Maths Knowledge Organiser

Year: 9 Term: Autumn (Terms 1-2)

<table>
<tr><th>Unit</th><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th><th>Sparx Code</th></tr>
<tr><td rowspan="3">Fractions, decimals and percentages</td><td>Converting between fractions, decimals and percentages</td><td>Equivalent fractions are fractions which represent the same value.

<table><tr><th colspan="2">Fraction, Decimal and Percentage Con</th></tr><tr><td>Fractions to Decimals</td><td>numerator ÷ denominator</td></tr><tr><td>Fractions to Percentages</td><td>numerator ÷ denominator x 100</td></tr><tr><td>Decimals to Fractions</td><td>-write decimal as a fraction over 1
-multiply numerator and denominator by 10 for each decimal digit
-simplify</td></tr><tr><td>Decimals to Percentages</td><td>x 100</td></tr><tr><td>Percentages to Fractions</td><td>-write as a fraction over 100
-simplify</td></tr><tr><td>Percentages to Decimals</td><td>÷ 100</td></tr></table></td><td><table><tr><th>version</th></tr><tr><td>1/4 = 1÷4 = 0.25</td></tr><tr><td>1/4 = 1÷4 = 0.25
0.25 x 100 = 25%</td></tr><tr><td>0.25 = 0.25/1
0.25/1 = 25/100
25/100 = 1/4</td></tr><tr><td>0.25 x 100 = 25%</td></tr><tr><td>25% = 25/100
25/100 = 1/4</td></tr><tr><td>25% ÷ 100 = 0.25</td></tr></table></td><td>U704
U594</td></tr>
<tr><td>Fractions of amounts</td><td>Divide by the denominator and multiply by the numerator.

A bar model may help visualise the steps.</td><td>Find $\frac{2}{5} of\ 60$:

$60 \div 5 = 12$
$12 \times 2 = 24$

<table><tr><td colspan="5">60</td></tr><tr><td>12</td><td>12</td><td>12</td><td>12</td><td>12</td></tr></table></td><td>U881
U916</td></tr>
<tr><td>Percentages of amounts</td><td>There are lots of different methods to find a percentage of an amount.

Non-calculator:

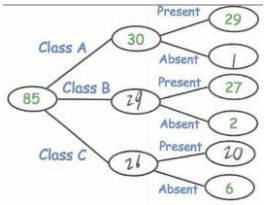
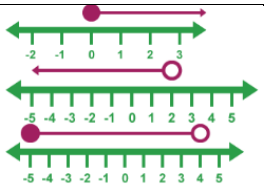
Find 1% by dividing by 100, and then multiply by the percentage you are looking to find. You could also find 10% by dividing by 10.

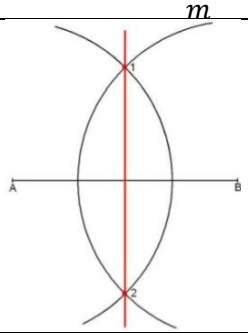
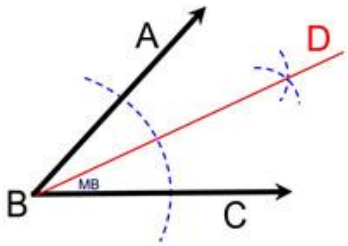
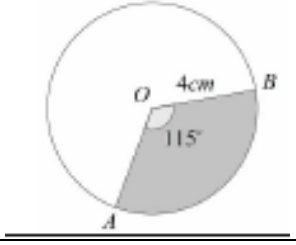
A t-table may help you organise your work. Remember that the percentage and the amount are directly proportional to each other.</td><td>Find 26% of 150

