Toynbee Curriculum

Knowledge Maps

MATHS (Shape)

Toynbee School

2D Shapes

Keywords:	Triangle / Quadrilateral / Polygon / Regular / Parallel

Definition / Description:				
Triangle: A three sided polygon	**Quadrilateral:** A four sided polygon	**Polygon:** A closed shape with all straight edges	**Regular:** When a polygon has equal sides and angles	**Parallel:** Two sides that never meet

Knowledge points:

Knowledge point examples:

Properties of triangles

All triangles have 3 sides and have a sum of interior angles of 180^0 however, different types of triangles have specific properties

Equilateral Triangle: equal sides; equal angles; (60^0); 3Lines of symmetry; Rotational symmetry order 3

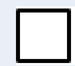
Isosceles triangle: 2 equal sides, 2 equal angles, 1 line of symmetry; Rotational symmetry order 1

Scalene triangle: No sies or angles are the same 0 lines of symmetry; Rotational symmetry order 1

Right angled triangle: 1 angle of 90^0. 0 lines of symmetry (unless also isosceles) Rotational symmetry order 1.

Properties of Quadrilaterals

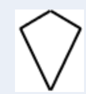
All quadrilaterals have 4 sides and have a sum of interior angles of 360^0 however different types of quadrilaterals have specific properties



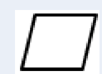
Square: Equal sides; 2 pairs of Parallel sides; All angles 90˚; Diagonals bisect each other and cross at 90°

Rectangle: 2 pairs of Equal sides; 2 pairs of Parallel sides; All angles 90˚; diagonals bisect but are NOT perpendicular

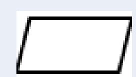
Trapezium: 1 pair of parallel sides; diagonals do not bisect and are NOT perpendicular



Kite: 2 pairs of equal sides; no parallel sides; diagonals do NOT bisect but are perpendicular

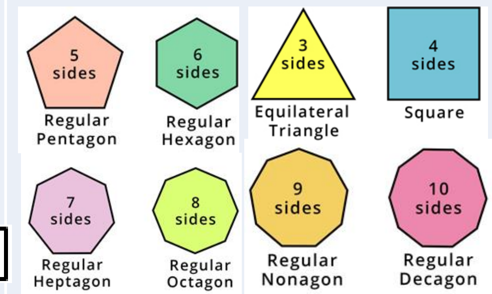


Rhombus: Equal sides; opposite sides are parallel; opposite angles are equal; diagonals bisect and are perpendicular



Parallelogram: 2 pairs of equal and parallel sides; opposite angles are equal; diagonals do NOT bisect and are NOT perpendicular

Regular Polygons



Linked Knowledge Maps

3D shapes / Transformations / Congruence and Similarity / Pythagoras and Trigonometry / Angles

3D SHAPE

Keywords: Volume / Prism / Net / Face / Cross-section / Surface area / Pyramid

Definition / Description:

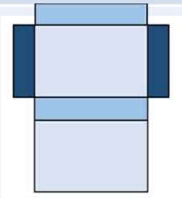
Volume	Prism	Net	Face	Cross-Section	Surface Area	Pyramid
Volume: The amount of space in a 3D container	Prism: A 3D shape with a uniform cross-section	Net: A surface that can be folded in a solid	Face: A flat surface of a solid shape	Cross-Section: A slice cut through at an angle 90º to its axis	Surface Area: Total area of a solids exterior surface	Pyramid: A solid shape with triangular faces that meet at a vertex

Knowledge points:

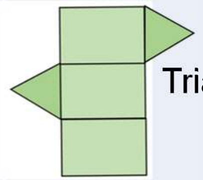
Nets	Plans and elevation	Volume of prisms	Surface area of prisms	Volume of a Pyramid	Spheres
Nets	Plans and elevation – 2D representations of a 3D shape	Volume of prisms: V = Cross Section x Length	Surface area of prisms: Total area of all faces	Volume of a Pyramid – The volume of a pyramid is $\frac{1}{3}$ the volume of a prism.	Spheres: V = $\frac{4}{3}\pi r^3$ SA = $4\pi r^2$

Knowledge point examples:

Nets

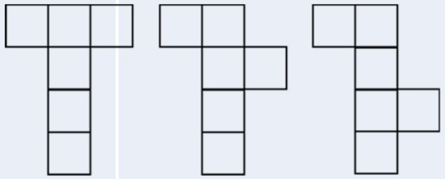


Cuboid

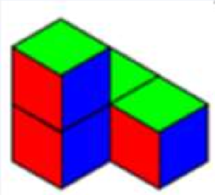


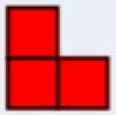
Triangular Prism

Some shapes may have more than 1 possible net like a cube:

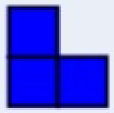


Plans and elevation

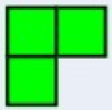




Front Elevation



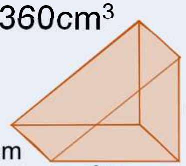
Side Elevation



Plan view (Birds eye)

