Express: - to write the answer

Evaluate: - to write the answer

Simplify: - to cancel down or collect terms so that the answer is in a simpler format

Square: - to multiply a term by itself

Square Root: - the inverse operation of square

Cube: - to multiple a term by itself, and then by itself again

Cube Root: - the inverse operation of cube.

Converting between standard form and ordinary numbers

Numbers in standard form are written in the form $A \times 10^x$ where A is between 1 and 10

$5 \times 10^3 = 5000$

The 5 moves three places to the left

$380000 = 3.8 \times 10^5$

$5 \times 10^{-2} = 0.05$

The 5 moves two places to the right

$0.00052 = 5.2 \times 10^{-4}$

Calculations in standard form

These can all be done on a calculator, but if it's a non-calculator paper ...

Remember to use the index laws!

$(3 \times 10^5) \times (8 \times 10^4) = 3 \times 8 \times 10^{5+4}$

$= 24 \times 10^9 = 2.4 \times 10^{10}$

$(4 \times 10^8) \div (5 \times 10^3) = (4 \div 5) \times 10^{8-3}$

$= 0.8 \times 10^5 = 8 \times 10^4$

When adding and subtracting convert to an ordinary number first. Do the calculation, then convert back to standard form.

$(3 \times 10^4) + (8 \times 10^3) = 30000 + 8000$

$= 38000 = 3.8 \times 10^4$

Factors

The Factors of 20 are: 1, 2, 4, 5, 10 and 20 because 1×20, 2×10, 4×5 all equal 20

HCF – highest common factor

The HCF is the biggest number that is a factor of both. The HCF of 20 and 50 is 10.

Powers and roots

The square numbers are: 1, 4, 9, 16, 25, 36, ...
These are found by multiplying a number by itself, for example $5^2 = 5 \times 5 = 25$

The cube numbers are: 1, 8, 27, 64, 125, ...
An example of how to find them:
$5^3 = 5 \times 5 \times 5 = 125$

Square rooting is the opposite of squaring. When we square root we are finding the number that was multiplied by itself, for example $\sqrt{100} = 10$ because 10×10

Index Laws

Multiplication law: $6^3 \times 6^5 = 6^{3+5} = 6^8$

Division law: $6^8 \div 6^5 = 6^{8-5} = 6^3$

Power law: $(6^3)^5 = 6^{3\times5} = 6^{15}$

$3a^3 \times 6a^4 = 18a^{3+4} = 18a^7$

$12a^7 \div 6a^4 = 2a^{7-4} = 2a^3$

$(3a^3)^2 = 3^2a^{3\times3} = 9a^9$

Multiples

The multiples of 8 are:

8, 16, 24, 32, 40, 48, 56, 64, ...

The multiples of 6 are:

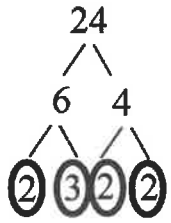
6, 12, 18, 24, 30, 36, 42, 48, 54, ...

LCM – lowest common multiple

The LCM of 8 and 6 is 24.

Product of primes

Every number can be written as a unique list of prime numbers multiplied together.



$24 = 2^3 \times 3$

Higher powers

The power tells us how many of that number we are multiplying together:

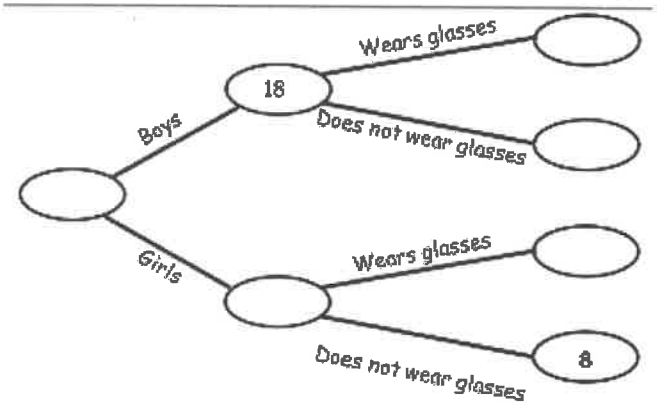
$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Frequency Tree

A diagram showing how information is categorised into various categories.