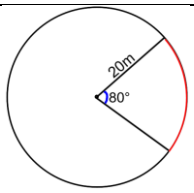
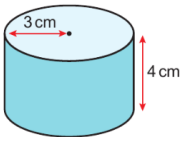
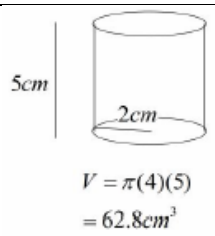
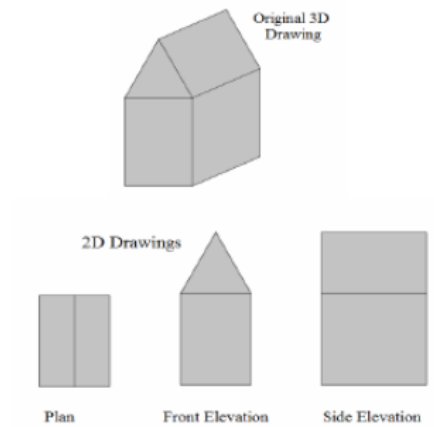
$150 \div 100 = 1.5$
$1.5 \times 26 = 39$

<table><tr><th>%</th><th>Amount</th></tr><tr><td>100</td><td>150</td></tr><tr><td>10</td><td>15</td></tr><tr><td>5</td><td>7.5</td></tr><tr><td>1</td><td>1.5</td></tr><tr><td>6</td><td>9</td></tr><tr><td>20</td><td>30</td></tr><tr><td>26</td><td>39</td></tr></table>
$26 \div 100 = 0.26$
$150 \times 0.26 = 39$</td><td>U554
U349</td></tr>
</table>

		Calculator: Turn the percentage you are looking to find into a multiplier, and then multiply the amount by this.		
	Percentage change	Key words to look for in percentage change questions- increase, decrease, profit, loss, depreciation. Percentage change =$\frac{Change}{Original} \times 100$	Work out the percentage increase from 40 to 56. Change=56-40=14 $\frac{14}{40} \times 100 = 35\%$	U278
	Percentage increase and decrease	Without a calculator, find the percentage and then add or subtract it from the original amount. With a calculator, find the multiplier and then multiply the original amount by this multiplier.	Increase 120 by 20%: 20% of 120=24 120+24=144 Decrease 150 by 13%: 100-13=87%=0.87 150 x 0.87=130.5	U773 U671
	Reverse percentages	Find the starting percentage given in the question, and then work to find 100% or the percentage required.	A jumper is £48.60 after a 10% off sale. Find it's original price. 90%=48.60 10%=5.40 100%= 54 Or 0.9 x P= 48.60 P= $48.60 \div 0.9 = 54$ £54 was the original price.	U286
	Simple interest	This is interest calculated as a percentage of the original amount.	£1000 is invested for 5 years at 2% simple interest. Calculate the interest. 2% of 1000=20 20 x 5= 100 £100 of interest.	U533
Probability	Expected results	To find the number of expected outcomes, multiply the probability by the number of trials.	The probability that a football team will win a game is 0.4. How many games are they expected to win out of 50? 50 x 0.4= 20 games	U166

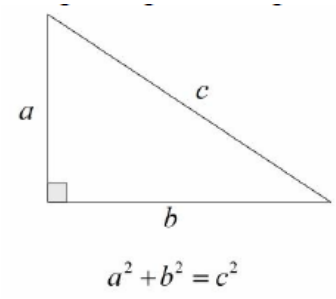
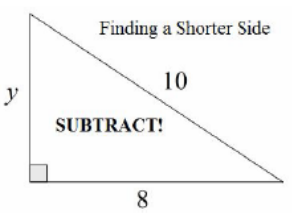
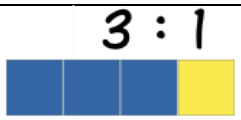
	Experimental probability	Probability that is determined on the basis of repeating an experiment many times. It is important that we write a probability as a fraction, decimal or a percentage. Another phrase for experimental probability is 'relative frequency'.	These are the results of spinning a spinner. Number / Frequency 1 / 6 2 / 13 3 / 15 4 / 16 The probability of getting a 1 is $\frac{6}{50} = \frac{3}{25}$	U580
	Frequency trees	A diagram showing how information is categorised into various categories. The numbers at the ends of branches tells us how often something happened (frequency). You can work out the missing numbers by making sure they add up.		U280
Standard form	Standard form calculations	Multiply: Multiply the numbers and add the powers. Divide: Divide the numbers and subtract the powers. For addition and subtraction, convert the standard form into ordinary numbers and then convert back after adding or subtracting. You must also be able to input standard form calculations into your calculator.	$(4 \times 10^5) \times (2 \times 10^4) = 8 \times 10^9$ $(2.1 \times 10^{-5}) \div (7 \times 10^{-4})$ $= 0.3 \times 10^{-1} = 3 \times 10^{-2}$ $(2.6 \times 10^6) + (7.1 \times 10^5)$ $= 2600000 + 710000$ $= 3310000 = 3.31 \times 10^6$	U264 U290 U161
Inequalities	Inequalities on number lines	Inequalities can be shown on number lines. Open circles are used for less than or greater then. Filled circles are used for less than or equal to or greater than or equal to.		U509
	Solving inequalities	Inequalities can be solved a similar way to solving equations. Remember that if you divide by a negative number, the inequality symbol must be reversed.	Solve $5x + 2 < 6$ $5x < 4$ $x < \frac{4}{5}$ Solve $2x + 9 > 19 - 8x$ $10x + 9 > 19$	U759 U738 U145 U337

