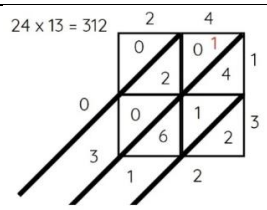
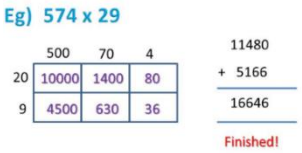
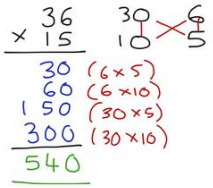
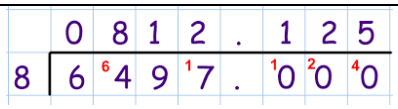
Year 9 Mathematics Foundation HT 1

Integers, Place Value and Decimals

Number Skills

1.	Addition	To find the sum or total of two or more numbers.
2.	Subtraction	To find the difference between two numbers.
3.	Multiplication	Repeated addition of a number. Also called 'product'
4.	Division	The process of calculating the number of times one number is contained in another.
5.	Divisible	Can be divided by a number without a remainder.
Multiplication methods		
6.	Lattice	
7.	Grid	
8.	Column	
Division methods		
9.	Short	e.g. 6497 ÷ 8 

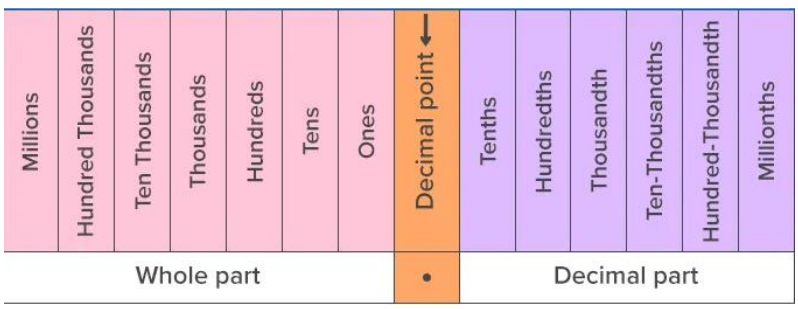
10.	Long	e.g. 13032 ÷ 24	1 - 24 2 - 48 3 - 72 4 - 96 5 - 120 6 - 144 7 - 168 8 - 192 9 - 216 543 24 | 13032 - 120 103 - 96 72 - 72 00

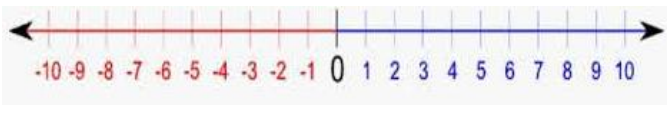
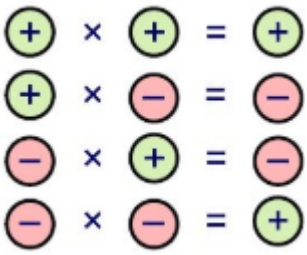
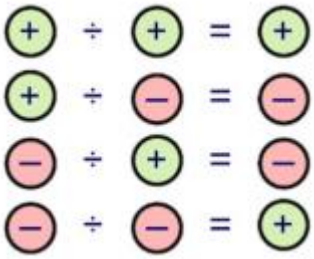
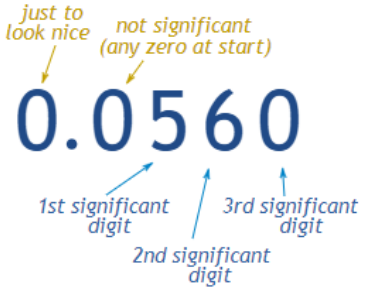
Times Tables

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Divisibility Rules

11.	A number is divisible	
	by:	if:
	2	The last digit is divisible by 2
	3	The sum of the digits is divisible by 3
	4	The number made by the last two digits is divisible by 4
	5	The last digit is 5 or 0
	6	The number is divisible by 2 and 3
	8	The number made by the last 3 digits is divisible by 8
	9	The sum of its digits is divisible by 9
	10	The last digit is 0.
12.	Place value	The value of a digit based on its place in a number