The numbers at the ends of branches tells us how often something happened (frequency).

The lines connected the numbers are called branches.



Probability – The likelihood/chance of something happening.

A table that **organises data** around **two categories.**

Fill out the information step by step using the information given.

Make sure all the totals add up for all columns and rows.

Question: Complete the 2 way table below.

	Left Handed	Right Handed	Total
Boys	10		
Girls			58
Total		84	100

Answer: Step 1, fill out the easy parts (the totals)

	Left Handed	Right Handed	Total
Boys	10	48	58
Girls			42
Total	16	84	100

Answer: Step 2, fill out the remaining parts

	Left Handed	Right Handed	Total
Boys	10	48	58
Girls	6	36	42
Total	16	84	100

Sample Space

The set of all possible outcomes of an experiment

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Mutually Exclusive

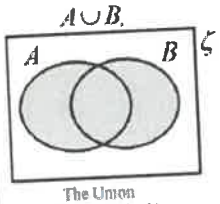
Events are mutually exclusive if they cannot happen at the same time. The probabilities of mutually exclusive events adds up to 1.

Exhaustive Outcomes

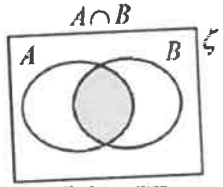
Outcomes are exhaustive if they cover the entire range of possible outcomes. The probabilities of an exhaustive set adds up to 1.

A Venn Diagram shows the **relationship between a group of different things** and how they overlap.

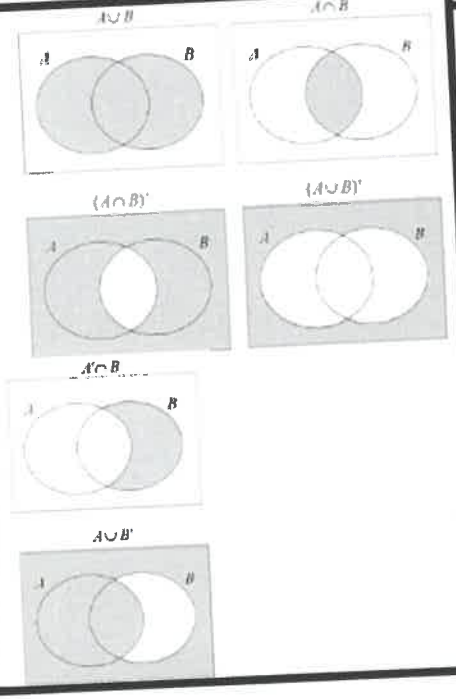
You may be asked to shade Venn Diagrams as shown below and to the right.



The Union
'A or B or Both'



The Intersection
'A and B'

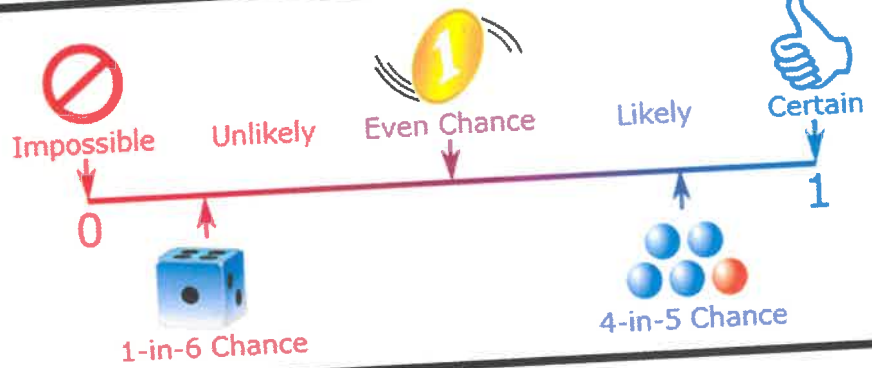


an

Independent events – the outcome of a previous event does not affect the outcome of the second event

