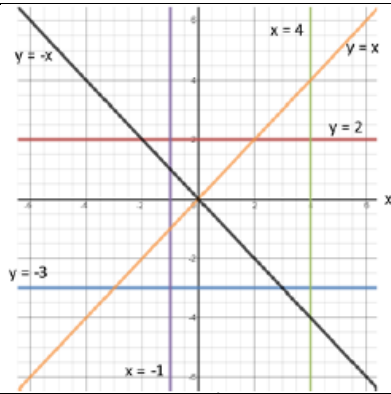
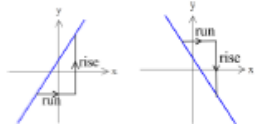
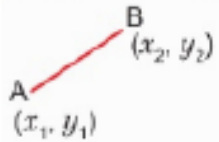


Graphs - definitions

1.	Axis	A reference line on a graph	
2.	Axes	Plural of axis	
3.	Quadrant	A quarter of a graph separated by a axes	
4.	Coordinate	Used to show a position on a coordinate plane, (x, y)	
		First coordinate is the horizontal position, (x axis) and the second is the vertical position (y axis)	
5.	Origin	The point $(0,0)$ on a set of axes	
6.	Plot	Mark a position or positions on a graph	
7.	y intercept	The y value where a graph crosses the y axis	where $x=0$
8.	x intercept	The x value where a graph crosses the x axis	where $y=0$
9.	Parallel	Lines that are equal distance apart that if extended will never meet	
10.	"y=" graph	Constant y coordinate	
		Will be parallel to the x axis	
11.	"x=" graph	Constant x coordinate	
		Will be parallel to the y axis	
12.	Linear function	An arithmetic sequence that can be represented by a straight line graph	
13.	Linear equation	An equation that produces a straight line graph	
14.	$y = mx = c$	The general equation of a straight line	$m =$ gradient and $c =$ y intercept

Linear graphs

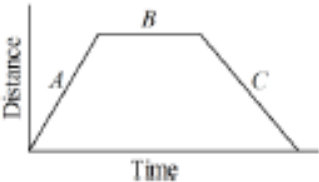
15.	Gradient	The steepness of a graph	
		$\text{Gradient} = \frac{\text{change in } y}{\text{change in } x}$ $= \frac{\text{rise}}{\text{run}}$	

16.	Gradient between two points	If A = (x ₁ , y ₁) and B = (x ₂ , y ₂) The gradient of line AB = $\frac{y_2 - y_1}{x_2 - x_1}$	
17.	Parallel lines	Have the same gradients	
18.	Mid-point	The coordinate half way between two point	If A = (x ₁ , y ₁) and B = (x ₂ , y ₂) the mid-point is $(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$

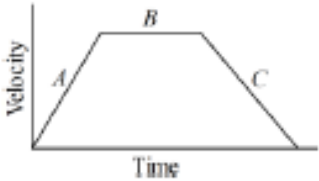
Real life graphs

19.	Steady speed	Travelling the same distance each minute
20.	Velocity	Speed in a particular direction
21.	Rate of change	Shows how a variable changes over time
22.	Acceleration	How fast velocity changes; measured in m/s ² or km/s ² etc

Distance - Time graphs

23.	Represent a journey	 <p>A = steady speed, B = no movement, C = steady speed back to start</p>
24.	Vertical axis represents the distance from the starting point	
25.	Horizontal axis represents the time taken	
26.	Straight lines mean constant speed	
27.	Horizontal lines mean no movement	
28.	Gradient = speed	
29.	Average speed = $\frac{\text{total distance}}{\text{total time}}$	

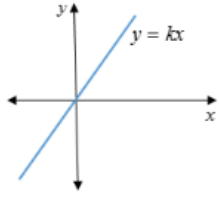
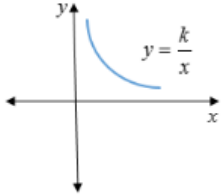
Velocity – Time graphs

30.	Represents the speed at given times	 <p>A = steady acceleration, B = constant speed, C = steady deceleration back to a stop</p>
31.	Straight lines mean constant acceleration or deceleration	
32.	Horizontal change means no change in velocity e.g. constant speed	
33.	Positive gradient = acceleration	
34.	Negative gradient = deceleration	
35.	Distance travelled = area under the graph	

