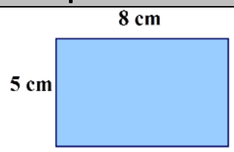
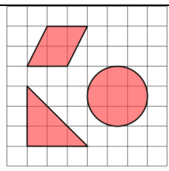
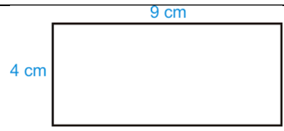
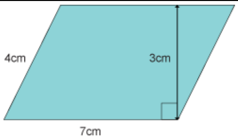
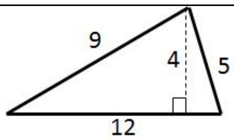
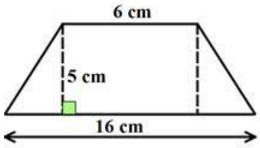
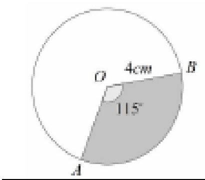
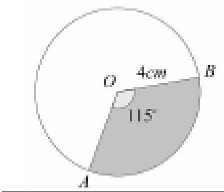
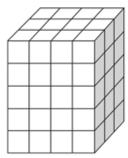
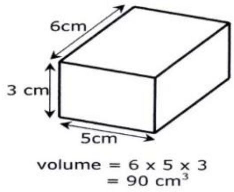
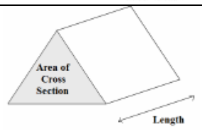
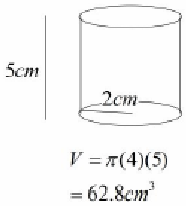
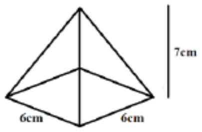
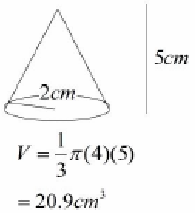
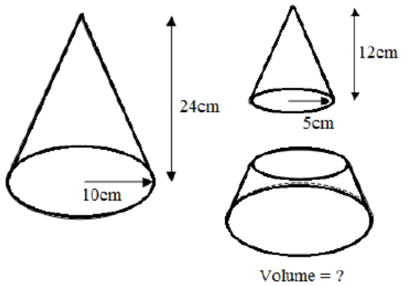
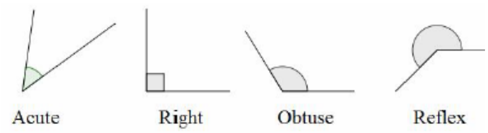
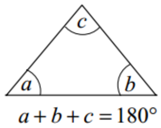
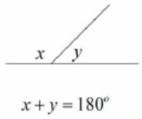
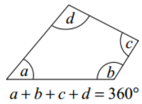
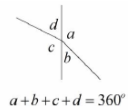
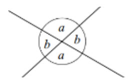
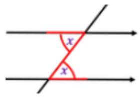
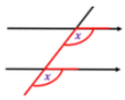
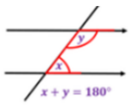
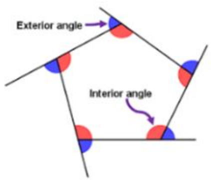
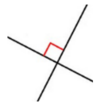
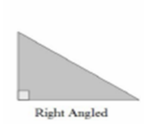
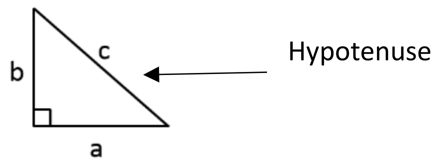
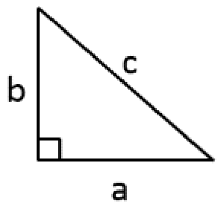
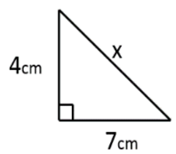
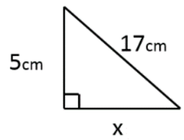
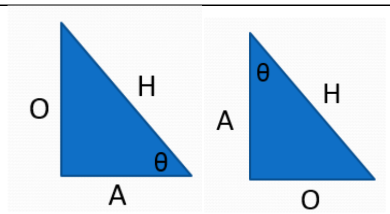
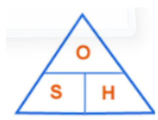
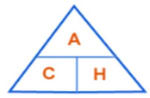
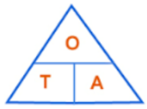
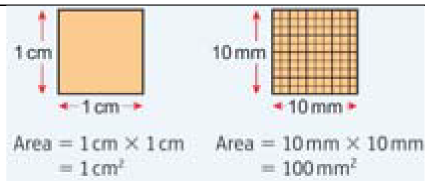
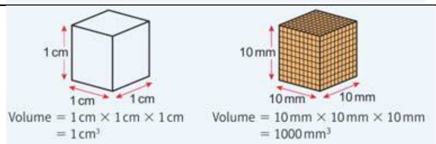
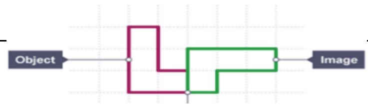
