

Unit	Topic/Skill	Definition/Tips	Example	Sparx Code
Percentages	Finding percentages of amounts without a calculator	To find 10% divide by 10. To find 1% divide by 100. All other percentages can be found from these building blocks.	What is 16% of 820? $16\% = 10\% + 5\% + 1\%$ Find 10% of 820 $10\% \text{ of } 820 = 820 \div 10 = 82$ Find 5% of 820 $5\% \text{ of } 820 = 82 \div 2 = 41$ Find 1% of 820 $1\% \text{ of } 820 = 820 \div 100 = 8.2$ Find 16% of 820 $16\% \text{ of } 820 = 82 + 41 + 8.2 = 131.2$ Side working $\begin{array}{r} 82.0 \\ 41.0 \\ + 8.2 \\ \hline 131.2 \end{array}$ 131.2, <u>ans</u>	M437
	Finding percentages of amounts with a calculator	Convert the percentage to a decimal multiplier. E.g. to find 47% multiply your amount by 0.47	Work out 90% of 122 Give your answer as a decimal. To find a percentage of an amount, multiply the percentage by the amount $90\% \text{ of } 122 = 90\% \times 122$ Convert the percentage to a decimal $= 0.9 \times 122$ Do the multiplication using a calculator $= 109.8$ Side working $90\% = 90 \div 100 = 0.9$ 109.8, <u>ans</u>	M905
	Percentage change without a calculator	Use the building block method to find the percentage and then either add this or subtract this from the original amount.	The price of some boots is £82. They are reduced by 18% in a sale. What is the new price of the boots? $18\% = 10\% + 5\% + 3\%$ Find 10% $10\% \text{ of } 82 = 8.2$ Find 5% $5\% \text{ of } 82 = 8.2 \div 2 = 4.1$ Find 3% $3\% \text{ of } 82 = 3 \times 0.82 = 2.46$ $18\% \text{ of } 82 = 8.2 + 4.1 + 2.46 = 14.76$ Subtract the reduction from the original price $82 - 14.76 = 67.24$ Remember units (£) £67.24, <u>ans</u>	M476
	Percentage increase with a calculator	Add 100% to the percentage and convert to a decimal to find the multiplier.	If we increase a number by 21%, then we get 786.5 as our answer. This means that 786.5 is 121% of the original number. What is the original number? Use the information in the question to write an equation Find the percentage change $21\% \text{ increase}$ $100\% + 21\% = 121\%$ It is an increase so add the percentage change to 100% Convert the percentage to a decimal $1.21 \times \text{original} = 786.5$ Solve the equation $\div 1.21$ Use a calculator to do the division $\text{original} = 786.5 \div 1.21 = 650$ 650, <u>ans</u>	M533
	Percentage decrease with a calculator	Subtract your percentage from 100% and convert to a decimal to find the multiplier.	Decrease £21 by 38% Find the percentage change $38\% \text{ decrease}$ It is a decrease so subtract the percentage change from 100% $100\% - 38\% = 62\%$ Calculate the new percentage of the amount $62\% \text{ of } 21 = 62\% \times 21$ Convert the percentage to a decimal $= 0.62 \times 21$ Do the multiplication on a calculator $= 13.02$ Remember units (£) £13.02, <u>ans</u> Side working $\begin{array}{r} 62\% \\ = 62 \div 100 \\ = 0.62 \end{array}$	M533

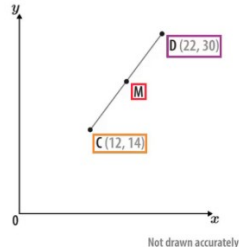
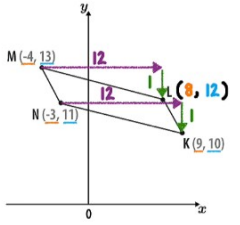
Money	Value for Money	Either work out the unit cost (cost of one item or 1 kg etc) or use the lowest common multiple method .	Two flower shops sell cactus plants for different prices, as shown below. What is the cheaper price for 20 cactus plants? Work out the cost of 20 cactus plants in each shop Find $\frac{1}{4}$ of £4.56 Subtract the reduction from the original price $4.56 \div 4 = 1.14$ $4.56 - 1.14 = 3.42$ Write the ratio of the number of plants to the cost Find an equivalent ratio where the number of plants is 20 Do the same thing to both sides of the ratio Find the cheaper price 68.4 Remember units (£) Shop A $4.56 \div 4 = 1.14$ $4.56 - 1.14 = 3.42$ Shop B Were £4.56 each Now $\frac{1}{4}$ off £17.60 for 5 cactus plants plants : cost (£) $1 : 3.42$ $\times 20 \rightarrow 20 : 68.4$ plants : cost (£) $5 : 17.6$ $\times 4 \rightarrow 20 : 70.4$ £68.40 ans	M681
Indices	Index rules with positive indices	When multiplying powers of the same base, add the indices. To divide, subtract the indices.	Calculate the value of r in the equality below. $13^{48} \div 13^6 \times 13^4 = 13^r$ Write the left side of the equality as a power of 13 Do the multiplying and dividing, working from left to right $13^{48} \div 13^6 \times 13^4 = 13^r$ $13^{(48-6)} \times 13^4 = 13^r$ $13^{42} \times 13^4 = 13^r$ $13^{(42+4)} = 13^r$ $13^{46} = 13^r$ $46 = r$ Compare the indices to find r 46 ans	M608
	Index rules with negative indices	Examples	What is the missing power in the equality below? $20^{-11} = \frac{1}{20^{\square}}$ $x^{-a} = \frac{1}{x^a}$ $20^{-11} = \frac{1}{20^{11}}$ 11 ans	M150
	Simplifying expressions using index laws		Fully simplify $\frac{k^{14} \times k^9}{k^5}$ Write as a single power of k Simplify the numerator using $[k^a \times k^b = k^{(a+b)}]$ Write the fraction as a single power of k using $[\frac{k^c}{k^d} = k^c \div k^d = k^{(c-d)}]$ $\frac{k^{14} \times k^9}{k^5} = \frac{k^{23}}{k^5} = k^{(23-5)} = k^{18}$ k^{18} ans	M120
	Simplifying algebraic fractions by cancelling common factors	Simplify the numbers in the fraction as usual. Simplify the letters using the laws of indices.	Simplify $\frac{9f^2}{36f}$ fully. Find the HCF of the numbers in the numerator and denominator Divide the numerator and denominator by the HCF Write out the variables in full $[f^2 = ff]$ Cancel each variable in the numerator if there is a corresponding variable in the denominator $\frac{f}{4}$ ans	M568