Transformations - definitions				
1.	Transformation	Changing a 2D shape in some way.		
		Rotation	Reflection	Translation
2.	Object	The name given to a shape before a transformation has occurred.		
3.	Image	The name given to a shape after a transformation has occurred		
4.	Rotation	A circular movement about a fixed point		
5.	Centre of rotation	The fixed point that the shape has been rotated about		
		Written as a coordinate (x, y)		
6.	Direction	Clockwise or anticlockwise		
7.	Reflection	An image as it would be seen in a mirror		
8.	Line of reflection	The "mirror line" used to perform reflections.		
		Written using algebraic notation e.g. $y = 3, x = -2, y = x$ or x/y axis		
9.	Translation	The movement of a shape without rotating or flipping it		
10.	Column vector	Notation used to represent translations		$\begin{pmatrix} x \\ - \\ y \end{pmatrix}$
		x is the horizontal movement		
		y is the vertical movement		
11.	Resultant vector	The vector that moves the shape to its final position after more than one translation		
12.	Enlargement	A change in size of a shape (can be bigger or smaller)		
13.	Scale factor	The proportions by which the dimensions of an object will increase/decrease by		
		If fractional then the image will be smaller than the object		
14.	Centre of enlargement	A fixed point to enlarge an object from		
		Written as a coordinate (x, y)		
15.	Single transformation	Where the object is only transformed once		
16.	Combination	Where the object is transformed multiple times		
17..	Origin	The point (0,0); where the x and y axis intersect		
18.	Similar	Same shape but different sizes		
		e.g. similar shapes are enlargements of one another		
19.	Congruent	Shapes that are the same shape and size		
20.	Describe	Use key words to accurately state what has happened to an object to make the resulting image		

Transformations			
21.	Rotation	<p>To carry out you need to:</p> <ol style="list-style-type: none"> 1. Draw object on tracing paper 2. Place pencil on 'centre of rotation' and carry out the motion 3. Draw your image on the grid 	<p>To describe you need to write:</p> <ol style="list-style-type: none"> a) "rotation" b) angle of rotation c) direction of rotation d) centre of rotation
22.	Reflection	<p>To carry out you need to:</p> <ol style="list-style-type: none"> 1. If required draw the 'line of reflection' 2. Count squares from object to line and repeat the other side of the line for all corners of the object 3. Join points up to create the image 	<p>To describe you need to write:</p> <ol style="list-style-type: none"> a) "reflection" b) the equation of the line of reflection
23.	Translation	<p>To carry out you need to:</p> <ol style="list-style-type: none"> 1. Use vector notation to work out the horizontal and vertical movement 2. Count squares to carry out movement on all corners of the object 3. Join up points to create the image 	<p>To describe you need to write:</p> <ol style="list-style-type: none"> a) "translation" b) the column vector
24.	Enlargement	<p>To carry out you need to:</p> <ol style="list-style-type: none"> 1. If required cross the coordinate that is the centre of enlargement 2. For each corner count from the line of reflection to the object 3. Multiply this movement by the required scale factor 4. Draw new corners from the centre of enlargement with new horizontal and vertical movement 5. Join up points to create image 	<p>To describe you need to write:</p> <ol style="list-style-type: none"> a) "enlargement" b) the scale factor c) the centre of enlargement