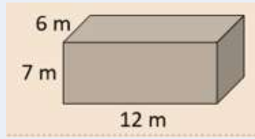
Volume of prisms

Volume=5 x 12 x 6
=60 x 6
= 360cm^3



Volume = $\frac{8 \times 6}{2}$ x 4
=24 x 4
= 96m^3

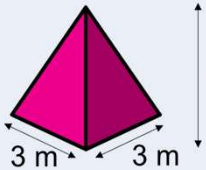
Surface area of prisms



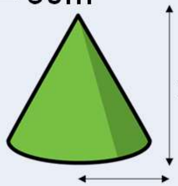
Surface Area =
$(6 \times 7) + (6 \times 7) + (7 \times 12) + (7 \times 12) + (12\times6) + (12 \times 6)$
= $2\times(6\times7)+(7\times12) + (12 \times 6)$= 270m^2

$\pi \times 14^2 = 616$
$2 \times \pi \times 14 \times 80 = 7\ 037$
$616 + 616 + 7\ 037 = 8\ 720$ cm^2

Volume of a Pyramid

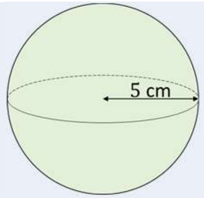


V = $\frac{1}{3}$ x 3 x 3 x 10
V = $\frac{1}{3}$ x 90
V = 30m^3



V = $\frac{1}{3}$ x π x 4^2 x 10
V = $\frac{1}{3}$ x 160π
V = 167.6m^3

Spheres



Volume =
$\frac{4}{3} \times \pi \times 5^3$
$= \frac{500}{3}\pi$
≈ 523.6 cm^3

Surface Area =
$4 \times \pi \times 5^2$
$= 100\pi$
≈ 314.2 cm^2

Linked Knowledge Maps: Pythagoras and Trigonometry / Compound and non-compound measures

Angles of polygons

Keywords: Polygon / Regular / Interior / Exterior

Definition / Description:

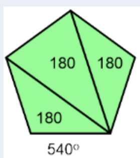
- **Polygon:** A closed shape with all straight edges
- **Regular:** When a polygon has equal sides and angles
- **Interior:** The inside of a polygon
- **Exterior:** The outside of a polygon

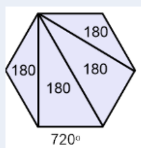
Knowledge points:

- **Sum of interior angles: = (n – 2) x 180** where n is the number of sides of the polygon
- **Exterior angles of a polygon = 360**
- **Exterior + Interior angles = 180**
- **Exterior angle of a REGULAR polygon: = 360 ÷ n** where n is the number of sides of the polygon

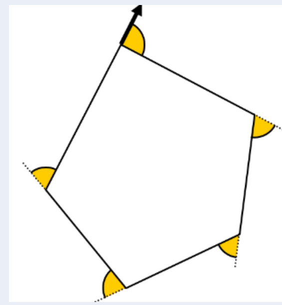
Knowledge point examples:

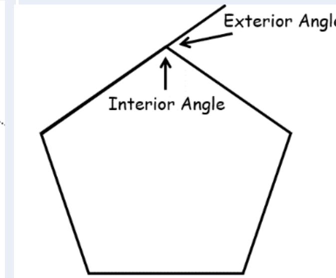
This formula is derived from the number of triangles that can be made in polygon from one vertex starting point and using the sum of interior angles of a triangle being 180^0





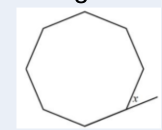
Shape	Sides	Sum of Interior Angles
	3	180
	4	360
	5	540
	6	720
	7	900
A polygon with n sides		(n-2) x 180





What is the exterior angle of an octagon:

360 ÷ 8 = 45^o



A regular polygon has an exterior angle of 4^o. How many sides does it have?

360 ÷ n = 4
n = 360 ÷ 4
n = 90

The regular polygon has 90 sides.

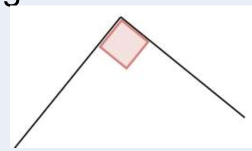
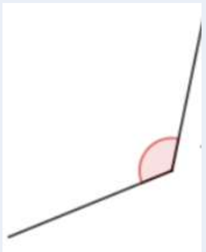
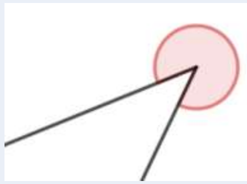
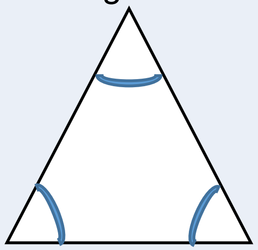
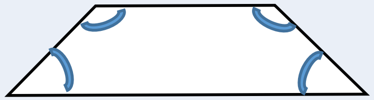
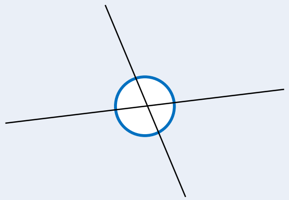
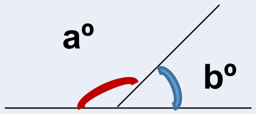
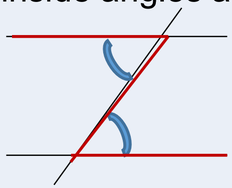
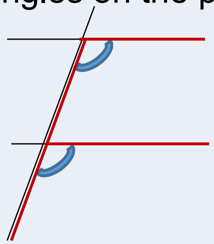
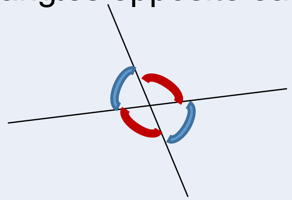
Linked Knowledge Maps

3D shapes / Transformations / Congruence and Similarity / Pythagoras and Trigonometry / Angles