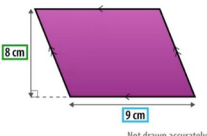
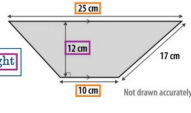
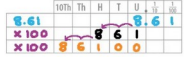
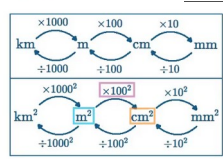
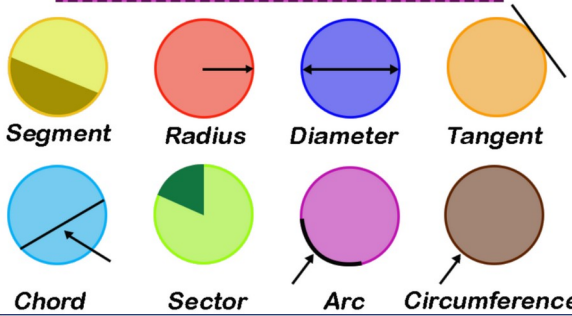
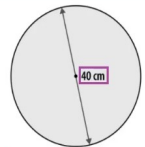
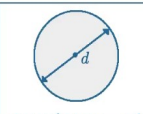
Equations	Solving equations of the form	Multiply both sides of the equation by the denominator.	a) Solve $\frac{x+3}{5} = 11$ b) Solve $\frac{x}{5} + 3 = 11$ Get x on its own Always do the same thing to both sides of an equation a) $\frac{x+3}{5} = 11$ $\times 5$ $\frac{x+3}{5} \times 5 = 11 \times 5$ $x+3 = 55$ -3 $x+3-3 = 55-3$ $x = 52$ b) $\frac{x}{5} + 3 = 11$ -3 $\frac{x}{5} + 3 - 3 = 11 - 3$ $\frac{x}{5} = 8$ $\times 5$ $\frac{x}{5} \times 5 = 8 \times 5$ $x = 40$ answer: a) $x = 52$ b) $x = 40$	M401
	Solving linear equations involving brackets	Expand the brackets first and then solve the equation using inverse operations (balancing method).	Solve $4(5c-8) = 28$ Get c on its own Expand the brackets Add 32 to both sides Divide both sides by 20 Always do the same thing to both sides of an equation Check: substitute the answer back into the equation answer: $c = 3$	M902
	Solving equations with the unknown in the denominator	Balance if needed to get the fraction on its own on one side of the equation. Then multiply both sides by the denominator.	Solve $21 + \frac{126}{7y} = 23$ Always do the same thing to both sides of an equation Subtract 21 from both sides We don't want y in the denominator Multiply both sides by 7y Divide both sides by 14 Write the answer with the variable first answer: $y = 9$	M387
	Solving equations with the unknown on both sides	Use inverse operations so that the unknown only appears on one side of the equation (in this example by subtracting 5q from both sides). Then balance as usual.	Solve $10q = 5q - 30$ Get q on its own Get q in only one place Subtract 5q from each side Divide each side by 5 Check Always do the same thing to both sides of an equation answer: $q = -6$	M554
	Constructing and solving equations	Translate the word question into algebra then solve the equation. Use a letter to represent the value you want to work out, e.g. Addams number.	Adam thinks of a number (n) and triples it. He then subtracts 4 and gets 14. Write an equation and use it to find Adam's original number. Write the problem as an equation Start with n Tripling a number is the same as multiplying the number by 3 Subtract 4 This expression is equal to the answer in the question Solve the equation to find n Always do the same thing to both sides of an equation answer: $n = 6$	M957

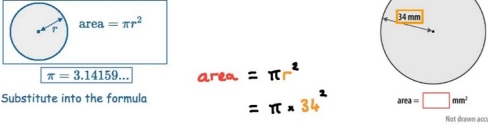
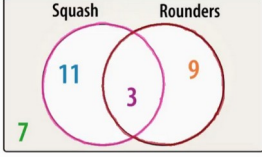
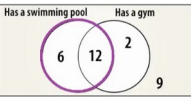
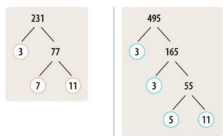
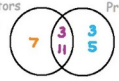
Sequences	Term-to-term rules for numerical sequences	A numerical sequence is a list of numbers in a certain order. Each number in the sequence is a term. The term to term rule is an instruction that allows you to work out the next term from the one before it.	The term-to-term rule for a sequence is to subtract 6 each time. The 12th term is 58. What is the 14th term? The term-to-term rule tells us how to get from one term to the next Start with the 12th term Use the term-to-term rule twice 12th term: 58 → 13th term: 52 → 14th term: 46 46 <u>ans</u>	M381
	Term-to-term rules for sequences of patterns	A sequence can also be made of patterns that grow/shrink following a rule. In this case each term would be a pattern	The start of a sequence of patterns made using dots is shown below. Copy and complete the rule for the sequence. Rule: Start with dots. Add dots each time Pattern number: 1, 2, 3, 4, ... Pattern: (diagrams of dot patterns) Find the starting value by counting the number of dots in the first pattern: 8 dots Find the term-to-term rule by counting how many dots are added each time: 3 dots Start with 8 dots. Add 3 dots each time. <u>ans</u>	M241
	Substituting into position-to-term rules	The position to term rule (or nth term) allows you to calculate any term in the sequence. 5n is the multiples of 5: 5, 10, 15, 20 ... 5n+1 is one more than the multiples of 5: 6, 11, 16, 21 ...	The nth term rule for a sequence is $7n + 3$ What is the 5th term of this sequence? The 5th term is the term at position 5. $n^{\text{th}} \text{ term} = 7n + 3$ Substitute the position into the nth term rule Include the multiplication sign Do the multiplying first Then do the adding $5^{\text{th}} \text{ term} = 7 \times 5 + 3$ $= 35 + 3$ $= 38$ 38 <u>ans</u>	M166
	Position-to-term rules for arithmetic sequences	Arithmetic sequences have a common difference. They go up or down by the same amount each time. The nth term helps you to find any term in the sequence	The beginning of an arithmetic sequence is shown below. By first working out the nth term rule, calculate the 11th term of this sequence. Arithmetic sequences have a common difference between the terms Find the difference between the terms The number that n is multiplied by is the difference between the terms rule: $9n + ?$ Subtract 9n from the sequence to find the rest of the rule Substitute 11 into the rule to find the term $9 \times 11 + 5 = 99 + 5 = 104$ 104 <u>ans</u>	M991
	Position-to-term rules for sequences of patterns	Convert the pattern sequence into a numerical sequence to find the rule easily.	Evie makes a sequence of patterns using tiles. Use the rule to work out how many tiles there are in the 11th pattern. Tiles in nth pattern: $6n + 1$ The 11th pattern is when the pattern number is 11 Substitute 11 for n in the expression Do the multiplying Then do the adding $n = 11$ tiles in the nth pattern = $6n + 1$ tiles in the 11th pattern = $6 \times 11 + 1$ $= 66 + 1$ $= 67$ 67 <u>ans</u>	M866