Ratio and Proportion - definitions

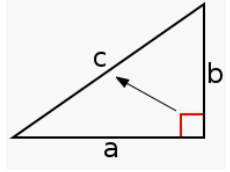
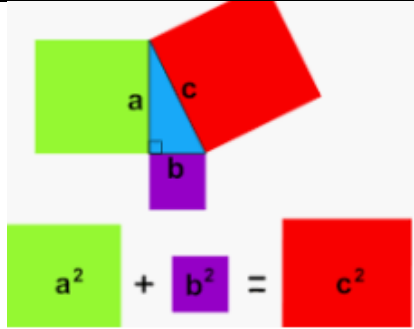
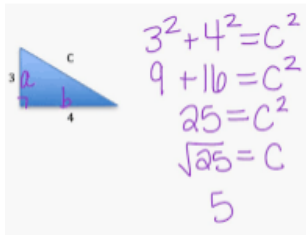
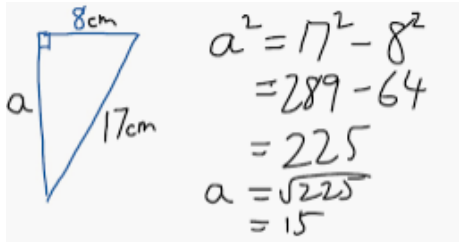
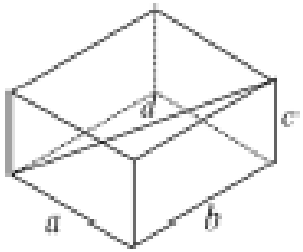
1.	Ratio	A relationship between two or more quantities	
2.	Unit ratio	Used to compare ratios, one of the parts is 1	
		The only time it is permissible to have a decimal in a ratio	
3.	Equivalent	Ratios that have the same simplified form are said to be equivalent	
4.	Scale	A ratio that represents the relationship between a length on a drawing or a map and the actual length	
5.	Proportion	Compares a part with a whole	
6.	Direct proportion	Two quantities increase at the same rate	$y \propto x$ $y = kx \text{ for a constant } k$ 
		Graph is a straight line that goes through the origin	
7.	Inverse/indirect proportion	One variable increases at a constant rate as the second variable decreases	$y \propto \frac{1}{x}$ $y = \frac{k}{x} \text{ for a constant } k$ 
8.	Proportional	A change in one is always accompanied by a change in the other	
9.	Constant of proportionality	Represented by k	
		Its value stays the same	
10.	Share	Splitting into parts as defined by a ratio	
11.	Unitary method	Finding the value of 1 item then using this to find the value of any number of that item	

Use to work out which products give the best value for money

Working with ratios

12.	Simplifying ratio	Divide all parts by the highest common factor All parts in the simplified version must be integers	e.g. 12:4 simplifies to 3:1 (divided by HCF of 4)					
13.	Divide in a given ratio	Divide an amount so the ratio of the final values simplifies to the given ratio	<p>share £20 in the ratio 3:2</p> <p style="text-align: center;">←————— £20 —————→</p> <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td style="background-color: #90EE90;">£4</td><td style="background-color: #90EE90;">£4</td><td style="background-color: #90EE90;">£4</td><td style="background-color: #ADD8E6;">£4</td><td style="background-color: #ADD8E6;">£4</td></tr></table>	£4	£4	£4	£4	£4
£4	£4	£4	£4	£4				

Pythagoras' Theorem

1.	Hypotenuse	The longest side of a right-angled triangle	
		It is always opposite the right angle	
2.	Right- angled triangle	A triangle that contains a right angle	
3.	Pythagoras' Theorem	$a^2 + b^2 = c^2$	
		Where c is the hypotenuse	
		Where a and b are the two shorter sides	
4.	To find the hypotenuse (c)		<ul style="list-style-type: none"> • Square • Add • Square root
5.	To find a short side (a/b)		<ul style="list-style-type: none"> • Square • Subtract • Square root
6.	Pythagoras' in 3D	$a^2 + b^2 + c^2 = d^2$	
		$d^2 - b^2 - c^2 = a^2$	

Trigonometry - Right angled – SOH CAH TOA

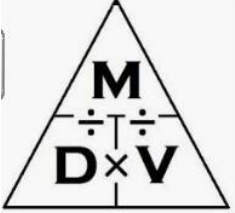
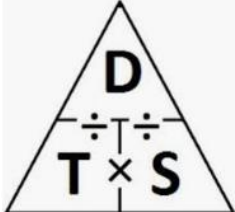