			$10x > 10$ $x > 1$	
Quadratics	Factorising quadratics where a=1	When a quadratic expression is in the form $x^2 + bx + c$ find the two numbers that add to give b and multiply to give c. Be careful with negatives	Factorise $x^2 + 10x + 16 = (x + 2)(x + 8)$ $x^2 + 3x - 40 = (x + 8)(x - 5)$	U178
	Difference of two squares	An expression of the form $a^2 - b^2$ can be factorised to give (a-b)(a+b)	Factorise $x^2 - 49 = (x + 7)(x - 7)$ $9w^2 - 16y^4 = (3w + 4y^2)(3w - 4y^2)$	U963
	Solving quadratic equations of the form $x^2 + bx + c = 0$	The expression will need to be factorised first and then each bracket solved =0.	Solve $x^2 + 4x - 12 = 0$ $(x + 6)(x - 2) = 0$ $x = -6 \text{ or } 2$	U228
Formulae	Changing the subject	Ensure that you perform the inverse operation to both sides of the equation.	Make x the subject of $y = mx + c$ $y - c = mx$ $\frac{y - c}{m} = x$	U556
Constructions	Perpendicular bisector	Perpendicular means 'at 90 degrees'. A bisector cuts into two equal pieces.		U245
	Angle bisector	An angle bisector cuts an angle in half.		U787
Circles	Area and circumference of a circle	$A = \pi r^2$ and $C = 2\pi r$ or πd	If the radius was 5cm, then: $A = \pi \times 5^2 = 78.5cm^2$ $C = \pi \times 10 = 31.4cm$	U604 U950
	Arc length	An arc is a piece of the circumference. $L = \frac{x}{360} \times 2\pi r$		U221

			The arc length $L = \frac{115}{360} \times \pi \times 8 = 8.03cm$	
	Sector area	A sector is a piece of the area. $A = \frac{x}{360} \times \pi r^2$	 $A = \frac{80}{360} \times \pi \times 20^2 = 279.3m^2$	U373
	Surface area of cylinder	The curved surface of a cylinder is $2\pi r^2 h$ The total SA= $2\pi r^2 + 2\pi rh$	 SA=$2 \times \pi \times 3^2 + 2 \times \pi \times 3 \times 4 = 42\pi\ cm^2 = 132cm^2$	U464
	Volume of cylinder	$V = \pi r^2 h$	 $V = \pi \times 2^2 \times 5 = 20\pi = 62.8cm^3$	U915
Rounding	Error intervals	Error intervals are the upper and lower bounds of a number where it has been rounded or truncated.	n=12.6 to 1 decimal place. The bounds are $12.55 \leq n < 12.65$	U657
	Truncation	Dropping all numbers past a given number of decimal places instead of rounding.	Truncate 15.67478 to 3dp= 15.674	U108 U301
3D shapes	Plans and elevations	2D representations of 3D shapes. Plan view= from above. Side view= from the side. Front view= from the front.		U743