Ratio	Writing and simplifying ratios	To simplify a ratio quickly divide each number by the lowest common multiple.	There are 28 boys and 12 girls at a youth club. What is the ratio of boys to girls in its simplest form? Ratios compare the relative sizes of different quantities Write down the ratio of boys to girls Simplify the ratio by dividing by a common factor Do the same thing to both sides of the ratio $\begin{array}{ccc} \text{boys} & : & \text{girls} \\ 28 & : & 12 \\ \div 4 & & \div 4 \\ 7 & : & 3 \end{array}$ 7 : 3 <u>ans</u>	M885
	Writing ratios in the form 1:n or n:1	Write an equivalent ratio where one of the numbers has to be 1. The other number may have to be written as a fraction or decimal.	The ratio of silver cars to blue cars in a car park is 107 : 49. Rewrite this as an equivalent ratio of the form n : 1. Give any decimals in your answer to 2 d.p. Write down the ratio of the numbers of cars Find an equivalent ratio where the number of blue cars is 1 Do the same thing to both sides of the ratio Round the value to 2 d.p. $\begin{array}{ccc} \text{silver cars} & : & \text{blue cars} \\ 107 & : & 49 \\ \div 49 & & \div 49 \\ 2.1836... & : & 1 \\ 2.18 & : & 1 \end{array}$ 2.18 : 1 <u>ans</u>	M543
	Converting a fraction to a ratio.	A fraction is the number of parts out of the total number of parts.	$\frac{2}{9}$ of the animals in a pet shop are parrots. What is the ratio of parrots to non-parrots in the pet shop? fraction of parrots = $\frac{\text{number of parrots}}{\text{total animals}}$ 2 out of every 9 animals are parrots How many animals are not parrots? $9 - 2 = 7$ Write down the ratio parrots : non-parrots 2 : 7 <u>ans</u>	M267
	Converting a ratio to a fraction	A fraction is the number of parts out of the total number of parts.	Cyclobutene is made up of hydrogen and carbon atoms. The ratio of hydrogen to carbon atoms in cyclobutene is 3:2. What fraction of the atoms in cyclobutene are hydrogen atoms? Ratios compare the relative sizes of different quantities fraction of atoms that are hydrogen = $\frac{\text{parts of the ratio corresponding to hydrogen}}{\text{total parts in the ratio}}$ Find the total number of parts $3 + 2 = 5$ Find the parts corresponding to hydrogen 3 Find the fraction of atoms that are hydrogen $\frac{3}{5}$ $\frac{3}{5}$ <u>ans</u>	M267
	Converting a ratio to a percentage	Convert the ratio to a fraction as above and then convert the fraction into a percentage.	The students in a class were asked whether they preferred football, athletics or rugby. The ratio of students who preferred football to athletics to rugby was 3:12:5. What percentage of students preferred athletics? Find the total number of parts in the ratio $3 + 12 + 5 = 20$ Find the fraction who preferred athletics 12 out of 20 = $\frac{12}{20}$ Find the percentage who preferred athletics Percent means "out of 100" Convert to an equivalent fraction with a denominator of 100 The numerator is the percentage $\frac{12}{20} = \frac{60}{100}$ 60 % <u>ans</u>	M267

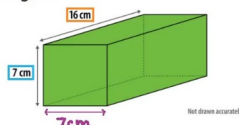
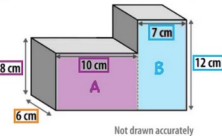
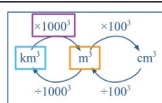
	Using equivalent ratios to find unknown amounts	Scale up the ratio to match the amount that you know.	Milkshake, syrup is mixed with milk in the ratio 1:9. If you use 360 ml of milk, how much syrup do you need? The ratio tells us that for every 1 ml of syrup there are 9 ml of milk $\begin{array}{ccc} \text{syrup} & : & \text{milk} \\ 1 & : & 9 \\ \times 40 & & \times 40 \\ \hline 40 & : & 360 \end{array}$ Find an equivalent ratio How do we get from 9 to 360? Do the same thing to each side Remember units (ml) 40 ml ans	M801
	Sharing amounts in a given ratio	A bar model is very helpful here.	Tommie, Yusra and Sophia share 35 grapes in the ratio 1:1:3. How many grapes does Sophia have? Find the total parts in the ratio $1 + 1 + 3 = 5$ Write down the ratio Tommie : Yusra : Sophia Total $1 : 1 : 3$ 5 Form an equivalent ratio with a total of 35 How do you get from a total of 5 to a total of 35? Do the same thing to each section $\begin{array}{ccc} \times 7 & & \times 7 \\ \hline 7 & : & 7 : 21 \\ & & + \\ & & 35 \end{array}$ How many grapes does Sophia have? 21 ans	M525
	Drawing and interpreting scale diagrams		On the map below, 1 cm represents 4 km. a) What is the distance from the museum to the theme park in real life, in kilometres? b) The museum is 12.8 km from the ice rink. What is the distance from the museum to the ice rink on the map, in centimetres? a) Read the distance on the map from the ruler 9.5 cm Use the scale to work out how many kilometres in real life are represented by 9.5 cm on the map Side working $\begin{array}{r} 9.5 \times 10 = 95 \\ \times 4 \\ \hline 380 \end{array}$ $\begin{array}{r} 95 \\ \times 9.5 \\ \hline 380 \end{array}$ $380 \div 10 = 38$ 9.5 cm represents 38 km b) Use the scale to work out how many centimetres on the map represent 12.8 km in real life 1 cm represents 4 km $\begin{array}{r} 12.8 \\ \times 3.2 \\ \hline 412.8 \end{array}$ Side working $\begin{array}{r} 3.2 \\ \times 4 \\ \hline 12.8 \end{array}$ answer: a) 38 km b) 3.2 cm	M112
Rounding	Rounding integers using significant figures		Round 83,802 to a) 2 significant figures. b) 3 significant figures. The first significant figure is the first non-zero digit working from the left of the number Split the number after the significant figure you are rounding to If the next digit is 4 or below, round down 5 or above, round up Replace digits after the split with zeros a) 84,000 b) 83,800 ans	M994
	Rounding decimals using significant figures		a) Round 0.0125 to 2 s.f. b) Round 0.0491 to 2 s.f. The first significant figure is the first non-zero digit working from the left of the number Split the number after the second significant figure If the next digit is 4 or below, round down 5 or above, round up Stop at the split a) 0.013 b) 0.049 ans	M131

