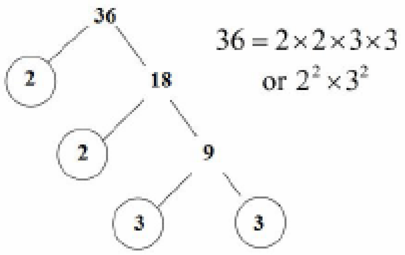
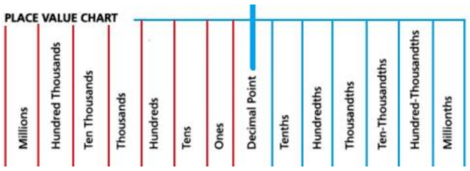
Topic: Basic Number and Decimals

Topic/Skill	Definition/Tips	Example
1. Integer	A **whole number** that can be positive, negative or zero.	$-3, 0, 92$
2. Decimal	A number with a **decimal point** in it. Can be positive or negative.	$3.7, 0.94, -24.07$
3. Negative Number	A number that is **less than zero**. Can be decimals.	$-8, -2.5$
4. Addition	To find the **total**, or **sum**, of two or more numbers. 'add', 'plus', 'sum'	$3 + 2 + 7 = 12$
5. Subtraction	To find the **difference** between two numbers. To find out how many are left when some are taken away. 'minus', 'take away', 'subtract'	$10 - 3 = 7$
6. Multiplication	Can be thought of as **repeated addition**. 'multiply', 'times', 'product'	$3 \times 6 = 6 + 6 + 6 = 18$
7. Division	Splitting into equal parts or groups. The process of calculating the **number of times one number is contained within another one**. 'divide', 'share'	$20 \div 4 = 5$ $\frac{20}{4} = 5$
8. Remainder	The amount '**left over**' after dividing one integer by another.	The remainder of $20 \div 6$ is 2, because 6 divides into 20 exactly 3 times, with 2 left over.
9. BIDMAS	An acronym for the **order** you should do calculations in. BIDMAS stands for **'Brackets, Indices, Division, Multiplication, Addition and Subtraction'**. Indices are also known as 'powers' or 'orders'. With strings of division and multiplication, or strings of addition and subtraction, and no brackets, work from left to right.	$6 + 3 \times 5 = 21, not\ 45$ $5^2 = 25$, where the 2 is the index/power. $12 \div 4 \div 2 = 1.5, not\ 6$
10. Recurring Decimal	A decimal number that has **digits that repeat forever**. The part that repeats is usually shown by placing a dot above the digit that repeats, or dots over the first and last digit of the repeating pattern.	$\frac{1}{3} = 0.333\ldots = 0.\dot{3}$ $\frac{1}{7} = 0.142857142857\ldots = 0.\dot{1}4285\dot{7}$ $\frac{77}{600} = 0.128333\ldots = 0.128\dot{3}$

Topic: Factors and Multiples

Topic/Skill	**Definition/Tips**	**Example**
1. Multiple	The result of multiplying a number by an integer. The **times tables** of a number.	The first five multiples of 7 are: $7, 14, 21, 28, 35$
2. Factor	A number that **divides exactly** into another number without a remainder. It is useful to write factors in pairs	The factors of 18 are: $1, 2, 3, 6, 9, 18$ The factor pairs of 18 are: $1, 18$ $2, 9$ $3, 6$
3. Lowest Common Multiple (LCM)	The **smallest** number that is in the **times tables** of each of the numbers given.	The LCM of 3, 4 and 5 is 60 because it is the smallest number in the 3, 4 and 5 times tables.
4. Highest Common Factor (HCF)	The **biggest** number that **divides exactly** into two or more numbers.	The HCF of 6 and 9 is 3 because it is the biggest number that divides into 6 and 9 exactly.
5. Prime Number	A number with **exactly two factors**. A number that can only be divided by itself and one. The number **1 is not prime**, as it only has one factor, not two.	The first ten prime numbers are: $2, 3, 5, 7, 11, 13, 17, 19, 23, 29$
6. Prime Factor	A factor which is a prime number.	The prime factors of 18 are: $2, 3$
7. Product of Prime Factors	Finding out which **prime numbers multiply** together to make the **original** number. Use a **prime factor tree.** Also known as ‘prime factorisation’.	

Topic: Accuracy

Topic/Skill	Definition/Tips	Example
1. Place Value	The **value** of where a **digit** is within a number.	In 726, the value of the 2 is 20, as it is in the ‘tens’ column.
2. Place Value Columns	The names of the columns that **determine the value of each digit**. The ‘ones’ column is also known as the ‘units’ column.	
3. Rounding	To make a number simpler but keep its value close to what it was. If the **digit to the right** of the rounding digit is **less than 5, round down**. If the **digit to the right** of the rounding digit is **5 or more, round up**.	74 rounded to the nearest ten is 70, because 74 is closer to 70 than 80. 152,879 rounded to the nearest thousand is 153,000.
4. Decimal Place	The **position** of a digit to the **right of a decimal point**.	In the number 0.372, the 7 is in the second decimal place. 0.372 rounded to two decimal places is 0.37, because the 2 tells us to round down. Careful with money - don’t write £27.4, instead write £27.40
5. Significant Figure	The significant figures of a number are the digits which **carry meaning** (ie. are significant) to the size of the number. The **first significant figure** of a number **cannot be zero**. In a number with a decimal, trailing zeros are not significant.	In the number 0.00821, the first significant figure is the 8. In the number 2.740, the 0 is not a significant figure. 0.00821 rounded to 2 significant figures is 0.0082. 19357 rounded to 3 significant figures is 19400. We need to include the two zeros at the end to keep the digits in the same place value columns.
6. Truncation	A method of approximating a decimal number by **dropping all decimal places** past a certain point **without rounding**.	3.14159265… can be truncated to 3.1415 (note that if it had been rounded, it would become 3.1416)
7. Error Interval	A **range of values** that a number could have taken before being rounded or truncated. An error interval is written using inequalities, with a **lower bound** and an **upper bound**.	0.6 has been rounded to 1 decimal place. The error interval is: $0.55 \le x < 0.65$ The lower bound is 0.55

Topic/Skill	**Definition/Tips**	**Example**
	Note that the lower bound inequality can be 'equal to', but the upper bound cannot be 'equal to'.	The upper bound is 0.65
8. Estimate	To find something **close to the correct answer**.	An estimate for the height of a man is 1.8 metres.
9. Approximation	When using approximations to estimate the solution to a calculation, **round each number in the calculation to 1 significant figure**. ≈ means 'approximately equal to'	$\frac{348+692}{0.526} \approx \frac{300+700}{0.5} = 2000$ 'Note that dividing by 0.5 is the same as multiplying by 2'
10. Rational Number	A number of the form $\boldsymbol{\frac{p}{q}}$, where $\boldsymbol{p}$ **and** $\boldsymbol{q}$ **are integers** and $\boldsymbol{q \neq 0}$. A number that cannot be written in this form is called an 'irrational' number	$\frac{4}{9}, 6, -\frac{1}{3}, \sqrt{25}$ are examples of rational numbers. $\pi, \sqrt{2}$ are examples of an irrational numbers.
11. Surd	The **irrational number** that is a **root of a positive integer,** whose value cannot be determined exactly. Surds have **infinite non-recurring decimals**.	$\sqrt{2}$ is a surd because it is a root which cannot be determined exactly. $\sqrt{2} = 1.41421356\ldots$ which never repeats.
12. Rules of Surds	$\boldsymbol{\sqrt{ab} = \sqrt{a} \times \sqrt{b}}$ $\boldsymbol{\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}}$ $\boldsymbol{a\sqrt{c} \pm b\sqrt{c} = (a \pm b)\sqrt{c}}$ $\boldsymbol{\sqrt{a} \times \sqrt{a} = a}$	$\sqrt{48} = \sqrt{16} \times \sqrt{3} = 4\sqrt{3}$ $\sqrt{\frac{25}{36}} = \frac{\sqrt{25}}{\sqrt{36}} = \frac{5}{6}$ $2\sqrt{5} + 7\sqrt{5} = 9\sqrt{5}$ $\sqrt{7} \times \sqrt{7} = 7$
13. Rationalise a Denominator	The process of rewriting a fraction so that the **denominator contains only rational numbers**.	$\frac{\sqrt{3}}{\sqrt{2}} = \frac{\sqrt{3} \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{\sqrt{6}}{2}$ $\frac{6}{3+\sqrt{7}} = \frac{6(3-\sqrt{7})}{(3+\sqrt{7})(3-\sqrt{7})}$ $= \frac{18-6\sqrt{7}}{9-7}$ $= \frac{18-6\sqrt{7}}{2} = 9 - 3\sqrt{7}$

Topic: Fractions

Topic/Skill	Definition/Tips	Example
1. Fraction	A mathematical expression representing the **division** of one integer by another. Fractions are written as **two numbers separated by a horizontal line**.	$\frac{2}{7}$ is a 'proper' fraction. $\frac{9}{4}$ is an 'improper' or 'top-heavy' fraction.
2. Numerator	The **top** number of a fraction.	In the fraction $\frac{3}{5}$, 3 is the numerator.
3. Denominator	The **bottom** number of a fraction.	In the fraction $\frac{3}{5}$, 5 is the denominator.
4. Unit Fraction	A fraction where the **numerator is one** and the denominator is a positive integer.	$\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ $etc.$ are examples of unit fractions.
5. Reciprocal	The reciprocal of a number is **1 divided by the number**. The reciprocal of x is $\frac{1}{x}$ **When we multiply a number by its reciprocal we get 1**. This is called the 'multiplicative inverse'.	The reciprocal of 5 is $\frac{1}{5}$ The reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$, because $\frac{2}{3} \times \frac{3}{2} = 1$
6. Mixed Number	A number formed of both an **integer part** and a **fraction part**.	$3\frac{2}{5}$ is an example of a mixed number.
7. Simplifying Fractions	**Divide the numerator and denominator by the highest common factor**.	$\frac{20}{45} = \frac{4}{9}$
8. Equivalent Fractions	Fractions which represent the **same value**.	$\frac{2}{5} = \frac{4}{10} = \frac{20}{50} = \frac{60}{150}$ $etc.$
9. Comparing Fractions	To compare fractions, they each need to be rewritten so that they have a **common denominator**. **Ascending** means **smallest to biggest**. **Descending** means **biggest to smallest**.	Put in to ascending order : $\frac{3}{4}, \frac{2}{3}, \frac{5}{6}, \frac{1}{2}$. Equivalent: $\frac{9}{12}, \frac{8}{12}, \frac{10}{12}, \frac{6}{12}$ Correct order: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}$
10. Fraction of an Amount	**Divide** by the **bottom**, **times** by the **top**	Find $\frac{2}{5}$ of £60 $60 \div 5 = 12$ $12 \times 2 = 24$
11. Adding or Subtracting Fractions	Find the **LCM of the denominators** to find a common denominator. Use equivalent fractions to change each fraction to the **common denominator**.	$\frac{2}{3} + \frac{4}{5}$ Multiples of 3: 3, 6, 9, 12, **15**.. Multiples of 5: 5, 10, **15**.. LCM of 3 and 5 = 15