7.	Trigonometry	The ratios between the sides and angles of triangles																											
8.	Labelling the triangle	θ is the angle involved																											
		H is the hypotenuse																											
		O is the opposite																											
		A is the adjacent																											
9.	Sine	SOH		$\sin \theta = \frac{Opp}{Hyp}$ $\theta = \sin^{-1} \frac{Opp}{Hyp}$																									
10.	Cosine	CAH		$\cos \theta = \frac{Adj}{Hyp}$ $\theta = \cos^{-1} \frac{Adj}{Hyp}$																									
11.	Tangent	TOA		$\tan \theta = \frac{Opp}{Adj}$ $\theta = \tan^{-1} \frac{Opp}{Adj}$																									
12.	Exact Values	<table border="1"> <thead> <tr> <th>θ</th> <th>0°</th> <th>30°</th> <th>45°</th> <th>60°</th> <th>90°</th> </tr> </thead> <tbody> <tr> <td>Sin θ</td> <td>0</td> <td>$\frac{1}{2}$</td> <td>$\frac{\sqrt{2}}{2}$</td> <td>$\frac{\sqrt{3}}{2}$</td> <td>1</td> </tr> <tr> <td>Cos θ</td> <td>1</td> <td>$\frac{\sqrt{3}}{2}$</td> <td>$\frac{\sqrt{2}}{2}$</td> <td>$\frac{1}{2}$</td> <td>0</td> </tr> <tr> <td>Tan θ</td> <td>0</td> <td>$\frac{\sqrt{3}}{3}$</td> <td>1</td> <td>$\sqrt{3}$</td> <td style="background-color: black;"></td> </tr> </tbody> </table>				θ	0°	30°	45°	60°	90°	Sin θ	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	Cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	Tan θ	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	
		θ	0°	30°	45°	60°	90°																						
Sin θ	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1																								
Cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0																								
Tan θ	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$																									
<p>These can be found using the triangles:</p>																													
13.	Angle of elevation		Angle of depression																										

Probability - definitions

1.	Probability	The extent to which an event is likely to occur Written as a fraction, decimal or percentage	For equally likely outcomes the probability that an event will happen is $P = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$
2.	Theoretical probability	Calculated without doing an experiment	
3.	Experimental probability	Probabilities based on the data collected during an experiment	$\text{estimated probability} = \frac{\text{frequency of event}}{\text{total frequency}}$
		Also known as estimated probability	
		The more trials you do the more reliable your set of results	
4.	P() notation	P() means the probability of the thing inside the brackets happening e.g. P(tails)	
5.	Experiment	A repeatable process that gives rise to a number of outcomes	
6.	Relative frequency	In an experiment, how often something happens as a proportion of the number of trials	$\text{Relative frequency} = \frac{\text{how often something happens}}{\text{all outcomes}}$
7.	Predictions	You can predict the number of outcomes you will get using relative frequency	
		Predicted number of outcomes = probability x number of trials	
8.	Event	A collection of one or more outcomes	
9.	Independent	When one event has no effect on another	Here $P(A \text{ and } B) = P(A) \times P(B)$
10.	Dependent	When the outcome of one event, changes the probability of the next event	
11.	Exhaustive	Events are exhaustive if they cover all possible outcomes	
12.	Biased	Unfair	
13.	Unbiased	Fair	
14.	Sample space	The set of all possible outcomes	
15.	Sample space diagram	A diagram showing all possible outcomes from an experiment	
16.	Venn diagram	Can be used to represent events graphically	

		Frequencies or probabilities can be placed in the regions		
17.	$A \cap B$	A intersection B	All elements in A and B	
18.	$A \cup B$	A union B	All the elements in A OR B OR both	
19.	A'	Complement of A	Not in A	
20.	Mutually exclusive	Events that have no outcomes in common		<p>$P(A \text{ or } B) = P(A) + P(B)$</p>
		Here $P(A \text{ or } B) = P(A) + P(B)$		
21.	Tree diagram	Used to show the outcomes of two (or more) events happening in succession		
22.	AND rule	Multiply the probabilities		
23.	OR rule	Add the probabilities		
24.	Conditional probability	The probability of a dependent event		
		The probability of a second outcome depends on what has already happened in the first outcome		