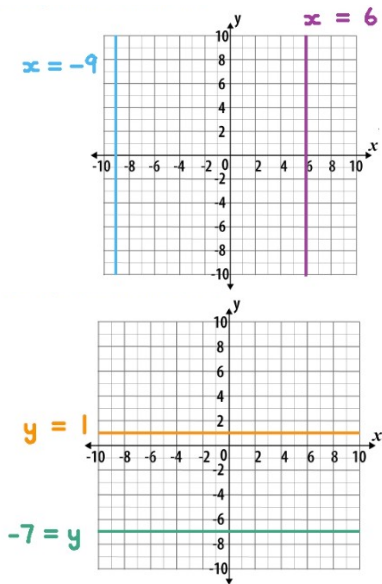
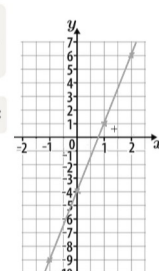
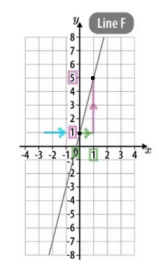
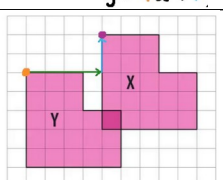
	Estimating calculations	To estimate a calculation, round each value in the calculation to 1 significant figure and then carry out the calculation.	Estimate $4.77 + 3.12$ To estimate, round each value in the calculation to 1 significant figure $\approx$ means "approximately equal to" The first significant figure is the first non-zero digit working from the left of the number If the next digit is 4 or below, round down 5 or above, round up $4.77 \approx 5$ $3.12 \approx 3$ Rewrite the calculation with the rounded values $4.77 + 3.12 \approx 5 + 3$ Do the calculation $5 + 3 = 8$ 8 ans	M878
Coordinates	Calculating midpoints	The midpoint of 2 pairs of coordinates is the point in the middle.	Point M is the midpoint of line segment CD, shown below. What are the coordinates of point M? The midpoint is halfway between two points coordinates of midpoint of (x_1, y_1) and (x_2, y_2) = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ $(x_1, y_1) = (12, 14)$ $(x_2, y_2) = (22, 30)$ Calculate the x-coordinate of the midpoint $\frac{12 + 22}{2} = 17$ Calculate the y-coordinate of the midpoint $\frac{14 + 30}{2} = 22$ (17, 22) ans 	M622
	Mixed problems: Coordinates and midpoints		<i>KLMN</i> is a parallelogram. What are the coordinates of <i>L</i>? Opposite sides of a parallelogram are the same length and parallel to each other Calculate the horizontal and vertical distance between adjacent points <i>N</i> and <i>K</i> $9 - -3 = 12$ $10 - 11 = -1$ Use the horizontal distance to work out the x-coordinate of <i>L</i> $x = -4 + 12$ $x = 8$ Use the vertical distance to work out the y-coordinate of <i>L</i> $y = 13 - 1$ $y = 12$ answer: L = (8, 12) 	M311

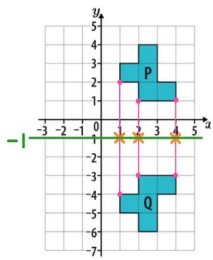
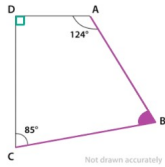
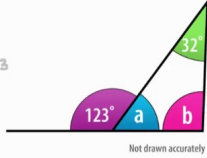
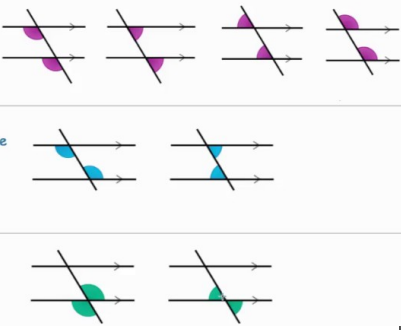
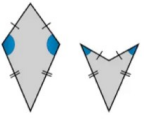
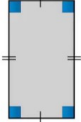
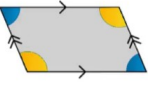
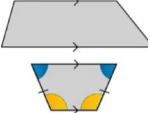
Unit	Topic/Skill	Definition/Tips	Example	Spar x Cod e
Area	Finding the area of parallelograms	A quadrilateral with two pairs of parallel sides	Work out the area of the parallelogram. area of a parallelogram = $\text{base} \times \text{perpendicular height}$ $\text{base} = 9 \text{ cm}$ $\text{perpendicular height} = 8 \text{ cm}$ $\text{area} = 9 \times 8$ $= 72$ Remember units (cm^2) 72 cm^2 ans 	M29 1
	Finding the area of trapeziums	A quadrilateral with one pair of parallel sides	Calculate the area of this trapezium. area of a trapezium = $\frac{(\text{sum of parallel sides})}{2} \times \text{perpendicular height}$ $= \frac{25 + 10}{2} \times 12$ $= \frac{35}{2} \times 12$ $= 17.5 \times 12$ $= 210$ Remember units (cm^2) 210 cm^2 ans  means the two lines are perpendicular	M70 5
	Converting units of area		Convert 8.61 m^2 into cm^2 Identify what calculation we need to do to get from m^2 to cm^2 $8.61 \text{ m}^2 \times 100^2 = ? \text{ cm}^2$ $8.61 \times 100 \times 100 = ?$ Do the calculation It may be helpful to use a place value grid  Remember units answer: $86,100 \text{ cm}^2$ 	M72 8
Circles	Parts of a circle		Parts of a circle  Segment Radius Diameter Tangent Chord Sector Arc Circumference	M59 5
	Circumference	The diameter is twice the radius	The diameter, d, of the circle shown is 40 cm. What is the circumference of the circle? Give your answer to 1 d.p. circumference = πd Substitute into the formula $= \pi \times 40$ $= 125.6637...$ $= 125.7 \text{ to 1 d.p.}$ Remember units answer: 125.7 cm   circumference = πd $\pi = 3.14159...$	M16 9