ANGLES

Keywords:	**Angle, Acute, Obtuse, Reflex, Right-Angle, Parallel**

Definition / Description:	**Angle**: A measure of turn	**Acute:** An angle that lies between 0º and 90º	**Obtuse:** an angle that lies between 90º and 180º	**Reflex:** an angle that lies between 180º and 360º	**Right-Angle:** a quarter of a revolution, or exactly 90º	**Parallel:** lines that never meet

Knowledge points:	**Types of angles:** Recognise the different classifications of angles	**Angle Facts:** Recognise the properties of certain shapes and rules of angles	**Angles in Parallel Lines :**Recognise the different classifications of equal angles within parallel lines
Knowledge point examples:	Acute: an angle that measures between 0º and 90º  Right-Angle: an angle that measures exactly 90º  Obtuse: an angle that measures between 90º and 180º  Reflex: an angle that measures between 180º and 360º 	Angles in a triangle total 180º  Angles in a quadrilateral total 360º  Angles around a point total 360º  Angles on a straight line total 180º aº + bº = 180º 	Alternate angles: when a line transects two parallel lines to create a “Z” or “S” shape, the inside angles are equal  Corresponding angles: when a line transects two parallel lines to create an “F” shape, the angles on the parallel lines are equal  Vertically Opposite: when two lines intersect, angles opposite each other are equal 

Linked Knowledge	Constructions / Congruence and Similarity

Circles

Keywords: Diameter, Radius, Circumference, Chord, Arc, Sector, Segment, Tangent, Pi (π)

Definition / Description:

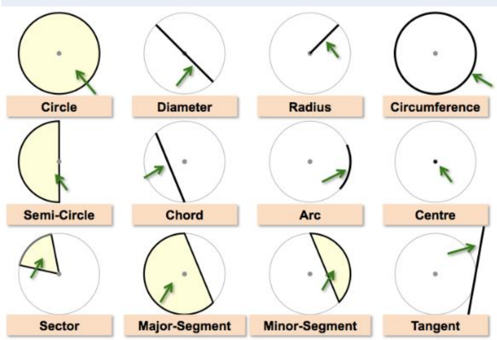
Diameter: the chord that passes through the centre of a circle
Radius: a line that joins the centre of a circle to the circumference
Circumference: The perimeter of a circle
Chord: a line that joins two points on the circumference
Arc: part of the circumference
Sector: the section of a circle between two radii and an arc
Segment: the section of a circle between a chord and an arc
Tangent: a straight line that touches a circle without crossing it
Pi (π): the ratio of a circumference to the diameter of a circle

Knowledge points:

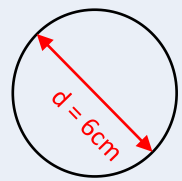
Parts of a circle	Circumference	Area:	Area of sector:	Length of arc:	Perimeter of a sector
	$C = \pi d$	$A = \pi r^2$	$A = \frac{\theta}{360} \times \pi r^2$ Where Ɵ is the angle	$L = \frac{\theta}{360} \times \pi d$ Where Ɵ is the angle	

Knowledge point examples:

Parts of a circle

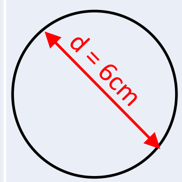


Circumference



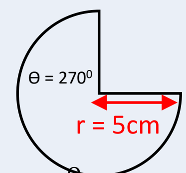
$C = \pi d$
$= \pi \times 6$
$= 18.8$cm (1dp)

Area



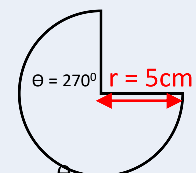
$A = \pi r^2$
$= \pi \times 3^2$
$= 28.3\text{cm}^2$ (1dp)

Area of sector



$A = \frac{\theta}{360} \times \pi r^2$
$= \frac{270}{360} \times \pi \times 5^2$
$= 58.9\text{cm}^2$ (1dp)

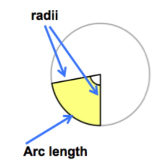
Length of arc



$L = \frac{\theta}{360} \times \pi d$
$= \frac{270}{360} \times \pi \times 10$
$= 23.6$cm(1dp)

Perimeter of a sector

When calculating the perimeter of a sector we first calculate the arc length and then add on 2 radii radii is the plural word for radius). Usually measured in cm, m, mm.



Linked Knowledge Maps

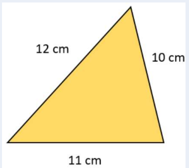
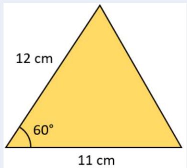
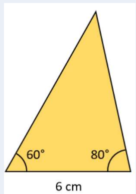
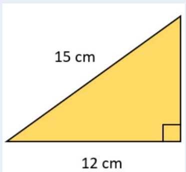
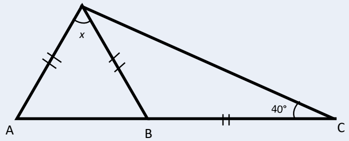
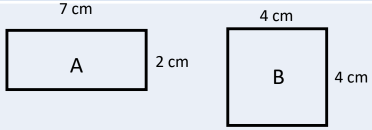
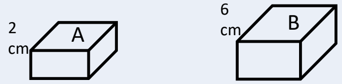
Angles
Circle Theorems
Non-linear graphs – circle, reciprocal, exponential
3D shapes