Topic/Skill	Definition/Tips	Example
	Then just **add or subtract the numerators** and keep the **denominator the same**.	$\frac{2}{3} = \frac{10}{15}$ $\frac{4}{5} = \frac{12}{15}$ $\frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$
12. Multiplying Fractions	**Multiply** the **numerators** together and **multiply** the **denominators** together.	$\frac{3}{8} \times \frac{2}{9} = \frac{6}{72} = \frac{1}{12}$
13. Dividing Fractions	**'Keep it, Flip it, Change it – KFC'** Keep the first fraction the same Flip the second fraction upside down Change the divide to a multiply Multiply by the reciprocal of the second fraction.	$\frac{3}{4} \div \frac{5}{6} = \frac{3}{4} \times \frac{6}{5} = \frac{18}{20} = \frac{9}{10}$

Topic: Basic Percentages

Topic/Skill	**Definition/Tips**	**Example**
1. Percentage	**Number of parts per 100.**	31% means $\frac{31}{100}$
2. Finding 10%	To find **10%**, **divide by 10**	10% of £36 = 36÷10=£3.60
3. Finding 1%	To find **1%**, **divide by 100**	1% of £8 = 8÷100 = £0.08
4. Percentage Change	$\frac{\boldsymbol{Difference}}{\boldsymbol{Original}} \times \mathbf{100\%}$	A games console is bought for £200 and sold for £250. % change = $\frac{50}{200} \times 100 = 25\%$
5. Fractions to Decimals	**Divide the numerator by the denominator** using the bus stop method.	$\frac{3}{8} = 3 \div 8 = 0.375$
6. Decimals to Fractions	**Write as a fraction** over 10, 100 or 1000 and simplify.	$0.36 = \frac{36}{100} = \frac{9}{25}$
7. Percentages to Decimals	**Divide by 100**	$8\% = 8 \div 100 = 0.08$
8. Decimals to Percentages	**Multiply by 100**	$0.4 = 0.4 \times 100\% = 40\%$
9. Fractions to Percentages	Percentage is just a fraction out of 100. **Make the denominator 100 using equivalent fractions**. When the denominator doesn't go in to 100, use a calculator and **multiply the fraction by 100**.	$\frac{3}{25} = \frac{12}{100} = 12\%$ $\frac{9}{17} \times 100 = 52.9\%$
10. Percentages to Fractions	Percentage is just a fraction out of 100. **Write the percentage over 100** and simplify.	$14\% = \frac{14}{100} = \frac{7}{50}$

Topic: Calculating with Percentages

Topic/Skill	**Definition/Tips**	**Example**
1. Increase or Decrease by a Percentage	Non-calculator: **Find the percentage** and **add** or **subtract** it from the **original** amount. Calculator: Find the **percentage multiplier** and multiply.	Increase 500 by 20% (Non Calc): 10% of 500 = 50 so 20% of 500 = 100 500 + 100 = 600 Decrease 800 by 17% (Calc): 100%-17%=83% 83% ÷ 100 = 0.83 0.83 x 800 = 664
2. Percentage Multiplier	The **number** you **multiply** a quantity by to **increase or decrease** it by a **percentage**.	The multiplier for increasing by 12% is 1.12 The multiplier for decreasing by 12% is 0.88 The multiplier for increasing by 100% is 2.
3. Reverse Percentage	Find the **correct percentage given in the question**, then work backwards to **find 100%** Look out for words like '**before**' or '**original**'	A jumper was priced at £48.60 after a 10% reduction. Find its original price. 100% - 10% = 90% 90% = £48.60 1% = £0.54 100% = £54
4. Simple Interest	Interest calculated as a **percentage of the original** amount.	£1000 invested for 3 years at 10% simple interest. 10% of £1000 = £100 Interest = 3 × £100 = £300

Topic: Algebra

Topic/Skill	**Definition/Tips**	**Example**
1. Expression	A mathematical statement written using **symbols**, **numbers** or **letters**,	$3x + 2$ or $5y^2$
2. Equation	A statement showing that **two expressions are equal**	$2y – 17 = 15$
3. Identity	An equation that is **true for all values** of the variables An identity uses the symbol: ≡	$2x \equiv x+x$
4. Formula	Shows the **relationship** between **two or more variables**	Area of a rectangle = length x width or A= LxW
5. Simplifying Expressions	**Collect 'like terms'.** Be careful with negatives. x^2 and x are not like terms.	$2x + 3y + 4x - 5y + 3$ $= 6x - 2y + 3$ $3x + 4 - x^2 + 2x - 1 = 5x - x^2 + 3$
6. x times x	The answer is x^2 not $2x$.	Squaring is multiplying by itself, not by 2.
7. $p \times p \times p$	The answer is p^3 not $3p$	If p=2, then p^3=2x2x2=8, not 2x3=6
8. $p + p + p$	The answer is 3p not p^3	If p=2, then 2+2+2=6, not $2^3 = 8$
9. Expand	To expand a bracket, **multiply** each term **in the bracket** by the expression **outside** the bracket.	$3(m + 7) = 3x + 21$
10. Factorise	The **reverse** of **expanding**. Factorising is writing an expression as a product of terms by '**taking out' a common factor**.	$6x - 15 = 3(2x - 5)$, where 3 is the common factor.

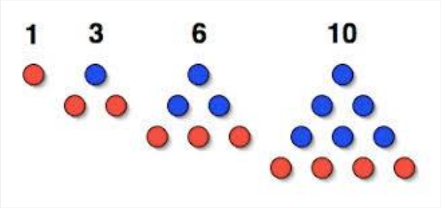
Topic: Equations and Formulae

Topic/Skill	Definition/Tips	Example
1. Solve	To find the **answer**/value of something **Use inverse operations** on both sides of the equation (balancing method) until you find the value for the letter.	Solve $2x - 3 = 7$ Add 3 on both sides $2x = 10$ Divide by 2 on both sides $x = 5$
2. Inverse	**Opposite**	The inverse of addition is subtraction. The inverse of multiplication is division.
3. Rearranging Formulae	**Use inverse operations** on both sides of the formula (balancing method) until you find the expression for the letter.	Make x the subject of $y = \frac{2x-1}{z}$ Multiply both sides by z $yz = 2x - 1$ Add 1 to both sides $yz + 1 = 2x$ Divide by 2 on both sides $\frac{yz + 1}{2} = x$ We now have x as the subject.
4. Writing Formulae	**Substitute letters for words** in the question.	Bob charges £3 per window and a £5 call out charge. $C = 3N + 5$ Where N=number of windows and C=cost
5. Substitution	**Replace letters with numbers**. Be careful of $5x^2$. You need to square first, then multiply by 5.	$a = 3, b = 2\ and\ c = 5$. Find: 1. $2a = 2 \times 3 = 6$ 2. $3a - 2b = 3 \times 3 - 2 \times 2 = 5$ 3. $7b^2 - 5 = 7 \times 2^2 - 5 = 23$

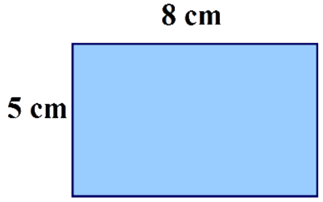
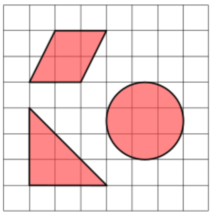
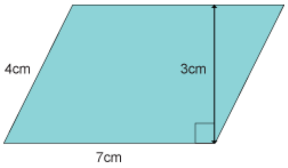
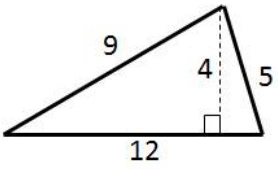
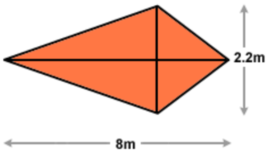
Topic: Solving Quadratics by Factorising