Dependent events – the outcome of a previous event does affect the outcome of the

Probability Scale



Arithmetic sequences

3, 7, 11, 15 the rule is + 4 so the next term is 19

11, 6, 1, -4 rule is – 5, the next term is -9

Geometric sequences

3, 6, 12, 24 rule is × 2, the next term is 42

81, 27, 9, 3 rule is ÷ 3, the next term is 1

Fibonacci sequence

1, 1, 2, 3, 5, 8, the next term is found by adding the two previous terms, so 5 + 8 = 13

Substitute - replacing a letter in a term with a number

Sequence – a list of numbers that follow a rule or pattern

Substituting into expressions

If a = 4, then 5a + 3 = 5 × 4 + 3 = 20 + 3 = 23

If a = 4 and b = 3, then 2a – b = 2 × 4 – 3 = 5

Substituting into formulae

A chicken takes 45 mins per kg + 20 mins.

If a chicken weighs 2 kg then the cooking time is:

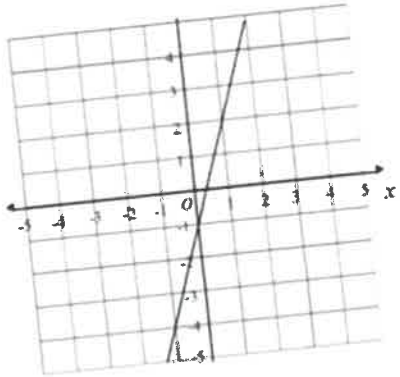
45 × 2 + 20 = 90 + 20 = 110 minutes or 1h 50

Plotting graphs

To plot y = 3x – 1 use a table to find the coordinates

x	-1	0	1	2
y = 3x – 1				

When x = 2, y = 3 × 2 – 1 = 5, therefore the coordinates are (2,5)
These coordinates can be plotted and joined with a straight line



Nth term

The nth term enables you to find any term in the sequence. N stands for the position in the sequence. So for the first term n=1, for the second term n=2, third term n= 3 and so on.

If the nth term is 5n – 2, the first term is 5 × 1 – 2 = 3, the second term is 5 × 2 – 2 = 8 and the third term is 5 × 3 – 2 = 13. Therefore the sequence 5n – 2 is 3, 8, 13, 18, 23 ... notice the rule is + 5

The sequence 3n + 5 would be 8, 11, 14, 17 ..... the rule is + 3

Equation of a straight line

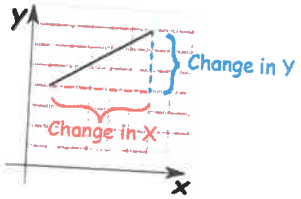
Gradient (m)

$$y = mx + c$$

y intercept (c)

is the general form of the equation of any straight line.

To calculate the *gradient (m)*:



$$m = \frac{\text{Change in Y}}{\text{Change in X}}$$

To find the *y intercept (c)*, just see where the line crosses the y axis.

Finding the nth term

The sequence 7, 12, 17, 22 goes up by 5 each time, therefore the nth term is 5n + something
5n is 5, 10, 15, 20, 25,
therefore 7, 12, 17, 22 is 5n + 2.