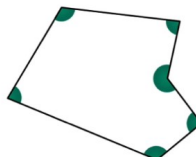
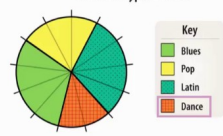
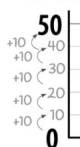
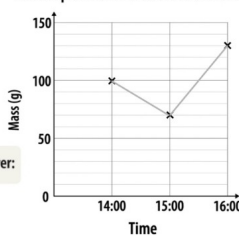
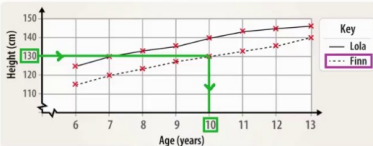
	Area	The radius is half the diameter	The radius of the circle below is 34 mm. Calculate the area of the circle. Give your answer to 1 d.p.  area = πr^2 $\pi = 3.14159...$ Substitute into the formula Use the π button on your calculator Round the final answer to 1 d.p. Remember units (mm^2) area = πr^2 $= \pi \times 34^2$ $= \pi \times 1156$ $= 3631.681...$ $= 3631.7 \text{ to 1 d.p.}$ $3631.7 \text{ mm}^2 \text{ ans}$	M23 1
Standard Form	Using standard form with positive indices	A number in standard form looks like this: 6.7×10^2 This part is written as a number between 1 and 10. This part is written as a power of 10.	Write 8.01×10^6 as an ordinary number. Notice that this is a number multiplied by a power of 10. 8.01×10^6 An ordinary number is a number written without any index notation Do the multiplication using a place value grid Multiplying by 10^6 is the same as multiplying by 10 6 times  $8,010,000 \text{ ans}$	M71 9
	Using standard form with negative indices		Write 4.1×10^{-5} as an ordinary number. Give your answer as a decimal. Notice that this is a number multiplied by a power of 10. 4.1×10^{-5} An ordinary number is a number written without any index notation Do the multiplication using a place value grid Multiplying by 10^{-5} is the same as dividing by 10 5 times  0.000041 ans	M67 8
Venn Diagrams	Using Venn diagrams		Corey asked 30 people whether they play squash and whether they play rounders. The Venn diagram below shows the numbers of people who play squash, rounders, both or neither.  a) How many people play squash? b) How many people play rounders? a) Add up the number of people who are in the squash circle $11 + 3 = 14 \text{ people ans}$ b) Add up the number of people who are in the rounders circle $3 + 9 = 12 \text{ people ans}$	M82 9
	Probabilities from Venn diagrams		The Venn diagram below shows the number of hotels in a town that have a swimming pool and a gym. What is the probability that a hotel picked at random has a swimming pool? Give your answer as a fraction in its simplest form.  $P(\text{has a swimming pool}) = \frac{\text{number of hotels that have a swimming pool}}{\text{total number of hotels}}$ How many hotels have swimming pools? $6 + 12 = 18$ How many hotels are there in total? $6 + 12 + 2 + 9 = 29$ Work out the probability Simplify if possible $\frac{18}{29}$ $\frac{18}{29} \text{ ans}$	M41 9
	Finding the HCF using prime factor decomposition		The prime factor trees for 231 and 495 are given below. Use the prime factor trees to find the highest common factor (HCF) of 231 and 495.  231 = $3 \times 7 \times 11$ 495 = $3 \times 3 \times 5 \times 11$ Draw a Venn diagram showing the prime factors of each number. Put the numbers that are prime factors of both numbers in the overlapping section  Prime factors of 231: 3, 7, 11. Prime factors of 495: 3, 5, 11. The HCF is equal to the product of the common prime factors $3 \times 11 = 33$ answer: 33	M36 5

	Finding the LCM using prime factor decomposition		The prime factor trees for 510 and 935 are shown below. Use the prime factor trees to find the lowest common multiple (LCM) of 510 and 935. $510 = 2 \times 3 \times 5 \times 17$ $935 = 5 \times 11 \times 17$ Draw a Venn diagram showing the prime factors of each number Put the numbers that are prime factors of both numbers in the overlapping section Prime factors of 510 Prime factors of 935 The LCM is equal to the product of all the prime factors in the Venn diagram $2 \times 3 \times 5 \times 17 \times 11 = 5610$ answer: 5610	M36 5
3D Shapes	Properties of 3D shapes	Faces are the sides, edges are the lines between the faces and vertices are the corners	How many faces, how many edges and how many vertices does the cuboid on the right have? Count the faces 6 faces <i>ans</i> Count the edges 12 edges <i>ans</i> Count the vertices 8 vertices <i>ans</i>	M76 7
	Nets of 3D shapes		Match each of the 3D shapes below to its corresponding net. Look at the shape of each face 6 rectangles 6 rectangles and 2 hexagons 6 triangles and 1 hexagon Net A Net B Net C 6 triangles and 1 hexagon 6 rectangles and 2 hexagons 6 rectangles Use this to match the 3D shapes to their nets Cuboid: Net C, Hexagonal prism: Net B, Hexagonal pyramid: Net A <i>ans</i> A net is a 2D diagram that can be folded to make a 3D shape Look at the shapes that form each net	M51 8
Surface Area and Volume	Finding the surface area from a net		The net of a cuboid is shown below. Work out the surface area of the cuboid. The surface area of a shape is equal to the area of its net Identify the dimensions of the net Find the area of each of the different rectangles $4 \times 7 = 28$ $4 \times 11 = 44$ $7 \times 11 = 77$ total area = $2 \times 28 + 2 \times 44 + 2 \times 77$ = $2 \times 28 + 2 \times 44 + 2 \times 77$ = $56 + 88 + 154$ = 298 answer: 298 mm²	M88 4
	Finding the surface area of cubes and cuboids		A cuboid has a length of 25 cm, a width of 18 cm and a height of 21 cm. What is the surface area of the cuboid? The surface area is the total area of all the faces $21 \times 18 = 378$ $25 \times 21 = 525$ $25 \times 18 = 450$ Opposite faces of a cuboid are identical Work out the area of each face area of a rectangle = length $\times$ width Find the surface area: surface area = $(2 \times 378) + (2 \times 525) + (2 \times 450)$ = $756 + 1050 + 900$ = 2706 Remember units (cm²) 2706 cm² ans	M53 4
	Finding the surface area of prisms		The prism below has two faces that are regular hexagons. Each hexagonal face has an area of 65 cm². What is the surface area of the prism? The surface area is the total area of all the faces A prism has two identical cross-sectional faces Find the area of each cross-sectional face 65 A prism whose cross-section is a regular hexagon has six identical rectangular faces Work out the area of each rectangular face area of a rectangle = length $\times$ width = 7×5 = 35 Find the surface area: surface area = $(2 \times 65) + (6 \times 35)$ = 340 Remember units (cm²) 340 cm² ans	M66 1