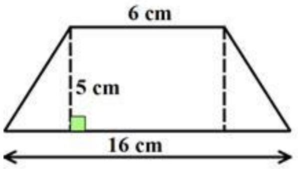
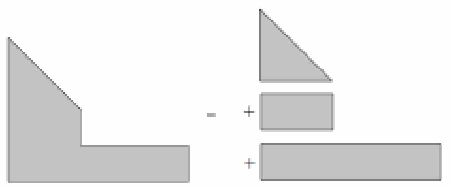
Topic/Skill	Definition/Tips	Example
1. Quadratic	A quadratic expression is of the form $\boldsymbol{ax^2 + bx + c}$ where a, b and c are numbers, $\boldsymbol{a \neq 0}$	Examples of quadratic expressions: x^2 $8x^2 - 3x + 7$ Examples of non-quadratic expressions: $2x^3 - 5x^2$ $9x - 1$
2. Factorising Quadratics	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**.	$x^2 + 7x + 10 = (x + 5)(x + 2)$ (because 5 and 2 add to give 7 and multiply to give 10) $x^2 + 2x - 8 = (x + 4)(x - 2)$ (because +4 and -2 add to give +2 and multiply to give -8)
3. Difference of Two Squares	An expression of the form $\boldsymbol{a^2 - b^2}$ can be factorised to give $(\boldsymbol{a} + \boldsymbol{b})(\boldsymbol{a} - \boldsymbol{b})$	$x^2 - 25 = (x + 5)(x - 5)$ $16x^2 - 81 = (4x + 9)(4x - 9)$
4. Solving Quadratics $(ax^2 = b)$	Isolate the x^2 term and square root both sides. Remember there will be a **positive and a negative solution**.	$2x^2 = 98$ $x^2 = 49$ $x = \pm 7$
5. Solving Quadratics $(ax^2 + bx = 0)$	**Factorise** and then **solve = 0**.	$x^2 - 3x = 0$ $x(x - 3) = 0$ $x = 0 \text{ or } x = 3$
6. Solving Quadratics by Factorising $(a = 1)$	**Factorise** the quadratic in the usual way. **Solve = 0** Make sure the equation = 0 before factorising.	Solve $x^2 + 3x - 10 = 0$ Factorise: $(x + 5)(x - 2) = 0$ $x = -5 \text{ or } x = 2$
7. Factorising Quadratics when $a \neq 1$	When a quadratic is in the form $ax^2 + bx + c$ 1. Multiply a by c = ac 2. Find two numbers that add to give b and multiply to give ac. 3. Re-write the quadratic, replacing bx with the two numbers you found. 4. Factorise in pairs – you should get the same bracket twice 5. Write your two brackets – one will be the repeated bracket, the other will be made of the factors outside each of the two brackets.	Factorise $6x^2 + 5x - 4$ 1. $6 \times -4 = -24$ 2. Two numbers that add to give +5 and multiply to give -24 are +8 and -3 3. $6x^2 + 8x - 3x - 4$ 4. Factorise in pairs: $2x(3x + 4) - 1(3x + 4)$ 5. Answer = $(3x + 4)(2x - 1)$
8. Solving Quadratics by Factorising $(a \neq 1)$	**Factorise** the quadratic in the usual way. **Solve = 0** Make sure the equation = 0 before factorising.	Solve $2x^2 + 7x - 4 = 0$ Factorise: $(2x - 1)(x + 4) = 0$ $x = \frac{1}{2} \text{ or } x = -4$

Topic: Sequences

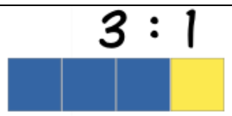
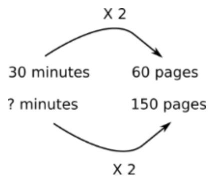
Topic/Skill	**Definition/Tips**	**Example**
1. Linear Sequence	A number pattern with a **common difference**.	2, 5, 8, 11… is a linear sequence
2. Term	**Each value** in a sequence is called a term.	In the sequence 2, 5, 8, 11…, 8 is the third term of the sequence.
3. Term-to-term rule	A rule which allows you to **find the next term** in a sequence if you **know the previous term**.	First term is 2. Term-to-term rule is 'add 3' Sequence is: 2, 5, 8, 11…
4. nth term	A rule which allows you to **calculate the term** that is in the **nth position** of the sequence. Also known as the 'position-to-term' rule. **n** refers to the **position** of a term in a sequence.	nth term is $3n - 1$ The 100th term is $3 \times 100 - 1 = 299$
5. Finding the nth term of a linear sequence	1. Find the **difference**. 2. **Multiply that by n.** 3. Substitute $n = 1$ to **find out what number you need to add or subtract to get the first number in the sequence**.	Find the nth term of: 3, 7, 11, 15… 1. Difference is +4 2. Start with $4n$ 3. $4 \times 1 = 4$, so we need to subtract 1 to get 3. nth term = $4n - 1$
6. Fibonacci type sequences	A sequence where the next number is found by **adding up the previous two terms**	The Fibonacci sequence is: 1,1,2,3,5,8,13,21,34 … An example of a Fibonacci-type sequence is: $4, 7, 11, 18, 29 \ldots$
7. Triangular numbers	The sequence which comes from a pattern of dots that form a triangle. $1, 3, 6, 10, 15, 21 \ldots$	

Topic: Perimeter and Area

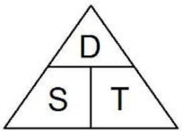
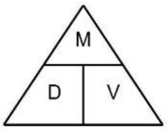
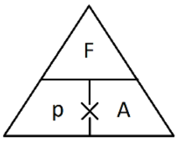
Topic/Skill	Definition/Tips	Example
1. Perimeter	The **total distance** around the **outside** of a shape. Units include: mm, cm, m etc.	 $P = 8 + 5 + 8 + 5 = 26cm$
2. Area	The amount of **space inside** a shape. Units include: mm^2, cm^2, m^2	
3. Area of a Rectangle	**Length x Width**	 $A = 36cm^2$
4. Area of a Parallelogram	**Base x Perpendicular Height** Not the slant height.	 $A = 21cm^2$
5. Area of a Triangle	**Base x Height ÷ 2**	 $A = 24cm^2$
6. Area of a Kite	Split in to **two triangles** and use the method above.	 $A = 8.8m^2$

Topic/Skill	Definition/Tips	Example
7. Area of a Trapezium	$\frac{(\boldsymbol{a}+\boldsymbol{b})}{\boldsymbol{2}} \times \boldsymbol{h}$ "Half the sum of the parallel side, times the height between them. That is how you calculate the area of a trapezium"	 $A = 55cm^2$
8. Compound Shape	A shape made up of a **combination of other known shapes** put together.	

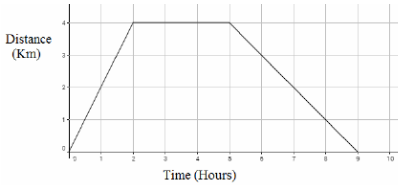
Topic: Ratio

Topic/Skill	Definition/Tips	Example
1. Ratio	Ratio compares the size of **one part** to **another part**. Written using the ‘:’ symbol.	
2. Proportion	Proportion compares the size of **one part** to the size of the **whole**. Usually written as a fraction.	In a class with 13 boys and 9 girls, the proportion of boys is $\frac{13}{22}$ and the proportion of girls is $\frac{9}{22}$
3. Simplifying Ratios	**Divide** all parts of the ratio by a **common factor**.	5 : 10 = 1 : 2 (divide both by 5) 14 : 21 = 2 : 3 (divide both by 7)
4. Ratios in the form 1 : n or n : 1	**Divide** both parts of the ratio by one of the numbers to make **one part equal 1**.	5 : 7 = 1 : $\frac{7}{5}$ in the form 1 : n 5 : 7 = $\frac{5}{7}$: 1 in the form n : 1
5. Sharing in a 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
6. Proportional Reasoning	Comparing two things using **multiplicative reasoning** and applying this to a new situation. Identify one multiplicative link and use this to find missing quantities.	
7. Unitary Method	Finding the **value of a single unit** and then finding the necessary value by **multiplying** the single unit value.	3 cakes require 450g of sugar to make. Find how much sugar is needed to make 5 cakes. 3 cakes = 450g So 1 cake = 150g (÷ by 3) So 5 cakes = 750 g (x by 5)
8. Ratio already shared	Find what **one part** of the ratio is worth using the **unitary method**.	Money was shared in the ratio 3:2:5 between Ann, Bob and Cat. Given that Bob had £16, found out the total amount of money shared. £16 = 2 parts So £8 = 1 part 3 + 2 + 5 = 10 parts, so 8 x 10 = £80
9. Best Buys	Find the **unit cost** by **dividing** the **price by the quantity**. The **lowest** number is the best value.	8 cakes for £1.28 → 16p each (÷by 8) 13 cakes for £2.05 → 15.8p each (÷by 13) Pack of 13 cakes is best value.

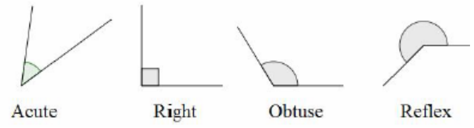
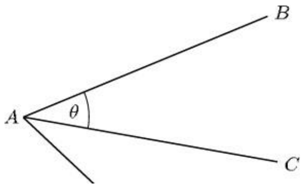
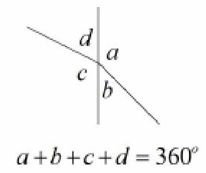
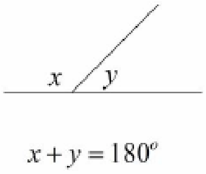
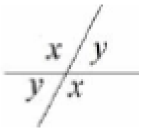
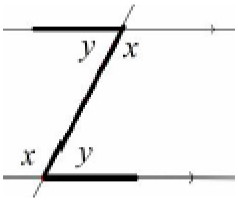
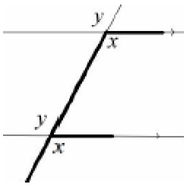
Topic: Compound Measures

