Instructions for Teachers

To search for a specific topic, use the FIND function.

All questions have the method box completed, set to an animation so it won’t be seen on the slide show until clicked.

Solutions are in the notes at the bottom of each slide.

LOs

GOOD
- identify the key techniques required from the question

GOOD +

EXCELLENT
- carry out the key techniques to find an answer

Good + Excellent +
- clearly explain each step taken
- give full answer to question asked
What is the ratio of money spent on clothes to money spent on bus fares?
Washing powder is sold in two sizes, 600 grams and 1500 grams. Which size is better value for money?
Pippa is filling a water tank from a tap that pours at 4cm³/second. The tank is 40cm long, 20cm wide and 10cm tall. Unfortunately there is a small hole 5cm up one side of the tank from which the water leaks at 2cm³/second.

How long does it take to fill the tank?
Nigel’s rent increased from £200 to £220 per week. At the same time, Nigel’s wages increased from £450 to £490 per week. Work out the percentage increase in the amount of money Nigel has left to spend each week.

There is an 8% increase in the amount of money he can spend each week.
There is no single formula for finding all of the primes however, the formula $P_n = n^2 + n + 11$ produces many prime numbers. Look at the first five numbers of the sequence are they prime? Can you find a value for $n$ that does not produce a prime number?
Ace Parking owns two car parks, one at Franton and one at Cefn. Ace Parking wants to increase the capacity of their car parks. Franton is to increase by 20%, whereas Cefn is to increase by 25%.
The capacity of the car park in Cefyn will be twice that of the car park in Franton.
In total there will be 4800 places to park vehicles.
How many more spaces are there now at Cefn than there are at Franton?

- reverse percentages

Source: WJEC Intermediate Textbook
Joel and Billy were exercising at the weekend. Joel walked 15km. Billy jogged 6km, and he did this at a speed which was 4km/hr faster than Joel’s walking pace. Both Billy and Joel took 1 hour to complete their exercise. How fast does Billy jog?
The table shows information about two journeys. The total time of the two journeys is 1 hour. Set up and solve an equation to find the average speed of Journey A.

<table>
<thead>
<tr>
<th>Journey</th>
<th>Distance (km)</th>
<th>Average speed (km/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15</td>
<td>$x$</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>$x + 4$</td>
</tr>
</tbody>
</table>
A company claims the following fuel consumption for two cars:
- Car A: 68 miles per gallon
- Car B: 55 miles per gallon.

Annie drives car A and gets 30% fewer per gallon than claimed. Ben drives car B and gets three-quarters of the consumption claimed.

Annie drives 50,000 miles per year and Ben drives 12,000 miles per year.

Which driver uses more fuel each year?
The diagram shows a cone, which is cut horizontally such that two separate shapes are formed, cone A and frustum B. Both A and B have the same volume. Calculate the length $x$ shown on the diagram.
The length of one side of a triangle is 10cm. Hannah says “the perimeter of the triangle is between 10cm and 20cm”.

Is Hannah

- always true
- sometimes true
- never true

Source: AQA Unit 3
The fare, £\(y\), for a journey is directly proportional to the square root of the distance, \(x\) miles.

The fare is £5.40 for a 3.8 mile journey.

Select the correct sketch graph to represent this information and give its equation.

- proportion
- solving equation

Source: AQA Unit 3
Problem Solving – Answering the Question!

The length of a rectangle is $x$ cm.
The width of the rectangle is 3 cm less than the length.
The perimeter of the rectangle is 40 cm.
Set up and solve an equation to work out the length of the rectangle.

The length is 6.5 cm.
The diagram shows two aircraft, A and B, travelling in opposite directions.

Aircraft B flies on a bearing of 225°. What bearing is aircraft A flying on?
What type of triangle is T?

Not to scale.

Source: AQA Unit 3
What kind of triangle is this?

- triangle

Source: AQA Unit 3
The diagram shows a square with area $100\text{cm}^2$.

Work out the values of $x$ and $y$. 

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**Problem Solving – Answering the Question!**

**Source:** AQA Unit 3
The cost, $C$ pence, of $x$ cups of tea and $y$ cups of coffee is given by

$$C = 30x + 50y$$

(a) Circle the cost of a cup of tea.

- 30p
- 50p
- £30
- £50

(b) Work out the total cost, in pounds, of four cups of tea and five cups of coffee.

(a) 30
(b) £3.70
Problem Solving – Answering the Question!

\( x, y \) and \( x - y \) are all two-digit numbers.
- \( x \) is a square number
- \( y \) is a cube number
- \( x - y \) is a prime number

Find one possible pair of values for \( x \) and \( y \).

One possible solution is:
\[ x = 16, \quad y = 27 \]
so \( x - y = 11 \).
the product is double the sum. Work out the numbers I could be thinking of.
A plasterer uses this formula to work out how much she charges (£C). \( C = 30 + 10A \) A is the area to be plastered to the nearest square metre. How much does she charge for a rectangular ceiling measuring 7.6 m by 2.4 m?
The diagram shows a badge made from two similar pentagons.

Work out the width of the badge.
These patterns are made using sticks. How many sticks in total are needed to make the first 5 patterns?
There are 200 students in Year 10; 110 are boys. There are 250 students in Year 11; 140 are boys. Which year has the greater proportion of boys? You must show your working.
One lap of a racing circuit is 3–km. Work out the total distance for 4–laps.

?
\[ \sqrt{10} (3\sqrt{20} + 7\sqrt{5}) \text{ simplifies to } a\sqrt{2} \]

Work out the value of \( a \)
Problem Solving – Answering the Question!

$2^m = 32$ and $9^p = 3^m$

Work out the values of $m$ and $p$
Put the correct symbol in each box.

Choose from $<$ $>$ $=$

$11 \times 12$ $<$ $22 \times 6$

$3^2$ $<$ $2^3$

$\frac{10}{0.5}$ $<$ $10$

Source: CALCULATIONS
Problem Solving – Answering the Question!

Here are three offers for a computer.

- **Tablet World**
  - Usual price £170
  - 20% off

- **IT Supplies**
  - Usual price £180
  - $\frac{1}{4}$ off

- **PC Heaven**
  - Special offer
  - Pay £23 each month for 6 months

Which offer is the cheapest? You **must** show your working.

Source: CALCULATIONS
Problem Solving – Answering the Question!

Charge, $C$ (£)

Time taken, $t$ (minutes)
In year 1, the value of a watch increases by 12%. In year 2, the value increases by the same amount of money as in year 1. The owner wants to work out the value of the watch at the end of year 2. Which multiplier can be used with the original value to work this out? Circle your answer. [1 mark] 1.12 1.24 1.122 1.242

11 (b) In year 1, the value of a car decreases by 12%. In year 2, the value decreases by 12% of the value at the end of year 1. The owner wants to work out the value of the car at the end of year 2. Which multiplier can be used with the original value to work this out? Circle your answer. [1 mark] 0.76 0.88 0.762 0.882
Kerry needs – of a tank of petrol to drive home. She has – of a tank of petrol. Does she have enough petrol to drive home? You must show your working.
Customers at a shop who spend £100 or more can pay by these methods. A 12 payments Each payment is 10% of the cost price B 24 payments Each payment is 6% of the cost price C 36 payments Each payment is 4% of the cost price Which method is the cheapest? You must show your working.
These points are in a straight line.
Point 1 (4, 6)
Point 2 (8, 10)
Point 3 (12, 14)
Point 4 (16, 18)
Write down the coordinates of Point n in this sequence.
A tin contains red beads, white beads and blue beads in the ratio red : white : blue = $x : 2x : x^2$

(a) Show that the fraction of blue beads in the tin is $\frac{x}{x+3}$

(b) The percentage of blue beads is 90%
Work out the value of $x$. 

Source: CALCULATIONS
A sequence increases by 5 each time. The first term is \( x \).

(a) Write down an expression for the second term.

(b) The sum of the first four terms is 54. Set up and solve an equation to work out the value of \( x \).
Brianair calculate the cost of checking in a suitcase using the table below.

<table>
<thead>
<tr>
<th>Weight of suitcase</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 15 kg</td>
<td>Free</td>
</tr>
<tr>
<td>15 kg – 22 kg</td>
<td>£20</td>
</tr>
<tr>
<td>Over 22 kg</td>
<td>£20 plus £5 for each extra kilogram or part of a kilogram over 22 kg</td>
</tr>
</tbody>
</table>

A different airline, SimplePlane, has a fixed charge of £6 then charges £2 per kilogram.

Kate has a suitcase which weighs more than 22kg. She finds that both companies will charge the same for her suitcase. What is the weight of her suitcase?
Alf claims that he stopped for less than one-quarter of his total journey time. Is he correct? You must show your working.
On Sunday I earn £50 more than on Saturday. Altogether I earn £600. Work out how much I earn on Saturday.
One day 460 people visit a zoo.
280 are adults.
The ratio of adult women to adult men is 4 : 3
5
9
of the children are boys.
Jane says that altogether there were more females. Show that she is correct.
Show that $x^2 - 8x + 20$ can be written in the form $(x - a)^2 + a$ where $a$ is an integer.

Hence explain how you know that $x^2 - 8x + 20$ is always positive.
Alice has £4. Billie has twice as much as Alice. Billie has two-thirds of the amount Chris has. The amount Chris has is four-fifths of his age in years. How old is Chris?
Given that \( a = 5, \ b = -8, \ c = -4 \)

work out the value of \( \frac{ac - b}{c + 2} \)
Smith and Jones both play for a local football team. Which player has the higher proportion of goals scored per game played? You must show your working.

<table>
<thead>
<tr>
<th></th>
<th>Goals scored</th>
<th>Games played</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith</td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td>Jones</td>
<td>8</td>
<td>32</td>
</tr>
</tbody>
</table>

\[ \text{Proportion for Smith} = \frac{6}{27} \]

\[ \text{Proportion for Jones} = \frac{8}{32} \]

\[ \text{Proportion for Smith} = \frac{1}{4.5} \approx 0.222 \]

\[ \text{Proportion for Jones} = \frac{1}{4} = 0.25 \]

Jones has the higher proportion of goals scored per game played.
Circle the correct formula for hiring a car from Roy’s Rentals. 

- \( C = 20d + 100 \)
- \( C = 10d + 20 \)
- \( C = 20d + 10 \)
- \( C = 5d + 20 \)

The cost of hiring a car from First Cars is given by the formula 

\( C = 8d + 30 \)
The diagram shows three identical rectangles that have their sides parallel to the axes.
Find the co-ordinates of point C.

C = (9,8)
Phoebe drops her camera off the top of the leaning tower of Pisa. It falls to the ground, 3m from the base of the tower. The tower was leaning at an angle of 87.1° to the ground. Given that the final velocity, \( v \), is given by

\[
v^2 = 19.6s
\]

where \( s \) is distance, calculate the speed at which the camera hits the ground.

The camera hits at 34.1m/s.
Problem Solving – Answering the Question!

\[ x = 1.0\dot{2} \text{ and } y = 0.\dot{4} \]

Show that \( x - y \) is greater than \( \frac{5}{9} \)

\[ x - y \text{ is } \frac{26}{45} \text{ which is greater than } \frac{25}{45}, \text{ i.e. } \frac{5}{9} \]

Source: Miss Jo Morgan
Look at the series of diagrams.

How many squares are in a diagram 50?

There are 197 squares.
The ‘Bermuda triangle’ is claimed to be 500,000 square miles in area. It is a triangle connecting Miami, San Juan and Bermuda. How far out is the claim?

- sine rule
- area of a triangle

The area is 62,188 square miles less than the claim.
A swimming club has junior, senior and veteran members. The ratio of juniors to seniors is 3:2. The ratio of seniors to veterans is 5:2. Which of the following could be the total number of members in the club?

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30</td>
<td>B</td>
<td>35</td>
<td>C</td>
</tr>
<tr>
<td>D</td>
<td>58</td>
<td>E</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

58 is the only possible total number of members.
Each side of an isosceles triangle is a whole number of cm. Its perimeter is 20cm. How many possibilities are there for the length of its sides?

- perimeter
- isosceles
Explain why the 1st of April is always on the same day of the week as the 1st of July.
In a wipeout game, one number is chosen to be removed from a list, but the mean must be a whole number. What number should be wiped out from the list below?
1, 2, 3, 4, 5, 6
Lech went on holiday from his home in Wales to Poland. Before going, he went into his local money exchange shop to buy some Polish zloty. Lech only had £250 to spend on buying zloty. He wanted to buy as many zloty as possible. Unfortunately, the money exchange shop only had 50 zloty notes. The exchange rate to buy zloty was £1 = 4.37 zloty. How much did Lech pay for the zloty?
Sabrina sees the following advertisement.

**Money Today**
Borrow today - why wait until payday?
Costs 1% per day compound interest

Sabrina knows that she will be paid in 2 weeks’ time. She decides to borrow £400 for a period of 2 weeks. How much will Sabrina have to pay back after 2 weeks? Show all your working.

**CALCULATIONS**

- money
- compound interest
- percentage multipliers
Vijaya the racing driver is in a 400km race. For the first 6% of the race, she averages 210km/h. She then drives 100km in 35 minutes. What average speed does she need to achieve for the remainder of the race to finish the whole race in 2 hours?
The diagram shows 15 identical circles, arranged as a rectangle, and a shaded triangle. The vertices of the triangle are at the centre of the circles. Calculate the area and perimeter of the triangle.
The ratio of the length : height : depth of this cuboid is 1:2:3.
The total surface area is 4950cm². Calculate the volume of the cuboid.
Three dice are numbered 1 to 6. Two of them are red and one is blue. All three dice are rolled. What is the probability that the total on the two red dice will be equal to the score on the blue dice?
Three numbers have a mean of 23.
Two of the numbers have a mean of 12.
Two of the numbers have a mean of 30.
What are the three numbers?

The numbers are 9, 21 and 39.
Posters cost £2.75 each. You have to pay postage and packing charges as well. These are given in the table. Zeke has £50. How many posters can he get by post if he spends £50?

<table>
<thead>
<tr>
<th>Postage and packing</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 10 posters</td>
<td>£3.25</td>
</tr>
<tr>
<td>11 to 20 posters</td>
<td>£6.00</td>
</tr>
<tr>
<td>21 to 30 posters</td>
<td>£8.75</td>
</tr>
<tr>
<td>over 30 posters</td>
<td>£11.50</td>
</tr>
</tbody>
</table>

He can buy 16 posters.
The table below shows the change in the value of Seesaw plc shares over the last three years.

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in value</td>
<td>+25%</td>
<td>−40%</td>
<td>+40%</td>
</tr>
</tbody>
</table>

*Note: the percentage change each year is based upon the value at the start of that year and the end of that year.*

Calculate the percentage change in Seesaw plc shares from the start of 2004 to end of 2006.
42 members of Arwick Youth Club go on a trip to a leisure centre (including 2 staff). They go on minibuses that can seat up to 15 people each.

It costs £30 for each minibus and £150 for the group to have use of the leisure centre.

How much will the trip cost per person (staff do not pay)?

It costs £6 per person.
A right-angled triangle has an area of \((3\sqrt{3} - 4)\text{cm}^2\) and a base length of \(4 + 6\sqrt{3}\text{cm}\). Find the height \(h\) of the triangle in the form \((a + b\sqrt{3})\text{cm}\).
A ball is dropped and bounces up to a height that is 75% of the height from which it was dropped. It then bounces again to a height that is 75% of the previous height and so on. How many bounces does it make before it bounces up to less than 25% of the original height from which it was dropped?
Which is better, two 20% discounts or a 40% discount?

- percentages

Source: Robin Schwartz
A cube has edges of 10cm each. Three slices, each of thickness x cm, are cut off the cube. Slice A is cut off the side, slice B is cut off the top and slice C is cut off the front. What is the volume of each slice in terms of x?
A cube is cut into three parts by two vertical slices. Find the volume of the shaded part.
The average person’s body has 8 pints of blood within it. When blood is donated, 500ml is given. What percentage of the total blood is this?

