tr>
<tr>
<td>9</td>
<td>72</td>
<td>74</td>
</tr>
<tr>
<td>10</td>
<td>93</td>
<td>107</td>
</tr>
<tr>
<td>11</td>
<td>85</td>
<td>65</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Year Group</th>
<th>Boys in Sample</th>
<th>Girls in Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

<table>
<thead>
<tr>
<th>Year Group</th>
<th>Boys in Sample who answered YES</th>
<th>Girls in Sample who answered YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question.
1) The table below shows the number of employees in each section of a company.

<table>
<thead>
<tr>
<th>Department</th>
<th>Managerial</th>
<th>Sales</th>
<th>Technical</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>18</td>
<td>45</td>
<td>288</td>
<td>549</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Department</th>
<th>Managerial</th>
<th>Sales</th>
<th>Technical</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees in sample</td>
<td>2</td>
<td>5</td>
<td>32</td>
<td>61</td>
</tr>
</tbody>
</table>

\[
\frac{100}{900} \times 18 \quad \frac{100}{900} \times 45 \quad \frac{100}{900} \times 288 \quad \frac{100}{900} \times 549
\]

2) MathsWatch High-School has 798 pupils.

   The size of each year group is shown below.

<table>
<thead>
<tr>
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<td>65</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Year Group</th>
<th>Boys in Sample</th>
<th>Girls in Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>(\frac{80}{798} \times 77) 8</td>
<td>(\frac{80}{798} \times 72) 7</td>
</tr>
<tr>
<td>8</td>
<td>(\frac{80}{798} \times 74) 7</td>
<td>(\frac{80}{798} \times 79) 8</td>
</tr>
<tr>
<td>9</td>
<td>(\frac{80}{798} \times 72) 7</td>
<td>(\frac{80}{798} \times 74) 7</td>
</tr>
<tr>
<td>10</td>
<td>(\frac{80}{798} \times 93) 9</td>
<td>(\frac{80}{798} \times 107) 11</td>
</tr>
<tr>
<td>11</td>
<td>(\frac{80}{798} \times 85) 9</td>
<td>(\frac{80}{798} \times 65) 7</td>
</tr>
</tbody>
</table>

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

<table>
<thead>
<tr>
<th>Year Group</th>
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<tr>
<td>10</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

\[8 + 14 = 22\]

\[
\frac{22}{80} \times 100 = 27.5
\]

b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question. **27.5%**