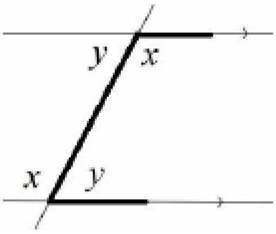
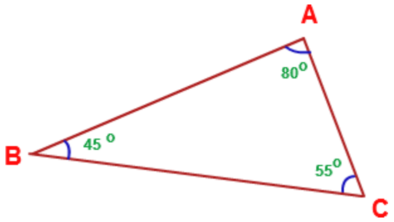
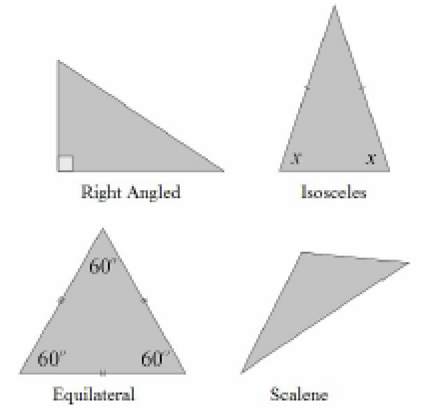
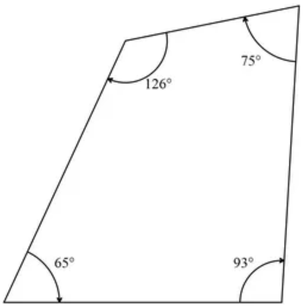
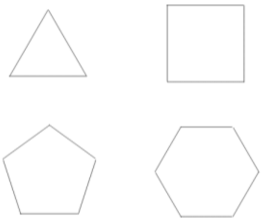
Topic/Skill	**Definition/Tips**	**Example**
1. Metric System	A system of measures based on: - the metre for length - the kilogram for mass - the second for time **Length: mm, cm, m, km** **Mass: mg, g, kg** **Volume: ml, cl, l**	$1kilometres = 1000\,metres$ $1\,metre = 100\,centimetres$ $1\,centimetre = 10\,millimetres$ $1\,kilogram = 1000\,grams$
2. Imperial System	A system of weights and measures originally developed in England, usually based on human quantities **Length: inch, foot, yard, miles** **Mass: lb, ounce, stone** **Volume: pint, gallon**	$1lb = 16\,ounces$ $1\,foot = 12\,inches$ $1\,gallon = 8\,pints$
3. Metric and Imperial Units	Use the **unitary method** to convert between metric and imperial units.	$5\,miles \approx 8\,kilometres$ $1\,gallon \approx 4.5\,litres$ $2.2\,pounds \approx 1\,kilogram$ $1\,inch = 2.5\,centimetres$
4. Speed, Distance, Time	**Speed = Distance ÷ Time** **Distance = Speed x Time** **Time = Distance ÷ Speed**  Remember the correct units.	Speed = 4mph Time = 2 hours Find the Distance. $D = S \times T = 4 \times 2 = 8\,miles$
5. Density, Mass, Volume	**Density = Mass ÷ Volume** **Mass = Density x Volume** **Volume = Mass ÷ Density**  Remember the correct units.	Density = 8kg/m³ Mass = 2000g Find the Volume. $V = M \div D = 2 \div 8 = 0.25m^3$
6. Pressure, Force, Area	**Pressure = Force ÷ Area** **Force = Pressure x Area** **Area = Force ÷ Pressure**  Remember the correct units.	Pressure = 10 Pascals Area = 6cm² Find the Force $F = P \times A = 10 \times 6 = 60\,N$

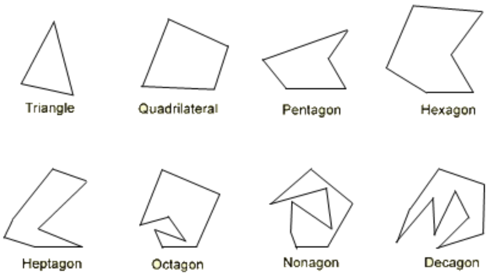
Topic: Compound Measures

Topic/Skill	**Definition/Tips**	**Example**
7. Distance-Time Graphs	You can find the **speed** from the **gradient** of the line (Distance ÷ Time) The steeper the line, the quicker the speed. A **horizontal** line means the object is not moving (**stationary**).	

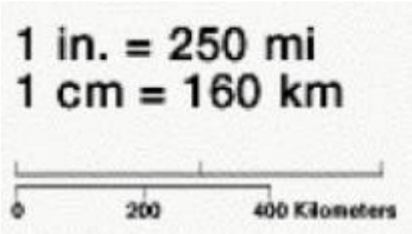
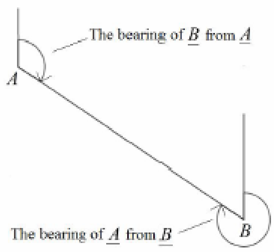
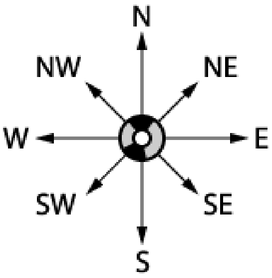
Topic: Angles

Topic/Skill	Definition/Tips	Example
1. Types of Angles	**Acute angles** are less than 90°. **Right angles** are exactly 90°. **Obtuse angles** are greater than 90° but less than 180°. **Reflex angles** are greater than 180° but less than 360°.	
2. Angle Notation	Can use **one lower-case** letters, eg. θ or x Can use **three upper-case** letters, eg. BAC	
3. Angles at a Point	**Angles around a point add up to 360°**.	
4. Angles on a Straight Line	**Angles around a point on a straight line add up to 180°**.	
5. Opposite Angles	**Vertically opposite angles are equal**.	
6. Alternate Angles	**Alternate angles are equal**. They look like Z angles, but never say this in the exam.	
7. Corresponding Angles	**Corresponding angles are equal**. They look like F angles, but never say this in the exam.	

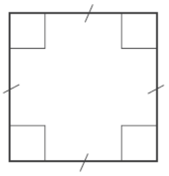
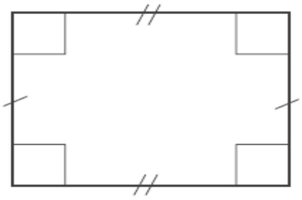
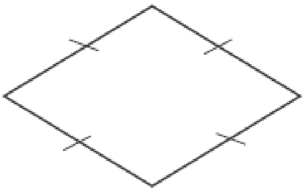
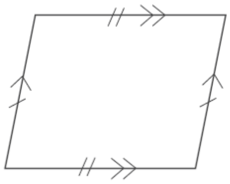
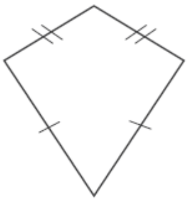
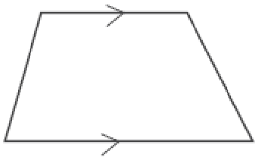
Topic/Skill	Definition/Tips	Example
8. Co-Interior Angles	**Co-Interior angles add up to 180°**. They look like C angles, but never say this in the exam.	
9. Angles in a Triangle	**Angles in a triangle add up to 180°.**	
10. Types of Triangles	**Right Angle** Triangles have a **90°** angle in. **Isosceles** Triangles have **2 equal sides** and **2 equal base angles**. **Equilateral** Triangles have **3 equal sides** and **3 equal angles (60°)**. **Scalene** Triangles have **different sides** and **different angles**. **Base angles in an isosceles triangle are equal.**	
11. Angles in a Quadrilateral	**Angles in a quadrilateral add up to 360°.**	
12. Polygon	A **2D** shape with **only straight edges**.	Rectangle, Hexagon, Decagon, Kite etc.
13. Regular	A shape is regular if all the **sides** and all the **angles** are **equal**.	

Topic/Skill	Definition/Tips	Example
14. Names of Polygons	**3**-sided = **Triangle** **4**-sided = **Quadrilateral** **5**-sided = **Pentagon** **6**-sided = **Hexagon** **7**-sided = **Heptagon**/Septagon **8**-sided = **Octagon** **9**-sided = **Nonagon** **10**-sided = **Decagon**	
15. Sum of Interior Angles	$\boldsymbol{(n-2)\times 180}$ where n is the number of sides.	Sum of Interior Angles in a Decagon = $(10-2)\times 180 = 1440°$
16. Size of Interior Angle in a Regular Polygon	$\boldsymbol{\frac{(n-2)\times 180}{n}}$ You can also use the formula: $\boldsymbol{180 - Size\ of\ Exterior\ Angle}$	Size of Interior Angle in a Regular Pentagon = $\frac{(5-2)\times 180}{5} = 108°$
17. Size of Exterior Angle in a Regular Polygon	$\boldsymbol{\frac{360}{n}}$ You can also use the formula: $\boldsymbol{180 - Size\ of\ Interior\ Angle}$	Size of Exterior Angle in a Regular Octagon = $\frac{360}{8} = 45°$

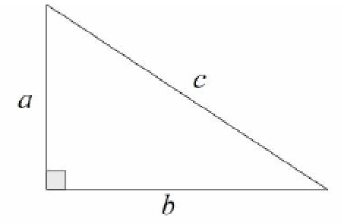
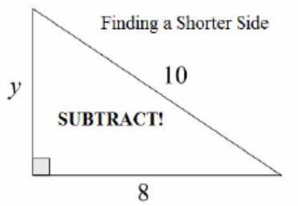
Topic: Bearings and Scale Diagrams

Topic/Skill	Definition/Tips	Example
1. Scale	The **ratio** of the **length** in a **model** to the length of the **real** thing.	 Real Horse 1500 mm high 2000 mm long Drawn Horse 150 mm high 200 mm long
2. Scale (Map)	The **ratio** of a **distance on the map** to the actual **distance in real life**.	
3. Bearings	1. Measure from **North** (draw a North line) 2. Measure **clockwise** 3. Your answer must have **3 digits** (eg. 047°) Look out for where the bearing is measured <u>from</u>.	
4. Compass Directions	You can use an acronym such as **'Never Eat Shredded Wheat'** to remember the order of the compass directions in a clockwise direction. Bearings: $NE = 045°, W = 270°\ etc.$	

Topic: Properties of Polygons

Topic/Skill	**Definition/Tips**	**Example**
1. Square	• **Four equal sides** • **Four right angles** • **Opposite sides parallel** • **Diagonals bisect** each other at **right angles** • **Four lines** of **symmetry** • **Rotational symmetry** of **order four**	
2. Rectangle	• **Two pairs** of **equal sides** • **Four right angles** • **Opposite sides parallel** • **Diagonals bisect** each other**, not at right angles** • **Two lines** of **symmetry** • **Rotational symmetry** of **order two**	
3. Rhombus	• **Four equal sides** • **Diagonally opposite angles are equal** • **Opposite sides parallel** • **Diagonals bisect** each other at **right angles** • **Two lines** of **symmetry** • **Rotational symmetry** of **order two**	
4. Parallelogram	• **Two pairs** of **equal sides** • **Diagonally opposite angles are equal** • **Opposite sides parallel** • **Diagonals bisect** each other**, not at right angles** • **No lines** of **symmetry** • **Rotational symmetry** of **order two**	
5. Kite	• **Two pairs** of **adjacent sides** of **equal** length • **One pair** of **diagonally opposite angles are equal** (where different length sides meet) • **Diagonals intersect** at **right angles, but do not bisect** • **One line** of **symmetry** • **No rotational symmetry**	
6. Trapezium	• **One pair** of **parallel sides** • **No lines of symmetry** • **No rotational symmetry** Special Case: Isosceles Trapeziums have one line of symmetry.	