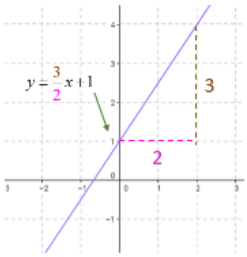
Maths Knowledge Organiser

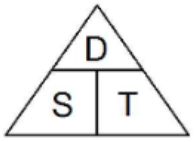
Year: 9 Term: Spring (Terms 3-4)

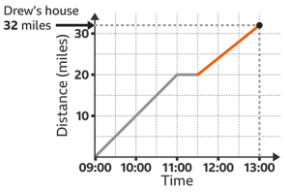
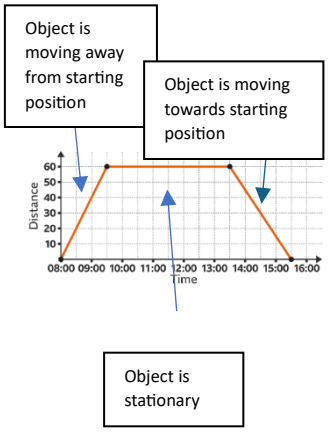
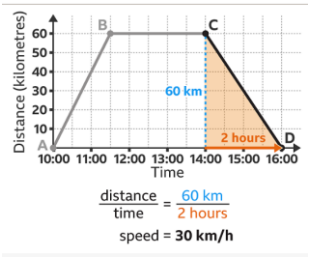
Unit	Topic/Skill	Definition/Tips	Example	Sparx Code
Pythagoras' Theorem	Use Pythagoras's theorem in two dimensions	For any **right-angled triangle**:  $a^2 + b^2 = c^2$ Used to find **missing lengths**. a and b are the shorter sides, c is the **hypotenuse** (**longest side**).	 $a = y,\ b = 8,\ c = 10$ $a^2 = c^2 - b^2$ $y^2 = 100 - 64$ $y^2 = 36$ $y = 6$	U385
Ratio and Proportion	Writing and simplifying ratios	Ratio compares the size of **one part** to **another part**. Written using the '**:**' symbol. To simplify a ratio, **divide** all parts of the ratio by a **common factor**.	 **The ratio of blue to yellow is 3:1** 5 : 10 = 1 : 2 (divide both by 5) 14 : 21 = 2 : 3 (divide both by 7)	U687
	Sharing amounts in a given ratio	**1. Add** the total parts of the ratio. **2. Divide** the amount to be shared by this value to find the value of one part. **3. Multiply** this value by each part of the ratio. Use only if you **know the total**.	Share £60 in the ratio 3 : 2 : 1. 3 + 2 + 1 = 6 60 ÷ 6 = 10 3 x 10 = 30, 2 x 10 = 20, 1 x 10 = 10 £30 : £20 : £10	U577
	Solving direct proportion	If two quantities are in direct proportion, **as one increases**, the **other**	3 apples cost 45p. Work out the cost of 5 apples.	U721

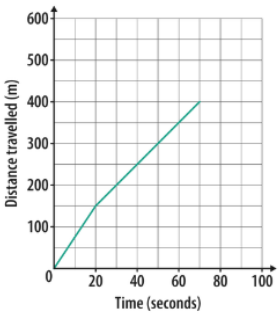
÷ 3 ÷ 3

× 5 × 5

	word problems	**increases** by the **same proportion**. Use a table to work out the value of 1 and then scale up to the required amount	<table><tr><th>Amount</th><th>Cost</th></tr><tr><td>3</td><td>45p</td></tr><tr><td>1</td><td>15p</td></tr><tr><td>5</td><td>75p</td></tr></table>	
	Solving inverse proportion word problems	If two quantities are inversely proportional, **as one increases**, the **other decreases** by the **same proportion**. Multiply to find the value for 1, then divide by the required amount	It takes 2 people 10 days to build a wall. Assuming they work at the same rate, how long would it take 5 people to build the same wall 1 person would take $2 \times 10 = 20$ days So 5 people would take $20 \div 5 = 4$ days	U357
Linear graphs	Plotting straight line graphs	Complete a **table of values** to calculate some **coordinates** that are on the line Alternatively, identify the **gradient** and **y-intercept** of the line, plot the y-intercept and use the gradient to plot another point, then draw a line through the two points	<table><tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y= x +3</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr></table> 	U741
	Finding equations of straight line graphs	All straight lines have an equation in the form $\boldsymbol{y = mx + c}$, where m is the **gradient** and c is the **y-intercept** Identify the **gradient** of the line and a point on the line. Then **substitute** the gradient and point into $\boldsymbol{y = mx + c}$ and **solve** to find c	Find the equation of the line with a gradient of 2 that passes through the point (3, 5) Substitute the gradient and x and y values from the coordinate $y = mx + c$ $5 = 2(3) + c$ $5 = 6 + c$ $c = -1$	U315