13.	Digit	A single symbol used to make a number	
		0, 1, 2, 3, 4, 5, 6, 7, 8, 9 are the ten digits we use every day.	
14.	Integer	A whole number that is can be positive, negative or zero.	
15.	Negative number	A number that is less than zero.	
16.	Negative number rules	When multipllying or dividing with numbers that include negative numbers to following applies:	 
17.	Ascending order	A set of numbers arranged from smallest to biggest.	
18.	Descending order	A set of numbers arranged from biggest to smallest.	
19.	Decimal	A number with a decimal point in it, which can be negative or positive.	
20.	Terminating decimal	A decimal that has digits that end.	0.25 (it has two decimal digits) 3.0375 (it has four decimal digits)
21.	Recurring decimal	A decimal with a digit or groups of digits that repeat forever.	$\frac{1}{3}$ = 0.333... = $0.\dot{3}$ = $0.\overline{3}$ Fraction Ways to show recurring decimals
22.	Decimal place	The number of digits after the decimal point	
23.	Rounding	Changing a number to a simpler, easy to use value.	
24.	Approximate	An easier figure to use close to the value.	
25.	Significant figure	The digits of a number that express a size to a given degree of accuracy	
Rounding to decimal places			

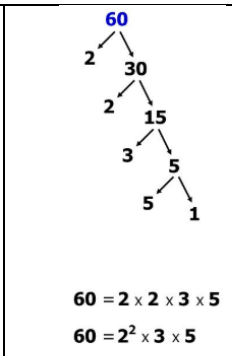
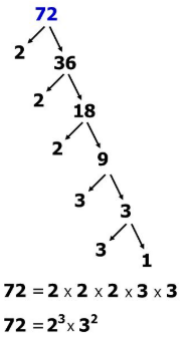
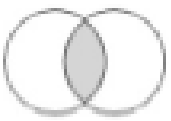
26.	• Count the number of decimal places you need • Look at the number directly to the right of that digit to decide if it rounds up or down • 5 or more means it rounds up; 4 or less means it rounds down		
27.	e.g. 256.1873	256.1 | 873	To 1 d.p. is 256.2
		256.18 | 73	To 2 d.p. is 256.19
		256.187 | 3	To 3 d.p. is 256.187
Rounding large numbers to significant figures			
28.	• Count the number of digits you need from the left • Look at the number to the right of the digit to decide if it rounds up or down • 5 or more means it rounds up; 4 or less means it rounds down • Replace remaining digits with zeros as placeholders		
29.	e.g. 256. 1873	2 | 56.1873	To 1 s.f. is 300
		25 | 6.1873	To 2 s.f. is 260
		256 | .1873	To 3 s.f. is 256
Rounding small numbers to significant figures			
30.	• Zeros are not significant until after the first non-zero term • Find the first non-zero term and count the number of digits you need from there • Look at the number directly to the right of that digit to decide if it rounds up or down • 5 or more means it rounds up; 4 or less means it rounds down		
31	e.g. 0.0023681	0.002 | 3681	To 1 s.f. is 0.002
		0.0023 | 681	To 2 s.f. is 0.0024
		0.00236 | 81	To 3 s.f. is 0.00237
Inequality notation			
32.	=	Equal to	
33.	≠	Not equal to	
34.	<	Less than	
35.	>	Greater than	
36.	≤	Less than or equal to	
37.	≥	Greater than or equal to	

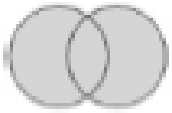
Indices, powers and roots

38.	Operations	Symbols and words to show how to combine numbers.		
		× Multiply	+ Add	
		÷ Divide	− Subtract	
39.	Order of operations	The order in which operations should be carried out.	B I DM AS	Brackets Indices Divide and Multiply Add and Subtract
40.	Inverse operations	The operation used to reverse the original operation		
		+ and − are inverse	× and ÷ are inverse	
		Finding the square root is the inverse of finding the square of a number.		
		Finding the cube root is the inverse of finding the cube of a number.		
41.	Square numbers	The product of a number multiplied by itself.	4  2^2 or 2 x 2 = 4	
42.	Cube numbers	The product of multiplying a number by itself three times	$2^3 = 2 \times 2 \times 2 = 8$ 	
43.	Square root	A value that can be multiplied by itself to give the original number	$\sqrt{1} = \pm 1$ $\sqrt{4} = \pm 2$ $\sqrt{9} = \pm 3$ $\sqrt{16} = \pm 4$ $\sqrt{25} = \pm 5$ $\sqrt{36} = \pm 6$ $\sqrt{49} = \pm 7$ $\sqrt{64} = \pm 8$	$\sqrt{81} = \pm 9$ $\sqrt{100} = \pm 10$ $\sqrt{121} = \pm 11$ $\sqrt{144} = \pm 12$ $\sqrt{169} = \pm 13$ $\sqrt{196} = \pm 14$ $\sqrt{225} = \pm 15$
44.	Cube root	A value that can be multiplied by itself three times to give the original number	$\sqrt[3]{1} = 1$ $\sqrt[3]{8} = 2$ $\sqrt[3]{27} = 3$ $\sqrt[3]{64} = 4$ $\sqrt[3]{125} = 5$	$\sqrt[3]{216} = 6$ $\sqrt[3]{343} = 7$ $\sqrt[3]{512} = 8$ $\sqrt[3]{729} = 9$ $\sqrt[3]{1000} = 10$
45.	Index	A small number to the upper right of a base number that shows how many times the base number is multiplied by itself.		
46.	Power	Another word for an index.		