Topic: Pythagoras' Theorem

Topic/Skill	Definition/Tips	Example
1. Pythagoras' Theorem	For any **right angled triangle**: $$\boldsymbol{a^2 + b^2 = c^2}$$  Used to find **missing lengths**. a and b are the shorter sides, c is the **hypotenuse** (**longest side**).	 $a = y,\ b = 8,\ c = 10$ $a^2 = c^2 - b^2$ $y^2 = 100 - 64$ $y^2 = 36$ $y = 6$
2. 3D Pythagoras' Theorem	Find missing lengths by **identifying right angled triangles**. You will often have to find a missing length you are not asked for before finding the missing length you are asked for.	Can a pencil that is 20cm long fit in a pencil tin with dimensions 12cm, 13cm and 9cm? The pencil tin is in the shape of a cuboid. Hypotenuse of the base = $\sqrt{12^2 + 13^2} = 17.7$ Diagonal of cuboid = $\sqrt{17.7^2 + 9^2} = 19.8cm$ No, the pencil cannot fit.

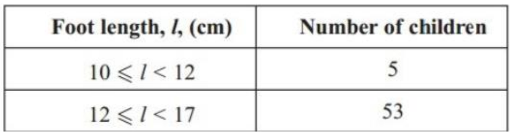
Topic: Summarising Data

<table>
<tr><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Types of Data</td><td>**Qualitative** Data – **non-numerical** data
Quantitative Data – **numerical** data

Continuous Data – data that can take **any numerical value** within a given range.
Discrete Data – data that can take **only specific values** within a given range.</td><td>Qualitative Data – eye colour, gender etc.

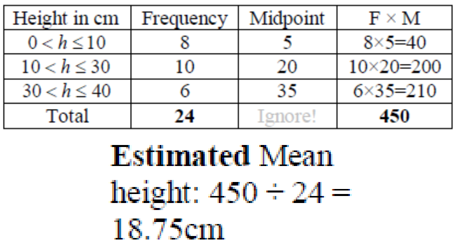
Continuous Data – weight, voltage etc.

Discrete Data – number of children, shoe size etc.</td></tr>
<tr><td>2. Grouped Data</td><td>Data that has been **bundled in to categories**.

Seen in grouped frequency tables, histograms, cumulative frequency etc.</td><td>
<table>
<tr><th>Foot length, l, (cm)</th><th>Number of children</th></tr>
<tr><td>$10 \leqslant l < 12$</td><td>5</td></tr>
<tr><td>$12 \leqslant l < 17$</td><td>53</td></tr>
</table></td></tr>
<tr><td>3. Primary /Secondary Data</td><td>**Primary** Data – **collected yourself** for a specific purpose.

Secondary Data – **collected by someone else** for another purpose.</td><td>Primary Data – data collected by a student for their own research project.

Secondary Data – Census data used to analyse link between education and earnings.</td></tr>
<tr><td>4. Mean</td><td>**Add** up the values and **divide** by how many values there are.</td><td>The mean of 3, 4, 7, 6, 0, 4, 6 is
$$\frac{3+4+7+6+0+4+6}{7} = 5$$</td></tr>
<tr><td>5. Mean from a Table</td><td>1. Find the midpoints (if necessary)
2. Multiply Frequency by values or midpoints
3. Add up these values
4. Divide this total by the Total Frequency

If **grouped** data is used, the answer will be an **estimate**.</td><td>
<table>
<tr><th>Height in cm</th><th>Frequency</th><th>Midpoint</th><th>F × M</th></tr>
<tr><td>$0 < h \leq 10$</td><td>8</td><td>5</td><td>8×5=40</td></tr>
<tr><td>$10 < h \leq 30$</td><td>10</td><td>20</td><td>10×20=200</td></tr>
<tr><td>$30 < h \leq 40$</td><td>6</td><td>35</td><td>6×35=210</td></tr>
<tr><td>Total</td><td>**24**</td><td>Ignore!</td><td>**450**</td></tr>
</table>
Estimated Mean height: 450 ÷ 24 = 18.75cm</td></tr>
<tr><td>6. Median Value</td><td>The **middle** value.

Put the data in order and find the middle one.
If there are **two middle values**, find the number half way between them by **adding them together and dividing by 2**.</td><td>Find the median of: 4, 5, 2, 3, 6, 7, 6

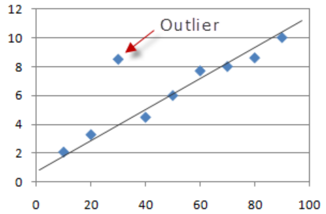
Ordered: 2, 3, 4, **5**, 6, 6, 7

Median = 5</td></tr>
<tr><td>7. Median from a Table</td><td>Use the formula $\frac{(n+1)}{2}$ to find the position of the median.

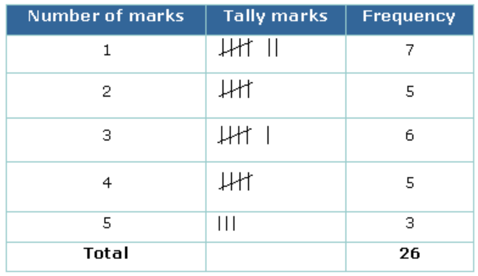
n is the total frequency.</td><td>If the total frequency is 15, the median will be the $\left(\frac{15+1}{2}\right) = 8th$ position</td></tr>
<tr><td>8. Mode /Modal Value</td><td>**Most** frequent/common.

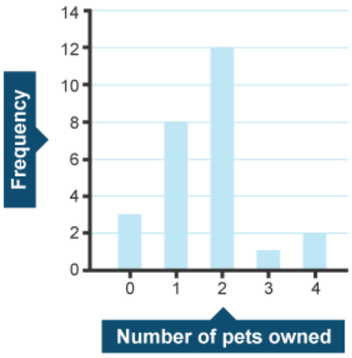
Can have more than one mode (called bi-modal or multi-modal) or no mode (if all values appear once)</td><td>Find the mode: 4, 5, 2, 3, 6, 4, 7, 8, 4

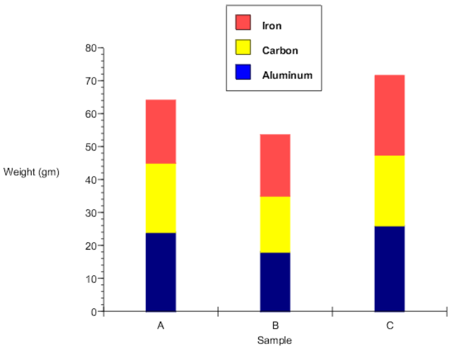
Mode = 4</td></tr>
</table>

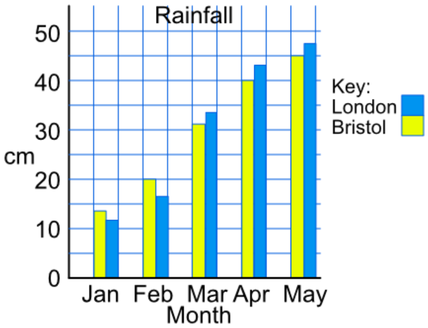
Topic/Skill	**Definition/Tips**	**Example**
9. Range	**Highest value subtract the Smallest value** Range is a ‘measure of spread’. The smaller the range the more consistent the data.	Find the range: 3, 31, 26, 102, 37, 97. Range = 102-3 = 99
10. Outlier	A value that ‘**lies outside**’ most of the other values in a set of data. An outlier is **much smaller or much larger** than the other values in a set of data.	
11. Lower Quartile	**Divides** the **bottom half** of the data into **two halves**. **LQ =** $\boldsymbol{Q_1 = \frac{(n+1)}{4} th}$ **value**	Find the lower quartile of: 2, **3**, 4, 5, 6, 6, 7 $Q_1 = \frac{(7+1)}{4} = 2nd$ value → 3
12. Lower Quartile	**Divides** the **top half** of the data into **two halves**. **UQ =** $\boldsymbol{Q_3 = \frac{3(n+1)}{4} th}$ **value**	Find the upper quartile of: 2, 3, 4, 5, 6, **6**, 7 $Q_3 = \frac{3(7+1)}{4} = 6th$ value → 6
13. Interquartile Range	The **difference** between the **upper quartile and lower quartile.** $\boldsymbol{IQR = Q_3 - Q_1}$ The **smaller** the **interquartile range**, the **more consistent** the data.	Find the IQR of: 2, 3, 4, 5, 6, 6, 7 $IQR = Q_3 - Q_1 = 6 - 3 = 3$

Topic: Representing Data

<table>
<tr><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Frequency Table</td><td>A record of how often each value in a set of data occurs.</td><td>
<table>
<tr><th>Number of marks</th><th>Tally marks</th><th>Frequency</th></tr>
<tr><td>1</td><td>𝍸 ||</td><td>7</td></tr>
<tr><td>2</td><td>𝍸</td><td>5</td></tr>
<tr><td>3</td><td>𝍸 |</td><td>6</td></tr>
<tr><td>4</td><td>𝍸</td><td>5</td></tr>
<tr><td>5</td><td>|||</td><td>3</td></tr>
<tr><td>Total</td><td></td><td>26</td></tr>
</table></td></tr>
<tr><td>2. Bar Chart</td><td>Represents data as vertical blocks.