COMPOUND MEASURES

Keywords:	Compound / Density / Pressure / Newton			
Definition / Description:	**Compound:** A Mixture	**Density:** an objects mas per unit volume	**Pressure:** Force per unit area	**Newton:** Unit for weight and force
Knowledge points:	**Speed Distance, Time:** Speed = Distance ÷ Time	**Average Speed:** Total Distance ÷ Total Time	**Density:** Density = Mass ÷ Volume	**Pressure:** Pressure = Force ÷ Area
Knowledge point examples:	If I travel 72 miles in 3 hours what is my speed? Speed = Distance ÷ Time 72 miles ÷ 3 hours = **24mph** Mark cycles 42 km at an average speed of 14 km/h. How long does it take him? Time = distance ÷ Speed 42km ÷ 14km/h = **3 hours** A bird flies for 40 minutes at an average speed of 11m/s. How far does the bird fly in kilometres? 40 minutes = 2400 seconds Distance = Speed x Time 11m/s x 2400s = 26400m = **26.4km**	A car travels 60km at 30 km/h and then a further 180km at 160 km/h. Find: a) the total time taken in hours: Time = distance ÷ Speed = = 60 ÷ 30 = 2 hours = 180 ÷ 160 = 1.125 hours =**3.125hrs** b) the average speed for the whole journey Speed = Distance ÷ Time = (60 + 180) ÷ 3.125 =**76.8 km/h**	A piece of silver has a mass of 42g and a volume of 4cm^3. Work out the density of silver Density = Mass ÷ Volume =42g ÷ 4cm^3 = **10.5 g/cm^3** A 50g piece of wood which has a density of 0.4g/cm^3 Work out the volume of the block. Volume = Mass ÷ Density 50g ÷ 0.4g/cm^3 = **125cm^3**	A force of 30 Newtons is applied to an area of 1.5 m^2. Work out the pressure in N/m^2 Pressure = Force ÷ Area 30N ÷ 1.5m^2 = **20N/m^2** A force is applied to an area of 4.5 m^2. It produces pressure of 12 N/m^2. Work out the force in Newtons. Force = Pressure x Area 12N/m^2 x 4.5m^2 = **54N**
Linked Knowledge Maps	Non-compound measures / Bounds			

CONGRUENCE AND SIMILARITY

Keywords:	Scale factor / Ratio / Enlargement / Similar / Congruent / Identical /					
Definition / Description:	Scale factor: The ratio of the enlarged distance to the original value	Ratio: A part to part comparison	Enlargement: Changing the size of a shape by a given scale factor	Similar: Two shapes whose sides are in proportion to one another	Congruent: How to mathematically describe 2 shapes that are identical	Identical: Exactly alike

Knowledge points:	**Use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)** Understand and identify congruent triangles; prove congruency using formal arguments	**Use congruence and similarity to prove missing angles and sides** Recognise similar shapes when rotated or reflected; apply mathematical reasoning	**Compare lengths, areas and volumes using ratio notation** Make links to similarity and scale factors	**Apply the concepts of congruence and similarity, including relationships between lengths, areas and volumes**
Knowledge point examples:	*Condition for Congruence = Side, Side, Side (SSS)*  *Condition for Congruence = Angle, Side, Angle (ASA)*  *Condition for Congruence = Side, Angle, Side (SAS)*   *Condition for Congruence = Right Angle, Hypotenuse, Side (RHS)*	ABC is a straight line. Work out *x*.  *Triangle AB and Triangle BC are both isosceles triangles -> Angles at A and B are equal and angles at C and corresponding base are equal.* *Angle at B in Triangle BC: 180º - (40º + 40º) = 100º* *Angles on a straight line total 180º, therefore angle at B in Triangle AB = 80º.* *Angles at A and B are equal, so x is 180º - (80º + 80º) = 20º.*	 Write the ratio perimeter *A* : perimeter *B* in its simplest form. *Perimeter A:* *2(7 + 2) = 18 cm* *Perimeter B:* *4 + 4 + 4 cm + 4* *= 16 cm* *Ratio = 18 : 16* ÷ 2 *9 : 8* Write the ratio area *A* : area *B* in its simplest form. *Area A: 7 x 2 = 14 cm²* *Area B: 4 x 4 = 16 cm²* *Ratio = 14 : 16* ÷ 2 *7 : 8*	These boxes are similar.  What is the ratio of the volume of box *A* to the volume of box *B*? *Ratios of side lengths = 2 cm : 6 cm = 1 : 3 (in simplest form)* *If length ratio is a : b, then area ratio is $a^2 : b^2$ and volume ratio is $a^3 : b^3$.* *Therefore, ratio of volumes =* *$1^3 : 3^3$ = 1 : 27*
Linked Knowled…	Constructions / Angles / Transformations (Enlargement)			

MEASURES

Keywords: Metric / Capacity / Mass / Imperial

Definition / Description:

- **Metric:** A number system based on multiples of 10
- **Capacity**: How much liquid a 3D solid can hold
- **Mass**: How heavy an object is
- **Imperial:** a system of weights and measures that includes pounds, ounces, feet, yards, miles, etc

Knowledge points: / **Knowledge point examples:**

Metric Units of length:

1 centimetre	=	10 millimetres
1 metre	=	100 centimetres
1 kilometre	=	1000 metres