Multiplicative reasoning – definitions and formulae

1.	Proportion	Compares a part with a whole	
2.	Proportional	A change in one is always accompanied by a change in another	
3.	Ratio	A relationship between two or more quantities	
4.	Compound measure	Combine measures of two different quantities	
5.	Density	The mass of a substance contained in a certain volume	
		Usually measured in g/cm ³ or kg/m ³	
		$density = \frac{mass}{volume}$	
6.	Velocity	Speed in a given direction	Usually measured in m/s
7.	Acceleration	The rate of change of velocity	Usually measured in m/s ²
8.	Speed	The distance travelled in an amount of time	
		Usually measured in m/s, mph or km/h	
		$speed = \frac{distance}{time}$	
9.	Pressure	The force applied over an area	
		$pressure = \frac{force}{area}$	
		Usually measured in N/m ²	

Percentages

10.	Percentage	Means 'out of 100'
11.	Multiplier	A decimal you multiply by to represent a percentage
		To use a multiplier to find a percentage, divide your percentage by 100, then multiply the amount by this value.

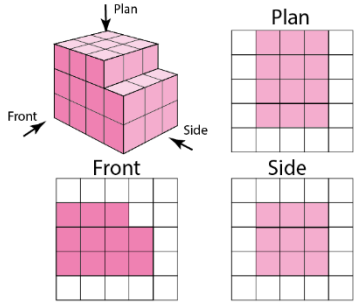
12.	Percentage increase	Calculate the percentage and add onto the original	
		Or use a multiplier	$amount \times \frac{100 + \% \text{ increase}}{100}$
13.	Percentage decrease	Calculate the percentage and subtract from the original	
		Or use a multiplier	$amount \times \frac{100 - \% \text{ increase}}{100}$
14.	Percentage change	$\frac{\text{Change}}{\text{Original}} \times 100$	
15.	Express one number as a percentage of another	$\frac{\text{Number 1}}{\text{Number 2}} \times 100$	
16.	Reverse percentage	Use when asked to find the original amount after a percentage increase or decrease.	
		$\text{Original Value} \times \text{Multiplier} = \text{New Value}$ $\text{Original Value} = \frac{\text{New Value}}{\text{Multiplier}}$	
17.	Interest	A fee paid for borrowing money or money earned through investing.	
18.	Simple interest	Interest that is calculated as a percentage of the original	$I = Prt$
			I – Interest P – Original amount r – interest rate t – time
19.	Compound interest	When interest is calculated on the original amount and any previous interest	$P \left(1 + \frac{R}{100} \right)^n$
		Or $Original \times Multiplier^{time}$	P – Original amount R – Interest rate n – the number of interest periods (e.g. yrs)
20.	Tax	A financial charge placed on sales or savings by the government e.g. VAT	
21.	Loss	Income minus all expenses, resulting in a negative value	
22.	Profit	Income minus all expenses, resulting in a positive value	
23.	Depreciation	A reduction in the value of a product over time	


24.	Annual	Means yearly
25.	Per annum	Means per year
26.	Salary	A fixed regular payment, often paid monthly

2D shapes and 3D solids - definitions

1.	Face	A flat surface of a 3D shape
2.	Edge	A line segment where two faces meet
3.	Vertex	A point where two or more edges meet
4.	Vertices	The plural of vertex
5.	Dimension	The size of something in a particular directions e.g. length, width, height, diameter, depth
6.	Plane	A flat 2D surface
7.	Plane of symmetry	When a solid can be cut exactly in half and a part on one side of the plane is an exact reflection of the part on the other side of the plane
8.	Prism	A 3D shape with a uniform cross section
9.	Pyramid	A 3D shape with a polygon as a base and triangular sides that meet at the top
10.	Arc	A section from the circumference (outside) of a circle
11.	Sector	A region of a circle bound by two radii and an arc
12.	Congruent	Exactly the same shape and size e.g. identical
13.	Regular	A shape where all the sides and angles are the same

Plans and elevations

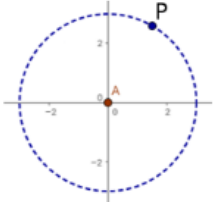
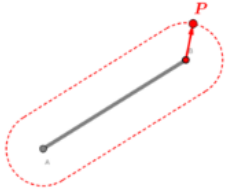
14.	Plan	The view from above a solid	
15.	Front elevation	The view from the front of a solid	
16.	Side elevation	The view from a side of the solid	
17.	Clockwise	Following the direction of a clock	
18.	Anticlockwise	Following the opposite direction of a clock	