	Finding the volume of cubes and cuboids		The cuboid below has two square faces with side length 7 cm. Work out the volume of the cuboid. The sides of a square are all the same length volume of a cuboid = length $\times$ width $\times$ height $= 16 \times 7 \times 7$ $= 112 \times 7$ $= 784$ Remember units (cm^3) 784 cm^3 <u>ans</u> 	M76 5																																																				
	Finding the volume of prisms		The cross-section of this prism is a compound shape formed of two rectangles. Work out the volume of the prism. volume of a prism = area of cross-section $\times$ length Calculate the area of the cross-section area of a rectangle = base $\times$ height area of A = 10×8 $= 80$ area of B = 7×12 $= 84$ area of cross-section = $80 + 84$ $= 164$ Calculate the volume of the prism volume = 164×6 $= 984$ Remember units (cm^3) 984 cm^3 <u>ans</u> 	M72 2																																																				
	Converting units of volume		Convert 0.00841 km^3 into m^3. Identify what calculation we need to do to get from km^3 to m^3 km^3 $\times 1000^3$ = ? m^3 $0.00841 \times 1000 \times 1000 \times 1000$ = ? Do the calculation It may be helpful to use a place value grid <table><thead><tr><th></th><th>M</th><th>100Th</th><th>10Th</th><th>Th</th><th>H</th><th>T</th><th>U</th><th>$\frac{1}{10}$</th><th>$\frac{1}{100}$</th><th>$\frac{1}{1000}$</th><th>$\frac{1}{10,000}$</th><th>$\frac{1}{100,000}$</th></tr></thead><tbody><tr><td>$\times 1000$</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td>0</td><td>0</td><td>8</td><td>4</td><td>1</td></tr><tr><td>$\times 1000$</td><td></td><td></td><td></td><td>8</td><td>4</td><td>1</td><td>0</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>$\times 1000$</td><td>8</td><td>4</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table> answer: $8,410,000 \text{ m}^3$ 		M	100Th	10Th	Th	H	T	U	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10,000}$	$\frac{1}{100,000}$	$\times 1000$							0	0	0	8	4	1	$\times 1000$				8	4	1	0						$\times 1000$	8	4	1	0	0	0	0						M46 5
	M	100Th	10Th	Th	H	T	U	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10,000}$	$\frac{1}{100,000}$																																												
$\times 1000$							0	0	0	8	4	1																																												
$\times 1000$				8	4	1	0																																																	
$\times 1000$	8	4	1	0	0	0	0																																																	

Unit	Topic/Skill	Definition/Tips	Example	Spar x Code										
Linear Graphs	Plotting horizontal, vertical, and diagonal lines	Lines of the form $x=a$: Are vertical Are parallel to the y-axis Lines of the form $y=a$: Are horizontal Are parallel to the x-axis		M79 7										
	Plotting straight line graphs	Straight line graphs show all of the possible coordinates (x,y) which satisfy an equation	By first completing the table below, plot the line $y = 5x - 4$. <table border="1"> <tr> <td>x</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr> <tr> <td>y</td><td>-9</td><td>-4</td><td>1</td><td>6</td></tr> </table> Substitute each x value into the equation of the line to find the corresponding y value On a set of axes, mark the coordinates of each point in the table Draw a straight line through the coordinates answer: 	x	-1	0	1	2	y	-9	-4	1	6	M93 2
x	-1	0	1	2										
y	-9	-4	1	6										
	Finding equations of straight line graphs	The equation of a straight line tells us the gradient and the y-intercept	Copy and complete the equation of line F below. $y = \underline{\hspace{1cm}} x + \underline{\hspace{1cm}}$ The equation of a straight line can be written as $y = mx + c$ • m is the gradient • c is the y-intercept Work out the gradient, m gradient = $\frac{\text{change in } y}{\text{change in } x}$ $m = \frac{5-1}{1-0}$ $m = \frac{4}{1}$ $m = 4$ Work out the y-intercept, c The y-intercept is where the line crosses the y-axis $c = 1$ $y = mx + c$ $y = 4x + 1$ 	M54 4										
Transformati ons	Translati on	“translation” means moving a shape without. Translated shapes are congruent (same size same shape)	a) Describe the translation to shape X from shape Y. b) Describe the translation to shape Y from shape X. a) Using two corresponding vertices: - Count the number of squares left or right 4 - Count the number of squares up or down 2 answer: a) 4 squares to the right and 2 squares up.  b) The translation to shape Y from shape X is the inverse of the translation to shape X from shape Y answer: b) 4 squares to the left and 2 squares down.	M13 9										

	Reflection	If you fold your graph along the line of reflection, the original and reflected shapes should match up	What is the equation of the line of reflection that transforms shape P onto shape Q Corresponding vertices of reflected shapes are the same distance away from the line of reflection, but are on the opposite side Draw straight lines between the corresponding vertices Find the midpoints of these lines The line of reflection goes through all these midpoints Find the equation of the line of reflection $x = a$ is a vertical line $y = a$ is a horizontal line $y = -1$  answer: $y = -1$	M29 0
Angles	Angles in quadrilaterals	Angles in a quadrilateral always sum (add up) to 360°	Work out the size of angle ABC. Identify the angle ABC Angles in a quadrilateral sum to 360° A right angle is 90° $90 + 124 + 85 + ABC = 360$ Side working $\begin{array}{r} 90 \\ + 124 \\ + 85 \\ \hline 299 \end{array}$ $299 + ABC = 360$ $ABC = 360 - 299$ $ABC = 61$  Side working $\begin{array}{r} 360 \\ - 299 \\ \hline 61 \end{array}$ answer: $ABC = 61^\circ$	M67 9
	Combining angle facts		Find the sizes of angles a and b. Angles on a straight line sum to 180° $123 + a = 180$ $a = 180 - 123$ $a = 57$ Angles in a triangle sum to 180° $b + a + 32 = 180$ $b + 57 + 32 = 180$ $b + 89 = 180$ $b = 91$ Remember units ($^\circ$) $a = 57^\circ, b = 91^\circ$ 	M31 9
	Angles on parallel lines	When you are asked to "give a reason for your answer", this means you need to write the rule you used	Corresponding angles Same side of the crossing line Same side of the parallel lines Alternate angles Opposite sides of the crossing line Between the parallel lines Vertically opposite angles Opposite sides of where two straight lines cross 	M60 6
	Using quadrilateral properties to find angles		Kite - Two pairs of equal-length sides - One pair of equal angles  Rectangle - Two pairs of equal-length sides - All interior angles are right angles  Parallelogram - Two pairs of parallel sides - Two pairs of equal angles  Trapezium - One pair of parallel sides 	M39 3