- percentage
- unit conversion: \(1 \frac{3}{4} \text{ pints} = 1 \text{ litre}\)
It costs £10,000 to transport 0.5kg of material to the international space station. There are 6 people on the space station each needing 2 litres of water a day. The cost of recycling is 0.1% of the cost of transporting into space. How much money is saved per day by the recycling water for the 6 people?
Find all the pairs of values where 
\[(2x + a)(x + b)\] is equivalent to \[2x^2 - 18\]
Explain why \( B-A \) is always a multiple of 7.
There are seven numbers in a sequence. The difference between a term and the next one in the sequence is always the same amount. The middle term of the sequence is $m$.

Find in terms of $m$ the sum of the seven numbers.
A long straight coil of wire can be used to generate a nearly uniform magnetic field similar to that of a bar magnet. Such coils, called solenoids, have an enormous number of practical applications.

The size of the magnetic field is given by the formula $B = \mu n I$

where $B$ is the magnetic field, $\mu$ is the permeability, $n$ is the number of circle coils per metre and $I$ is the current.

A solenoid has a length of 20cm and a diameter of 7.9cm. Wrapped around it is 3m of wire.

(a) Show that the number of coils per metre is 36.

(b) Given a permeability of $2.5 \times 10^{-4}$ and a magnetic field of 1.2, calculate the current in the wire.
p and q are two integers, each greater than zero. p is greater than q.
The square of the sum of p and q is 100.
The square of the difference of p and q is 64.
Find the values of p and q.
A model of a bridge component is being made. It is composed of triangle BDE and has a supporting strut AC. The model is scaled at 1:500. Calculate the length of AC for the real bridge.
A child’s train is being constructed and is shown in the diagram. The train wheels will be cut from a rectangular piece of wood with a width of 90cm. The wheels are identically sized. Another component is needed to hold the wheels in line, connecting A with B.

(a) What percentage of wood will be wasted in cutting the wheels?
(b) What is the distance AB?
A length of tape is 135 centimetres long. It is cut into two pieces. The first piece is twice as long as the second piece. How long is the shorter of the two pieces of tape?
The propeller on a Red Bull racer turns 50 times each second. The tip of the propeller is travelling at 340 m/s, the speed of sound. Calculate the radius, $r$, of the propeller.
Three different numbers multiply together to make 1000.

(a) Explain why 8 could be one of the numbers but 9 could not.
(b) Explain why at least one of the numbers must be less than 10.
(c) If one of the numbers is 125, would the other two have to be even? Explain your answer.
These towers are made of identical hexagons and identical rectangles. Calculate the height of the smallest tower.
Problem Solving – Answering the Question!

An equilateral triangle has a perimeter of 12 cm. Two of the triangles are joined together, edge to edge. What is the new perimeter?

Source: AQA GCSE Problem-Solving Questions, 2008 - Additional Mathematics
The cost of hiring a boat is £4.50 for the first hour and then £2.50 for each hour after that.

(a) Write a word formula for the cost of hiring a boat, in terms of the number of hours.

(b) Vicky and her friends want to hire a boat. They can afford £12 at most. How many hours can they hire the boat for?
The diagram shows a square of side length $x$ with two rectangles cut out of it.

Find the perimeter of the shaded shape in terms of $x$ and $y$. 

Source: CALCULATIONS
‘Purple fire’ paint is made by mixing red and blue paint in the ratio 3 : 1

‘Purple sea’ paint is made by mixing red and blue paint in the ratio 1 : 3

1 litre of purple fire paint is mixed with 500 millilitres of purple sea by mistake.

How much red paint needs to be added to the mixture to make it purple fire again?
Five times a number gives the same answer as adding 24 to the number. What is the number?
7 6 5 4

Arrange these four digits to make the number that is the closest possible to 5000.
Show clearly that the mean and median of $\sqrt{3}, \sqrt{12}, \sqrt{48}$ and $\sqrt{75}$ are equal.

The mean and median are both $3\sqrt{3}$
Before a sale, a store sells a shirt for £24 plus VAT at 20%. During the sale the store reduces the price you have to pay for the shirt by one quarter. How much will you have to pay for the shirt in the sale?

Source: WJEC Unit 1 Maths in Everyday Life
The mass of an object is 80g correct to 2sf and the volume is 115cm³ to 3sf. Calculate the maximum possible density of the object.
Problem Solving – Answering the Question!

John is making a pendulum by tying a mass on the end of a string. The time, in seconds, for one complete swing of the pendulum is given by the formula:

\[ T = 2\pi \sqrt{\frac{L}{9.8}} \]

Where \( L \) is the length of the pendulum, in metres.

John wants the time for one swing to be 1 second so that he can use it as a timer. Work out the length of the pendulum.

Source: Mrs Greenwood
Pierre is one quarter of his father’s age.
In 16 years’ time he will be half his father’s age.
How old is Pierre?
Aaron and Ben have some sweets. If Aaron gives Ben 10 sweets, they will have the same number of sweets. If Ben gives Aaron 10 sweets, Aaron will have twice as many as Ben. How many sweets does each person have?

- writing equations
- solving equations
The ratio of the ages of Jack and Kate is 1:2. In ten years’ time the ratio will be 2:3. How old are Jack and Kate?
Jeremy likes Hondas. He owns some cars and some motorcycles. There are 9 Hondas all together. They have a total of 26 tires. How many of the Hondas are motorcycles?
There was a war on the planet Grumble. It lasted 1,000 days. If the planet Grumble uses the same calendar that we use on Earth, and the 1,000-day war started on a Monday in March of a leap year, what day of the week did the 1,000-day war end?

The war ended on a Sunday.
A restaurant has a total of 60 tables. Some of the tables can seat 4 people and some can seat 2 people. All of the seats are occupied when there are 160 people seated. How many tables for 4 are there than tables for 2?

There are 20 more tables for 4 than tables for 2.
Tommy has a 12-hour clock. The clock runs continuously without stopping. It is currently 2:00 p.m. What time will be shown on Tommy’s clock 1,000 hours from now? Will it be a.m. or p.m.?
Sammy and Elyse work at the same grocery store. They are both part-time employees. Elyse is always scheduled to work 1 day and then has 5 days off. Sammy works 1 day and then has 8 days off. The store is open every day. If Elyse and Sammy both worked on Wednesday, when is the next time they will both be scheduled on the same day?

? lowest common multiple

They will next work together on a Sunday.

Source: George Mason University – Challenge and Logic Puzzles
The golden ratio is a positive number $G$ with the property that the square of $G$ is one more than $G$. That is: $G^2 = G + 1$

Find the exact value of $G$. 
Here is a useful fact: $\sin(60) = \frac{\sqrt{3}}{2}$

The length of each side of an equilateral triangle is $a$ cm.

(a) Show that the area of the triangle is $\frac{\sqrt{3}}{4} a^2$ cm$^2$  

(b) Find a formula for the area of a regular hexagon of side $a$ cm.
The nth term of one sequence is \( n^2 + 1 \)
The nth term of a second sequence is \( 100 - 2n \)
Which terms appear in both sequences?
How many red squares, blue squares and total squares will be in pattern 40?

- sequences
- quadratic
The formula for a person’s body mass index ($I$) is $I = \frac{M}{H^2}$ where $M$ is mass in kg and $H$ is height in metres.

Jack’s mass is 85kg. He says “my body mass index is less than 25.”

What can you say about his height?
The diagram shows a square of side 24cm. There are four circle of equal size inside the square. Find the area of the shaded region, not covered by the circles.

**Information**
- area of circle
- area of square

**Calculations**

**Source:** Mrs Greenwood
The points A and B are 5m apart. A wheel makes 2 complete rotations in moving from A to B. Find the radius of the wheel.
A 4m plank, CB, is leaning against a low wall, AX, which is 1.2m high. The other end of the plank is on the ground. The angle between the plank and the ground is 24°. Find the length of AB, the amount by which the end of the plank hands over the wall.

**Source:** Mrs Greenwood
$N$ is a three-digit number.
The product of the digits of $N$ is 6.
How many different possible value are there for $N$?

- combinatorix
- factors
- product

Source: Mrs Greenwood
Byron is swimming lengths in a pool. He has a target of the number of lengths he wants to swim. At one point he has swum half his target. After six more lengths he has swum three-fifths of this target. Work out his target.
Mick has a bag of biscuits. If he shares them equally among 5 people there will be one biscuit left over. If he shares them equally among 7 people there will be one biscuit left over. Work out the smallest possible number of biscuits in the bag.

The smallest number of biscuits is 36.
A and B are two-digit numbers.

\[ \sqrt{A} \div \sqrt{B} = 3 \]

Work out the values of A and B.

\[ A = 99, B = 11 \]
\[ \text{or} \]
\[ A = 90, B = 10 \]
John is thinking of a three-digit number. He halves the number and subtracts 4. He does the same thing with the answer. After he has done this several times, the answer is 1. What could his number have been?
Katie is baking a cake. The recipe requires 300g of flour for a 20cm tin. She will be using a 17.5cm square tin. She wants the cake to be the same height as the cake in the recipe. How much flour does she need?
When a ball bounces it rises to 70% of the height it fell from. The ball is dropped from 2 metres. How many times will it bounce before it rises less than 50cm?

After the 4\textsuperscript{th} bounce it will not rise above 50cm.
What are the units digits for $3^{30}$?
Give a reason for your answer.

- **index laws**
- **pattern spotting**

The units digit will be 9.
Karla works 40 hours each week and receives an hourly rate of pay. She gets a pay rise of 10%. She decides to reduce the number of hours she works each week by 10%. How will the amount of money she earns each week change?

It will go down by 1%.
On a farm there are goats, sheep and chickens. The ratio of goats to sheep is 2:3. The ratio of sheep to chickens is 2:5. What is the ratio of goats to chickens?
Two fractions add up to 1.
The difference between them is \( \frac{3}{4} \).
What are the fractions?

The fractions are \( \frac{1}{8} \) and \( \frac{7}{8} \).
Jodi and Karl each throw a dice. Find the probability that Jodi throws a higher number than Karl.

Jodi has a chance of \( \frac{5}{12} \) of throwing a higher number than Karl.
Two cars are on a motorway travelling at 63 miles per hour. The cars are 40m apart. By using the two-second rule, decide if these cars are safe.
A circle passes through the vertices of an equilateral triangle. The perimeter of the triangle is 30cm. Calculate the circumference of the circle.
Radio signals travel at $3 \times 10^8$ m/s. The distance from the Earth to the Moon is 239,000km. How long does it take for a radio signal to travel from the Earth to the Moon?
Marlon went to New Zealand on holiday. After he arrived he exchanged £800 for New Zealand dollars. He spent 1391 dollars in New Zealand. At the end of his visit he changed the dollars he had left over into as many 10 dollar notes as possible. He kept these 10 dollar notes. He placed the rest of the money in a charity box at the airport. On his return to the U.K. he changed the 10 dollar notes into pounds (£). The exchange rate for buying dollars when he arrived in New Zealand was £1 = 2.08 dollars. The exchange rate for selling dollars when he returned to the U.K. was £1 = 2.25 dollars. How many pounds did he receive on his return?
The diagram shows a trapezium, whose area is $36\text{cm}^2$. Calculate the length of the shortest side of the trapezium.

- solving equation
For a ladder to be safe it must be inclined between 70° and 80° to the ground.

The diagram shows a ladder resting against a wall.

Is it safe?

You must show your working.
On 25 April 2013, David exchanged £650 into Russian roubles before departing for Moscow. During his stay in Moscow he spent 21240 roubles. He returned to the UK on 7 May 2013 and exchanged the roubles he had left into pounds. Data on the exchange values at these times is shown below.

Calculate how much he received for his roubles on his return to the UK. Give your answer correct to the nearest penny.

<table>
<thead>
<tr>
<th></th>
<th>25 April 2013</th>
<th>7 May 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion from pounds</td>
<td>£1 = 43.2 roubles</td>
<td>£1 = 44.7 roubles</td>
</tr>
<tr>
<td>Conversion back to pounds</td>
<td>£1 = 48.8 roubles</td>
<td>£1 = 49.5 roubles</td>
</tr>
</tbody>
</table>

**CALCULATIONS**

?  

- exchange rates
Problem Solving – Answering the Question!

The formula used for converting a temperature measured in degrees Celsius (°C) to its value in degrees Fahrenheit (°F) is

\[ F = \frac{9C}{5} + 32 \]

Metal is heated to a temperature of 140°F.

Rearrange the formula above such that C is the subject, and use this to calculate the temperature to which the metal is heated in Fahrenheit.

\[ ? \]

• rearranging formulae

Source: WJEC Unit 1 Maths in Everyday Life
An empty cylindrical tank is shown in the diagram.
Water is pumped into the tank at a constant rate of 1800 litres per minute. The pump stops automatically immediately before the tank overflows. For how many whole minutes is water pumped into the tank?
(a) What is the percentage increase in stopping distance from 30mph to 40mph?
(b) Write down a formula relating thinking distance (in m) to speed (in miles per hour)

(a) The stopping distance increases by 36% from 30 to 40mph
(b) TD = 0.3 x Speed
A major high street store employs 3655 people. This is a reduction of 14% in the number of people it employed last year. How many people were employed by the store last year?
Fiona runs at a speed of 10m/s for 40 minutes. Jeremy runs at a speed of 12m/s for 30 minutes. Who runs further and by how much?
The mean of eight numbers is 41. The mean of two of the numbers is 29. What is the mean of the other six numbers?
Kathryn has £3 which is \( \frac{5}{6} \) of the amount he needs to buy a chocolate bar.

What is the meaning of \( 3 \div \frac{5}{6} \)?

(a) The fraction of a candy bar that Kathryn has enough money for.

(b) The cost of a chocolate bar

(c) The number of chocolate bars that Kathryn can buy with £2.50

(d) The cost of \( \frac{5}{6} \) of a chocolate bar
The diagram shows how scores are given in a junior javelin competition.

Javelins landing in the grey area score 10 points, whilst landing in the striped area scores 2 points.

AOB is a sector of a circle, where angle AOB is 70°.

The distance OA is 40m, whilst the distance AC is 15m.

Calculate the percentage of area in which 10 points can be scored.
The diagram shows a square. Work out the perimeter of the square.

- writing equation
- perimeter
The diagram shows how scores are given in a junior javelin competition. Javelins landing in the grey area score 10 points, whilst landing in the striped area scores 2 points. AOB is a sector of a circle, where angle AOB is 70°. The distance OA is 40m, whilst the distance AC is 15m.

All borders must be painted on the field to mark out the zones. Calculate the total distance which must be painted.

\[ \text{Total distance to be painted} = \text{sector area} + \text{percentages} \]
Diana has created a very large sculpture for display in a city centre park. It is called ‘Mother and Child’ and is in the form of a large hemisphere with a small hemisphere attached as shown. The radius of the small hemisphere is one-fifth of the radius of the large hemisphere. The total volume of the sculpture is $456\text{m}^3$. Calculate the radius of the large hemisphere.
(a) Looking only at the two graph lines drawn, how could someone mistakenly think that there has been a greater increase in complaints to the Llankavani council than to the Rossmuch council?

(b) Rerdraw these graphs such that they could be easily compare.
A town planning committee has asked for a report on the percentage increase in the town’s population between 2001 and 2011. Given the following fact, present a clear report to the committee showing all the necessary calculations.

- Population has gone up from 12502 to 14497 between 2001 and 2011.

You should use appropriate approximations.

You must show all your working.
Problem Solving – Answering the Question!