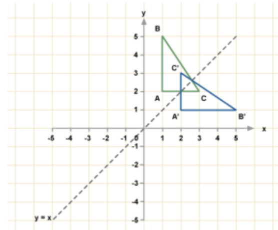
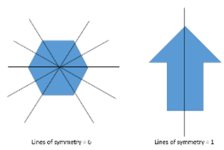
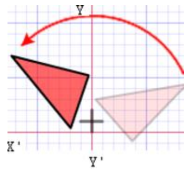
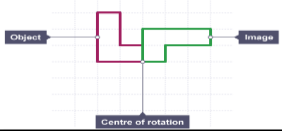
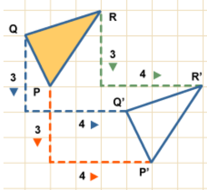
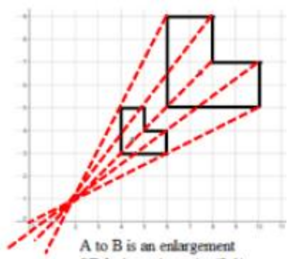
	Shape Formulae		Examples
1	**Perimeter**	The **total distance** around the **outside** of a shape. Units include: mm, cm, m etc.	 Perimeter $= 8 + 5 + 8 + 5 = 26$cm
2	**Area**	The amount of **space inside** a shape. Units include: mm^2, cm^2, m^2	
3	**Area of a rectangle**	Length x Perpendicular height	 Area = 9 x 4 = 36cm^2
4	**Area of a parallelogram**	Base x Perpendicular Height	 Area = 7 x 3 = 21cm^2
5	**Area of a triangle**	½ Base x Perpendicular Height	 Area = ½ (12 x 4) = 24cm^2
6	**Area of a trapezium**	½ (a + b) x perpendicular height Where a and b are the parallel sides.	 Area = ½ (6 + 16) x 5 = 11 x 5 = 55cm^2
7	**Area of a circle**	πr^2	Find the area of a circle with radius 5cm Area = $\pi \times 5^2 = 25\pi\ cm^2$
8	**Circumference of a circle**	πd or $2\pi r$	Find the circumference of a circle with radius 5cm (diameter = 10cm) Circumference = π x 10 (or 2 x π x 5) = 10π cm
9	**Area of a sector**	$\frac{\theta}{360}$ x πr^2	Area = $\frac{115}{360} \times \pi \times 4^2 = 16.1$cm^2 
10	**Arc length of a sector**	$\frac{\theta}{360}$ x $2\pi r$	Arc Length = $\frac{115}{360} \times \pi \times 8 = 8.03$cm 

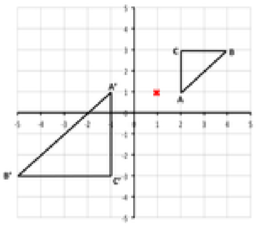
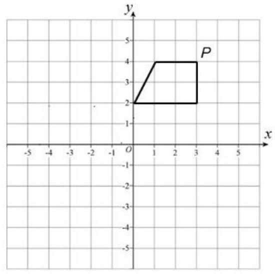
11	**Volume**	Volume is a measure of the amount of **space inside** a solid shape. Units: mm^3, cm^3, m^3 etc.	