	Angles in polygons		The sum of the interior angles of a polygon with n sides is $180^\circ \times (n - 2)$ Work out the sum of the interior angles of a polygon with 6 sides. Find the value of n $n = 6$ Make the substitution $180 \times (n - 2)$ $= 180 \times (6 - 2)$ Find the value inside the brackets $= 180 \times 4$ Do the multiplication $= 720$ answer: 720° 	M65 3															
Statistical diagrams	Drawing pie charts	To find the angles at the centre, remember that angles around a point add up to 360°	Show the information in this table on the pie chart. Work out the fraction of the total that each animal is Fraction who said an animal = $\frac{\text{number who said the animal}}{\text{total}}$ <table><thead><tr><th>Favourite animal</th><th>Frequency</th><th>Fraction</th></tr></thead><tbody><tr><td>Dolphin</td><td>7</td><td>$\frac{7}{9}$</td></tr><tr><td>Wolf</td><td>1</td><td>$\frac{1}{9}$</td></tr><tr><td>Lion</td><td>1</td><td>$\frac{1}{9}$</td></tr><tr><td>Total</td><td>$7 + 1 + 1 = 9$</td><td></td></tr></tbody></table> Shade the correct fraction of the pie chart  answer	Favourite animal	Frequency	Fraction	Dolphin	7	$\frac{7}{9}$	Wolf	1	$\frac{1}{9}$	Lion	1	$\frac{1}{9}$	Total	$7 + 1 + 1 = 9$		M57 4
Favourite animal	Frequency	Fraction																	
Dolphin	7	$\frac{7}{9}$																	
Wolf	1	$\frac{1}{9}$																	
Lion	1	$\frac{1}{9}$																	
Total	$7 + 1 + 1 = 9$																		
	Interpreting pie charts		A teacher asked the students in her class what their favourite type of music was and displayed the results in this pie chart, which is split into equal sections. a) What was the least popular type of music of those shown in the chart? b) What fraction of the class chose this type of music? Favourite type of music  a) Find the smallest sector of the pie chart Read the key to find the type of music this represents <u>Dance</u> <u>ans</u> b) Count how many sections represent dance <u>2</u> Count the total number of sections <u>13</u> What fraction of the pie chart represents dance? $\frac{2}{13}$ <u>ans</u> Simplify if possible	M16 5															
	Drawing line graphs	Time always goes on the x-axis	Plot this data on the grid below. <table><thead><tr><th>Time</th><th>14:00</th><th>15:00</th><th>16:00</th></tr></thead><tbody><tr><td>Mass (g)</td><td>100</td><td>70</td><td>130</td></tr></tbody></table> Find the size of each small step  5 small steps is an increase of 50 1 small step is an increase of 10 Plot the points and join them with line segments  answer:	Time	14:00	15:00	16:00	Mass (g)	100	70	130	M14 0							
Time	14:00	15:00	16:00																
Mass (g)	100	70	130																
	Interpreting line graphs	Check the axis scale carefully when finding and reading values	This line graph shows yearly measurements of Lola and Finn's heights. What age was Finn when his height was recorded as 130 cm?  Read the key Find the height from the question <u>130 cm</u> Read across to the correct line Read down to the 'age' axis Remember units (years) <u>10 years</u>	M18 3															

	Drawing stem-and-leaf diagrams		The number of cakes sold in a bakery each day, for 10 days, are listed below. 23 17 12 8 12 9 13 20 21 12 Draw an ordered stem-and-leaf diagram to represent this information. Step 1 - Identify the numbers that you will need in the stem Step 2 - Write down the numbers in the stem and draw a vertical line Step 3 - Write down the numbers in order in the leaves Step 4 - Include a key Cake sales <table><tr><td>0</td><td>8 9</td></tr><tr><td>1</td><td>2 2 2 3 7</td></tr><tr><td>2</td><td>0 1 3</td></tr></table> Key: 0 8 represents 8 cakes	0	8 9	1	2 2 2 3 7	2	0 1 3	M64 8						
0	8 9															
1	2 2 2 3 7															
2	0 1 3															
	Interpreting stem-and-leaf diagrams		The number of points obtained by each of the top 15 football teams in the 2015/16 Championship is shown in the stem-and-leaf diagram below. How many of these teams obtained more than 65 points? Championship 2015/16 points <table><tr><td>5</td><td>5 8 9</td></tr><tr><td>6</td><td>0 2 3 5 8 9</td></tr><tr><td>7</td><td>4 8</td></tr><tr><td>8</td><td>3 9 9</td></tr><tr><td>9</td><td>3</td></tr></table> Key 9 3 represents 93 points Read the key The stem represents the tens digit and the leaf represents the units digit Count how many teams have a score of more than 65 8	5	5 8 9	6	0 2 3 5 8 9	7	4 8	8	3 9 9	9	3	M21 0		
5	5 8 9															
6	0 2 3 5 8 9															
7	4 8															
8	3 9 9															
9	3															
	Finding averages from diagrams	The mode is the most common The range is the difference between the largest and smallest values	This stem-and-leaf diagram shows the heights of 7 giraffes living in a zoo. What is the median height? Heights of giraffes <table><tr><td>2</td><td>2 4</td></tr><tr><td>3</td><td></td></tr><tr><td>4</td><td>7</td></tr><tr><td>5</td><td>0 2 6</td></tr><tr><td>6</td><td>1</td></tr></table> Key 2 4 represents 2.4 m Read the key The stem represents the units digit and the leaf represents the tenths digit It can be helpful to write out the values from the diagram 2.2, 2.4, 4.7, 5.0, 5.2, 5.6, 6.1 median = middle value of an ordered list Values in a stem-and-leaf diagram are ordered Cross off outer values until one is left Remember units (m) 5.0 m <u>ans</u> +	2	2 4	3		4	7	5	0 2 6	6	1	U854		
2	2 4															
3																
4	7															
5	0 2 6															
6	1															
Inequalities	Reading and drawing linear inequalities on number lines		Write down the inequality shown on the number line below. Find the variable f Find the number below the circle -2 Find the correct inequality symbol <table><tr><td>○ →</td><td>less than</td><td><</td></tr><tr><td>○ →</td><td>greater than</td><td>></td></tr><tr><td>● →</td><td>less than or equal to</td><td>≤</td></tr><tr><td>● →</td><td>greater than or equal to</td><td>≥</td></tr></table> f is greater than -2 f > -2 answer: f > -2	○ →	less than	<	○ →	greater than	>	● →	less than or equal to	≤	● →	greater than or equal to	≥	M38 4
○ →	less than	<														
○ →	greater than	>														
● →	less than or equal to	≤														
● →	greater than or equal to	≥														
	Solving single inequalities	Solving inequalities is just like solving equations, but with an inequality sign instead of an = sign	Solve the following inequality: $y - 5 \leq 12$ ≤ less than or equal to ≥ greater than or equal to When solving inequalities, do the same thing to both sides Add 5 to both sides of the inequality $+5 \quad y - 5 \leq 12 \quad +5$ $y \leq 12 + 5$ $y \leq 17$	M11 8												
Brackets	Expanding double brackets	You might find it easier to use a grid method	Expand and simplify $(x + 2)(x + 3)$ Multiply each term in the first set of brackets by each term in the second set of brackets Use the "eyebrows" to help $(x + 2)(x + 3)$ $= x \times x + x \times 3 + 2 \times x + 2 \times 3$ $= x^2 + 3x + 2x + 6$ Collect like terms $= x^2 + 5x + 6$	M96 0												