The following is a formula that is used by engineers to measure the velocity of an object travelling in a straight line under certain conditions.

\[ v^2 = u^2 + 2as \]

- \( s \) is the distance travelled from the start
- \( v \) is the object’s velocity after it has travelled a distance \( s \)
- \( u \) is the object’s initial velocity
- \( a \) is the constant acceleration of the object

(a) Rearrange the formula such that \( a \) is the subject.

(b) The initial velocity of an object is 4 metres per second. After travelling a distance of 64 metres, its velocity is 20 metres per second. Find the acceleration of the object.

Source: WJEC Mathematics in Everyday Life Unit 1 Paper
At an oil refinery, it takes 2 hours for 11 pumps to deliver 60 thousand litres of oil to a storage tank. How long would it take for 8 of these pumps to deliver 40 thousand litres of oil to the tank? The rate of delivery is equal and constant for each pump. Give your answer in hours and minutes.
A machine is supposed to deliver a single chemical capsule into a water-purifying tank once every 20 minutes. The timing mechanism used to release the capsules is started when the first capsule is released. The timing mechanism is only accurate to the nearest minute. Calculate both the least number and the greatest number of capsules that could be released into the tank in a period of 24 hours.
A French bus company runs a service from Cherbourg to Rennes, a distance of 172 kilometres. Thierry catches the 13:45 bus at Cherbourg and arrives in Rennes at 16:15. What was the average speed of the bus in miles per hour?

The bus averages 43mph.
A water feature consists of a cone-shaped container filling up with water which, when full, tips its contents into a hemispherical bowl.

Mr Davies buys a cone-shaped container, which has a radius of 19.8 cm and a height of 15 cm. The hemispherical-shaped containers are produced in various sizes. Each hemispherical container holds a whole number of litres, ranging from 2 litres to 10 litres.

What is the diameter, correct to the nearest mm, of the smallest possible hemispherical bowl that Mr Davies should buy in order to collect all the water from his cone-shaped container?
You are asked to check Damian’s homework. He has answered 7 questions. The homework questions and Damian’s answers are given in the table below.

For every false answer, correct it, showing Damian how to find the answer.

<table>
<thead>
<tr>
<th>Question number</th>
<th>Question</th>
<th>Damian’s answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculate $48 + 62$</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Simplify $3a - 5b + 26a - 26b$</td>
<td>$29a + 31b$</td>
</tr>
<tr>
<td>3</td>
<td>Expand $6(x + 2)$</td>
<td>$6x + 12$</td>
</tr>
<tr>
<td>4</td>
<td>Simplify $3(2x + 5) - (x - 3)$</td>
<td>$5x + 12$</td>
</tr>
<tr>
<td>5</td>
<td>Factorise $24x + 8$</td>
<td>$8(3x + 0)$</td>
</tr>
<tr>
<td>6</td>
<td>Factorise $3x + 15$</td>
<td>$3(x + 5)$</td>
</tr>
<tr>
<td>7</td>
<td>Find the value of $2a - 3b$ when $a = 6$ and $b = -4$</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: WJEC Mathematics in Everyday Life Unit 1 Paper
A certain number has exactly eight factors, including 1 and itself. Two of its factors are 21 and 35. What is the number?

The number is 105.
Cheryl and Ben planned a cycle ride using a 1 : 25000 scale map. The route they planned measured approximately 83 cm on the map.

After the ride, Cheryl’s cycle-computer showed that she travelled at an average speed of 11.5km/h, for 126 minutes.

How much further did they travel than was expected? Give your answer in metres.
The following comment and graph appeared in a newspaper.

“The number of red squirrels doubled between 2000 and 2005 and doubled again between 2005 and 2010.”

Explain why it is not possible to check from the diagram whether the comment is true or not.
At a particular time, the following three exchange rates were available.

£1 = 1.20 euros, £1 = $1.58, €1 = $1.26

A sum of money is exchanged from pounds (£) to euros. That amount of euros (€) is then changed to dollars ($). Calculate the percentage loss in doing this compared with changing the initial sum of money directly into dollars.
Two websites, Science Now and Planet Along, show the data displayed in the tables below.

What is the difference between the density that would be calculated for Jupiter given the data on each website? Give your answer in kg/m³.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Radius, km</th>
<th>Mass, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>2439</td>
<td>3.30 × 10²³</td>
</tr>
<tr>
<td>Venus</td>
<td>6052</td>
<td>4.87 × 10²⁴</td>
</tr>
<tr>
<td>Earth</td>
<td>6378</td>
<td>5.98 × 10²⁴</td>
</tr>
<tr>
<td>Mars</td>
<td>3397</td>
<td>6.42 × 10²³</td>
</tr>
<tr>
<td>Jupiter</td>
<td>71 492</td>
<td>1.90 × 10²⁷</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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</tr>
<tr>
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<td>6052</td>
<td>4.9 × 10²⁴</td>
</tr>
<tr>
<td>Earth</td>
<td>6378</td>
<td>6.0 × 10²⁴</td>
</tr>
<tr>
<td>Mars</td>
<td>3394</td>
<td>6.4 × 10²³</td>
</tr>
<tr>
<td>Jupiter</td>
<td>71 398</td>
<td>1.9 × 10²⁷</td>
</tr>
</tbody>
</table>
Three farmers shared an order for organic compost between them in the ratio 3 : 4 : 7. Jade got the largest share. Bethan got the smallest share. Noah’s share was 60kg. Calculate how much of the compost Jade and Bethan each received.
As part of a competition twenty tickets are placed in a hat. The tickets are numbered from 1 to 20.
Anna is going to pick out two tickets.
If the rule for winning a prize is ‘numbers that are factors of eighteen win a prize’, calculate the probability that Anna picks out at least one winning ticket.

- probability
- factor
A currency exchange shop displays the following two posters. Keith went to the exchange shop to buy 600 euros for his trip to Portugal. The following day he realised that he would be unable to go on the trip. He returned to the exchange shop and changed the 600 euros back into pounds. The shop was displaying the same information as shown above. How much money did Keith lose because of these two transactions?
Twelve spherical balls, each of diameter 10cm, are to be packed into containers. There are two types of container available.

(1) Cylinders: radius 5.5cm and height 63cm
(2) Boxes: cuboids 42cm by 32cm by 11cm

Assuming the minimum number of containers is used in both cases, calculate which container has the lower empty volume percentage.

**Source:** WJEC Mathematics in Everyday Life Unit 1 Paper
A trolley is rolled up some steps, as shown in the sketch. The wheels of the trolley always stay in contact with the steps on the way up. The diagram shows the side view of a trolley wheel and the steps. On the diagram, draw the locus of the centre of the trolley wheel as the trolley is pulled up onto the top step.
Sofia had planned to exchange £300 for euros during a visit to the local town one Saturday. She had checked the exchange rate for that day, and found it to be £1 = 1.20 euros. Unfortunately, she had to cancel her visit to town that day, and it was not until the following Saturday that she was able to exchange her £300 for euros. By this date the exchange rate was £1 = 1.17 euros. How many fewer euros did she receive due to this delay? What percentage loss was caused by this delay?
Identical wooden sheds are displayed side by side along a straight wall in a builder’s yard. The sheds are 270cm wide, measured correct to the nearest 10cm. The wall is 36m long, measured correct to the nearest metre. Show that it is not always possible to fit 13 of these sheds along the wall.
Diego makes the following statement.

‘If you drive any distance at a constant speed, it would take the same amount of time to complete the journey as if you travelled half of that distance at twice that speed and the other half at half that speed.’

Show that this is incorrect.
Sian is driving along a road in Germany, which has a speed limit of 80km per hour. She is driving at 55mph. By how much is her speed above or below the speed limit?
A newspaper printed the diagram shown below with the headline ‘Huge and steady increase in burglary over the last ten years’.

Give two reasons why the diagram and headline might be misleading:

- real-life graphs
A person’s Taxable Income is calculated as follows.

\[ \text{Taxable Income} = \text{Gross Income} - \text{Pension Contribution} - \text{Other Allowances} \]

Rafael has a Gross Income of £57 500 and pays a Pension Contribution of £5175.
His Other Allowances total £7475.
Rafael pays tax at the rate of 20% on the first £35 000 of his Taxable Income, and at a rate of 40% on the rest of his Taxable Income.

Calculate the total amount of tax that Rafael pays.
A replacement part for a machine is made using one spring, one washer and one rod.

Packs containing one spring, one washer and one rod are to be made for selling in a spare parts shop.

To make up these packs, boxes of springs, washers and rods are bought. Boxes contain 40 springs or 24 washers or 16 rods.

All of the contents of the boxes bought must be used in making up the packs. There must be no springs or washers or rods left over after making up the packs of one spring, one washer and one rod. Calculate a suitable number of boxes each of springs, washers and rods that are needed to make up the packs. You must show all your working.

- lowest common multiple

Source: WJEC Mathematics in Everyday Life Unit 1 Paper
Laura lives 80 miles from the port of Dover. She is thinking about buying a computer in a local store, priced at £1650. Her friend tells her that the same model of computer can be bought in a shop in Calais, France, for 1500 euros. Laura decides to drive to Dover, take the ferry to Calais, buy the computer in Calais, and then return home. Using the following information, calculate how much money Laura would save by doing this compared with buying the computer at her local store.

- Her car travels 40 miles per gallon.
- A gallon of fuel costs £6.24.
- A return ferry ticket costs £23.75.
- The exchange rate at this time is £1 = 1.18 euro.

Show all your working and give your answer correct to the nearest pound.
Each year, a fruit-growing company reduces the number of strawberry plants it grows by \( \frac{1}{8} \) of the number of plants it grew the previous year. In 2012, it grew 5440 strawberry plants. How many strawberry plants did the company grow in 2014?
Seven friends hire a boat, The Wave, to explore where dolphins swim. The cost of hiring The Wave for a week is £2380. Two sponsors, Connelly Boats and Water Watch, pay part of the hire cost. The cost of hiring The Wave is shared in the ratio 2 : 3 : 5 with:
- Connelly Boats paying the smallest share
- Water Watch paying the largest share
- The seven friends sharing the remaining cost equally.

How much more does Water Watch pay than each friend individually?
The number of seats won in the May 2010 general election are shown in the table.

(a) What percentage of votes were for Labour?

(b) The total number of seats in parliament remains constant. If the Liberal Democrats and “Others” categories remained constant, by how many more seats would Labour need such that they would be in the majority?

<table>
<thead>
<tr>
<th>Political Party</th>
<th>Number of seats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservative</td>
<td>306</td>
</tr>
<tr>
<td>Labour</td>
<td>258</td>
</tr>
<tr>
<td>Liberal Democrats</td>
<td>57</td>
</tr>
<tr>
<td>Others</td>
<td>29</td>
</tr>
</tbody>
</table>

40% of votes were for Labour
25 more seats are needed for a majority.
Jenny wants to fill a rectangular sandpit for her son. The dimensions of the sand pit are 2m by 3m by 20 cm.

The mass of a grain of sand is $6.66 \times 10^{-4}$ g.

The volume of a grain of sand is $2.51 \times 10^{-10}$ m$^3$.

Calculate the mass of sand that she will need to buy and state any assumptions you have made and the impact they have on your calculation.

She will need 3184 kg of sand. This assumes there are no gaps between grains of sand.
A red blood cell measures $7.6 \times 10^{-4}$ mm. How many blood cells would you need to line up end to end to make a metre? Give your answer in standard form, correct to 3 significant figures.

You would need $1.32 \times 10^6$ red blood cells to make a metre.

Source: Miss Scudder
Human hair grows by $4.2 \times 10^{-2}$ cm every day. How much does your hair grow each year? Give your answer in metres.

Hair grows by 0.15m every year.
Problem Solving – Answering the Question!

The population for 5 villages is given in the table.

A committee is set up to discuss the plans for a nearby solar farm. The committee is set up of a stratified sample by village, which includes 2 people from Caerwys.

How many people are in the committee in total?

<table>
<thead>
<tr>
<th>Village</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aberwen</td>
<td>1550</td>
</tr>
<tr>
<td>Bronllew</td>
<td>3700</td>
</tr>
<tr>
<td>Caerwys</td>
<td>600</td>
</tr>
<tr>
<td>Dunwen</td>
<td>650</td>
</tr>
<tr>
<td>Edenton</td>
<td>5500</td>
</tr>
</tbody>
</table>

Source: Miss Scudder
Marlon went to New Zealand on holiday.

After he arrived he exchanged £800 for New Zealand dollars.

He spent 1391 dollars in New Zealand.

At the end of his visit he changed the dollars he had left over into as many 10 dollar notes as possible.
He kept these 10 dollar notes.
He placed the rest of the money in a charity box at the airport.

On his return to the U.K. he changed the 10 dollar notes into pounds (£).

The exchange rate for buying dollars when he arrived in New Zealand was £1 = 2.08 dollars.
The exchange rate for selling dollars when he returned to the U.K. was £1 = 2.25 dollars.

How many pounds did he receive on his return?
The diagram shows the spacecraft, Juno, which is on a mission to Jupiter. It is constructed of 3 solar panels, each measuring 2.7m wide and 8.9m long. At Jupiter, a square metre of solar panel will give 6.2 watts of power. Calculate the amount of power that Juno will have from its solar panels when it arrives at Jupiter.

? • area

Juno will have 447 watts of power at Jupiter.
Two robots are programmed to run toward each other. Robot A is set to a speed of $8\text{ms}^{-1}$. The robots begin 1 km apart. They meet after 80s. Calculate the speed of robot B.

Robot B runs at $4.5\text{ms}^{-1}$.
£50 is reduced by 10%.
This amount is then increased by 10%.
Is the new amount £50? Explain how you know.

- £50 reduced by 10% is £45.
- £45 increased by 10% is £49.50, so it is not £50.
The rectangle shown has a perimeter of 72cm. The rectangle is cut in half to make two squares. Calculate the area of one of the squares.

The area of one of the squares is 144cm².
Aled and Huw live at the same house and go to the same school. It is 200m from their house to school. The blue line on the graph shows Huw’s journey to school one day. The red lines show when the crossing lights are red. Huw did not need to stop at either set of lights. Aled set off 1 minute after Huw, and walked at the same speed as him. Show Aled’s journey on the graph, and calculate how many minutes later Aled arrived than Huw.

Aled arrived 2.5 minutes after Huw.
Neptune is approximately 4.5 billion kilometres from the Sun. Between Neptune and the Sun, there is approximately 3.7 million pieces of space dust each kilometre.
If I were to travel from the Sun to Neptune, how much space dust would I pass?
There are approximately 120,000 hairs on a human head. Each hair is approximately $1.4 \times 10^{-5}$ metres in diameter. If all the hairs on a head were laid side by side, what would the total width be?

Source: Miss Baker
Problem Solving – Answering the Question!

Pyg Track: the shortest distance to the top of the mountain but parts of it are very steep. Watkin Path: starts at the lowest point but the ending is very difficult. Many people have accidents here.

Llanberis Path: this path follows the track of the railway. It is the longest path and the gradient is about the same the whole way.

Miner’s Track: this path was built to serve a mine, so is almost flat for a third of the way. It becomes rough, steep and rocky after this.

Source: Numeracy Tests
Imagine Craig and Bolt in the same 100m race, running in the times shown above. Bolt would win, but after 9.6 seconds how far would Craig be from the finish line?

After 9.6s, Craig would be 11.1m from the finish line.
This question is about a station on the London Underground Tube Service.
The greatest number of people that can use the escalators in one minute is 100.
The graph shows the percentage of the maximum number of people that can be on the escalators at different times through the day.

(a) What time do you think the tube opens?
(b) Estimate how many people use the tube between 6pm and midnight.

(a) The tube opens between 5 and 6am.
(b) Approximately 10200 people use the tube between 6pm and midnight.
The picture shows the world’s biggest lolly. It weighs 3175 kilograms. Jane says that it takes her 5 minutes to eat a small lolly, which weighs 20 grams.