The sequence 4, 10, 16, 22 goes up by 6,
6n is 6, 12, 18, 24, 30
therefore 4, 10, 16, 22 is 6n – 2

The sequence -1, 3, 7, 11 goes up by 4,
4n is 4, 8, 12, 16, 20
therefore -1, 3, 7, 11 is 4n - 5

Vertices – corners of a shapes

Edges – outside lines on a shape

Faces – the flat surface on a solid

Volume – measurement of the space inside a

Surface area – the total sum of the area of each face

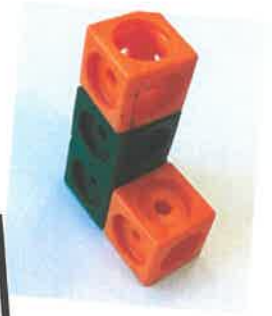
Nets – a flat drawing of the faces of an object which could be folded up to create the 3D shape

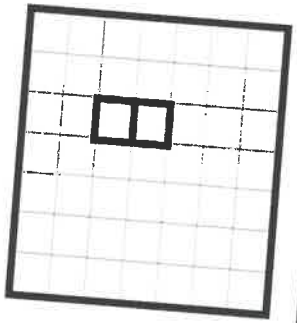
Prism – a 3D shape with a constant cross section

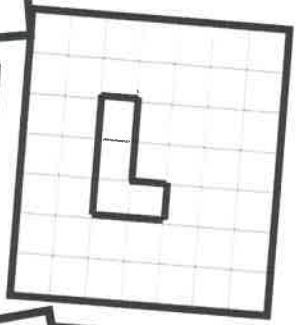
Pyramid – a 3D shape with a polygon base and triangular sides that meet at a point

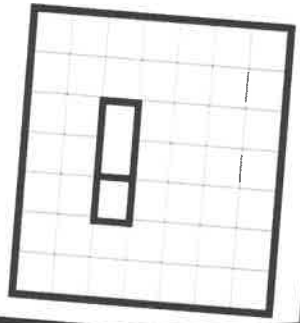
Plans and elevations

The plan is a 2D picture of what the object looks like from above. Elevations are 2D pictures of what the object looks like from the front and side.