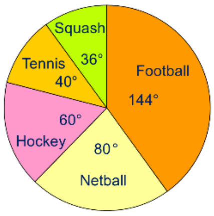
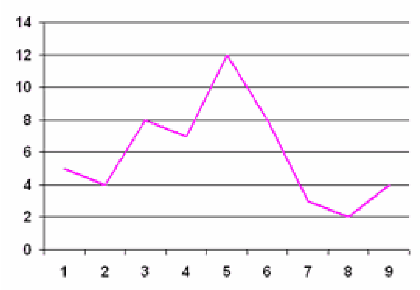
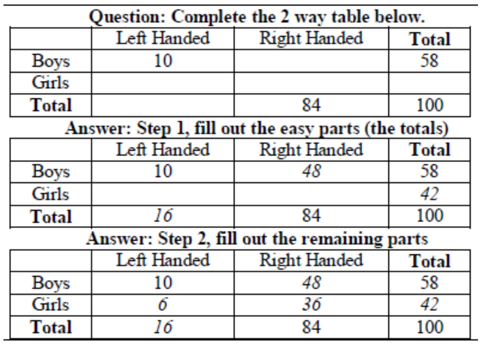
$x - axis$ shows the type of data
$y - axis$ shows the frequency for each type of data
Each bar should be the same width
There should be gaps between each bar
Remember to label each axis.</td><td>
</td></tr>
<tr><td>3. Types of Bar Chart</td><td>Compound/Composite Bar Charts show data stacked on top of each other.

Comparative/Dual Bar Charts show data side by side.</td><td>



Dual Bar Chart</td></tr>
</table>

Topic: Representing Data

Topic/Skill	Definition/Tips	Example
4. Pie Chart	Used for showing **how data breaks down into** its constituent **parts**. When drawing a pie chart, **divide 360° by the total frequency**. This will tell you how many degrees to use for the frequency of each category. Remember to **label** the category that each sector in the pie chart represents.	 If there are 40 people in a survey, then each person will be worth 360÷40=9° of the pie chart.
5. Pictogram	Uses **pictures** or symbols to **show the value** of the data. A pictogram must have a **key**.	
6. Line Graph	A graph that uses **points connected by straight lines** to show how data changes in values. This can be used for **time series data**, which is a series of data points spaced over uniform time intervals in **time order**.	
7. Two Way Tables	A table that **organises data** around **two categories.** Fill out the information step by step using the information given. Make sure all the totals add up for all columns and rows.	

Question: Complete the 2 way table below.

	Left Handed	Right Handed	**Total**
Boys	10		58
Girls			
Total		84	100

Answer: Step 1, fill out the easy parts (the totals)

	Left Handed	Right Handed	**Total**
Boys	10	*48*	58
Girls			*42*
Total	*16*	84	100

Answer: Step 2, fill out the remaining parts

	Left Handed	Right Handed	**Total**
Boys	10	*48*	58
Girls	*6*	*36*	*42*
Total	*16*	84	100

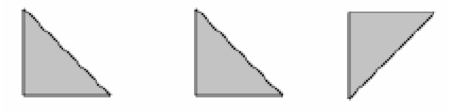
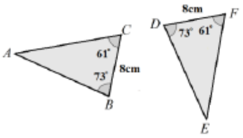
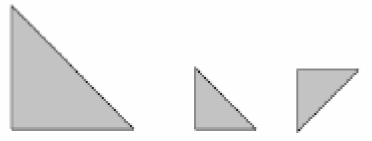
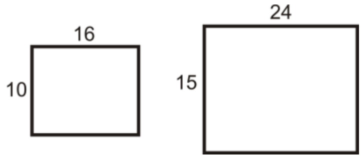
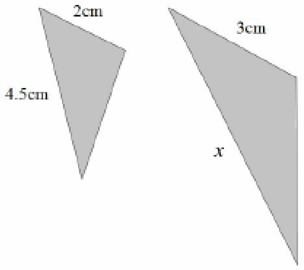
Topic: Indices

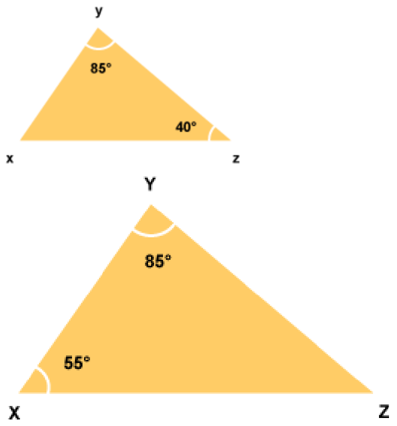
Topic/Skill	Definition/Tips	Example
1. Square Number	The number you get when you **multiply a number by itself**.	**1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225…** $9^2 = 9 \times 9 = 81$
2. Square Root	The **number you multiply by itself** to get another number. The reverse process of squaring a number.	$\sqrt{36} = 6$ because $6 \times 6 = 36$
3. Solutions to $x^2 =$ ….	**Equations** involving **squares** have **two solutions**, one **positive** and one **negative**.	Solve $x^2 = 25$ $x = 5 \; or \; x = -5$ This can also be written as $x = \pm 5$
4. Cube Number	The number you get when you **multiply a number by itself and itself again**.	1, 8, 27, 64, 125… $2^3 = 2 \times 2 \times 2 = 8$
5. Cube Root	The **number you multiply by itself and itself again** to get another number. The reverse process of cubing a number.	$\sqrt[3]{125} = 5$ because $5 \times 5 \times 5 = 125$
6. Powers of…	The powers of a number are that **number raised to various powers**.	The powers of 3 are: $3^1 = 3$ $3^2 = 9$ $3^3 = 27$ $3^4 = 81$ etc.
7. Multiplication Index Law	When **multiplying** with the same base (number or letter), **add the powers**. $\boldsymbol{a^m \times a^n = a^{m+n}}$	$7^5 \times 7^3 = 7^8$ $a^{12} \times a = a^{13}$ $4x^5 \times 2x^8 = 8x^{13}$
8. Division Index Law	When **dividing** with the same base (number or letter), **subtract the powers**. $\boldsymbol{a^m \div a^n = a^{m-n}}$	$15^7 \div 15^4 = 15^3$ $x^9 \div x^2 = x^7$ $20a^{11} \div 5a^3 = 4a^8$
9. Brackets Index Laws	When raising a power to another power, multiply the powers together. $\boldsymbol{(a^m)^n = a^{mn}}$	$(y^2)^5 = y^{10}$ $(6^3)^4 = 6^{12}$ $(5x^6)^3 = 125x^{18}$
10. Notable Powers	$\boldsymbol{p = p^1}$ $\boldsymbol{p^0 = 1}$	$99999^0 = 1$

Topic: Standard Form

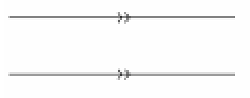
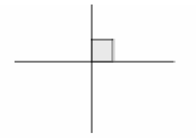
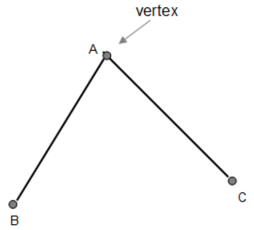
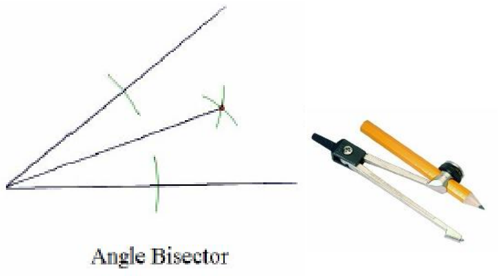
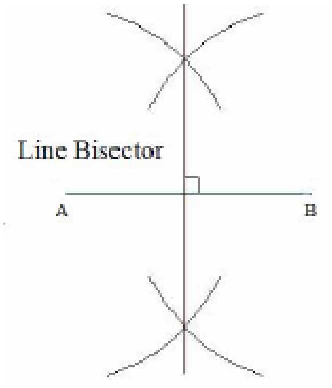
Topic/Skill	**Definition/Tips**	**Example**
1. Standard Form	$\boldsymbol{A \times 10^{b}}$ $where\ \mathbf{1 \leq \boldsymbol{A} < 10}, \quad \boldsymbol{b = integer}$	$8400 = 8.4 \text{ x } 10^{3}$ $0.00036 = 3.6 \text{ x } 10^{-4}$
2. Multiplying or Dividing with Standard Form	Multiply: **Multiply the numbers** and **add the powers**. Divide: **Divide the numbers** and **subtract the powers**.	$(1.2 \times 10^{3}) \times (4 \times 10^{6}) = 8.8 \times 10^{9}$ $(4.5 \times 10^{5}) \div (3 \times 10^{2}) = 1.5 \times 10^{3}$
3. Adding or Subtracting with Standard Form	**Convert** in to **ordinary** numbers, **calculate** and then **convert back** in to standard form	$2.7 \times 10^{4} + 4.6 \times 10^{3}$ $= 27000 + 4600 = 31600$ $= 3.16 \times 10^{4}$

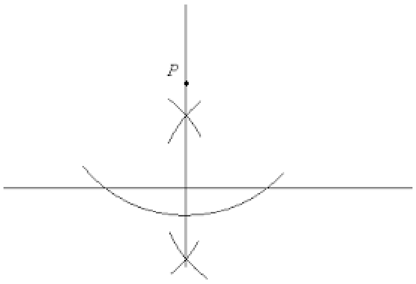
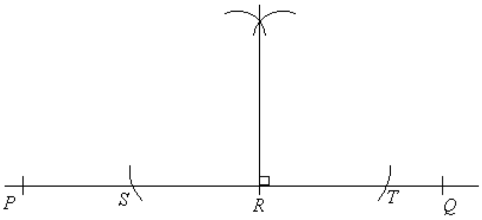
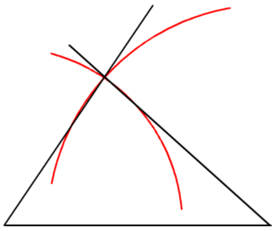
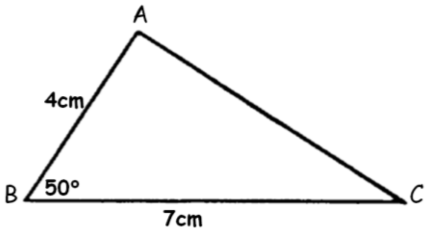
Topic: Congruence and Similarity