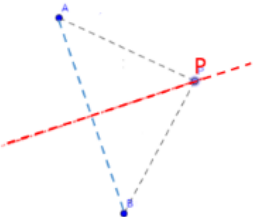
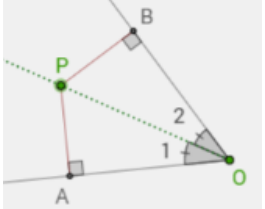
19.	Compass directions	Terminology needed to accurately describe a location or directions	
20.	Sketch	An approximate drawing of an object	
21.	Scale	A ratio that shows the relationship between a length on a drawing/map and the actual length	

Constructions and loci

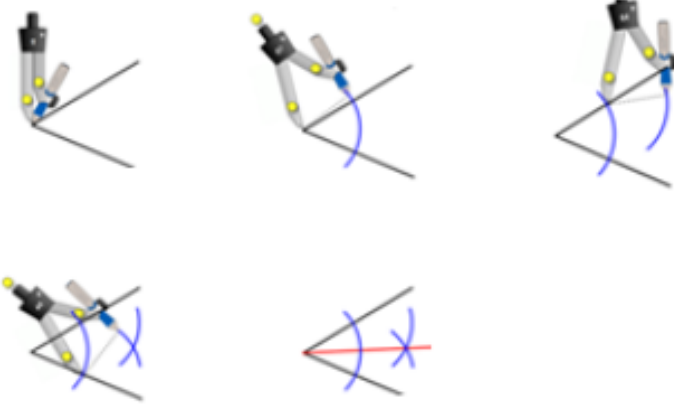
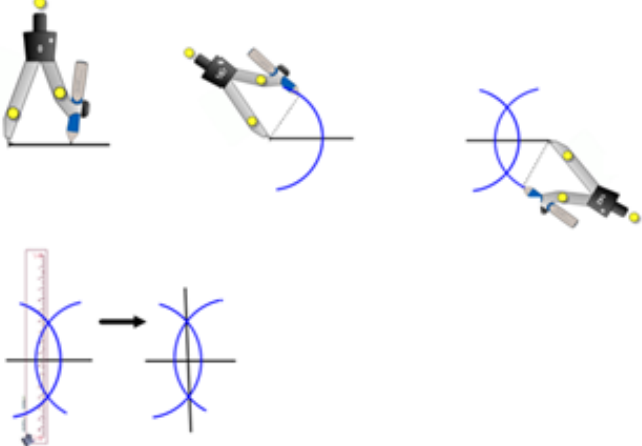
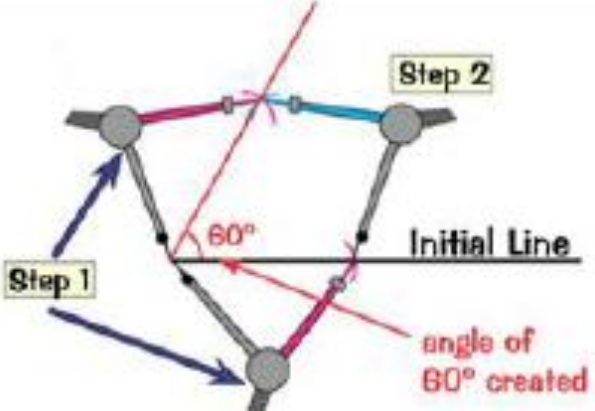
22.	Construct	Draw accurately using a ruler and a pair of compasses.	
23.	Construction lines	Lines or arcs drawn as part of working out	
		They must not be rubbed out as they show the working	
24.	Equidistant	The same distance from each other or in relation to other things	
25.	Bisect	Cut in half	
26.	Perpendicular	At a 90 degree angle (right angle)	
27.	Perpendicular bisector	A line that cuts another in half at a right angle	
28.	Angle bisector	A line that cuts an angle exactly in half	
29.	Locus	The set of all points that fulfil a certain rule	
		Often drawn as a continuous path	
30.	Loci	The plural of locus	
31.	Region	An area bounded by a loci	

Loci

32.	Circle	Locus of points that are a fixed distance from a fixed point	
33.	Parallel line	Locus of points a fixed distance from a fixed line	

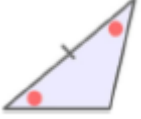
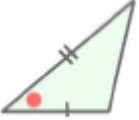

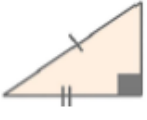
34.	Perpendicular bisector	The line that cuts another in half at a right angle	
35.	Angle bisector	The locus of points equidistant between two fixed points.	