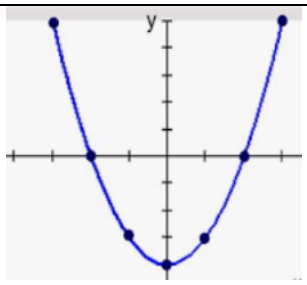
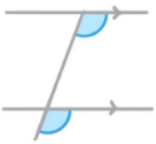
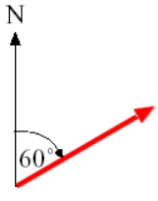
			Equation: $y = 2x - 1$	
	Interpreting equations of straight line graphs	**Compare** the equation of the line to $\boldsymbol{y = mx + c}$ to identify the **gradient** and **y-intercept**. m is the **gradient** and c is the **y-intercept**. You may need to **rearrange** the equation to **make $\boldsymbol{y}$ the subject** first	Find the gradient and y-intercept of $y = 3x - 1$ Gradient: 3 Y-intercept: -1 Find the gradient and y-intercept of $4x + 2y = 6$ Make y the subject: $2y = 6 - 4x$ $y = 3 - 2x$ Gradient: -2 Y-intercept: 3	U669
Compound measures	Calculating with speed	$speed = \frac{distance}{time}$ $distance = speed \times time$ $time = \frac{distance}{speed}$  Remember to include the **correct units**	A car travels 60 miles in 2 hours. Work out the average speed of the car. $speed = \frac{distance}{time}$ $speed = \frac{60}{2}$ $= 30\ miles\ per\ hour$ A sprinter runs 100m at an average speed of 8m/s. How long does the sprinter take to complete the 100m $time = \frac{distance}{speed}$ $time = \frac{100}{8} = 12.5s$	U151
	Calculating with rates	Speed is the **rate of change** of **distance**, you can use similar formulae to find the **rate of change** of other **measures**. e.g. the **rate of flow** of water out of a tap $rate\ of\ flow = \frac{volume\ of\ water}{time}$ The **download speed** of an internet connection $speed = \frac{size\ of\ file}{time}$	It takes 20 seconds for a tap to fill a 2 litre bottle. Calculate the rate of flow of the water. $rate = \frac{2}{20}$ $= 0.1\ litres\ per\ second$ How long would it take to download a 100mb file on an internet connection with a download speed of $25\ mb/s$ $time = \frac{100}{25} = 4s$	U256