1 cm	=	10 mm
1 m	=	100 cm
1 km	=	1000 m

7cm = _70_ mm

90mm = _9_ cm

350cm = _3.5_ m

Metric Capacity and Mass

Metric Capacity	
1000 mL	1 L

3 L = 3000 mL

8 L = 8,000 mL

Metric Mass	
1000 mg	1 g
1000 g	1 kg

43g = _0.043 kg

57g = _0.057 mg

Imperial Units

Length

1 inch = 2.5 cm

1 foot = 30 cm

1 yard = 90 cm

5 miles = 8 km

Capacity

1.75 pints = 1 litre

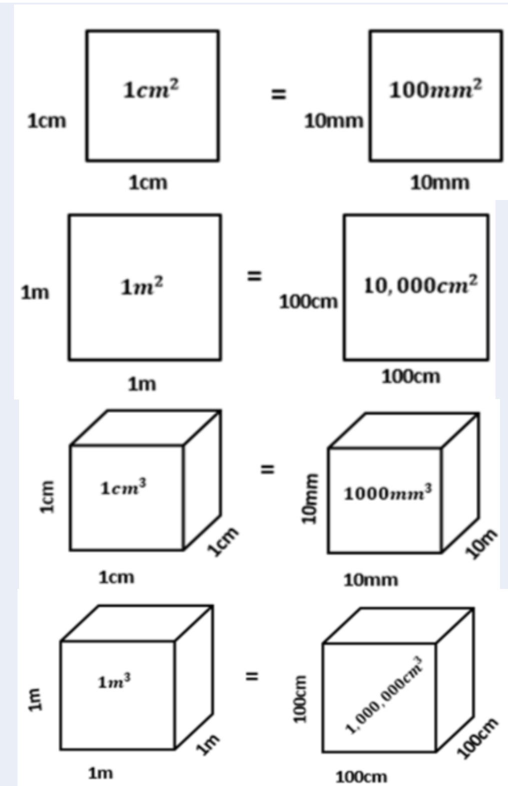
9 fl oz = 250 ml

Weight

8 ounces = 225 g

2.2 pounds = 1 kg

Area and Volume conversion



Linked Knowledge Maps

Place Value Decimals Rounding, Estimation Bounds / FDP conversion / Compound measures

PYTHAGORAS AND TRIGONOMETRY

Keywords: Hypotenuse / Opposite / Adjacent / Complementary angle / Square Root / Inverse

Definition / Description:

Hypotenuse: The longest side of a right angled triangle	**Opposite:** The side opposite the given angle	**Adjacent:** The side in between the given angle and the right angle	**Complementary**: Angles to add up to 90^{o}	**Square Root:** A number which produces a specified quantity when multiplied by itself.	**Inverse:** The reverse or opposite

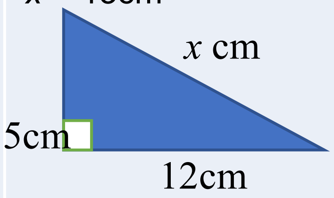
Knowledge points:

Calculate missing sides of a right angled triangle
Use Pythagoras to solve problems in 3D
Work fluently with the hypotenuse, opposite and adjacent sides
Use the tangent, sine and cosine ratio to find missing side lengths
Use sine, cosine and tangent to find missing angles
Select the appropriate method to solve right-angled triangle problems

Knowledge point examples:

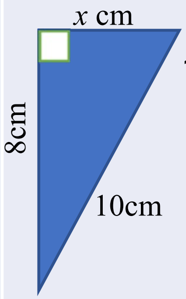
Finding the hypotenuse:

$a^2 + b^2 = c^2$
$5^2 + 12^2 = x^2$
$25 + 144 = x^2$
$169 = x^2$
$\sqrt{169} = x$
$x = 13$cm

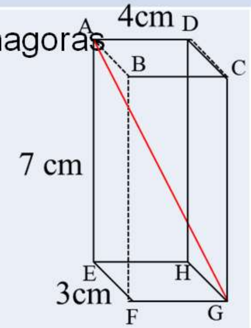


Finding the Shorter Side

$c^2 - b^2 = a^2$
$10^2 - 8^2 = x^2$
$100 - 64 = x^2$
$36 = x^2$
$\sqrt{36} = x$
$x = 6$cm



3D Pythagoras

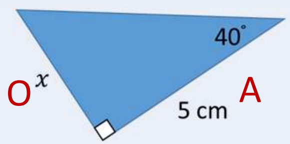


$$AG = \sqrt{a^2 + b^2 + c^2}$$
$$= \sqrt{7^2 + 3^2 + 4^2}$$
$$= \sqrt{76}$$
$$= 8.6 \text{ cm}$$

SOHCAHTOA: Side

Label your triangle and select the correct ratio

$$\tan\theta = \frac{opp}{adj}$$
$$\tan 40 = \frac{x}{5}$$
$$5 \times \tan 40 = x$$
$$4.19 \text{ cm} = x$$

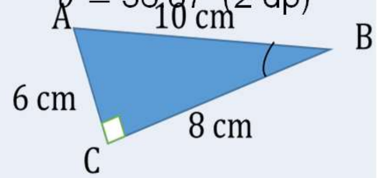


SOHCAHTOA : Angle

Label, select ratio and Do not forget to use $\sin^{-1}$ when finding the angle

Let angle ABC $= \theta$

$$\sin\theta = \frac{6}{10}$$
$$\theta = \sin^{-1}\frac{6}{10}$$
$$\theta = 36.87^{\circ} \text{ (2 dp)}$$