Constructions

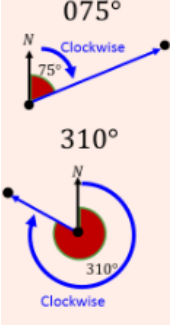
36.	Angle bisector	
37.	Perpendicular bisector	
38.	Constructing 60° angles	

Constructing triangles

You can draw an accurate triangle when you are given:

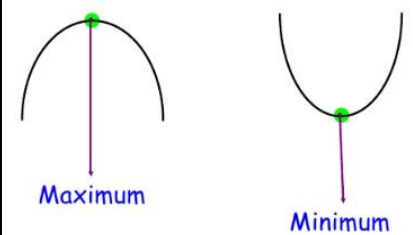
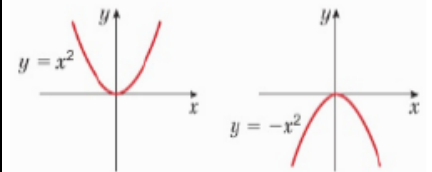
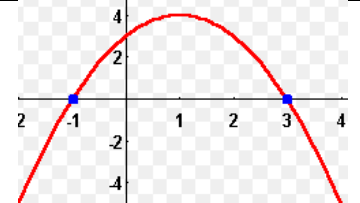
39.	ASA	an angle, side, angle	
40.	SAS	a side, angle, side	
41.	SSS	all three sides	
42.	RHS	that it has a right angle, the hypotenuse and another side	

Bearings

43.	Bearing	The direction of a line in relation to the North-South line	
		It is always measured clockwise	
		Always measured from the North line	
		Always written using 3 digits	

Quadratics - definitions

1.	Expression	One or a group of terms
2.	Quadratic expression	An expression where the highest index is 2 e.g. $2x^2 + 2x + 2$
3.	Function	A relation of expression involving one or more variables
		Also a rule for working out values of y given values for x
4.	Roots	Solutions to a quadratic equation/function $ax^2 + bx + c = 0$
		The x values where the graph crosses the x axis
		A quadratic can have 0, 1 or 2 roots
5.	Quadratic graph	Curved shaped called a parabola
		A positive x^2 will give a 'U' shape
		A negative x^2 will give a '∩' shape
6.	Turning points	The point where a curve turns in the opposite direction
		Can be called a minimum or maximum



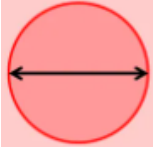
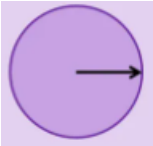

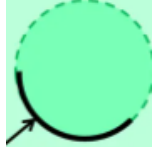
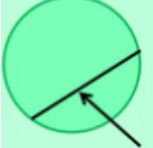
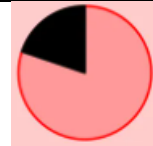
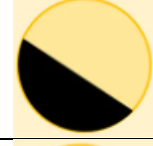
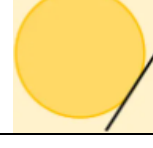
Expanding double brackets

7.	Everything in the first bracket must be multiplied by everything in the second	
8.	<p>Grid method</p>	<p>FOIL method</p> <p>FIRST : $(x + 3)(x - 4)$ gives $x \times x = x^2$</p> <p>OUTER : $(x + 3)(x - 4)$ gives $x \times (-4) = -4x$</p> <p>INNER : $(x + 3)(x - 4)$ gives $3 \times x = 3x$</p> <p>LAST : $(x + 3)(x - 4)$ gives $3 \times (-4) = -12$</p>