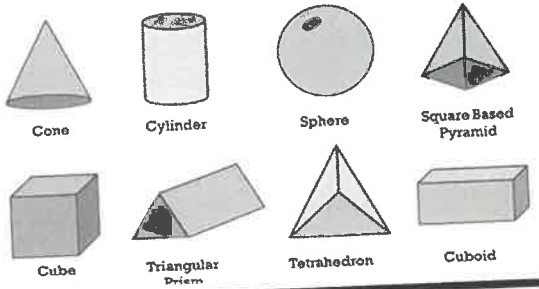




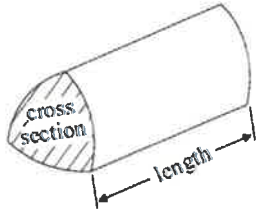




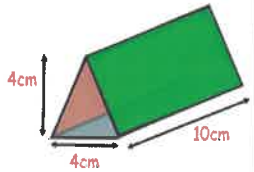
3D shapes



Volume of prism = area of cross section × length



Volume of a Triangular Prism



Find the volume of the triangular prism

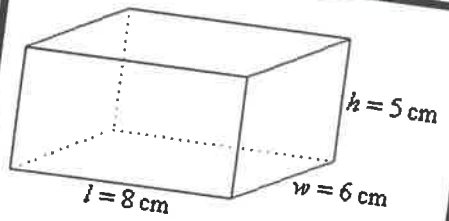
Working

Triangle Area = $\frac{1}{2}bh$

$= 2 \times 4 = 8\ cm^2$

Volume = Area x length

$= 8 \times 10 = 80cm^3$

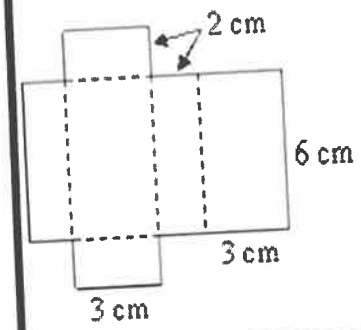


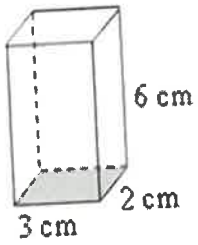
Volume of a cuboid

= length × width × height

$= 8 \times 6 \times 5 = 240cm^3$

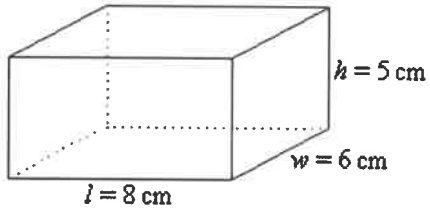
Nets





Surface area

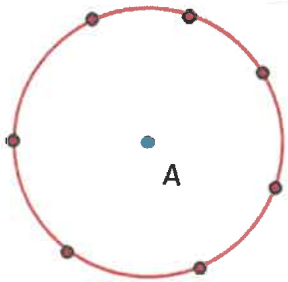
The cuboid has 6 faces. The surface area of the cuboid is the area of all 6 faces added together.



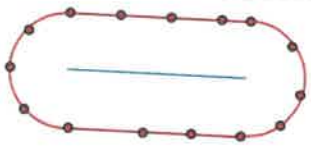
The area of the:

top	$= 6 \times 8 = 48cm^2$
bottom	$= 6 \times 8 = 48cm^2$
front face	$= 5 \times 8 = 40cm^2$
back face	$= 5 \times 8 = 40cm^2$
right face	$= 5 \times 6 = 30cm^2$
left face	$= 5 \times 6 = 30cm^2$

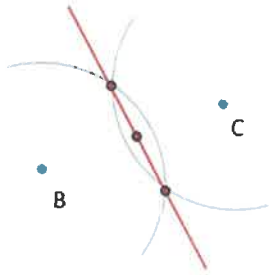
Total surface area = 48 + 48 + 40 + 40 + 30 + 30 = $236cm^2$



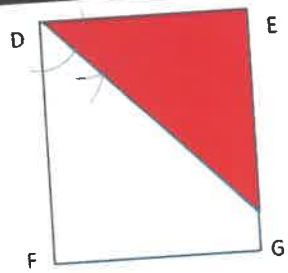
Equidistant from a point



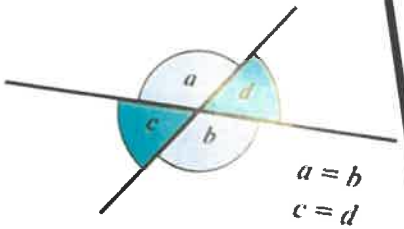
Equidistant from a line



Equidistant from two points



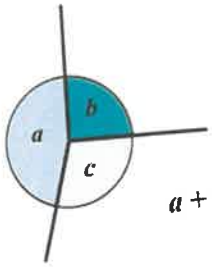
Equidistant from two lines



$a = b$

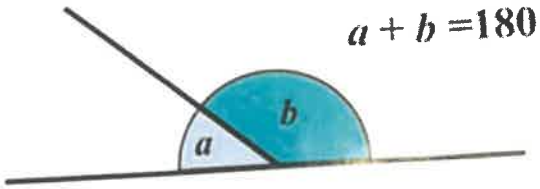
$c = d$

Vertically opposite angles are equal



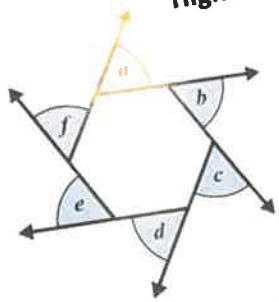
$a + b + c = 360$

Angles about a point sum to 360°



Angles on a straight line sum to 180°

Higher only

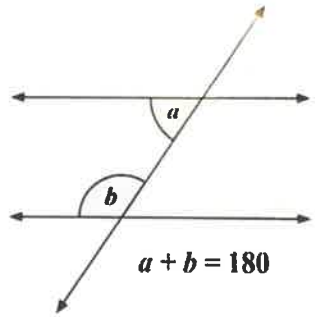


$a + b + c + d + e + f = 360$

Exterior angles of a polygon sum to 360°

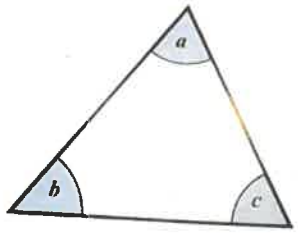
Bisect – from Latin, *bi* meaning two and *sect* meaning to cut