If she never stops eating, how many days would it take her to eat the lolly?

It would take her 551 days.
Peter has an analogue clock. His clock loses the same amount of time each day. When will the man’s clock next tell the correct time?

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 31st</td>
<td>10:00</td>
</tr>
<tr>
<td>September 1st</td>
<td>9:45</td>
</tr>
<tr>
<td>September 2nd</td>
<td>9:30</td>
</tr>
<tr>
<td>September 3rd</td>
<td>9:15</td>
</tr>
</tbody>
</table>

The clock will next be correct on 18th October.
Select a test which is best described by each of these statements.

(a) Most of the students gained high marks.
(b) The range of students’ marks was smallest.
(c) Most of the marks were low.

(a) Test B
(b) Test C
(c) Test A
As part of her training, an athlete runs for 5 minutes and then walks for 1 minute. She repeats this without stopping for a period of one hour.

Her average running speed is 18km/h.

Her average walking speed is 6km/h.

Calculate how many kilometres she will complete during the hour.

She will complete 16km in the hour.
Kate lives in the UK. She goes on holiday to Paris with two friends, Janie who lives in America and Ami who lives in Japan. They meet in London for a few days and then fly to Paris together. Janie exchanges 450 American dollars to pounds and Ami exchanges 30,000 Japanese yen to pounds. In London, Janie and Ami each spend £100 and exchange their remaining money to euros. Kate also exchanges £250 to euros.

Use the exchange rates shown to calculate how many euros in total the three girls take to Paris.

- £1 = 129.82 Japanese yen
- £1 = 1.57 American dollars
- £1 = 1.18 euros

In total they take €669.90.
Maryam makes dolls. She uses the following formula to work out the cost, \( £C \), of making \( n \) dolls.

\[
C = 5n + 432
\]

Maryam makes 170 dolls. She sells them for £8.50 each. How much profit does she make?

\[
\text{Profit} = \text{Revenue} - \text{Cost} = (8.50 \times 170) - (5 \times 170 + 432)
\]

\[
= 1445 - 850 - 432 = 163
\]

She makes a profit of £163.
Idris has been awarded a salary increase from £23500 per annum to £23970 per annum. By what percentage has his salary increased?
During an experiment, a scientist notices that the number of bacteria halves every second. There were $2^{50}$ bacteria at the start of the experiment. How many bacteria were left after 5 seconds? Give your answer in index form.

There were $2^{45}$ bacteria left after 5 seconds.

- index laws
Points A and B in a park are connected by a straight path and also a semi-circular path as shown.

The radius of the semi-circular path is 50 metres.

Clive walks from point A to B along the semi-circular path and the returns to A along the straight path.

Calculate the total distance that Clive walked, giving your answer to the nearest 10 metres.

Clive walked 260m, to the nearest 10m.
The weight of fruit collected from an orchard decreases by 8% each year. This year, 1058kg was collected. What weight of fruit was collected two years ago?

1250kg was collected 2 years ago.
Twenty five rectangular cards, each measuring 10cm by 5cm, are laid on a table in a straight line as shown below.

They are laid in such a way that the 2\(^{nd}\) card overlaps the 1\(^{st}\), the 3\(^{rd}\) overlaps the 2\(^{nd}\) and so on, with the 25\(^{th}\) card overlapping the 24\(^{th}\) card. Each card overlaps the previous one by 2cm ± 0.1 cm.

Calculate the least length of the line of cards, giving your answer in metres.

The least length is 1.996m
Sophie has a spinner, shown here. It is coloured such that red is opposite white and purple is opposite yellow. Sophie has begun to calculate the probability of the spinner landing on each colour. Complete her table.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Red</th>
<th>White</th>
<th>Yellow</th>
<th>Purple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Calculations**

- $P(white) = 0.2$
- $P(yellow) = 0.3$
- $P(purple) = 0.3$

**Source:** WJEC Unit 2 Paper
Some mobile phones show a number of world clocks. Peter takes off from London Heathrow airport at 23:30 local time on Tuesday and lands in New York at 00:15 local time on Wednesday. How long was his flight?

Peter’s flight time was 5 hours and 45 minutes.
Some patterns are shown here. Pattern 1 is made from 3 small squares. How many small squares are needed to make Pattern 47?

2303 small squares are needed for pattern 47.

Source: WJEC Unit 2 Paper
Write this ratio in its simplest form.
\[ \sqrt{8} : \sqrt{50} : \sqrt{128} \]

2 : 5 : 8
One hundred raffle tickets are sold. The tickets are numbered from 1 to 100. The raffle tickets are placed in a drum. Two raffle tickets are selected at random, one ticket at a time, and not replaced in the drum.

Find the probability that at least one of the tickets drawn is even.

There is a 75.5% chance that at least one drawn ticket is even.
The perimeter of a rectangle is $\sqrt{128}$. The length of one side is $\sqrt{18}$.

(a) What is the length of the other side?

(b) What is the area of the rectangle?

(a) The other side is $\sqrt{2}$

(b) The area is 6.
The following graph about members of a youth club is given in a newspaper with the headline “number of boys in youth club is over 3 times as many as girls”.

Comment on the accuracy of this statement.

There are about 85 girls and 97 boys. 
85 x 3 = 255 boys which is not true.
Olga wants to paint one side of a garden wall. The wall is 2 metres high and 35 metres long. She has found the following information about the special paint that she needs:

- It is only sold in 5 litre and 2 litre tins
- One litre is enough to cover an area of 6m²
- A 5 litre tin costs £12
- A 2 litre tin costs £6

Find the least amount she has to pay for enough paint to cover the wall.

She has to pay £132.
A jug has a capacity of 600ml measured correct to the nearest 10ml.
A tank has a capacity of 73 litres measured correct to the nearest litre.
Explain with calculations why it is not always possible for the tank to hold water poured from 120 full jugs without overflowing.

Calculations:
\[
\frac{\text{Min Tank}}{\text{Max Jug}} = 118
\]
so 120 jugs won’t fit.
A building firm used 3 machines to concrete an area of 600m², to a fixed depth, in 5 hours. The following day they need to concrete a further area of 1120m², to the same depth, with the work being completed in 4 hours. Give that all conditions are similar, what is the least number of machines the firm should use on the second day?

They need a minimum of 7 machines.

- proportion
Two friends are each travelling 120 miles on holiday.
Ryan travels the whole distance at an average speed of 50mph.
Ryan’s friend, Tom, travels half the distance at an average speed of 40mph and half the distance at an average speed of 60mph.
If they both set off at the same time, who arrives first and by how much?

Ryan arrives first by 6 minutes.
Kathryn is on a treasure hunt and is given clues to find a mystery path.

Clue 1: the mystery path is parallel to the one shown.

Clue 2: the mystery path goes through the co-ordinates (0,5).

Draw the mystery path on the diagram.
The mean of 5 numbers in a list is 24. When two extra numbers are added to the list, the mean increases by four. What does this tell you about the values of the two extra numbers?

The sum of the two extra numbers is 76.
Problem Solving – Answering the Question!

Calculate the side length $x$, giving your answer in simplest surd form.

Side $x$ is $3\sqrt{2}$. 

Source: Miss JH Turner (TES)
What is the mean of $\sqrt{8}$, $5\sqrt{2}$, and $\sqrt{50}$?

The mean is $4\sqrt{2}$.
An engineer uses a formula to work out the number of metres of cable he needs to complete a job. His calculator displays the answer $10 \sqrt{70}$. The button for converting this to a decimal is not working. He has 80 metres of cable. Without using a calculator decide whether he has enough cable. Show clearly how you decide.

- **surds**

He doesn't have enough cable.
The area of rectangle A is the same as the area of rectangle B. Calculate the length of side $x$, giving your answer in surd form.

Length $x$ is $2\sqrt{6}$. 

**Calculations**

- surd
- area of rectangle
A birthday gift measures 55cm by 40cm by 5cm. The wrapping paper you have measures 75cm by 100cm.

Is the paper large enough to wrap the gift? Explain your answer with calculations.

There is enough paper (7500cm$^2$) to wrap the gift (5350cm$^2$).
If both of these cans of pizza sauce are cylinders, which is better value for money?

Show you working to support your answer.

The large sauce gives 461 cm³ per $1, so is cheaper compared to 446 cm³ for the small.
You are painting the walls of a room that is 8m long, 14m wide and 2.5m high. The paint is sold in gallon tins, which cost £6.50 each. A gallon of paint covers 11m² of wall. How much will it cost to paint the room?

It will cost £65 to paint the room.
A disposable water cup is in the shape of a cone. It has a slope length of 10cm and a perpendicular height of 8cm. Calculate the volume of water that can be contained within the cone. What assumptions have you made in your calculation?

The cup will contain 302cm³ of water, assuming it has no thickness.
A tent is shaped like a triangular prism as shown.

Calculate the total amount of canvas required to make the tent, giving your answer in cm$^2$.

Do you think the actual amount of fabric will be more or less than your answer? Explain your choice.

1 foot = 30cm

The tent requires 252000cm$^2$ of material.
A company is deciding which box to use for their merchandise. The first box measures 8 inches by 6.25 inches by 10.5 inches. The second box measures 9 inches by 5.5 inches by 11.75 inches. Which box required more material to make?

The second box requires more (581cm$^2$ compared to 525cm$^2$).
A baked bean tin has a diameter of 6cm and a height of 10cm. The label fits the full height and has a 1cm overlap. What is the area of the label?

The label has an area of 198cm$^2$. 

Source: Miss Scudder
A cylinder and a cone both have a diameter of 12cm. The cone is 20cm, whilst the cylinder is 5cm shorter. Which has the larger surface area and by how much?

The cylinder has a larger surface area by 285cm².

Source: Miss Scudder
Jacob has two buckets of water which are mathematically similar. The smaller bucket has a width of 10cm at the top, whilst the larger bucket has a width of 50cm at the top. Jacob fills the small bucket with water. He then pours the contents into the large bucket. How many times will he have to do this before the large bucket is full?

Jacob will need to do this 125 times before the large bucket is full.
Jacob has two buckets of water which are mathematically similar. The smaller bucket has a width of 10cm at the top, whilst the larger bucket has a width of 40cm at the top. Jacob fills the small bucket with water. He then pours the contents into the large bucket. How many times will he have to do this before the large bucket is full?

Miss Scudder

Jacob will need to do this 64 times before the large bucket is full.

Source: Miss Scudder
These two shapes are similar.
What is the length of the smaller shape?

The smaller shape is 6cm tall.
Cylinder A and cylinder B are mathematically similar. The volume of cylinder A is $80\text{cm}^3$, whilst B has a volume of $10\text{cm}^3$. The radius of cylinder B is 5cm. What is the **height** of cylinder A?

? 

- similar shapes
- volume of cylinder

Cylinder A is $0.25\text{cm}$ tall.

Source: Miss Scudder
The Eiffel Tower has a mass of 7.3 million kilograms and a height of 324 metres. Its base is square with a side length of 125 meters.

Chloe buys a keychain which is a scale model of the Eiffel Tower and is 6 cm tall.

What is the mass of keychain? Give your answer in grams.

This answer appears unrealistic, can you explain why?

- similar shapes

The keychain would have a mass of 0.046g. The keychain would be a continual piece of material, unlike the tower, so would have a greater mass.
Taylor has some buttons. Wendy has twice as many buttons as Taylor. Yusif has 12 more buttons than Taylor. In total they have 260 buttons. How many buttons does Yusif have?

Yusif has 74 buttons.
The perimeter of the shape is 60cm.
The area of the shape is $116\text{cm}^2$.
Find the length of the sides marked $w$ and $h$. 

The lengths are $w=4\text{cm}$, $h=5\text{cm}$. 
Jennifer has a tennis ball and a football.

- The volume of the tennis ball is 130cm$^3$.
- The volume of the football is 43550cm$^3$.
- The surface area of a tennis ball is 125cm$^2$

By modelling both balls as spheres, calculate the surface area of the football.

The surface area of the football is 6030cm$^2$. 

**Similar shapes**
The table shows the radius of different types of sports balls.

Given that the volume of a ping pong ball is $27\text{cm}^3$, calculate the volume of a basketball.

<table>
<thead>
<tr>
<th>Type of Ball</th>
<th>Radius (in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ping-pong Ball</td>
<td>0.74</td>
</tr>
<tr>
<td>Golf Ball</td>
<td>0.84</td>
</tr>
<tr>
<td>Billard Ball</td>
<td>1.13</td>
</tr>
<tr>
<td>Tennis Ball</td>
<td>1.26</td>
</tr>
<tr>
<td>Baseball</td>
<td>1.47</td>
</tr>
<tr>
<td>Bowling Ball</td>
<td>4.29</td>
</tr>
<tr>
<td>Basketball</td>
<td>4.72</td>
</tr>
</tbody>
</table>

The basketball has a volume of $7006\text{cm}^3$. 
The Wharf is soon to be demolished and replaced with high-rise flats. A single block of flats will be built on 400m² of land. Given that the model uses 1600cm² of the base, and the height of the tallest block of model flats is 60cm, calculate the height of the tallest block of flats that will replace the Wharf.

The tallest flats will be 30m tall.
Some data is shown in the table. The mean of the data is 5.3. Calculate the value of $a$. 

<table>
<thead>
<tr>
<th>$x$</th>
<th>frequency, $f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>$a$</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

\[ a = 24 \]
300 students are asked how they travel to school.

- 60% say they walk to school.
- The remaining travel by car or by bus.
- The ratio of students who travel by car to those that travel by bus is 2 : 3

How many more students walk to school than travel by car?

132 more students walk to school than travel by car.
Ronald is making two rectangular flower beds. The dimensions of the larger rectangle will be three times the dimensions of the smaller rectangle. There is going to be the same depth of soil in each flower bed.

Ronald needs 50kg of soil for the smaller flower bed. Work out how much soil Ronald needs for the larger flower bed.

Ronald needs 450kg of soil for the larger flower bed.
By forming an equation, calculate the size of the largest angle in this triangle.

- angles in a triangle add up to 180°
- writing an equation

The largest angle is 85°.
The circumference of circle K is $\pi$. The circumference of circle L is $4\pi$. What is the ratio of their areas?

The ratio of area K to L is $1 : 16$. 

Source: Miss Scudder
AB is parallel to CD.
AB = 13cm, CD = 5cm
AD = (2x − 5) cm and
DE = x cm
Find the area of the trapezium ABCD.

The area of the trapezium is 180cm².
A 50p coin has seven sides. The diagram shows part of a different foreign coin. It is shaped as a regular polygon. By writing an equation, find how many sides the coin has.

Miss Scudder

- interior angles
- regular polygon
- writing and solving equation

The coin has 24 sides.

Source: Miss Scudder
A train leaves Rock City at an average speed of 50 miles per hour and heads for Gnome City. Another train leaves Gnome City at an average speed of 40 miles per hour and heads for Rock City. If the route is 360 miles long, how many hours will it take for the 2 trains to meet?
Problem Solving – Answering the Question!

Solve for the variables A through F in the equations below, using the digits from 0 through 5. Every digit should be used only once. A variable has the same value everywhere it occurs, and no other variable will have that value.

\[ A + A + A = A^2 \]
\[ B + C = B \]
\[ D \times E = D \]
\[ A - E = B \]
\[ B^2 = D \]
\[ D + E = F \]

A = 3, B = 2, C = 0, D = 4, E = 1, F = 5

Source: George Mason University
Alicia was paid £125 for babysitting five days after school for the Smith family. Each day Mrs. Smith paid her £3 more than the day before. How much money did she earn on the first day?

Alicia earnt £19 on the first day.
You have a list of 7 numbers. The mean of the numbers is 9. If you take away one of the numbers, the mean of the numbers is 8. What number did you take away?