Algebraic fractions	Calculating with fractions	Flipping a fraction gives the <u>reciprocal</u>	Work out $10 \div \frac{15}{7}$ Give your answer as a whole number or as a fraction in its simplest form. Write the division as a multiplication Change $\div$ to $\times$ Flip the fraction $10 \div \frac{15}{7} = 10 \times \frac{7}{15}$ Cancel if possible $= \frac{10 \times 7}{15}$ $= \frac{2 \times 7}{3}$ $= \frac{14}{3}$ Check that the answer is fully simplified ✓ $\frac{14}{3}$	M64 5									
	Calculating with mixed numbers	When you multiply and divide mixed numbers, you need to turn them into <u>improper fractions</u> first	a) $2\frac{7}{11} + 4\frac{4}{11}$ Split each mixed number into a whole number and a fraction $= \frac{7}{11} + 4 + \frac{4}{11}$ Add the whole numbers and add the fractions Numerators can be added or subtracted when they are over the same denominator $= 4 + \frac{7+4}{11}$ Simplify the fraction if possible $= 4 + 1$ $= 5$ Write the mixed numbers as improper fractions $2\frac{7}{11} \times 1\frac{1}{3} = \frac{25}{11} \times \frac{4}{3}$ Cancel if possible $= \frac{25 \times 4}{11 \times 3}$ $= \frac{100}{33}$ b) $2\frac{3}{17} + 6\frac{10}{17}$ $= 2 + \frac{3}{17} + 6 + \frac{10}{17}$ $= 8 + \frac{3+10}{17}$ $= 8 + \frac{13}{17}$ $= 8\frac{13}{17}$ Side working $2\frac{3}{17} = 2 + \frac{3}{17}$ $= \frac{22}{17} + \frac{3}{17}$ $= \frac{22+3}{17}$ $= \frac{25}{17}$	M61 9									
	Simplifying algebraic fractions by factorising	Factors can be numbers, variables, and even expressions in brackets	Write $\frac{16x+40}{56x}$ as a fraction in its simplest form. Factorise the numerator $\frac{16x+40}{56x} = \frac{8(2x+5)}{56x}$ Cancel the <u>coefficients</u> Divide by the highest common factor 8 $\frac{8 \times (2x+5)}{56 \times x} = \frac{1 \times (2x+5)}{7 \times x}$ $= \frac{2x+5}{7x}$ Side working $16x+40 = 8 \times 2x + 8 \times 5 = 8(2x+5)$ Multiplying an expression by 1 doesn't change it	M75 4									
	Adding and subtracting algebraic fractions	To add and subtract fractions you need a <u>common denominator</u>	Write $\frac{9}{13} - \frac{4}{13t}$ as a single fraction in its simplest form. Convert the fractions to equivalent fractions with the same denominator Notice the number is the same in each denominator Make the variables the same in each denominator $\frac{9}{13} - \frac{4}{13t} = \frac{9t}{13t} - \frac{4}{13t}$ Numerators can be added and subtracted when they are over the same denominator $= \frac{9t-4}{13t}$ Side working $\frac{9}{13} = \frac{9t}{13t}$	M33 6									
Recurring decimals	Using recurring decimal notation		Writing recurring decimals using dot notation "Recurring" means "repeating" Write any digits <u>before</u> the recurring decimal pattern and then <u>one</u> copy of the recurring pattern If <u>only one digit</u> is recurring, write a dot above that recurring digit $0.88888... = 0.\dot{8}$ $0.44444... = 0.\dot{4}$ If there is <u>more than one digit</u> in the recurring pattern - write a dot above the <u>first digit</u> in the recurring pattern - write another dot above the <u>last digit</u> in the recurring pattern $0.676767... = 0.\dot{6}\dot{7}$ $0.245245... = 0.\dot{2}\dot{4}\dot{5}$ $0.101101101... = 0.\dot{1}0\dot{1}$ Any digits before the recurring pattern stay the same $0.266666... = 0.2\dot{6}$ $0.8919191... = 0.8\dot{9}\dot{1}$	M70 1									
	Converting fractions to recurring decimals	The most important ones to know:	Write $\frac{5}{6}$ as a recurring decimal using dot notation. Do the division using the bus stop method Add extra zeros as needed $\frac{5}{6} = 5 \div 6$ $6 \overline{) 5.000000}$ Look for a <u>recurring pattern</u> in the digits and the remainders Write using dot notation Write a dot over the <u>recurring digit</u> $0.8\dot{3}$ Side working <table><tr><td>1 × 6 = 6</td></tr><tr><td>2 × 6 = 12</td></tr><tr><td>3 × 6 = 18</td></tr><tr><td>4 × 6 = 24</td></tr><tr><td>5 × 6 = 30</td></tr><tr><td>6 × 6 = 36</td></tr><tr><td>7 × 6 = 42</td></tr><tr><td>8 × 6 = 48</td></tr><tr><td>9 × 6 = 54</td></tr></table> answer: $0.8\dot{3}$	1 × 6 = 6	2 × 6 = 12	3 × 6 = 18	4 × 6 = 24	5 × 6 = 30	6 × 6 = 36	7 × 6 = 42	8 × 6 = 48	9 × 6 = 54	M92 2
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