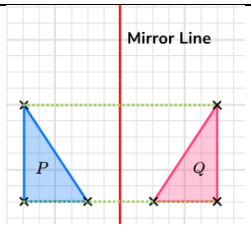
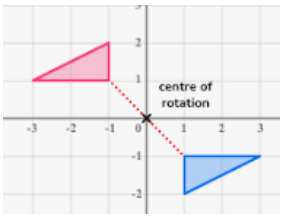
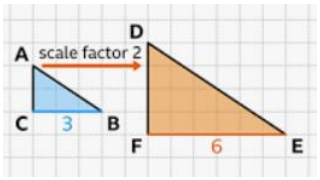
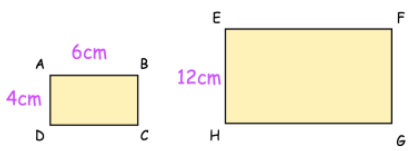
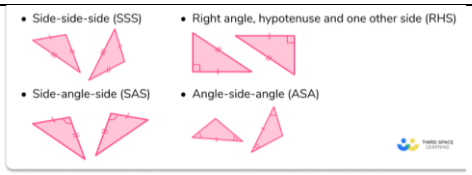
Motion-time graphs	Plotting distance-time graphs	A **distance-time graph** is a way of representing a journey. The x**-axis** represents the **time taken**. The y**-axis** represents the **distance travelled**. For each part of the journey **plot** the **distance travelled** and **time taken** and connect with a **straight line**. A **return journey** means the line segment is drawn back towards the x**-axis**.	Ava cycles 32 miles to Drew's house. Ava leaves home at 0900 and cycles 20 miles in 2 hours. Ava then stops for a rest for 20 minutes before completing the rest of the journey. Ava arrives at Drew's house at 1300. Plot Ava's journey on a distance-time graph. 	U403
	Interpreting distance-time graphs	Each **straight-line segment** represents one part of the whole journey. A **horizontal** line segment indicates **no movement**, i.e. the object is stationary. A **non-horizontal** line segment indicates that the object is **moving at some constant speed**.		U914
	Calculating speed from a distance-time graph	The **gradient** of a line segment on a distance-time graph gives the **constant speed** for that **part of the journey**. The **steeper** the line segment the **greater the speed**. To find the **speed**, find the **distance travelled** and the		U462

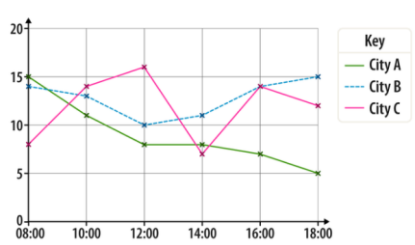
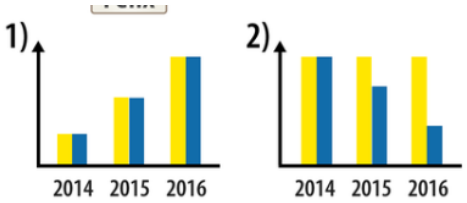
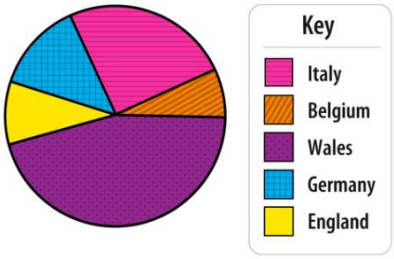
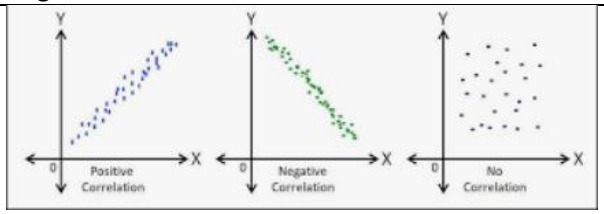
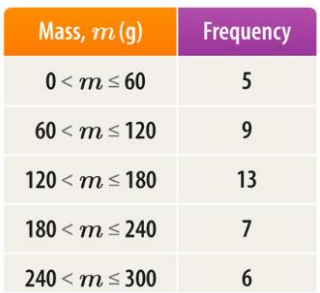
		time taken then **divide the distance by the time**.		
	Plotting distance-time graphs using speed	Use the **speed** to work out either the **distance travelled** or **time taken**, then use the distance and time to plot that part of the journey.	Archie ran a 400m race. For the first 20s he ran at a constant speed of 7.5m/s. He ran the rest of the race at a constant speed of 5m/s . Distance for first part: $distance = speed \times time$ $= 7.5 \times 20$ $= 150m$ Time for second part: $time = \frac{remaining\ distance}{speed} = \frac{250}{5}$ $= 50s$  	U966