15 was taken away.
Bakersfield Elementary School has a field day at the end of the school year in which students compete in sporting events. A group of 5 friends wanted to determine who was the “best” athlete of the day based on the results of 3 events – the 50-yard dash, the mile run, and the rope climb. The table below shows their results in the 3 events. Each of the events is of equal importance. By comparing each person with the mean of each event, determine who you think is the “best”.

<table>
<thead>
<tr>
<th>Names</th>
<th>50-yard Dash</th>
<th>Mile Run</th>
<th>Rope Climb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brei</td>
<td>8 seconds</td>
<td>6.12 minutes</td>
<td>6 feet</td>
</tr>
<tr>
<td>Charlie</td>
<td>10 seconds</td>
<td>8 minutes</td>
<td>7.5 feet</td>
</tr>
<tr>
<td>Dani</td>
<td>7.5 seconds</td>
<td>12 minutes</td>
<td>5.8 feet</td>
</tr>
<tr>
<td>Eddie</td>
<td>9 seconds</td>
<td>5.59 minutes</td>
<td>4.3 feet</td>
</tr>
<tr>
<td>Francine</td>
<td>12.2 seconds</td>
<td>10 minutes</td>
<td>8.2 feet</td>
</tr>
</tbody>
</table>
There are a total of 12 bicycles and tricycles at the park. Together they have a total of 29 wheels. How many are bicycles and how many are tricycles?

- simultaneous equations
- writing equations

There are 7 bicycles and 5 tricycles.
Brei likes to call her friend Kiley in California from her home in Washington. Brei’s mom makes her pay for all her long-distance phone calls. Last Sunday, Brei called Kiley at 7:00 a.m. and ended the phone conversation at 8:30 a.m.

Before 8:00 a.m. on Sundays, it only costs $0.35 for the first minute and then $0.20 per minute after that to make the call. After 8:00 a.m., the rate goes up to $0.40 for the first minute and $0.25 per minute after that.

How much does Brei owe her mom for the phone call?
A group of 4th graders were comparing their weight. Jeremy weighed more than Sam. Sam weighed more than Kim and Sarah. Mary and Donny weighed the same but less than Kim. Derek weighed more than Kim but less than Sam. Alyssa and Ashley weighed the same, which was less than Mary and Donny. Sarah weighed the least.

Who weighed the most?

Jeremy weighs the most.
There are 2 boys and their father trying to cross the lake in a boat. Each of the boys weighs 100 pounds, and the father weighs 200 pounds. The boat can only hold 200 pounds at a time. How many trips will it take them to get everyone over to the other side?

5 trips will be needed.
At the first meeting of the House of Eccentricities in the government of the Gnomes, each member shook hands with each other member. There are 25 members of the House. How many handshakes took place?
James and Andy each have a set of algebra cards. If the mean of James’ cards is equal to the mean of Andy’s cards, find the value of $y$.

<table>
<thead>
<tr>
<th>James’ cards</th>
<th>Andy’s cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y + 4$</td>
<td>$y$</td>
</tr>
<tr>
<td>$2y$</td>
<td>$y + 1$</td>
</tr>
<tr>
<td>$3y - 1$</td>
<td>$2y + 9$</td>
</tr>
</tbody>
</table>

The value of $y$ is 3.

Source: WRMaths Hub
Mr Khan buys some potatoes and carrots. 35% of the total weight are carrots. There are 2.7kg more potatoes than carrots. How many kg of potatoes does he have?

Mr Khan has 5.85kg of potatoes.
The triangle and rectangle shown have the same area.

(a) What is the area of the triangle?
(b) What is the area of the rectangle?
(c) What is the height of the rectangle?
(d) What is the perimeter of the rectangle?

\[
\begin{align*}
\text{Triangle: } & \quad \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} \\
\text{Rectangle: } & \quad \text{Area} = \text{length} \times \text{width}
\end{align*}
\]

\[
\begin{align*}
\text{Perimeter of the rectangle: } & \quad 2 \times (\text{length} + \text{width}) \\
\end{align*}
\]

\[
\begin{align*}
\text{Triangle: } & \quad \text{Area} = \frac{1}{2} \times 4 \times 6 = 12 \text{ cm}^2 \\
\text{Rectangle: } & \quad \text{Area} = 4 \times w = 12 \text{ cm}^2 \\
\text{Height of the rectangle: } & \quad w = 3 \text{ cm} \\
\text{Perimeter of the rectangle: } & \quad 2 \times (4 + w) = 14 \text{ cm}
\end{align*}
\]

\[
\begin{align*}
\text{Triangle: } & \quad \text{Area} = 12 \text{ cm}^2 \\
\text{Rectangle: } & \quad \text{Area} = 12 \text{ cm}^2 \\
\text{Height of the rectangle: } & \quad 3 \text{ cm} \\
\text{Perimeter of the rectangle: } & \quad 14 \text{ cm}
\end{align*}
\]
The box plot shows the heights in centimetres of 80 people. The median height is 172cm. The interquartile range is 18cm. Find the height of the tallest person.

The tallest person is 184cm.
The shape is made of two rectangles. The two rectangles have the same area.

(a) Find the perimeter of the shape.
(b) Find the length of the diagonal line shown.

(a) The perimeter is 62 cm.
(b) The diagonal is 21.9 cm

**Source:** Miss Scudder
The logo is made up of 4 congruent right-angled triangles.

(a) What fraction of the rectangle is covered by the triangles?
(b) Find the perimeter of the logo.

CALCULATIONS

- \( \frac{5}{21} \) is covered by triangles
- Perimeter is 59.7 cm.
Mary is doing a fitness test.
• She starts at A and runs to B
• She then returns to A
• She then runs to C and then returns to A
• She then runs to D and then returns to A
• \(BC = CD = 22\) metres

In total Mary runs 318 metres.
Calculate the distance between A and B.

The distance between A and B is 31m.
This graph shows the process of a cylindrical tank being filled and then emptied into a tanker.

(a) How long in minutes does it take to half fill the cylindrical tank?

(b) The business starts at 7am every day and shuts down at 6pm. The tank must be left either empty or full. What is the maximum number of times that the tank can be filled and emptied in 2 days?

(a) 36 minutes
(b) 4 times

Source: WJEC Question Bank
Cerys makes hats for a living. Each hat she makes needs 0.45m² of fabric, costing £3.40 per m², and 50cm of ribbon. Cerys pays herself £12.60 per hour. She can make 3 hats in two hours. There are no other costs or outgoings. Cerys sells each hat for £11.25, which gives her a £1 profit per hat.

Calculate how much the ribbon costs per metre.

Ribbon costs 64p per metre.
ABCD is a square that has sides of length 3cm.
E and F are the midpoints of two of the sides.
What fraction of the square is shaded?

Half the square is shaded.
ABCD is a square. E and F are the midpoints of two of the sides. What fraction of the square is white?

Half the square is shaded.
Problem Solving – Answering the Question!

Richard is doing a survey. He asks people to choose their favourite biscuit and the results are shown in the table below. There are four biscuits A, B, C or D. 160 people chose B. How many people chose A?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20%</td>
<td>15%</td>
<td>30%</td>
<td></td>
</tr>
</tbody>
</table>

56 people chose A.
A 7 metre ladder rests against a wall. The ladder reaches 5.5 metres up the wall. The ladder is then moved so that it now reaches 1 metre lower than last time. How much further is the base of the ladder now from the wall?

It is the distance marked $x$ in the diagram.

• Pythagoras

The ladder is 1.03m further from the wall.
40 children take part in a school show. The ratio of boys to girls in the show is 3 : 5.

\[
\frac{3}{5}
\]

of the children are dancers.
The rest of the children are singers.
There are 3 boys who are dancers in the show.

How many more girls are dancers than singers?

There are 17 more girls who are dancers than singers.
Rowena is making a scale model of the solar system.

She wants the distance from Earth to Saturn to be 20cm on her scale model.

The real distance from Earth to Saturn is $1.25 \times 10^9$ km.

Find the scale of the model in the form $1: n$ where $n$ is written in standard form.

The scale is $1 : 6.25 \times 10^{12}$.
Problem Solving – Answering the Question!

Here are the contents of three boxes:

<table>
<thead>
<tr>
<th>Box</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All red counters</td>
</tr>
<tr>
<td>B</td>
<td>30% red counters and the rest blue</td>
</tr>
<tr>
<td>C</td>
<td>Empty</td>
</tr>
</tbody>
</table>

There are the same number of counters in boxes A and B. The counters from boxes A and B are put together into box C. There are now 78 red counters in box C. How many blue counters are there?

There are 42 blue counters.

Source: WRMaths Hub
Here are three number cards: \(\sqrt{20}\), \(\sqrt{45}\), and \(\sqrt{80}\).

Another card is now added: \(\sqrt{a}\).

The mean of all four cards is double the mean of the three cards. Find the value of \(a\).

\[
\text{CALCULATIONS}
\]

\(a\) is 1125

\[
\begin{align*}
\text{surds} \\
\text{averages}
\end{align*}
\]
Max is saving to buy a computer game that costs £26.
He saves 5p, 10p and 50p coins in a jar.
The ratio of 5p to 10p to 50p coins is 2 : 5 : 1.
There are 120 coins in the jar.
How much more does he need to save?

He needs to save £9.50 more.
Here is an isosceles triangle. Calculate the area of the triangle.

The area is $16\text{cm}^2$. 

- isosceles
- area of triangle
- Pythagoras
280 people attend a theatre show. An adult ticket costs £6. \(\frac{4}{7}\) of the people are children. In total the theatre takes £1120 in ticket sales. How much does a child ticket cost?

A child ticket costs £2.50.
Tank A is \(\frac{3}{5}\) full.
Tank B is empty.
Half of the water from A is poured into B.
Tank B is now full.
Calculate the height of tank B.

Tank B is 19.3 cm tall.
The diagram shows a square inside a circle, which is itself inside a square. Calculate the distance marked $x$.

Pythagoras

The distance $x$ is $4 - 2\sqrt{2}$. 

Source: WRMaths Hub
Each type of musical note has a different length of time that it is played for. The image shows what fraction of a note each symbol represents. If a minim, crotchet and a quaver are played one after the other, what fraction of a whole note is played?

CALCULATIONS

\[
\begin{align*}
\text{whole note} & \quad \text{half note} \\
\text{quarter note} & \quad \text{eighth note} \\
\text{sixteenth note} & \quad \text{semibreve} \\
\text{minim} & \quad \text{crotchet} \\
\text{quaver} & \quad \text{semi-quaver}
\end{align*}
\]

\[ \frac{7}{8} \text{ of a note is played.} \]
Each type of musical note has a different length of time that it is played for. The image shows what fraction of a note each symbol represents.

How much longer is a minim than a semi-quaver?

A minim is $\frac{7}{16}$ of a note longer than a semi-quaver.
Each type of musical note has a different length of time that it is played for. The image shows what fraction of a note each symbol represents.

How long would it take to play 17 quavers?

It would take $2\frac{1}{8}$ of a note.
Each type of musical note has a different length of time that it is played for. The image shows what fraction of a note each symbol represents. How many semi-quavers are needed to last the same time as one minim?

8 semi-quavers are needed.
Age ratings are always given on DVDs. The 12A rating enables parents to decide if their child can watch a film.

On average, 70% of parents allow children between 9 and 11 inclusive to watch 12A films. 20% of parents allow children under the age of 9 to watch a 12A film.

The table shows the ages of children at a film night. What percentage of attendees could watch a 12A film?

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>60</td>
</tr>
</tbody>
</table>

45% of attendees could watch a 12A film.
This question is about right-angled triangles. None of the diagrams are drawn accurately. The height of each triangle below is 2cm. Which of the triangles are mathematically similar?

A and D are mathematically similar.
Problem Solving – Answering the Question!

Jasmine wants to draw a triangle. There are two rules.
The length of each side must be a whole number of centimetres.
The perimeter must be 24 cm.

Draw:
- an equilateral triangle
- an isosceles triangle
- a scalene triangle

• perimeter
• equilateral
• isosceles
• scalene
• triangle

Source: CALCULATIONS
The graph shows the official government statistics comparing the numbers of women working in 1914 and in 1918 in Wales and England.

What was the percentage increase in women working in industry from 1914 to 1918?
Problem Solving – Answering the Question!

a. Show that the perimeter of this rectangle is 24 cm.

12 \( - \) \( x \) cm

\( x \) cm

b. Show that an expression for the area of the rectangle is

\( 12x - x^2 \) cm\(^2\).

Source: WJEC Textbook

- perimeter
- area
- writing expression
The diagram shows a solid gold paperweight. The paperweight is an isosceles triangular prism. Given that gold costs £27.52 per cm$^3$, calculate the value of this paperweight.
Every year, Lucy gets a bottle of perfume for her birthday.

The bottle is shaped like a triangular prism.

The base of the prism has a width of 6cm and perpendicular height of 4cm, as shown on the diagram.

Lucy got her first bottle in June 2008. What is the total volume of perfume that she will have received by her next birthday?
The diagram shows a right-angled isosceles triangular prism. 70% of its volume is filled with water. To what height is the prism filled?
The diagram shows the dimensions of a swimming pool. The required chlorine concentration of a swimming pool is $10^{-4}\%$.

Calculate the volume of chlorine in the pool, giving your answer in cubic centimetres.
Are regular hexagons always similar?

Explain your answer.

- similar shapes
- regular polygons
- hexagon

Source: Miss Scudder
It takes 3 hours for a boat to travel 27 miles upstream. The same boat can travel 30 miles downstream in 2 hours. Find the speeds of the boat and the current.
Veronica is making emergency-preparedness kits to share with friends. She has 20 bottles of water and 12 cans of food, which she would like to distribute equally among the kits, with nothing left over. What is the greatest number of kits Veronica can make?
A plumber has a call out fee of £35. He then charges £20 an hour.

Write a formula for the plumber’s charge, in terms of the number of hours.
Some friends want to rent a cottage. There is a fixed charge of £120, then they also have to pay £60 per day that they stay. Write a formula for the total cost of renting the cottage, in terms of the number of days.
A gardener is asked to plant some trees. The gardener charges £10 per hour of work, plus £5 per tree planted. Write a formula for the total bill that the gardener charges.

- **Writing expressions**
The table shows the number of students in the school choir. The choir teacher plans to arrange the students in equal rows. Only girls or boys will be in each row. What is the greatest number of students that could be in each row?

<table>
<thead>
<tr>
<th>Students</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>48</td>
</tr>
<tr>
<td>Boys</td>
<td>64</td>
</tr>
</tbody>
</table>

• HCF
What percentage of the integer between 1 and 32 inclusive are factors of 32?
Paula and Megan are hosting events that are catered by the same company. Paula plans to have 80 adults and 86 children attend, so the total projected cost of her meals is £4,428. Megan has 71 adults and 86 children on her guest list, so she will pay the caterer £4,104. How much does the caterer charge for each meal?
Problem Solving – Answering the Question!

The triangle and the rectangle shown have the same area. Work out the perimeter of the rectangle.

- forming equations
- solving equations
- perimeter

Source: CALCULATIONS
If twice the son’s age in years is added to the father’s age, the sum is 70. But if the father’s age is added to the son’s age, the sum is 95. Find the ages of father and son.

Source: IES Jovellanos
Two runners start from the same point at the same time. They will be 4 miles apart at the end of two hours if running in the same direction, and they will be 16 miles apart at the end of one hour if running in opposite directions. Find their speeds.
The sum of the numerator and denominator of a fraction is 12. If the denominator is increased by 3, the fraction becomes \( \frac{a}{b+3} \). Find the fraction.

- simultaneous equations
- forming equations
The perimeter of the polygon is 35cm. Calculate the difference between the lengths of the longest and shortest sides.
Lara is going to Tanzania on an expedition. She has a mosquito net pole which measures 75cm. Will it fit in her suitcase, which measures 55cm by 50cm by 20cm?

- Pythagoras
- 3D
Problem Solving – Answering the Question!