Equidistant – from Latin, *aequi* meaning equal and *distantem* meaning distance



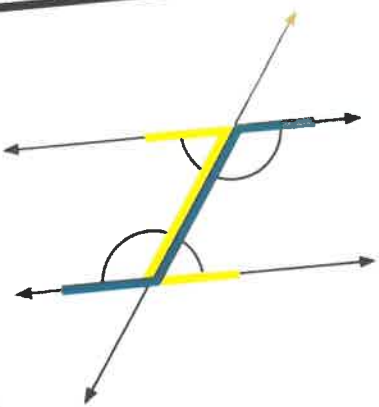
$a + b = 180$

Co-interior angles sum to 180°

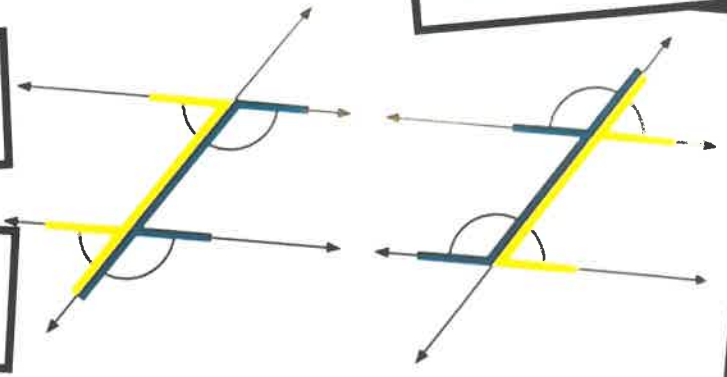


$a + b + c = 180$

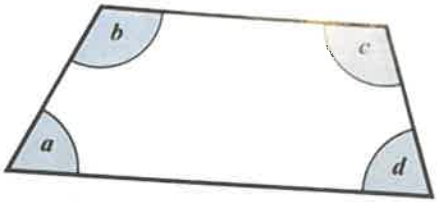
Angles in a triangle sum to 180°



Alternate angles are equal



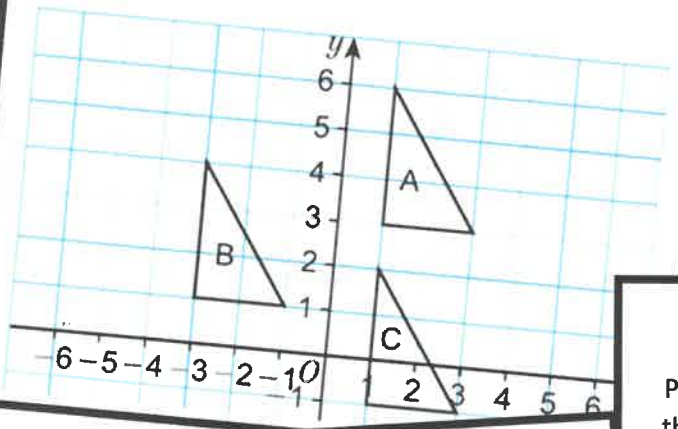
Corresponding angles are equal



$a + b + c + d = 360$

Angles in a quadrilateral sum to 360°

Translations – moves a shape, without changing its size or orientation. Below A has been moved 4 left and 2 down. Therefore we say it has been translated by the vector $\begin{pmatrix}-4\\-2\end{pmatrix}$. B has been translated by the vector $\begin{pmatrix}4\\-2\end{pmatrix}$ to become C.