Factorising a quadratic expression

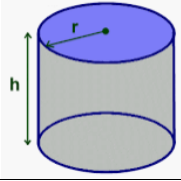
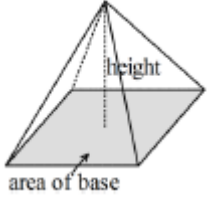
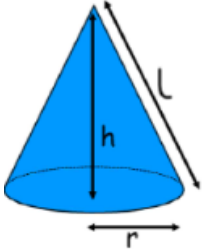
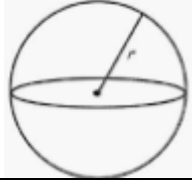
9.	Factorising a quadratic in the form $ax^2 + bx + c$	<p style="text-align: center;">Multiply to 5 ↙</p> <p>Factorise $x^2 + 5x + 6$ ← Add to 6</p> <p>2 and 3 add to 5 2 and 3 multiply to 6</p> <p>$(x + 2)(x + 3)$</p> <p>Check: $(x + 2)(x + 3) = x^2 + 5x + 6$</p>
10.	Difference of two squares	<p>A special type of quadratic which only has two terms.</p> <p>One term is subtracted from the other</p> <div style="border: 1px solid gray; padding: 5px; width: fit-content; margin: 10px auto;"> $x^2 - 25 = x^2 - 5^2 = (x + 5)(x - 5)$ $y^2 - 49 = y^2 - 7^2 = (y + 7)(y - 7)$ $a^2 - 16 = a^2 - 4^2 = (a + 4)(a - 4)$ </div>
Solving quadratic equations/functions		
11.	By factorising	<p>Take you factorised form and set each bracket equal to zero</p> <div style="border: 1px solid gray; padding: 10px; width: fit-content; margin: 10px auto;"> $x^2 + 4x + 3 = 0$ $(x + 3)(x + 1) = 0$ <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p>↙</p> $x + 3 = 0$ So $x = -3$ </div> <div style="text-align: center;"> <p>↘</p> $x + 1 = 0$ So $x = -1$ </div> </div> </div> <p>Solve each separate linear equation to find the solutions/roots</p>

Circles - definitions and formulae

1.	Diameter	A straight line from edge to edge passing through the centre	
		Double the size of the radius	
2.	Radius	A straight line from the centre to the edge	
		Half the size of the diameter	
3.	Radii	The plural of radius	
4.	Circumference	Distance around the outside of the circle	
5.	Arc	Part of the circumference	
6.	Chord	A line within a circle where each end touches the edge	
7.	Sector	The region created by two radii and an arc	
8.	Segment	The region created by a chord and an arc	
9.	Tangent	A line outside the circle which only touches the circumference at one point	
10.	Semi -circle	Half a full circle	
Area and circumference of circles formulae			
11.	Pi (π)	Constant ratio linking the circumference and diameter of a circle	
		3.14159265...	

12.	Circumference of a circle	$C = \pi d$	Alternatively, using relationship between r and d $C = 2\pi r$
13.	Arc length	$\frac{x}{360} \times \pi d$	Where x is the angle at the centre
14.	Perimeter of a sector	$\left(\frac{x}{360} \times \pi d\right) + 2r$	This represents the arc length plus the two radii
15.	Area of a circle	$A = \pi r^2$	
16.	Area of a sector	$\frac{x}{360} \times \pi r^2$	

Cylinders, pyramids, cones and spheres

17.	Volume of a cylinder	$V = \pi r^2 h$	
18.	Surface area of a cylinder	$Total\ surface\ area = 2\pi r^2 + \pi dh$	
19.	Volume of a pyramid	$V = \frac{1}{3} \times area\ of\ base \times perpendicular\ height$	
20.	Volume of a cone	$V = \frac{1}{3} \times \pi r^2 h$	
21.	Surface area of a cone	$Curved\ surface\ area = \pi r l$ $Total\ surface\ area = \pi r^2 + \pi r l$	
22.	Volume of a sphere	$V = \frac{4}{3} \times \pi r^3$	
23.	Surface area of a sphere	$Total\ surface\ area = 4\pi r^2$	