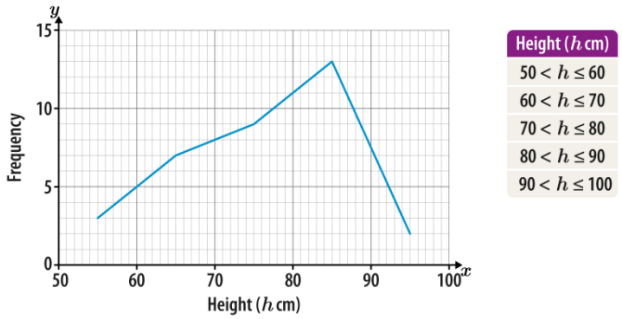
Maths Knowledge Organiser

Year: 9 Term: Summer (Terms 5-6)

Unit	Topic/Skill	Definition/Tips	Example	Sparx Code
Quadratic graphs	Plotting and interpreting quadratic graphs	Make sure that you have a table of values before plotting the graph. Be super careful when dealing with negative inputs. Quadratic graphs are always U or n shaped.		U989 U667 U601
Angles and bearings	Angles	Angles in a triangle sum to 180 degrees. Angles in quadrilateral sum to 360 degrees. Vertically opposite angles are equal. Interior angles in a polygon sum to (n-2) x 180 where n is the number of sides. Exterior angles sum to 360 degrees.	There are also rules for angles in parallel lines:  ALTERNATE  ALLIED  CORRESPONDING	U655 U826 U329 U427
	Bearings	Bearings are always measured clockwise from the north. They must be given in 3 figures.	 Bearing 060 °	U525 U107
Transformations	Transforming shapes	Translations are described using vectors.	$\begin{pmatrix} x \\ y \end{pmatrix}$ X is the left/right movement and y is the up/down movement.	U196 U799 U696 U519 M881

		Reflections must have a mirror line. Rotations must have a centre, direction and degrees. Enlargements must have a scale factor and centre of enlargement.	  	
Similarity and congruence	Similarity	Shapes are the same shape but a different size. The same scale factor must be applied to all of the sides. The angles do not change.	 Here the scale factor is 3 and side EF is 18cm	U551 U578
	Congruence	Congruent shapes are the same shape and size. There are 4 ways we can prove that triangles are congruent: • SSS (side, side, side) • ASA (angle, side, angle) • SAS (side, angle, side) • RHS (right angle, hypotenuse, side)		U790 U866 U187

Handing data and statistical diagrams	Collecting and presenting data	Data can be qualitative (words) or quantitative (numbers). It can also be collected from primary or secondary sources. You will be expected to interpret a variety of charts and graphs including time series, pie charts, bar charts and dual bar charts. Calculating the mean, median, mode and range.	   The mean is the total of the values divided by how many values. The median is the middle value when the data is in ascending or descending order. The mode is the most common. The range is the difference between the smallest and largest values.	U322 U571 U520 U717
	Scatter graphs	Scatter graphs can follow a positive, negative or no correlation. You must draw a line of best fit before estimating from them.		U199 U277 U128
	Grouped data	You will be required to use the midpoint when finding the total or mean from a grouped frequency table. Frequency polygons are also to be		U312 U877 U840

		plotted at the midpoint of the class.		
Vectors	Column Vectors	In a similar way to translations, vectors are written in the form $\begin{pmatrix} x \\ y \end{pmatrix}$ where x represents the left and right movement and y represents the up and down movement. Vectors have a direction and a magnitude. Parallel vectors are multiples of eachother e.g. **a** and 3**a** The resultant vectors is the result of adding two or more vectors together.	Vectors describe translations. $\begin{pmatrix} x \\ y \end{pmatrix}$ + move right / - move left; + move up / - move down Adding vectors: $\begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 5 \\ -4 \end{pmatrix} = \begin{pmatrix} 2+5 \\ 3+-4 \end{pmatrix} = \begin{pmatrix} 7 \\ -1 \end{pmatrix}$ Subtracting vectors: $\begin{pmatrix} 3 \\ 9 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 3-2 \\ 9--3 \end{pmatrix} = \begin{pmatrix} 1 \\ 12 \end{pmatrix}$ Vectors and scalar multipliers: $2\begin{pmatrix} 8 \\ -3 \end{pmatrix} = \begin{pmatrix} 2\times 8 \\ 2\times -3 \end{pmatrix} = \begin{pmatrix} 16 \\ -6 \end{pmatrix}$	U632 U903 U564 U660