Describe the single transformation

To describe a reflection: write reflection and the mirror line that was used.

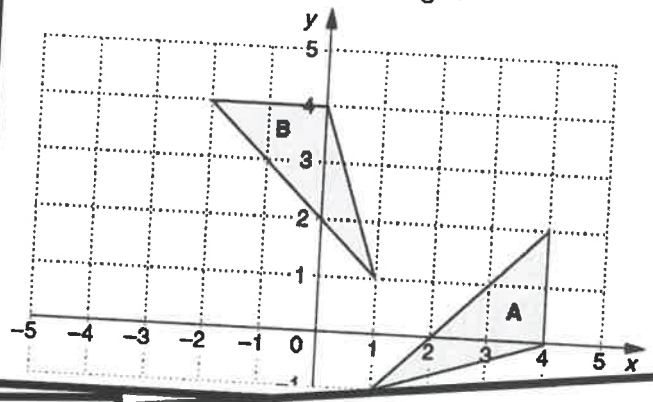
To describe a rotation: write rotation, how many degrees, what direction (clockwise or anticlockwise) and the centre of rotation.

To describe a translation: write translation and the vector which it was translated by.

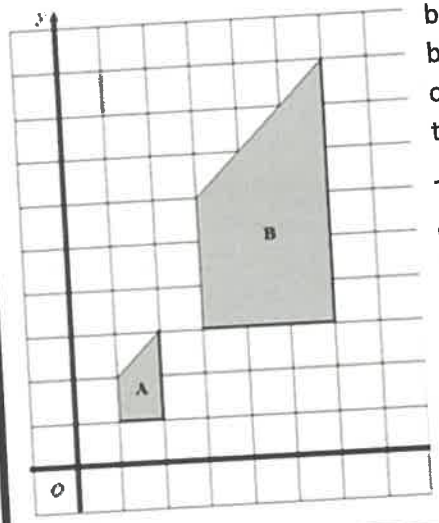
To describe an enlargement: write enlargement, the scale factor of enlargement and the centre of enlargement.

Rotations

A has been rotated 90 degrees anticlockwise using centre (0,0) also known as the origin.



Enlargements



Shape A has been enlarged by a scale factor of 3 – it is 3 times bigger

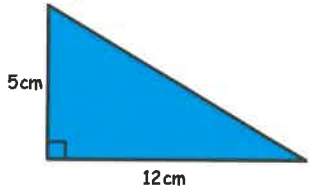
The centre of enlargement is the point (0,0). Shape B is 3 times further away from this point than shape A is.

Pythagoras' Theorem **Higher only**

Pythagoras discovered that if you square (multiply by itself) the two shorter sides and add them it is always equal to the square of the longest side, known as the hypotenuse.

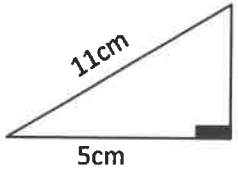
To find the hypotenuse on the right-angled triangle below:

Hypotenuse = $\sqrt{5^2 + 12^2} = \sqrt{169} = 13cm$



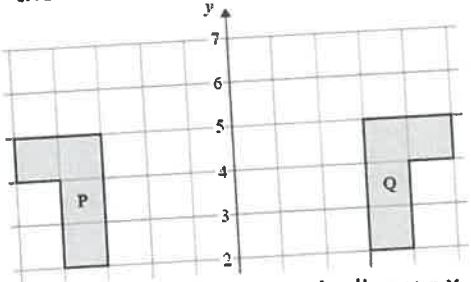
To find a shorter side we can subtract the square of the shorter side. For example to find the missing length below:

$\sqrt{11^2 - 5^2} = \sqrt{96} = 9.8cm$



Reflections

P has been reflected in the y-axis also known as the line x = 0 to obtain the shape Q.



A has been reflected in the line y = x to obtain the shape B.