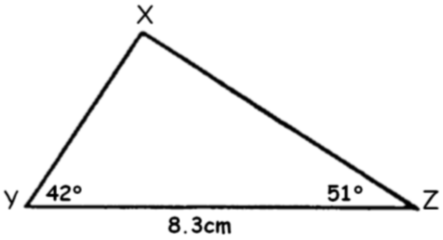
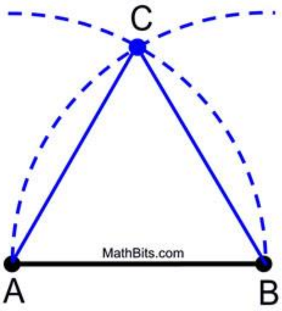
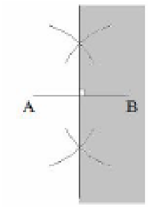
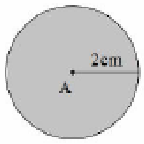
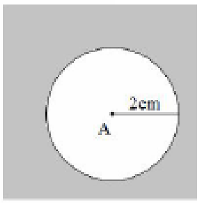
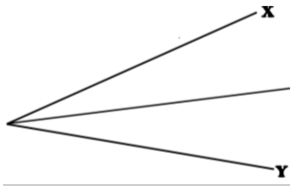
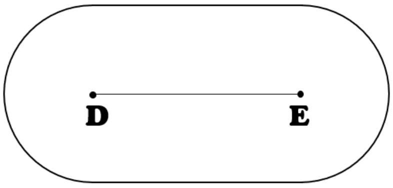
Topic/Skill	Definition/Tips	Example
1. Congruent Shapes	Shapes are congruent if they are **identical - same shape** and **same size.** Shapes can be rotated or reflected but still be congruent.	
2. Congruent Triangles	4 ways of proving that two triangles are congruent: 1. **SSS** (Side, Side, Side) 2. **RHS** (Right angle, Hypotenuse, Side) 3. **SAS** (Side, Angle, Side) 4. **ASA** (Angle, Side, Angle) or **AAS** <u>ASS does not prove congruency.</u>	 $BC = DF$ $\angle ABC = \angle EDF$ $\angle ACB = \angle EFD$ $\therefore$ The two triangles are congruent by AAS.
3. Similar Shapes	Shapes are similar if they are the **same shape but different sizes.** The proportion of the matching sides must be the same, meaning the ratios of corresponding sides are all equal.	
4. Scale Factor	The **ratio of corresponding sides** of two similar shapes. To find a scale factor, **divide a length** on one shape **by the corresponding length** on a similar shape.	 $\text{Scale Factor} = 15 \div 10 = 1.5$
5. Finding missing lengths in similar shapes	1. Find the **scale factor.** 2. **Multiply or divide** the corresponding side to find a missing length. If you are finding a missing length on the larger shape you will need to multiply by the scale factor. If you are finding a missing length on the smaller shape you will need to divide by the scale factor.	 $\text{Scale Factor} = 3 \div 2 = 1.5$ $x = 4.5 \times 1.5 = 6.75cm$

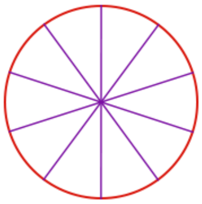
Topic/Skill	Definition/Tips	Example
6. Similar Triangles	To show that two triangles are similar, show that: 1. The three sides are in the same proportion 2. Two sides are in the same proportion, and their included angle is the same 3. The three angles are equal	

Topic: Loci and Constructions

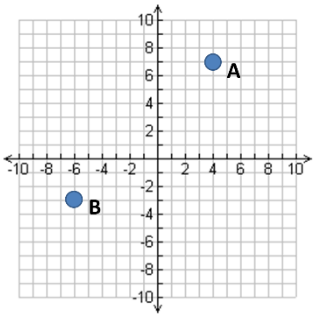
Topic/Skill	Definition/Tips	Example
1. Parallel	Parallel lines never meet.	
2. Perpendicular	Perpendicular lines are at right angles. There is a 90° angle between them.	
3. Vertex	A corner or a point where two lines meet.	
4. Angle Bisector	**Angle Bisector: Cuts the angle in half**. 1. Place the sharp end of a pair of compasses on the vertex. 2. Draw an arc, marking a point on each line. 3. Without changing the compass put the compass on each point and mark a centre point where two arcs cross over. 4. Use a ruler to draw a line through the vertex and centre point.	
5. Perpendicular Bisector	**Perpendicular Bisector: Cuts a line in half and at right angles**. 1. Put the sharp point of a pair of compasses on A. 2. Open the compass over half way on the line. 3. Draw an arc above and below the line. 4. Without changing the compass, repeat from point B. 5. Draw a straight line through the two intersecting arcs.	

Topic/Skill	Definition/Tips	Example
6. Perpendicular from an External Point	The **perpendicular distance** from a point to a line is the **shortest distance** to that line. 1. Put the sharp point of a pair of compasses on the point. 2. Draw an arc that crosses the line twice. 3. Place the sharp point of the compass on one of these points, open over half way and draw an arc above and below the line. 4. Repeat from the other point on the line. 5. Draw a straight line through the two intersecting arcs.	
7. Perpendicular from a Point on a Line	Given line PQ and point R on the line: 1. Put the sharp point of a pair of compasses on point R. 2. Draw two arcs either side of the point of equal width (giving points S and T) 3. Place the compass on point S, open over halfway and draw an arc above the line. 4. Repeat from the other arc on the line (point T). 5. Draw a straight line from the intersecting arcs to the original point on the line.	
8. Constructing Triangles (Side, Side, Side)	1. Draw the base of the triangle using a ruler. 2. Open a pair of compasses to the width of one side of the triangle. 3. Place the point on one end of the line and draw an arc. 4. Repeat for the other side of the triangle at the other end of the line. 5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.	
9. Constructing Triangles (Side, Angle, Side)	1. Draw the base of the triangle using a ruler. 2. Measure the angle required using a protractor and mark this angle. 3. Remove the protractor and draw a line of the exact length required in line with the angle mark drawn. 4. Connect the end of this line to the other end of the base of the triangle.	

Topic/Skill	Definition/Tips	Example
10. Constructing Triangles (Angle, Side, Angle)	1. Draw the base of the triangle using a ruler. 2. Measure one of the angles required using a protractor and mark this angle. 3. Draw a straight line through this point from the same point on the base of the triangle. 4. Repeat this for the other angle on the other end of the base of the triangle.	
11. Constructing an Equilateral Triangle (also makes a 60° angle)	1. Draw the base of the triangle using a ruler. 2. Open the pair of compasses to the exact length of the side of the triangle. 3. Place the sharp point on one end of the line and draw an arc. 4. Repeat this from the other end of the line. 5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.	
12. Loci and Regions	A **locus** is a **path of points that follow a rule**. For the locus of points **closer to B than A**, create a **perpendicular bisector** between A and B and shade the side closer to B. For the locus of points **equidistant from A**, use a compass to draw a **circle**, centre A. For the locus of points **equidistant to line X and line Y**, create an **angle bisector**. For the locus of points a set **distance from a line**, create **two semi-circles** at either end joined by **two parallel lines**.	 Points Closer to B than A.  Points less than 2cm from A  Points more than 2cm from A  

Topic/Skill	**Definition/Tips**	**Example**
13. Equidistant	A point is equidistant from a set of objects if the **distances between that point and each of the objects is the same**.	

Topic: Coordinates and Linear Graphs

<table>
<tr><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Coordinates</td><td>Written in pairs. The first term is the x-coordinate (movement across). The second term is the y-coordinate (movement up or down)</td><td>

A: (4,7)
B: (-6,-3)</td></tr>
<tr><td>2. Midpoint of a Line</td><td>Method 1: add the x coordinates and divide by 2, add the y coordinates and divide by 2

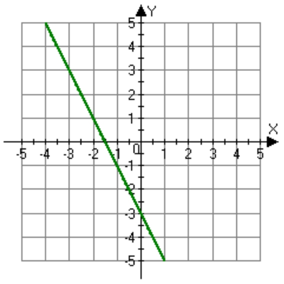
Method 2: Sketch the line and find the values half way between the two x and two y values.</td><td>Find the midpoint between (2,1) and (6,9)

$\frac{2+6}{2} = 4$ and $\frac{1+9}{2} = 5$

So, the midpoint is (4,5)</td></tr>
<tr><td>3. Linear Graph</td><td>Straight line graph.

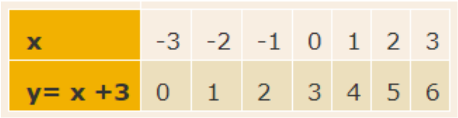
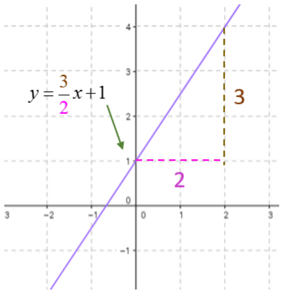
The general equation of a linear graph is
$\boldsymbol{y = mx + c}$

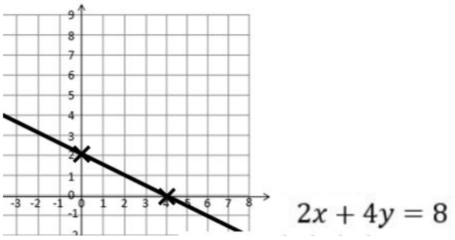
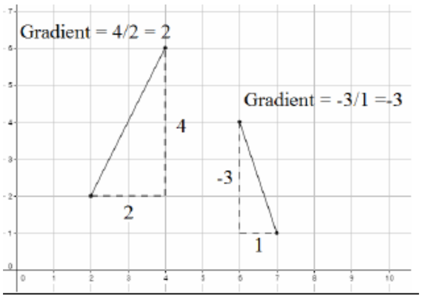
where $\boldsymbol{m}$ is the gradient and c is the y-intercept.