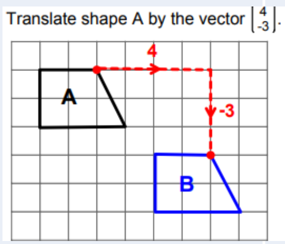


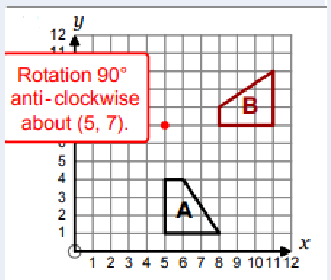
Linked Knowledge Maps: Further Trigonometry / 3D Shape / 2D Shape / Bearings

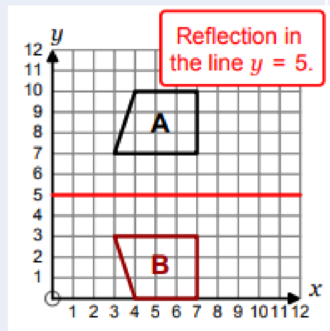
TRANSFORMATIONS

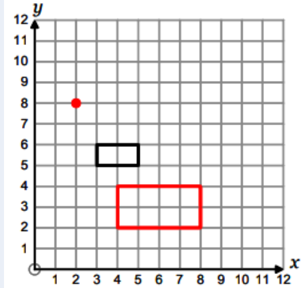
Keywords:	Translation / Vector / Rotation / Reflection / Symmetry / Enlargement					
Definition / Description:	Translation: When a shape is moved into a different position without being turned or flipped	Vector: The description of a movement for a translation	Rotation: The circular motion of an object are a centre	Reflection: When a shape is reflected in a mirror line it is flipped	Symmetry : A mirror image	Enlargement: When a shape changes size
Knowledge points:	Translation: • Column Vector	Rotation: • Centre of Rotation (x,y) • Direction (clockwise/anti-clockwise) • Angle of Rotation	Reflection: • Mirror Line (equation of straight line)	Enlargement: • Centre of Enlargement (x,y) • Scale Factor • A fractional scale factor generates a SMALLER image.	Enlargement – negative scale factor When the scale factor is negative the enlarged shape appears on the other side of the centre of enlargement	

Knowledge point

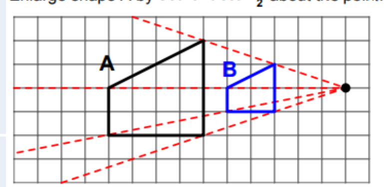


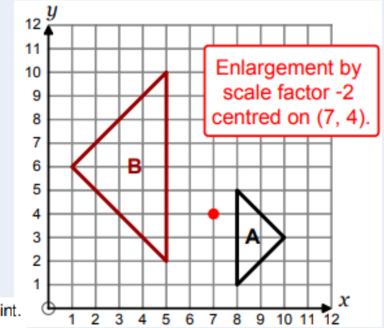





Enlarge the shape by scale factor 2 about the centre (2, 8).

Enlarge shape A by **scale factor** $\frac{1}{2}$ about the point.





Linked Knowledge Maps

2D shapes, Congruence and Similarity, Linear Graphs, Vectors, Scale

TRANSFORMATIONS

Keywords: Translation / Vector / Rotation / Reflection / Symmetry / Enlargement

Definition / Description:

Translation	Vector	Rotation	Reflection	Symmetry	Enlargement
Translation: When a shape is moved into a different position without being turned or flipped	Vector: The description of a movement for a translation	Rotation: The circular motion of an object are a centre	Reflection: When a shape is reflected in a mirror line it is flipped	Symmetry: A mirror image	Enlargement: When a shape changes size

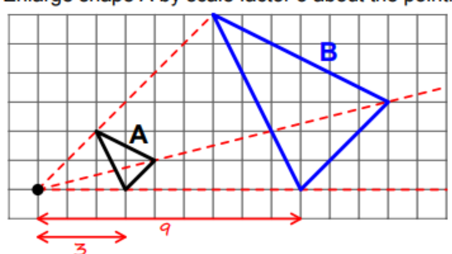
Knowledge points:

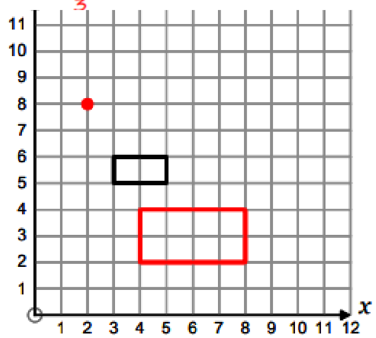
Enlargement

Knowledge point examples: see WR / AQA exemplar questions

The **distance from the centre** to each point is **multiplied by the scale factor** to give the point on the enlarged shape.

Enlarge shape A by scale factor 3 about the point.