What value goes in the box?
Half of $2^7 = 2$

- index laws
- indices
Marty and Luis each had a pizza. Marty ate $\frac{2}{3}$ of his pizza, whilst Luis ate $\frac{5}{6}$ of his. Marty claims that he ate more pizza than Luis. Is he correct?
Complete the multiplication table.

<table>
<thead>
<tr>
<th></th>
<th>(2\sqrt{6})</th>
<th>(\sqrt{6} - 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2\sqrt{6} + 6)</td>
<td>(\sqrt{6} - 2)</td>
<td>1</td>
</tr>
</tbody>
</table>

- multiplying and dividing surds

Source: Miss J Morgan
Find the perimeter of the rectangle.
Every row of the following square adds up to 18

\[
\begin{array}{ccc}
  a & a & a \\
  2b & a & a \\
  a & b & 2c \\
\end{array}
\]

Work out the value of \(a + b + c\)

- writing equations
- solving equations

Source: CALCUATIONS
Mr Jones wants to take his family to the local farm. He needs to pay for two adults and two children, one aged 3 and 1 aged 8.

(i) What is the total cost for the family?

(ii) Mr Jones pays with a £20 note. How much change does he receive?
The diagram shows a garden with a pond.

The garden is in the shape of a triangle.
The pond is in the shape of a rectangle.

Jim is going to cover the shaded region with gravel.

55kg of gravel is needed to cover 1m².

How much gravel does Jim need?
The diagrams show how 12 small identical rectangles can be placed to form a larger rectangle in two different ways.

Diagram 1

Diagram 2

Diagrams not drawn to scale

The perimeter of each of these diagrams is measured.
The perimeter of diagram 1 is 55 cm.
The perimeter of diagram 2 is 50 cm.

Find the dimensions of one of the 12 small identical rectangles.

- simultaneous equations
- writing equations

Source: WJEC Question Bank
Catrin and Susie both have necklaces with chunky beads. They notice that they have the same types of beads, but different numbers of each bead. The beads are either cubes or square based pyramids. All the cubes are identical. All the square based pyramids are identical.

The girls both take the beads off their necklaces and place them in straight lines.

Catrin’s beads

Susie’s beads

38.8 cm

35.6 cm

Calculate the length of the base of each type of bead.

• Simultaneous equations
• Writing equations
Problem Solving – Answering the Question!

Sam is organising a trip to a Theme Park

<table>
<thead>
<tr>
<th>Theme Park Tickets</th>
<th>Train Tickets</th>
</tr>
</thead>
<tbody>
<tr>
<td>£45 per ticket</td>
<td>Price = £12 per person</td>
</tr>
<tr>
<td>or</td>
<td>or</td>
</tr>
<tr>
<td>Group booking offer of 1/5 off for bookings of over 15 people</td>
<td>Saver ticket of £24 for four people</td>
</tr>
</tbody>
</table>

Sam has £800 to spend.
He wants to book 12 theme park tickets and 12 train tickets

Does Sam have enough money?
You must show all your working.
When you add the square of Thomas's age to Lauren's age the total is 62. When you add the square of Lauren's age to Thomas's age the total is 176. How old are Thomas and Lauren?
This lift has an advised maximum capacity of either 24 children or 15 adults.

When the door opens there are 16 children inside.

How many adults can safely get into the lift with them?
Hannah has a bag with six orange sweets and some yellow sweets. Overall, she has $n$ sweets.
The probability of her randomly taking two orange sweets from the bag to eat is one third.
Prove that $n^2 - n - 90 = 0$ and solve this quadratic.
The length of a rectangle is three times its width. If the area of the rectangle is 192cm$^2$, calculate its perimeter.
Problem Solving – Answering the Question!

What is the cost of this?

\[\text{Apples} + \text{Bananas} = 30\]
\[\text{Bananas} + \text{Coconuts} = 18\]
\[\text{Coconuts} - \text{Apples} = 2\]

? 

• simultaneous equations

Source: Facebook
What is the value of the diamond?
How do you know?
Is there another possible answer?
Did you need all the equations to know for sure?

\[
\begin{align*}
\square + \square - \Diamond - \Diamond &= 4 \\
\square + \Diamond &= 8 \\
\square + \square - \Diamond &= 7
\end{align*}
\]
Write an inequality that has the value of the unknown as between -6 and 3.
While watching their flocks by night the shepherds managed to lose two-thirds of their sheep. They found four fifths of the lost sheep again in the morning. What fraction of their original flock did they have left?
(a) If the question marks all represent the same number, what number is this?
(b) What could the question marks be if they are all different numbers?

\[
\frac{1}{?} + \frac{1}{?} + \frac{1}{?} = \frac{1}{9}
\]
When a barrel is 30% empty it contains 30 gallons more than when it is 30% full. How many gallons does the barrel hold when full?

- percentages
Problem Solving – Answering the Question!

One-half of the class got As. One-third of the rest got Bs. One-quarter of the remainder got Cs. One-fifth of the others got Ds.

What fraction of the class got Es or below?

- fractions
Tansy opened a regular savings account. Interest is only payable on 31st December each year. Tansy paid £20 into her account on the first day of every month, starting from 1st January 2012. On 31st December 2012, interest of 1.4% of the total amount of money that Tansy had saved during 2012 was added to her account. Calculate how much money Tansy had in her account on 15th April 2013.
A shopkeeper calculates the selling price of a coat by increasing the manufacturer’s price by 18%.
In a sale, the shopkeeper reduced the selling price of the coat by 15%. The sale price of the coat was £90.27.
Calculate the manufacturer’s price for the coat.
A white circular card is to be placed on a grey square card, whose side measures 20 cm.

The size of the circle is such that it can be placed on the square card with its edge just touching, but not overlapping, each of the four sides of the square.

Calculate the percentage of the grey card that will be still visible when the circle is placed on the square card as described. [5]

Source: WJEC Question Bank
Hannah borrows £1200 from a loan company who have an AER of 19.6%. The interest is calculated monthly. By how much is she in debt after 4 months?
Claudia was given the following information.

**UK Income Tax**

* April 2013 to April 2014
* **taxable income = gross income – personal allowance**
  * personal allowance is £9205
  * basic rate of tax: 20% on the first £32,255 of taxable income
  * higher rate tax: 40% is payable on all taxable income over £32,255

During the tax year 2013 to 2014, Claudia’s gross income was £52,250.

Calculate the total amount of tax that Claudia should pay.

You must show all your working.
A magic square!
Each row, column and diagonal sum to the same amount. Complete the square!

<table>
<thead>
<tr>
<th></th>
<th>(\sqrt{72})</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\sqrt{50})</td>
<td>(\sqrt{2})</td>
</tr>
<tr>
<td>(\sqrt{128})</td>
<td></td>
</tr>
</tbody>
</table>

- adding surds
- simplifying surds

Source: Miss J Morgan
Alex buys a mobile phone for £450 it depreciates at a rate of 16.3% every year.

Rhys buys a mobile phone for £320 and it loses value at a rate of 8.9% every year.

David buys a phone for £650 which depreciates by 21.89% each year.

Who’s phone is worth the most after 4 years?

• compound interest

Source: Miss Scudder
Problem Solving – Answering the Question!

The point A is shown on the unit grid below.
The point B is $2\sqrt{3}$ units from A and lies on the intersection of two grid lines.
Mark one possible position for B.
The diagram shows a line joining O to P.

The gradient of the line is 2
The length of the line is $\sqrt{2645}$
Work out the coordinates of P.
Problem Solving – Answering the Question!

\[
a \text{ is } 8.3 \text{ cm correct to the nearest mm} \\
b \text{ is } 6.1 \text{ cm correct to the nearest mm} \\
\text{Calculate the upper bound for } c. \\
\text{You must show your working.}
\]
The area of a right-angled, isosceles triangle is 4 cm$^2$. Work out the perimeter of the triangle in centimetres. Give your answer in the form $a + b\sqrt{c}$, where $a$, $b$ and $c$ are integers.

- Pythagoras
- surds
- area of triangle
- perimeter
The rectangle ABCD represents a park.

The lines show all the paths in the park.
The circular path is in the centre of the rectangle and has a diameter of 10m.

Calculate the shortest distance from A to C across the park, using only the paths shown.
Which is longer, a million hours or a billion seconds? By how much? Give your answer in standard form.
I roll four dice then try to arrange the values into the fractions below. What is the probability that the two fractions are indeed equal to each other?
On the number line shown below, $a$ is a number between 0 and 1, and $b$ is a number between 1 and 2. Mark possible positions on this line for

$$\sqrt{a}, \sqrt{b}, a^2, b^2 \text{ and } \sqrt{\frac{b}{a}}$$
An equilateral triangle has an area of 35cm$^2$. Calculate the perimeter of the triangle.
Write this ratio in its simplest form

\[ \frac{4\frac{1}{5}}{630} \text{ kg} : 630 \text{ g} \]
The price of all rail season tickets to London increased by 4%.
(a) The price of a rail season ticket from Cambridge to London increased by £121.60. Work out the price before this increase.
(b) After the increase, the price of a rail season ticket from Brighton to London was £2828.80. Work out the price before this increase.

- reverse percentages
A garage sells cars. It offers a discount of 20% off the normal price for cash. Dave pays £5200 cash for a car. Calculate the normal price of the car.
Liam invested some money for 3 years in a savings account. He got 2.5% per annum compound interest. After 3 years and no withdrawals, he now has a balance of £6132.50. How much did he invest 3 years ago?
Philip’s parents invested some money in a bank account offering 6.2% simple interest per year, when he was born. He is now 18 years old, and is given the full £1625 from this account. How much money did Philip’s parents invest when he was born?
A company bought a van brand new in 2013. Each year the value of the van depreciated by 23%. In 2016, the van is worth £12950. If the company sells the van for £13000, how much money have they spent on the car over the last 3 years?
Miss Scudder has to choose between two excellent students, Owain and Llywelyn, to take part in a Maths Challenge. There is only one space available.

The chart shows the times taken to correctly complete a series of maths questions.

Which student should Miss Scudder select? Give reasons for your answer.

- box plot
An isosceles triangle has a perimeter of 20cm, with a side measuring 8cm. Calculate the possible sizes of the largest angle.
A triangle has two angles which are 46° and 102°. The longest side is 10cm. Calculate the area of the triangle.
Jenny says that \(5.5^2\) is closer to \(5^2\) than \(6^2\). Is she correct? Explain, with mathematical calculations, the reason for your answer.
At a stall in a school fair, 32 people each paid £3 to choose a sealed envelope from a bag. Each envelope contained a shopping voucher. The table shows the number of each type of voucher in the bag.

The person in charge of the stall was asked “what was the average value of the vouchers?” She replied, “Are you asking for the mode, median of mean value?” Show clearly that these three values are different.

<table>
<thead>
<tr>
<th>Value of Voucher</th>
<th>Number of vouchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>£1</td>
<td>19</td>
</tr>
<tr>
<td>£2</td>
<td>6</td>
</tr>
<tr>
<td>£5</td>
<td>5</td>
</tr>
<tr>
<td>£10</td>
<td>2</td>
</tr>
</tbody>
</table>
A landing area, as shown, is marked out for a throwing event in a sports field. AB is an arc of a circle with centre O. The angle AOB = 60° and OA = OB = 80m.

A rope is used to mark the boundary of the whole landing area.

(a) Calculate the area enclosed by the rope.

(b) What is the total length of the rope that is used to mark the landing area?
\( \frac{3}{8} \) of Peter’s family live in Canada, \( \frac{2}{5} \) of his family live in England. The remaining 18 live in Wales. How many people are in Peter’s family?
A can of baked beans is 9cm tall and has a diameter of 6cm. If I emptied the contents of 10 cans into a rectangular dish which had a base measuring 20cm by 30cm, how high up the dish would the baked beans reach?

- volume of prism
An exotic fish is placed in a rectangular aquarium that has a length of 75cm and a width of 35cm. If the water level rises 2cm when the fish is placed in the aquarium, what is the volume of the fish?

**Volume of prism**

**Calculations**

- ?

Source: CALCULATIONS
A cup of gold colored metal beads was measured to have a mass 425 grams. By water displacement, the volume of the beads was calculated to be 48.0 cm$^3$. Given the following densities, identify the metal.

Gold: 19.3 g/mL
Copper: 8.86 g/mL
Bronze: 9.87 g/mL

? • density
I threw a plastic ball in the pool for my dog to fetch. The mass of the ball was 125 grams. What is the minimum volume of the ball such that the ball will float?

- density
The average man has a volume of $0.7 \text{m}^3$. For Jesus to have walked on water, what must his mass have been?
The volume of a small boat is 24m$^3$, and it has a mass of 400kg.

The boat has a small leak in the bottom, and water is coming in at a rate of 10cm$^3$ per second.

Assuming the crew are unable to remove any of the water or other weight from the ship, for how long will the boat stay afloat?

*Remember: the density of water is 1g/cm$^3$*
A glass paperweight consists of a hollow cylinder with a hollow cone on top as shown.
The paperweight contains just enough sand to fill the cylinder. The paperweight is now turned upside down. Calculate the depth of the sand (marked $x$ in the diagram).

**Problem:**

Given a hollow cylinder with a height of 4 cm and a base radius of 6 cm, and a hollow cone with a height of 2 cm and a base radius of 4 cm, calculate the depth of the sand ($x$).

**Solution:**

The volume of the sand in the cylinder is equal to the volume of the sand in the cone when the paperweight is turned upside down.

Volume of cylinder = \( \pi r^2 h \)

Volume of cone = \( \frac{1}{3} \pi r'^2 h' \)

where $r$ = 6 cm, $h$ = 4 cm, $r'$ = 4 cm, and $h'$ = 2 cm.

Set the volumes equal to each other and solve for $x$.

\[ \pi (6)^2 (4) = \frac{1}{3} \pi (4)^2 (2) \]

\[ 144 \pi = \frac{32}{3} \pi \]

\[ x = \frac{144}{32} \cdot 3 \]

\[ x = 13.5 \text{ cm} \]

**Answer:**

The depth of the sand is 13.5 cm.
Two tennis balls of radius 5cm just fit inside a tube. Calculate the volume of the tube not filled by the tennis balls.
A hemispherical bowl of radius 6 cm has the same volume as a cone of perpendicular height 27 cm. Calculate the base radius, $r$, of the cone.

[NON CALCULATOR]
The diagram shows a child’s rattle toy, constructed from a hemisphere and a cone, as shown in the diagram.

The toy is 75% filled with sand.

Given that the density of sand is 1600 kg/m³, calculate the mass of sand required for this toy.
A homogeneous rectangular solid of unknown density is 5cm long, 20 cm high, and 4cm wide. The mass of this solid is 2976 grams. What is the material?
A homogeneous solid cylinder has a diameter of 10cm and a height of 15cm. The mass of the object is 3190g. What is the cylinder made of?

**Material** | **Density (kg/m³)**
--- | ---
Tin | 7280
Wrought Iron | 7750
Manganese | 7440
Magnesium | 1738
Chromium | 7190
Aluminum | 2712
Cobalt | 8746
A company creates a new type of can where the height is twice the diameter. The volume of the can is 300cm$^3$. What is the height of the can?
A cube with an edge of 20 cm is filled with water. The water is then poured into a cylinder with height 7 cm. The water is 1 cm short of filling the cylinder. What is the diameter of the cylinder?
A wooden wedge is used to prop open a door. The wedge is a right triangular solid that is 8 cm long, 6 cm high (those are the measures of the legs of the triangle) and has a depth of 2 cm. It is wedged under a door which is 5 cm deep and has 3 cm clearance between the bottom of the door and the floor. What percent of the volume of the wedge is under the door?
Archimedes was tasked with calculating the volume of the King’s crown. To do this, he decided to have a bath.