The equation of a linear graph can contain an x-term, a y-term and a number.</td><td>Example:


Other examples:
$x = y$
$y = 4$
$x = -2$
$y = 2x - 7$
$y + x = 10$
$2y - 4x = 12$</td></tr>
<tr><td>4. Plotting Linear Graphs</td><td>Method 1: Table of Values
Construct a table of values to calculate coordinates.

Method 2: Gradient-Intercept Method (use when the equation is in the form $y = mx + c$)
1. Plots the y-intercept
2. Using the gradient, plot a second point.
3. Draw a line through the two points plotted.

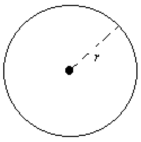
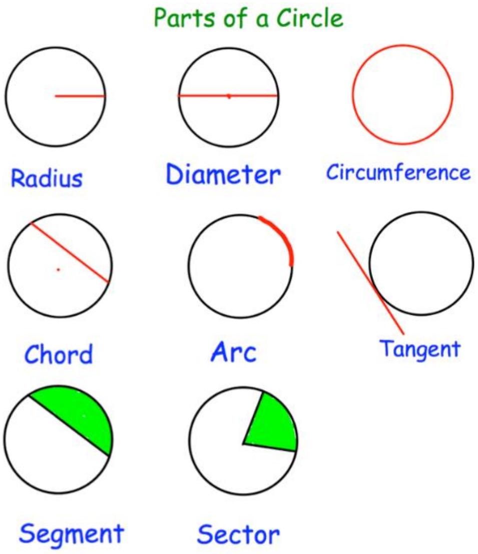
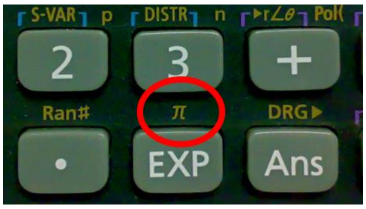
Method 3: Cover-Up Method (use when the equation is in the form $ax + by = c$)
1. Cover the x term and solve the resulting equation. Plot this on the $x - axis$.</td><td>
<table>
<tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>y= x +3</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
</table>

</td></tr>
</table>

Topic/Skill	Definition/Tips	Example
	2. Cover the y term and solve the resulting equation. Plot this on the $y-axis$. 3. Draw a line through the two points plotted.	
5. Gradient	The gradient of a line is how **steep** it is. **Gradient =** $\boldsymbol{\frac{Change\ in\ y}{Change\ in\ x}=\frac{Rise}{Run}}$ The gradient can be positive (sloping upwards) or negative (sloping downwards)	
6. Finding the Equation of a Line <u>given a point and a gradient</u>	**Substitute** in the **gradient (m)** and **point (x,y)** in to the equation $\boldsymbol{y=mx+c}$ and **solve for c**.	Find the equation of the line with gradient 4 passing through (2,7). $y=mx+c$ $7=4\times2+c$ $c=-1$ $y=4x-1$
7. Finding the Equation of a Line <u>given two points</u>	Use the two points to **calculate the gradient**. Then **repeat the method above** using the gradient and either of the points.	Find the equation of the line passing through (6,11) and (2,3) $m=\frac{11-3}{6-2}=2$ $y=mx+c$ $11=2\times6+c$ $c=-1$ $y=2x-1$

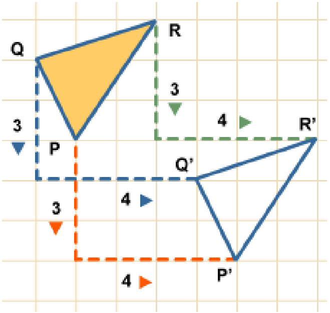
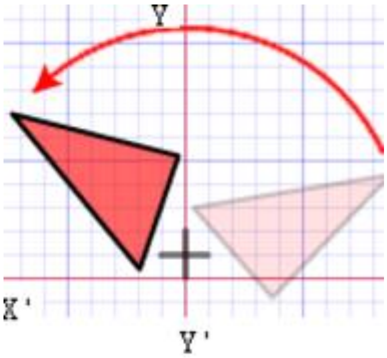
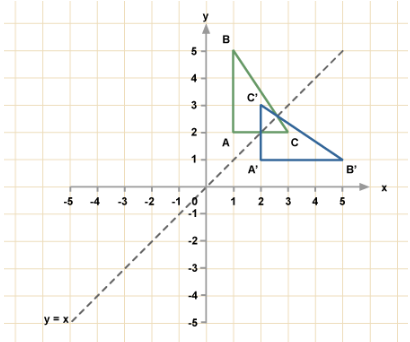
Topic: Coordinates and Linear Graphs

Topic/Skill	**Definition/Tips**	**Example**
8. Parallel Lines	If two lines are **parallel**, they will have the **same gradient**. The value of m will be the same for both lines.	Are the lines $y = 3x - 1$ and $2y - 6x + 10 = 0$ parallel? Answer: Rearrange the second equation in to the form $y = mx + c$ $2y - 6x + 10 = 0 \rightarrow y = 3x - 5$ Since the two gradients are equal (3), the lines are parallel.
9. Perpendicular Lines	If two lines are **perpendicular**, the **product** of their **gradients** will always equal **-1**. The gradient of one line will be the **negative reciprocal** of the gradient of the other line. You may need to rearrange equations of lines to compare gradients (they need to be in the form $y = mx + c$)	Find the equation of the line perpendicular to $y = 3x + 2$ which passes through (6,5) Answer: As they are perpendicular, the gradient of the new line will be $-\frac{1}{3}$ as this is the negative reciprocal of 3. $y = mx + c$ $5 = -\frac{1}{3} \times 6 + c$ $c = 7$ $y = -\frac{1}{3}x + 7$ Or $3x + x - 7 = 0$

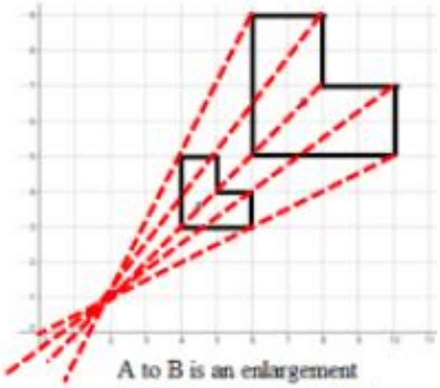
Topic: Circumference and Area

Topic/Skill	Definition/Tips	Example
1. Circle	A circle is the locus of all points equidistant from a central point.	
2. Parts of a Circle	**Radius** – the **distance** from the **centre** of a circle to the **edge** **Diameter** – the total **distance** across the **width** of a circle **through the centre**. **Circumference** – the **total distance** around the **outside** of a circle **Chord** – a **straight line** whose **end points lie on a circle** **Tangent** – a **straight line** which **touches** a circle at exactly **one point** **Arc** – a **part of the circumference** of a circle **Sector** – the **region** of a circle enclosed by **two radii** and their intercepted **arc** **Segment** – the **region** bounded by a **chord** and the **arc** created by the chord	
3. Area of a Circle	$\boldsymbol{A = \pi r^2}$ which means 'pi x radius squared'.	If the radius was 5cm, then: $A = \pi \times 5^2 = 78.5cm^2$
4. Circumference of a Circle	$\boldsymbol{C = \pi d}$ which means 'pi x diameter'	If the radius was 5cm, then: $C = \pi \times 10 = 31.4cm$
5. π ('pi')	Pi is the circumference of a circle divided by the diameter. $\boldsymbol{\pi \approx 3.14}$	

Topic: Shape Transformations

Topic/Skill	Definition/Tips	Example
1. Translation	**Translate** means to **move a shape**. The shape does not change **size** or **orientation**.	
2. Column Vector	In a column vector, the **top** number moves **left (-) or right (+)** and the **bottom** number moves **up (+) or down (-)**	$\begin{pmatrix}2\\3\end{pmatrix}$ means '2 right, 3 up' $\begin{pmatrix}-1\\-5\end{pmatrix}$ means '1 left, 5 down'
3. Rotation	The size does not change, but the **shape is turned around a point**. Use tracing paper.	Rotate Shape A 90° anti-clockwise about (0,1) 
4. Reflection	The size does not change, but the shape is '**flipped**' like in a **mirror**. Line x =? is a **vertical line**. Line y =? is a **horizontal line**. Line $y = x$ is a **diagonal line**.	Reflect shape C in the line $y = x$ 

Topic: Shape Transformations

Topic/Skill	Definition/Tips	Example
5. Enlargement	The shape will get **bigger or smaller**. Multiply each side by the **scale factor**.	Scale Factor = 3 means '3 times larger = multiply by 3' Scale Factor = ½ means 'half the size = divide by 2'
6. Finding the Centre of Enlargement	Draw **straight lines** through **corresponding corners** of the two shapes. The centre of enlargement is the point **where all the lines cross over**. Be careful with negative enlargements as the corresponding corners will be the other way around.	 A to B is an enlargement SF 2 about the point (2,1)
7. Describing Transformations	Give the following information when describing each transformation: Look at the number of marks in the question for a hint of how many pieces of information are needed. If you are asked to describe a 'transformation', you need to say the **name of the type of transformation** as well as the other details.	**- Translation, Vector** **- Rotation, Direction, Angle, Centre** **- Reflection, Equation of mirror line** **- Enlargement, Scale factor, Centre of enlargement**