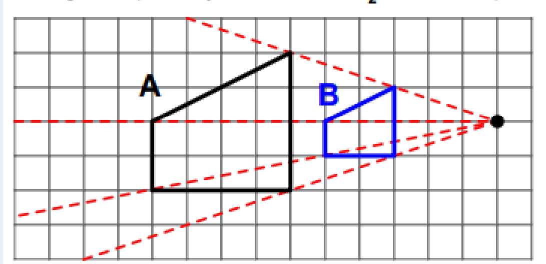


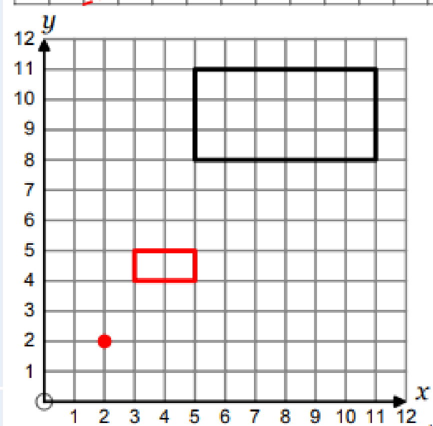
Enlarge the shape by scale factor 2 about the centre (2, 8).

Enlargement by a fractional scale factor

When the scale factor is between 0 and 1 the enlarged shape gets smaller

Enlarge shape A by **scale factor** $\frac{1}{2}$ about the point.



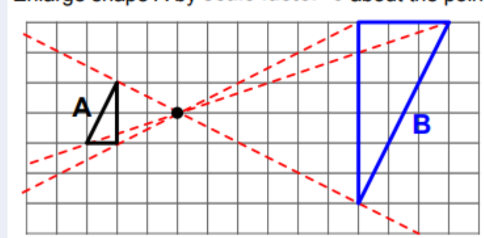


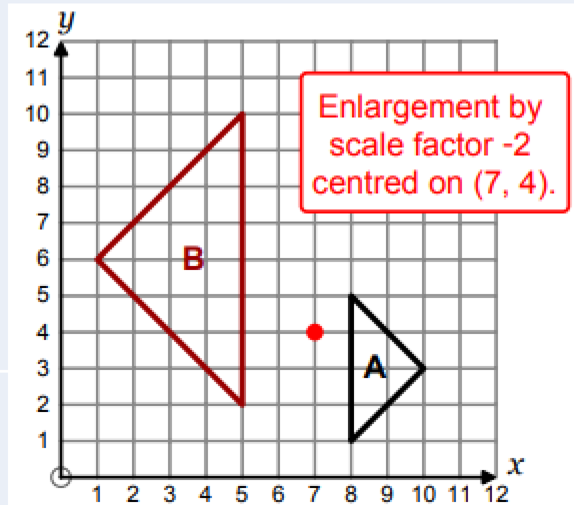
Enlarge the shape by scale factor $\frac{1}{3}$ about the centre (2, 2).

Enlargement by a Negative scale factor

When the scale factor is negative the enlarged shape appears on the other side of the centre of enlargment

Enlarge shape A by **scale factor -3** about the point.





Linked Knowledge Maps: 2D shapes / Congruence and Similarity / Linear Graphs

Trigonometry in non right angles triangles

Keywords: Opposite / Adjacent / perpendicular / inverse / subject

Definition / Description:

Opposite: The side opposite the given angle	**Adjacent:** The side in between the given angle and the right angle	**Perpendicular:** Two sides that are at a right angle to one another	**Inverse:** To apply an opposite function	**Subject:** The unknown variable of a formula

Knowledge points:

Label triangle to use with trigonometric formulae

Know and apply the sine rule to find unknown angles and sides

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

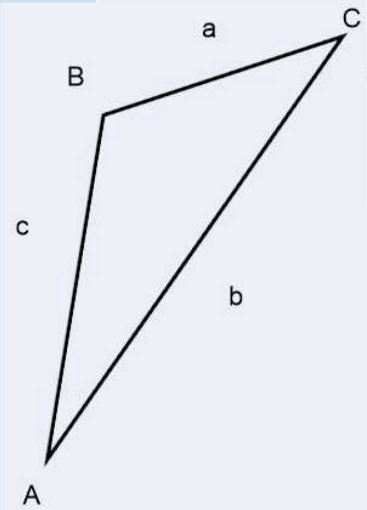
Know and apply the cosine rule to find unknown angles and sides

$a^2 = b^2 + c^2 - 2bc\cos A$

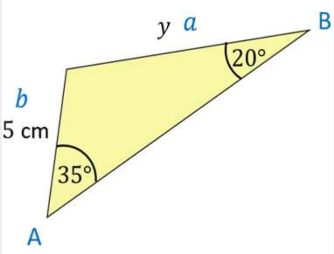
Know and apply Area $= \frac{1}{2}ab\sin C$ **to find area/ sides and angles**

Calculate area of a triangle when given 2 side lengths and an angle

Knowledge point examples:



Use the sine rule to work out the unknown length y.



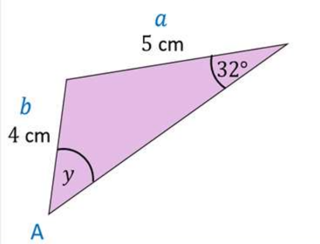
$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{a}{\sin 35} = \frac{5}{\sin 20}$

$a = \frac{5}{\sin 20} \times \sin 35$

$\underline{a = 8.39 \text{ cm}}$

Use the sine rule to work out the unknown angle y.