Archimedes filled the bath with 30 litres of water. The water reached a level at which the longest distance across the bath was 1.2m and the shortest distance across was 70cm. A sketch of the bath at this depth is shown to the right.

Archimedes then put the crown in the bath. The water level rose by 1mm.

What was the volume of the crown?
A company uses its logo in every part of its business. The smallest version, used on letterheads, has a perimeter of 9 cm and an area of 5 cm$^2$.

The largest similar version, used on their delivery vans, has a perimeter of 2.7 metres. Painting the logo on the delivery vans costs £200 per m$^2$.

How much it would cost to paint one logo on the side of a van?
Problem Solving – Answering the Question!

Select from the following options to answer the questions below.

\[ A \ 2y - 4x = 5 \quad B \ y + 4 = 2x \quad C \ 3y + x = 2 \]
\[ D \ 5y + 7 = 2x \quad E \ 2x + 6 = 3y \]

1. Which line(s) passes through the point (0,2)?
2. Which line(s) have a gradient of 2?
3. Which line(s) have a negative gradient?
4. Which line(s) cross the y-axis below 0?
At a stall in a school fair, 32 people each paid £3 to choose a sealed envelope from a bag. Each envelope contained a shopping voucher. The table shows the number of each type of voucher in the bag.

The person in charge of the stall was asked “what was the average value of the vouchers?” She replied, “Are you asking for the mode, median or mean value?” Show clearly that these three values are different.

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</tr>
<tr>
<td>£2</td>
<td>10</td>
</tr>
<tr>
<td>£5</td>
<td>5</td>
</tr>
<tr>
<td>£10</td>
<td>2</td>
</tr>
</tbody>
</table>

**Source:** WJEC Question Bank
You have 10 black balls and 10 white balls to be arranged between 2 jars. You will then close your eyes, select a jar at random and select a ball at random from that jar. How would you arrange the balls?
In a factory, Machine A is three times as quick as Machine B in assembling identical circuit boards.

Machine A is allocated two and a half times as many of these circuit boards to assemble as Machine B.

Machine B took 4 hours to assemble all of its allocation.

How long did it take for Machine A to complete its allocation?

Give your answer in hours and minutes.

• proportion
Brenda has 100 coloured beads.
   27 are red.
   41 are blue.
   The rest are green.

She wants to make a necklace using all these beads. She also wants to buy extra beads so she has the same number of each colour. What is the least number of each colour she needs to buy?

- addition
- subtraction
Three numbers multiplied together give an answer of $-12$. The sum of two of the numbers is zero. What could the three numbers be?
Problem Solving – Answering the Question!

Select from the following options to answer the questions below.

A \(2y - 4x = 5\) \hspace{1cm} B \(y + 4 = 2x\) \hspace{1cm} C \(3y + x = 2\)

D \(2y + 7 = 4x\) \hspace{1cm} E \(2x - y = 3\)

1. Which line(s) passes through the point (0,2)?
2. Which line(s) have a gradient of 2?
3. Which line(s) have a positive gradient?
4. Which line(s) cross the y-axis above 0?

Source: Miss Scudder
The electricity meter readings from a fridge-freezer are taken every 4 hours. At 11am, the reading is 3456.2kWh correct to 1 decimal place. At 3pm, the reading is 3460.1kWh correct to 1 decimal place. Electricity costs 7p per kWh. What is the maximum cost of running the fridge-freezer over a period of 2 weeks?
Problem Solving – Answering the Question!

The sum of two square numbers is 20.

What are they?

• square numbers

Source: PIXI Maths
Approximately how long is an edge of a cube with a volume of 200m³?
Approximately how long is a side of a square that has an area of 90cm²?

- square numbers
- square roots
- area
Select from the following options to answer the questions below.

A \[2y - 4x = 5\]  
B \[y + 4 = 2x\]  
C \[3y + x = 2\]  
D \[2y + 7 = 4x\]  
E \[2x - y = 3\]

1. Which line(s) passes through the point (0,2)?
2. Which line(s) are parallel to the line \(y = 2x + 1\)
3. Which line(s) have a positive gradient?
4. Which line(s) cross the y-axis above 0?

Source: Miss Scudder
The diagram shows a slice of pizza where the pizza was split into 5 equal slices. Estimate the area of the pizza slice.
Ashley and Charley each start with the same number. Charley works out half of the number. Ashley works out three-quarters of the number. The sum of their answers is 275. What number did they start with?

- fractions
- operations
Billy’s income increases by $\frac{1}{5}$ of what it was the previous year.

He now earns £43,200. How much did he earn two years ago?
The value of Hannah’s car decreases by $\frac{1}{10}$ each year. The value of her car is now £4050. What was the value of her car two years ago?
Peter ran 5km in 24 minutes and 48 seconds. His time was measured to the nearest second, and the distance to the nearest 10m. What is the slowest average speed he could have run at?
Rank these shapes in order from largest to smallest area.

- **A**
  - Trapezium: 2cm, 4cm, 8cm
- **B**
  - Area: 5cm, 12cm, 5cm, 16cm
- **C**

**Calculations**

- **A**
  - Trapezium area: \( \frac{1}{2} \times (2 + 8) \times 4 \)
- **B**
  - Area calculation needs to be completed.
- **C**
  - Area calculation needs to be completed.
The side of a square is measured to be 25cm to the nearest centimetre. What is the difference between the largest and smallest possible areas of the square?
A symmetrical archway is going to be built, with a width of 3, as shown in the diagram. The inner archway to walk through will be 1m wide.

What is the surface area of the front of the archway?

- area of sector
- circle
Which one is wrong?

(a) $\frac{9}{4} + 1.75 = 4$  
(b) $\frac{9}{5} + 2.2 = 4$  
(c) $\frac{6}{5} + 2.8 = 4$  
(d) $\frac{3}{2} + 1.5 = 4$

- fractions
- decimals

Source: Almost Impossible Number Puzzles – Tobar Ltd – Q 110
Eve has made a square cake with sides of length 20cm, to the nearest cm. Eve wants to put a ribbon round the cake. Her ribbon is 80cm long to the nearest cm. Does she definitely have enough ribbon for the cake? Explain your answer.
A particular book is 2.6cm thick, measured to the nearest tenth of a cm. Leesha has 50 of these paperback books. Her book shelf is 1.30 m in length to the nearest cm. What is the greatest possible number of these books Leesha can definitely put on her shelf?
Rank these shapes in order from largest to smallest perimeter.

A

- trapezium
- perimeter
- Pythagoras

B

C

CALCULATIONS
A ‘bit’ is the smallest unit of space in computing (holding a ‘0’ or ‘1’ value). There are 8 bits in a byte, $2^{10}$ bytes in a kilobyte (kB), $2^{10}$ kB in a megabyte (MB), $2^{10}$ MB in a gigabyte (GB), $2^{10}$ GB in a terabyte (TB). The size of the internet is approximately $5 \times 10^6$ TB. How many bits make up the internet?
Two odd numbers sum to 48. What is the greatest possible difference between the numbers?
Julie needs to make $4\frac{1}{2}$ servings of chilli to feed her family. Unfortunately she only has a small saucepan which can hold $\frac{3}{4}$ of a serving of chilli. What is the meaning of $4\frac{1}{2} \div \frac{3}{4}$?
Light travels approximately 300000000 metres each second. A light year is the total distance travelled by light in one year. Determine the length of a light year, expressing your answer in standard form.
The Earth is approximately spherical.
The radius of the Earth is 6378.1km.
Calculate the circumference of the Earth, giving your answer in standard form correct to 3 significant figures.
The total surface area of the Earth is approximately $5.112 \times 10^8$ square kilometres. Oceans cover an approximate area of $3.617 \times 10^8$ square kilometres and the remainder of the surface is covered by land. Calculate the area of the Earth covered by land, giving your answer in standard form.
Which shape has the larger area and by how much?

- circles
- area
Philip wants to buy some carrots. Carrots cost 78p per kg.
Philip decides to buy 2.5kg.
How much does this cost?
The graph shows the air temperature at different heights above sea level.

a) A temperature reading was taken at 2.5km above sea level. What was the temperature?
b) What kind of correlation is shown here?
c) Write a sentence to explain what is shown by the graph.
d) In another location, the temperature was measured to be 12°C. Use the graph to estimate the height above sea level of this location.
Which shape has the larger area and by how much?

- circles
- area
Which shape has the larger perimeter and by how much?

- circles
- perimeter
- circumference
Which shape has the larger perimeter and by how much?

- circles
- perimeter

\[ \text{Perimeter of circle} = 2\pi r \]
\[ r = 2 \text{ cm for circle 1} \]
\[ r = 5 \text{ cm for circle 2} \]

\[ \text{Perimeter of circle 1} = 2\pi \times 2 \]
\[ \text{Perimeter of circle 2} = 2\pi \times 5 \]

\[ \text{Difference in perimeter} = |\text{Perimeter of circle 2} - \text{Perimeter of circle 1}| \]
I have two circles. The radius of the larger circle is three times larger than the radius of the smaller circle. How much bigger is the area of the larger circle than the smaller circle?
The graph shows the annual profits of four different companies. Which company showed the greatest overall profit over the 7 years?

- Company A
- Company B
- Company C
- Company D

Source: Almost Impossible Number Puzzles – Tobar Ltd – Q 62
At the casino I had to pay a £1 entrance fee. I also gave the cloakroom girl £1 tip each evening. Each day for four days I lost half of the money I had left. I went home with £1. How much did I have to start with?

- writing equation
- fractions
If you simplify $89^2 - 88^2$ what is the correct answer?

(a) 176  (b) 177  (c) 178  (d) 179  (e) 180

Source: Almost Impossible Number Puzzles – Tobar Ltd – Q 71
The mean of two numbers is 41 ½. Another number is added to the list and the mean of these three numbers is 72. What is the third number?
A car travels 40 miles along the M5 in the same time as another car travelling 20mph faster covers 60 miles. How long does the journey take?
The combined age of Alan and Bertie is 43. The combined age of Alan and Charlie is 55. The combined age of Bertie and Charlie is 66. How old are Alan, Bertie and Charlie?

- simultaneous equations
5 friends live in the same road in house A, B, C, D and E. The road numbers run from 2 to 222.

The numbers of houses B, C, D when multiplied together equals 1260.
The numbers of houses B, C, D when added together equal twice E’s numbers, and is even.
A’s number is half as much again as E’s.

What are those 5 numbers?
Place all the factors of 60 and 84 in the Venn diagram below.

60

84
In 10 years time the total ages for two brothers and two sisters will be 100.
What will the total be in 7 years’ time?
Mr Smith has a number of children.
Mr Brown has a smaller number of children.
Mr Green has an even smaller number of children.
Mr Black has the smallest number
The total is less than 18.
The product of the children is the door number of Smiths’ house (120).

I asked Mr Smith: “Is there more than one child in the Black family?”

When he replied, as I know the house number, I also knew the number of children in each family.

How many children were there in each family?
Bill and Ben have a combined age of 91 years. Bill is now twice as old as Ben was when Bill was as old as Ben is now. How old are Bill and Ben now?
I went into a furniture shop in order to buy a picture. The salesman told me “the picture is five times the cost of that ashtray, the chair is 30 times the cost of the ashtray, the table is four times the costs of the chair and you can buy the lot for £312.” What was the price of the picture?

- writing equations

Source: Almost Impossible Number Puzzles – Tobar Ltd – Q 258
The mass of a spacecraft is $7.8 \times 10^4$ kg. The spacecraft is carrying equipment with a total mass of $2.4 \times 10^3$ kg. The spacecraft docks with a space station. The mass of the space station is $4.62 \times 10^5$ kg. The commander of the space station does not want the total mass on docking to be greater than $5.43 \times 10^5$ kg. Is the total mass within limits?

- standard form
A common mistake is for people to muddle 0.3 and \( \frac{1}{3} \). Which of the following has the greatest percentage error?
(i) Using 0.3 instead of \( \frac{1}{3} \)
(ii) Using \( \frac{1}{3} \) instead of 0.3
Stella is designing a central heating flue duct to take waste fumes out through the wall. The hole for the duct has to be sealed. There is a 16.5 cm square plate with a 4.5 cm radius circle removed from it. The measurements are correct to one decimal place. Write an inequality to show the upper and lower bounds of the area of the metal seal.
Irfan runs a 200m race in a local athletics event. His time for the race was given as 23.4 seconds. Irfan realise that these measurements were not accurate. The 200 metres was measured to the nearest metre. His time was measured to the nearest tenth of a second. Irfan is interested to know his average speed. Write an inequality to show the upper and lower bounds of Irfan’s average speed.
A can of pop is in the shape of a cylinder. The label states it contains 320ml. Malcolm measures the height and the diameter of the can. He says the height is 10cm, to the nearest mm and the diameter is 6.5cm, also to the nearest mm. Malcolm says “the can is not big enough to hold 330ml”. Decide whether Malcolm is (a) definitely right, (b) possibly right, or (c) definitely wrong.

Remember: $1cm^3 = 1ml$
Guto buys and sells antique furniture. At an auction, Guto buys a grandfather clock. As well as the price he bids, he pays an additional 15% commission to the auction house. He later sells the grandfather clock for £1288 making a profit of 40% on what he paid at the auction house. How much did Guto bid for the clock?

- percentages
- writing equations
Alwyn wants to find out the thickness of each page in his Maths text book. He uses a ruler to measure its thickness, which is between 1.2 and 1.3cm, not including the cover. The pages in the book are numbered i and viii and then 1 to 297. At the end there are 7 blank sides. (a) Work out the thickness of each page. (b) Suggest how Alwyn can get a more accurate answer.
What is the nth term of this sequence?

1, \( \frac{1}{2} \), \( \frac{1}{3} \), \( \frac{1}{4} \), \( \frac{1}{5} \)
A farmer measures his rectangular field to be 120m wide and 115m long to the nearest 5 metres. How much fencing should he buy to ensure that he has enough to border the field?
Write an inequality which has 2 and -6 as possible solutions. Your inequality should contain the terms $3x$ and $-5$. 

- inequalities
- writing inequality
A can of baked beans is 9cm tall and has a diameter of 6cm. If I emptied the contents of 10 cans into a rectangular dish which had a base measuring 10cm by 10cm, how high up the dish would the baked beans reach?

- volume of cylinder
- volume of cuboid
A car travels 400 miles on level terrain in the same amount of time it travels 160 miles on mountainous terrain. If the rate of the car is 30mph less in the mountains than on level ground, find its rate in the mountains.
A man buys 3 fish and 2 chips for £2.80
A woman buys 1 fish and 4 chips for £2.60
How much are the fish and how much are the chips?

• simultaneous equations
Light travels at a speed of 300000000 metres per second. A light year is the distance travelled by light in one year. The closest star to the sun is Alpha Centauri, which is 4.367 light years away. Express this distance in kilometres in standard form.
Fracking uses a staggering 100 billion gallons of water per year in the USA alone. The annual water usage of the animal agriculture industry in the USA is 340 times this amount. Calculate the amount of water used by USA animal agriculture per year, giving your answer in standard form.

Animal agriculture uses 3.4 x 10^{13} gallons per year in the USA.
Explain with calculations why a regular pentagon does not tessellate.
A 15m ladder is leant against a wall to reach a window which is 12m from the ground. How far from the base of the wall does the ladder have to be?

- Pythagoras
A square has a diagonal equal to the length of the diameter of a circle. The square has a side length of 5cm. Calculate the area of the circle.
Problem Solving – Answering the Question!

The diagonal of the rectangle is equal to the radius of the semicircle.

Calculate the perimeter of the semicircle.

Source: Miss Scudder
Bert went to the theatre. The show started at 7.30 p.m. The first act was 1 hour 10 minutes long, the interval lasted 25 minutes and the second act was 50 minutes long. What time did the show finish?
A footballer was paid £750 000 for playing a 90 minute game. How much was this an hour? Give the answer to the nearest penny.