12	**Volume of a cuboid**	Length x Width x Height	
13	**Volume of a prism**	Area of cross-section x length	
14	**Volume of a cylinder**	πr^2 x length/height	
15	**Volume of a pyramid**	⅓ area of base x height	 Volume = $\frac{1}{3} \times 6 \times 6 \times 7 = 84\text{cm}^3$
16	**Surface area of 3D shape**	Total area of all faces	
17	*** Volume of a cone**	⅓πr^2h	
18	***Curved surface area of a cone**	$\pi r l$ (l is the slant height)	The slant height of the cone above is 5.4cm Curved Surface Area = $\pi \times 2 \times 5.4 = 10.8\pi$
19	***Volume of a sphere**	$\frac{4}{3}\pi r^3$	Find the volume of a sphere with diameter 10cm. (radius = 5cm) $V = \frac{4}{3}\pi(5)^3 = \frac{500\pi}{3} cm^3$
20	***Surface area of a sphere**	$4\pi r^2$	Find the surface area of a sphere with diameter 10cm (radius = 5cm) $SA = 4 \times \pi \times 5^2 = 100\pi\ cm^2$
21	**Volume of a frustum**	A frustum is a solid (usually a cone or pyramid) with the **top removed**. Find the volume of the whole (large) shape, then take away the volume of the small cone/pyramid removed at the top.	 $V = \frac{1}{3}\pi(10)^2(24) - \frac{1}{3}\pi(5)^2(12) = 700\pi\text{cm}^3$

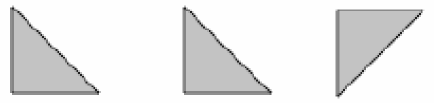
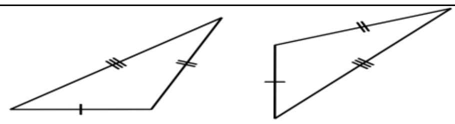
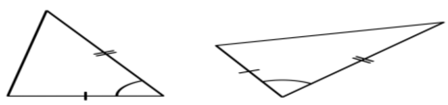
Angle Facts			Examples
22	**Acute angle**	less than 90°	
23	**Right angle**	exactly 90°	
24	**Obtuse angle**	greater than 90° but less than 180°	
25	**Reflex angle**	greater than 180° but less than 360°	
26	**Angles in a triangle**	Angles in a triangle sum to 180°	
27	**Angles on a straight line**	Angles on a straight line sum to 180°	
28	**Angles in a quadrilateral**	Angles in a quadrilateral sum to 360°	
29	**Angles at a point**	Angles about a point sum to 360°	
30	**Vertically opposite angles**	Vertically opposite angles are equal	
31	**Alternate angles**	(Z angles) Alternate angles in parallel lines are equal	
32	**Corresponding angles**	(F angles) Corresponding angles in parallel lines are equal	
33	**Co-interior angles**	Co-interior angles sum to 180°	
34	**Sum of Interior Angles in a polygon**	$\boldsymbol{(n-2)\times 180}$ where n is the number of sides.	Sum of Interior Angles in a Decagon = $(10-2)\times 180=1440°$
35	**Exterior angles of a polygon**	The sum of exterior angles of **any** polygon is 360°	Size of Exterior Angle in a Regular Octagon = $\frac{360}{8}=45°$
36	**Interior + exterior angle of a polygon**	In any polygon, interior + exterior angle = 180°	