$\frac{\sin A}{a} = \frac{\sin B}{b}$

$\frac{\sin A}{5} = \frac{\sin 32}{4}$

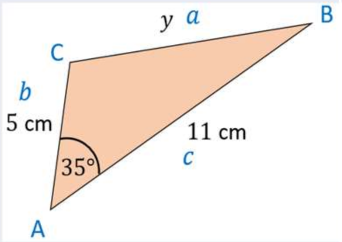
$\sin A = \frac{\sin 32}{4} \times 5$

$\sin A = 0.662$

$\sin^{-1}(0.662) = 41.5$

$\underline{y = 41.5°}$

Use the cosine rule to work out the unknown



$a^2 = b^2 + c^2 - 2bc\cos A$

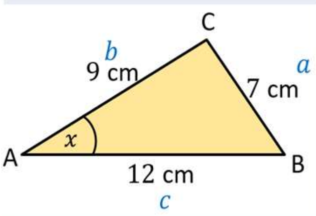
$y^2 = 5^2 + 11^2 - 2 \times 5 \times 11\cos 35$

$y^2 = 55.893$

$y = \sqrt{55.893}$

$\underline{y = 7.48 \text{ cm}}$

Use the cosine rule to work out angle x



$7^2 = 9^2 + 12^2 - 2 \times 9 \times 12 \times \cos x$

$49 = 225 - 216\cos x$

$216\cos x + 49 = 225$

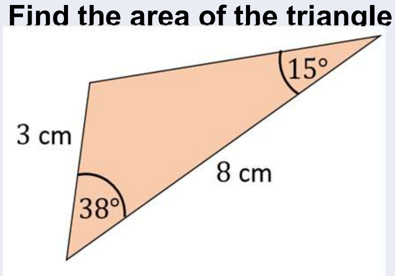
$216\cos x = 176$

$\cos x = \frac{176}{216}$

$\cos^{-1}\left(\frac{176}{216}\right) = 35.43$

$\underline{x = 35°}$

Find the area of the triangle

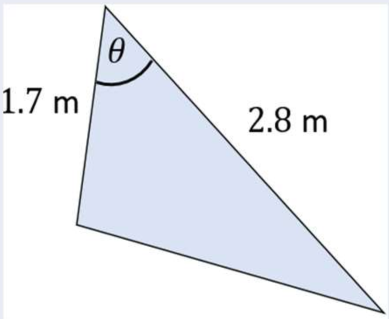


Area $= \frac{1}{2}ab\sin C$

Area $= \frac{1}{2} \times 3 \times 8 \times \sin 38$

$\underline{\text{Area} = 7.4 \text{ cm}^2}$

Area of the triangle = 1.5 m^2
Calculate the size of angle θ.



Area $= \frac{1}{2}ab\sin C$

$1.5 = \frac{1}{2} \times 1.7 \times 2.8\sin\theta$

$1.5 = 2.38\sin\theta$

$\frac{1.5}{2.38} = \sin\theta$

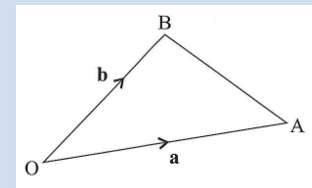
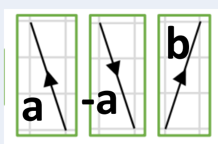
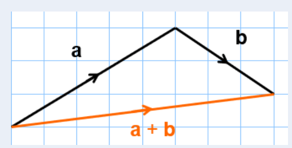
$\theta = \sin^{-1}(\frac{1.5}{2.38})$

$\underline{\theta = 39.1°}$

Linked Knowledge Maps

Pythagoras and Trigonometry in 2d and 3d

VECTORS

Keywords:	Vector / Magnitude / Parallel / Scalar					
Definition / Description:	**Vector:** a quantity with size and direction	**Magnitude:** The size of a vector (length)	**Parallel:** Two lines that never meet	**Scalar:** A quantity that has only magnitude		
Knowledge points:	Representing vectors: A vector can be represented using a line segment with an arrow. The MAGNITUDE of the vector is given by the length of the line. The direction of the vector is given by the arrow	Column Vectors: Are written in the form $\binom{x}{y}$ where x tells you how far to move left or right and y, how far to move up or down	Parallel vectors: Vectors that are multiples of one another. If one vector is parallel to another but a different size, they are SCALAR MULTIPLEs	Adding and subtracting vectors: Adding vectors is equivalent to applying one vector followed by the other	Multiplying vectors: A vector can be multiplied by a scalar to create a parallel vector	Vector geometry: 
Knowledge point examples:	 	$\begin{pmatrix}-9\\15\end{pmatrix}$ Move 9 places to the LEFT and 15 places UP	**a** = $\binom{2}{4}$ **b** = $\binom{-2}{-4}$ Vectors **a** and **b** are parallel and scalar multiples (multiple of -1) **c** = $\binom{4}{8}$ **b** = $\binom{3}{6}$ Vectors **c** and **d** are parallel and scalar multiples (multiple of -1)	**a** = $\binom{5}{3}$ **b** = $\binom{3}{-2}$ Find **a** + **b** **a** + **b** = $\binom{5+2}{3+-2}$ = $\binom{7}{1}$  	**p** = $\binom{2}{-3}$ $2\mathbf{p} = \begin{pmatrix}2\times 2\\2\times -3\end{pmatrix} = \begin{pmatrix}4\\-6\end{pmatrix}$ $-\mathbf{p} = \begin{pmatrix}-1\times 2\\-1\times -3\end{pmatrix} = \begin{pmatrix}-2\\3\end{pmatrix}$	a) $\overrightarrow{AO} = -\mathbf{a}$ b) $\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$ c) $\overrightarrow{BA} = -\mathbf{b} + \mathbf{a}$
Linked Knowledge Maps	Linear Graphs Transformations Angles Ratio 2D shapes					