- unit conversion
- time
- division
A sliced loaf is 24 cm long. Each slice is 8 mm thick. How many slices are there in the loaf?

- unit conversion
- division

Source: CALCULATIONS
Problem Solving – Answering the Question!

Put a circle round the term which is equal to $r \times r \times r \times r \times r$

- $5r$
- $r + 5$
- $r^5$
- $r^5$

• simplifying
There are 630 people on a cruise. Of these, 67% are over 65. How many of them are under 65?

- percentages

Source: CALCULATIONS
Sarah earns £34 720 a year. After deductions she receives £26 734.40. What percentage was deducted from her pay?
Stephen negotiated a 5% reduction in his rent. It originally was £140 a week. What was it after the reduction?
A low-sugar jam claims to have 42% less sugar. A normal jam contains 260 g of sugar. How much sugar does the low-sugar jam contain?

- percentages
Mr and Mrs Bell have twin daughters and a son.
Mr Bell is four years older than Mrs Bell. Mrs Bell is three times older than their twin daughters. The twin daughters are seven years older than the son. The sum of the five ages is 150.

Let \( x \) be the age of the twin daughters.

Set up and solve an equation to work out the age of the twin daughters.
Ellie drives 130 miles from Sheffield to London.

She drives at an average speed of 55 miles per hour.

She leaves Sheffield at 6:30 am.

Does she arrive in London before 9:00 am?
Ellie drives 240km from Sheffield to London.
She drives at an average speed of 65 miles per hour.
She leaves Sheffield at 6:30 am.
Does she arrive in London before 9:00 am?
Find the lowest common multiple of $6xy^2$ and $3x^2y$
Find the lowest common multiple of $10ab^2$ and $5a^2b^3$
Polly Parrot squawks every 120 seconds.  
Mr Toad croaks every 210 seconds.  
They both make a noise at the same time.  
After how long will they next make a noise at the same time? Give your answer in minutes and seconds.
Find the lowest common multiple of $10ab^2$ and $5a^2b^3$
In a test, Rhodri had to write down the value of the first digit of numbers written in standard form. The table shows her answers. How many correct answers did she get?

<table>
<thead>
<tr>
<th>Number</th>
<th>Value of First Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 x 10^4</td>
<td>6000</td>
</tr>
<tr>
<td>1.46 x 10^-2</td>
<td>1 unit</td>
</tr>
<tr>
<td>3.62 x 10^4</td>
<td>3 units</td>
</tr>
<tr>
<td>2 x 10^-2</td>
<td>2 hundredths</td>
</tr>
<tr>
<td>3.12 x 10^-4</td>
<td>3 thousandths</td>
</tr>
</tbody>
</table>

- **Operations**
The mass of a spacecraft is $7.8 \times 10^4$ kg. The spacecraft is carrying equipment with a total mass of $2.4 \times 10^3$ kg. The spacecraft docks with a space station. The mass of the space station is $4.62 \times 10^5$ kg. The commander of the space station does not want the total mass on docking to be greater than $5.43 \times 10^5$ kg. Is the total mass within this limit?
Eight different people get in a lift. The maximum safe load of the lift is 650kg. They all have the same mass to the nearest kilogram. What is the largest that their mass can safely be?
In July 2014 there was an increase of 460% on the July average in the Algarve, Portugal. In July 2014, there was a total rainfall of 5.6cm, compared to 0.9cm in July 2012. Compare the rainfall in July 2012 to the average rainfall for the month of July.

- reverse percentages
Prove that the square of any odd number is always 1 more than a multiple of 8.

- writing equation
- odd number
- multiple
Gina has £t. Danny has £10 less than Gina. Martin has twice as much as Gina. In total they have £200.

Write an equation for the total amount of money they all have, and use it to calculate how much money Danny has.

- writing equation
- solving equation
Five of the exterior angles in a hexagon are 72°. What is the size of the other exterior angle?
Three of the interior angles in a pentagon are 152°. If the other two angles are equal in size, what is the size of the smallest interior angle in the pentagon?
The value of a vintage car rises from £36 000 to £63 000. Work out the percentage increase in the price of the car.
Two gas companies have different ways of charging. Find the number of kilowatt hours after which Alpha gasCo becomes cheaper than Beta gasCo.

**Alpha gasCo**
- Fixed Charge: £9.60
- Price per kilowatt hour of gas: First 5 kilowatt hours free then £1.30 for every kilowatt hour over 5.

**Beta gasCo**
- Fixed Charge: No fixed charge
- Price per kilowatt hour of gas: £1.50 for every kilowatt hour.

**Operations**
A rectangular field has a width of 50m to the nearest 10m and a length of 120m to the nearest m. (a) What is the largest possible area of the field? (b) What is the shortest possible perimeter of the field?
At a concert, the ratio of adults to children in the audience is 2 : 3. There are 786 children in the audience. An adult ticket costs twice as much as a child ticket. The total box office takings for the concert are £11,921. Work out the cost of an adult ticket.
Write down five numbers with a mean of 5 and a range of 6
Here are instructions for cooking a turkey.
Cook for 15 minutes at 220°C
Reduce the oven temperature to 160°C and cook for 40 minutes per kilogram.
Kirsty is going to cook a 7 kilogram turkey.
She wants to take it out of the oven at 12.45pm.
At what time must she start to cook it?

- operations
- time conversion
On a school trip at least 1 teacher is needed for every 8 students. Work out the minimum number of teachers for 130 students.

- operations

Source: CALCULATIONS
A cinema has 37 rows of seats and 23 seats in each row. Tickets are £8 each. The cinema has sold tickets for every seat. The manager estimates that £6400 was made from these tickets. Use approximations to show how the manager did this.

- operations
- estimation
- money
Diaries are sold in boxes of 12. Pencils are sold in boxes of 10. Rulers are sold in boxes of 6. A teacher wants to buy the same number of diaries, pencils and rulers. Work out the **smallest** number of boxes of each item he could buy.
A patient has a disease. She has $4^3$ body cells affected on day 1. The number of affected cells doubles every day. The disease becomes serious when $2^{10}$ body cells are affected. On which day does the disease become serious?
What is the difference between $27^{\frac{1}{3}}$ and $2^{-1}$?
By writing each as $2^n$, put these expressions in ascending order.

\[
\begin{array}{cccc}
\frac{1}{8^2} & \frac{2}{4^3} & \frac{1}{32^3} & \frac{5}{2^6}
\end{array}
\]
### Problem Solving – Answering the Question!

**Put these expressions in ascending order.**

\[
\begin{align*}
4^{\frac{1}{2}} & \quad 3^{-2} & \quad 8^{\frac{2}{3}} & \quad 25^{-\frac{1}{2}} & \quad 9^{\frac{3}{2}}
\end{align*}
\]

- **index laws**

**Source:** Miss Scudder
Find two sets of values for $c$ and $d$ such that

$$16^c = 2^d$$
$16^c = 2^d$

What is the relationship between the possible values of $c$ and $d$?

- indices
Calculate the mean of three numbers: $\sqrt{75}$, $\sqrt{75}$ and $\frac{6}{\sqrt{3}}$. Give your answer in the form $a\sqrt{3}$.

- surds
- rationalising the denominator
- simplifying surds
Here is a recipe for raspberry ice cream.

- ½ litre of cream
- 1Kg raspberries
- 250g sugar

This recipe makes enough for 8 people.

Ellie makes enough ice cream for 12 people.

How much cream does she use?

- ratio
- operations

Source: CALCULATIONS
Lucy makes 250 grams of her special snack mixture. 15% of the weight is raisins, 25% of the weight is banana chips and the rest is peanuts. How many kilograms of peanuts does she use?
Dylan bought a cat and a dog. Later he sold them for £60 each. He made a profit of 20% on the dog. He made a loss of 20% on the cat. How much in total did he pay for the cat and the dog?

• inverse percentages
Emily makes a fraction using two number cards. She gives two clues...

“My fraction is equivalent to half.”

“One of my number cards is a 6.”

State all possible fractions she could have made.

• fractions
Problem Solving – Answering the Question!

Which prime factors are shared by 70 and 84?

• prime factors
A square has an area of 50cm\(^2\). What is the perimeter of the square? Give your answer in the form \(p\sqrt{2}\).
Jim’s pay is £240 each week. Jim asks his boss for an increase of £40 a week. Jim’s boss offers him a 15% increase. Is the offer from Jim’s boss more than Jim asked for?
John and Rosie own a home assessed at £98,000. If for every £1000 of assessed value they must pay £65.50 in taxes, how much is their tax bill?

- decimals
- multiplication
The table gives information about the costs of posting parcels. Alex has to post some parcels. He has to post:

- 1 parcel with a weight of 5.8 kg
- 1 parcel with a weight of 950 g
- 1 parcel with a weight of 3.25 kg
- 1 parcel with a weight of 16.5 kg

Alex has £45 to spend on posting the four parcels. Can he post all the parcels?

<table>
<thead>
<tr>
<th>Maximum weight of a parcel</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 kg</td>
<td>£4.40</td>
</tr>
<tr>
<td>4 kg</td>
<td>£7.60</td>
</tr>
<tr>
<td>6 kg</td>
<td>£9.50</td>
</tr>
<tr>
<td>8 kg</td>
<td>£11.70</td>
</tr>
<tr>
<td>10 kg</td>
<td>£12.60</td>
</tr>
<tr>
<td>20 kg</td>
<td>£14.50</td>
</tr>
</tbody>
</table>

- unit conversion
- operations
Terry is going to make some concrete mix. He needs to mix cement, sand and gravel in the ratio 2 : 3 : 5 by weight. He estimates he needs to make 220 kg of concrete mix.

Terry has:
- 50 kg of cement,
- 90 kg of sand,
- 100 kg of gravel

Does Terry have enough cement, sand and gravel to make the concrete mix?

- sharing in a ratio
- operations
Judy has cut out a circle with a diameter of 10cm. She folds it in half. Then she folds it in half again. She folds in half twice more. What is the area of the piece she has made?
The radius of the minute hand of a clock is 12cm.

In cm, how far does its **tip** move between the times 11:55am and 12pm?
The windshield wiper of a car is 24 inches long. The windscreen wiper rotates through 100°, then returns to its starting position. How many inches will the tip of the wiper trace out after 10 cycles of the windscreen wiper?

- circles
- area of sector
Gary, Salma and Jamie did a Maths test. The total for the test was 60 marks. Gary got 26 out of 60. Salma got 45% of the 60 marks. Jamie got \( \frac{2}{5} \) of the 60 marks. Who got the highest mark? You must show all your working.

- fractions
- percentages
The area of a square is 387.5cm$^2$
Work out the length of one side of the square.
Give all the figures on your calculator display.
Glen sells car insurance and home insurance. The table shows the cost of these insurances. Each month Glen earns £850 basic pay.

5% of the cost of all the car insurance he sells
10% of the cost of all the home insurance he sells

In August Glen sold **10 car insurances** and **5 home insurances**.

Work out the total amount of money Glen earned in August.

<table>
<thead>
<tr>
<th>Insurance</th>
<th>car insurance</th>
<th>home insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>£250</td>
<td>£300</td>
</tr>
</tbody>
</table>

**CALCULATIONS**

- money
- percentages
Problem Solving – Answering the Question!

Peter goes for a walk. He walks $17 \frac{1}{2}$ miles in 5 hours. Sunita said that on average Peter walked faster than 5km/h. Is Sunita right?

- unit conversion
- compound units
- speed, distance, time
Mr Watkins needs to buy some oil for his central heating. Mr Watkins can put up to 1200 litres of oil in his oil tank. There is already 650 litres of oil in the tank. Mr Watkins is going to fill the tank with oil. The price of oil is 77.2p per litre. Mr Watkins gets 5% off the price of the oil.

How much does Mr Watkins pay for the oil he needs to buy?
Mrs Binder owns a second hand book shop. She buys in 30 ‘good as new books’ for £3 each. She chooses a selling price that will give her a 40% profit. She sells \( \frac{3}{5} \) of the books at this price. She then reduced the selling price by 20% and sold the remaining books at this price. Calculate Mrs Binders overall percentage profit on this transaction.
Linda has her car serviced every 6000 miles. Here are some of the checks they carry out. How many miles does the car travel before it has a service that includes all five checks?

**Check** | **Every**
---|---
Brake Fluid | 6000 miles
Oil Filter Change | 12000 miles
Tyres | 6000 miles
Wiper Blades | 18000 miles
Timing Belt Change | 24000 miles

Source: CALCULATIONS
Bob the builder was plastering a wall while standing on a ladder. He noticed that number of rungs below the rung he was standing on was $\frac{1}{3}$ of the number of rungs above where he was standing. He then climbed another 10 rungs and noticed that the number of rungs below and above where he was standing were equal. How many rungs are on his ladder?

- fractions
- writing equation
Problem Solving – Answering the Question!

Look at this sequence of shapes.

a Find how many grey triangles there are in shape 50.
b Find how many white triangles there are in shape 100.
c Find the total number of triangles in shape 500.
d What is the number of the shape which has 998 triangles?
Problem Solving – Answering the Question!

1. How many hours and minutes is 700 minutes?
2. Janis has the £12 Promotional tariff. She pays by voucher. She does not use her phone for voice calls. So far in a month she has sent 43 texts. How many more can she send that month before service is suspended?
3. Andy has the £12 Promotional tariff. He pays by direct debit. How much will this cost per month after the 10% discount?
4. Ben has the ‘Mix and match 300’ tariff. Before any discounts or VAT how much would this cost for a 12-month contract?
5. Gordon has the ‘£12 Promotional tariff’. So far he has used 24 minutes on voice calls and sent 19 texts. How many more minutes or texts can he send before he gets charged extra?

• percentages
• operations
The cost, $C$, of placing an advertisement in a local newspaper is given by:

\[ C = 20 + 2N \]

where $N$ is the number of words used in the advertisement. How many words could be written if the advertisement cost £36?

• rearranging equations
My son is 25 years younger than I am. Our ages add up to 81. How old are we?

- writing equations
- solving equations
Paula is three times as old as Angus. Their ages add up to 52.

a Write down an equation to represent the information.
b Solve the equation to find both ages.

- writing equations
- solving equations
Two consecutive numbers add up to 135. What is the product of the two numbers?

- writing equations
- solving equations
Katherine says that $1\text{m}^3$ is equal to $100\text{cm}^3$. Explain why Katherine is wrong.

- unit conversion
Problem Solving – Answering the Question!

Oliver’s average fuel consumption is 42mpg (miles per gallon). How many kilometres would he expect to travel if his fuel tank held 40 litres?

• unit conversion
• compound units

Source:

CALCULATIONS
Here is some information about some bags of marbles:
Altogether, there are 10 bags
Each bag contains 12 marbles
Each marble weighs 7 grams

The answer is 120. What was the question?

• operations

Source: CALCULATIONS
Here is some information about some bags of marbles:
Altogether, there are 10 bags
Each bag contains 12 marbles
Each marble weighs 7 grams

The answer is 840. What was the question?
Here is some information about some bags of marbles:
Altogether, there are 10 bags
Each bag contains 12 marbles
Each marble weighs 7 grams

The answer is 84. What was the question?
Janet joins three points on a grid to make a triangle. The coordinates of the points are: (0, 0) (1, 1) (2, 0) Lucy enlarges Janet’s triangle so that the area is 25cm². Write down a set of possible co-ordinates for Lucy’s triangle.
The speed limit on British motorways is 70mph. A German driver, whose speedometer is in km/h, shows 100. Is he speeding?
Lennie, a driving instructor, used the following formula to charge learner drivers:

\[ C = £4 + £13H \]

where \( H \) is the number of hours in the driving lesson.

Jenny has a lesson which starts at 1:45pm and cost £35. At what time does her lesson finish?

- rearranging equations
- solving equations
- time