37	**Parallel**	Lines which are always the same distance apart – if extended they would never meet	

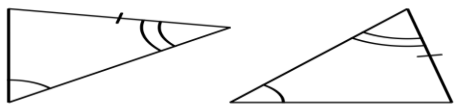
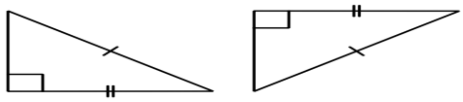
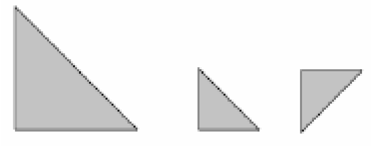
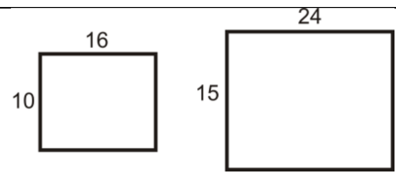
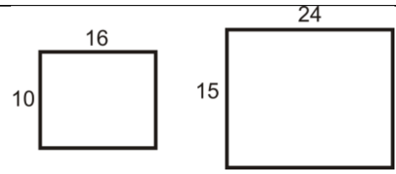
38	**Perpendicular**	Lines which cross at 90°	
Pythagoras & Trigonometry			**Examples**
39	**Right-angled triangle**	A triangle that contains a right-angle (90 degrees)	
40	**Hypotenuse**	The longest side - opposite the right-angle	
41	**Pythagoras' Theorem**	For any right angled triangle:  $a^2 + b^2 = c^2$	Used to find missing lengths. a and b are the shorter sides, c is the hypotenuse (longest side) e.g. To find the hypotenuse  $X^2 = 4^2 + 7^2$ $X^2 = 16 + 49$ $X^2 = 65$ $X = \sqrt{65} = 8.06$ cm e.g. To find a short side  $17^2 = x^2 + 5^2$ $289 = x^2 + 25$ $289 - 25 = x^2$ $x^2 = 264$ $x = \sqrt{264} = 16.25$cm
42	**Trigonometry**	The area of maths that studies the relationships between the sides and angles of triangles	
43	**Labelling a right angled triangle**	H = hypotenuse O = Opposite (to the angle involved) A = Adjacent (to the angle involved) θ is the angle involved	
44	**Right-angled Trigonometry SOH CAH TOA**	**SOH** $\text{Sin A} = \dfrac{\text{Opposite}}{\text{Hypotenuse}}$	

		CAH $\text{Cos A} = \dfrac{\text{Adjacent}}{\text{Hypotenuse}}$	
		TOA $\text{Tan A} = \dfrac{\text{Opposite}}{\text{Adjacent}}$	
Metric Unit Conversions			
45	**1 Kilometre**	= 1000 metres	
46	**1 metre**	= 100cm = 1000mm	
47	**1 centimetre**	= 10mm	
48	**1 tonne**	= 1000kg	
49	**1 Kilogram**	= 1000g	
50	**1 millilitre**	= $1cm^3$	
51	**1 litre**	= 1000ml = $1000cm^3$ = 100cl	
52	**$1cm^2$**	= 10mm X 10mm = $100mm^2$	
53	**$1m^2$**	= 100cm X 100cm = 10 $000cm^2$	
54	**$1cm^3$**	= 10mm X 10mm X 10mm = 1 $000mm^3$	
55	**$1m^3$**	= 100cm X100cm X 100cm =1 000 $000cm^3$	
Transformations – Key Concepts			**Examples**
56	**Transformation**	Shape changing in size or position by reflection, translation, rotation, enlargement.	
57	**Image**	New shape after a transformation.	
58	**Reflection**	When an object is repeated in reverse through a line of symmetry (mirror line). The size does not change, but the shape is **'flipped'** like in a **mirror**. Line $x = \#$ is a **vertical line**. Line $y = \#$ is a **horizontal line**. Line $y = x$ is a **diagonal line**.	Reflect shape C in the line $y = x$ 
59	**Line of symmetry**	Line which is mid-way between all points on an object and corresponding ones on its image, which acts as a mirror.	

60	**Rotation**	Turning of an object (must have angle, direction and centre of rotation as an instruction). The size does not change, but the **shape is turned around a point**. Use tracing paper.	Rotate Shape A 90° anti-clockwise about (0,1) 
61	**Centre of rotation**	Position around an object is rotated (can be a coordinate).	
62	**Angle of rotation**	Angle that an object is rotated around a fixed point.	
63	**Rotational symmetry**	A shape has rotational symmetry if it can be rotated (or turned) around a point to look exactly the same in a new position.	
64	**Order of Rotational Symmetry**	States how many occasions a shape appears the same as the object when rotated.	
65	**Translation**	Where an object is moved horizontally and vertically, the object does not change **size** or **orientation**.	
66	**Column Vector**	A way of describing a translation, with x- and y- values.	In a column vector, the **top** number moves **left (-) or right (+)** and the **bottom** number moves **up (+) or down (-)** $\begin{pmatrix}2\\3\end{pmatrix}$ means '2 right, 3 up' $\begin{pmatrix}-1\\-5\end{pmatrix}$ means '1 left, 5 down'
67	**Enlargement**	Transformation of an object onto its image with a change in size of its dimensions. The shape will get **bigger or smaller**. Multiply each side by the **scale factor**.	Scale Factor = 3 means '3 times larger = multiply by 3' Scale Factor = ½ means 'half the size = divide by 2'
68	**Scale Factor**	Ratio showing the difference in size of corresponding lengths on object and its image.	
69	**Centre of enlargement**	Point at which enlargement occurs, which connects the object to its image. Finding the Centre of Enlargement Draw **straight lines** through **corresponding corners** of the two shapes. The centre of enlargement is the point **where all the lines cross over**. Be careful with negative enlargements as the corresponding corners will be the other way around.	 A to B is an enlargement SF 2 about the point (2,1)

70	**Negative Scale Factor Enlargements**	Negative enlargements will **look like they have been rotated**. .	Enlarge ABC by scale factor -2, centre (1,1) $SF = -2$ will be rotated, and also twice as big 
71	**Invariance**	A point, line or shape is invariant if it **does not change/move** when a transformation is performed. An invariant point 'does not vary'.	If shape P is reflected in the $y - axis$, then exactly one vertex is invariant. 
72	**Describing Transformations**	If you are asked to describe a 'transformation', you need to say the **name of the type of transformation** as well as the other details.	Give the following information when describing each transformation: Look at the number of marks in the question for a hint of how many pieces of information are needed. **- Translation, Vector** **- Rotation, Direction, Angle, Centre** **- Reflection, Equation of mirror line** **- Enlargement, Scale factor, Centre of enlargement**

Similar & Congruent Shapes			**Examples**
73	**Congruent Shapes**	Shapes that are **identical** - **same shape** and **same size**.	 Shapes can be rotated or reflected but still be congruent.
74	**Congruent triangles**	Triangles are congruent when one of the 4 conditions of congruence is true	
75	**SSS**	Condition 1: Two triangles are congruent if all 3 sides are equal	
76	**SAS**	Condition 2: Two triangles are congruent if two sides and the **included** angle are equal	

77	**AAS**	Condition 3: Two triangles are congruent if two angles and the **corresponding** side are equal	
78	**RHS**	Condition 4: Two triangles are congruent if right angle, hypotenuse and one other side are equal	
79	**Proof**	A series of logical statements that show that something is true. Each statement must be supported by a mathematical reason or fact.	
80	**Similar Shapes**	Shapes are similar if they are the **same shape but different sizes**. Angles are equal Sides are in proportion (ratios of corresponding sides are equal) One shape is an enlargement of the other	
81	**Scale Factor**	The **ratio of corresponding sides** of two similar shapes. To find a scale factor, **divide a length** on one shape **by the corresponding length** on a similar shape.	 Scale Factor = $15 \div 10 = 1.5$
82	**Linear scale factor (LSF)**	the ratio of corresponding sides of two similar shapes. If k is the scale factor lengths are multiplied or divided by k	 Linear Scale Factor = $15 \div 10 = 1.5$