47.	Indices	The plural of index.	
48.	Index form	A number written to the power of an index.	
Laws of indices			
49.	Multiplying	Add the powers	$x^7 \times x^6 = x^{13}$
50.	Dividing	Subtract the powers	$x^5 \div x^6 = x^{-1}$
51.	Brackets	Multiply the powers	$(x^2)^3 = x^6$
52.	Power of 0	Always = 1	$x^0 = 1$
53.	Negative	Means "1 over"	$x^{-n} = \frac{1}{x^n}$
54.	Unit Fraction	Means root	$x^{\frac{1}{n}} = \sqrt[n]{x}$
55.	Fractional	Means root and bracket	$x^{\frac{a}{n}} = (\sqrt[n]{x})^a$

Factors, multiples and primes

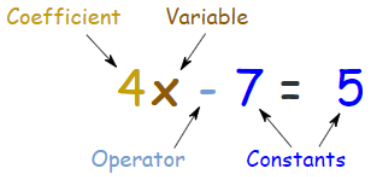
56.	Multiple	The result of multiplying a number by an integer.			
57.	Factor	A number that divides into another number without a remainder.			
58.	Remainder	An amount left over after dividing.			
59.	Prime number	A number with exactly two factors; 1 and itself.			
		2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.			
60.	Product	The answer when two or more numbers are multiplied together.			
61.	Prime factor decomposition	Writing a number as a product of its prime factors.			
62.	Highest common factor	HCF	The highest number that divides exactky into two or more numbers.	e.g. the HCF of 12 and 8 is 4	

63.	Lowest common multiple	LCM	The smallest positive integer that is a multiple of two or more numbers.	e.g. the LCM of 12 adm 8 is 24	

Year 9 Mathematics Foundation HT 2

Algebra: the basics

Definitions

1.	Variable	A letter representing a varying or unknown quantity.	
2.	Coefficient	A number which multiplies a variable e.g. 4 is the coefficient in 4a	
3.	Term	One part of an expression/equation/formula Can involve multiplying and dividing coefficients and variables Separated from other terms by addition and subtraction	e.g. $4c$ $\frac{w}{5}$
4.	Like terms	Terms that have the same variable but have different coefficients	e.g. c + 4c are like terms c^2 and c^3 are not like terms
5.	Constant	A fixed value. A number on its own or sometimes a letter such as a, b or c to represent a fixed number.	
6.	Expression	One or a group of terms. Can include variables, constants, operators and grouping symbols. No 'equals' sign	e.g. 3y -3 $3y^2 + y^3$
7.	Equation	Contains an 'equals' sign, = Has at least one variable	e.g. 3y – 3 = 12
8.	Formula	A special type of equation that shows the relationship between a set of variables	
9.	Formulae	Plural of 'formula'	
10.	Identity	An equation that is true no matter what values are chosen, ≡	e.g. 3y ≡ 2y – y for any value of y.
11.	Subject	The variable on its own on one side of the equals sign.	
12.	Substitute	Replace a variable with a number.	$a = 3, b = 2$ *and* $c = 5$. **Find:** 1. $2a = 2 \times 3 = 6$ 2. $3a - 2b = 3 \times 3 - 2 \times 2 = 5$ 3. $7b^2 - 5 = 7 \times 2^2 - 5 = 23$
13.	Simplify	Minimising the size of an expression	

14.	Factorise	Splitting an expression into a product of factors	
15.	Expand	Removing brackets by using multiplication	
16.	Solve	Find the value of an unknown	
Algebraic Notation			
17.	Adding like terms	Add the coefficients	$b + 2b = 3b$
18.	Subtracting like terms	Subtract the coefficients	$5b - 4b = b$
19.	Multiplying like terms	If the base is the same, add the powers	$b \times b = b^2$
20.	Dividing terms	If the base is the same, subtract the powers	$b^5 \div b^2 = b^3$
21.	Adding different terms	Cannot combine if the terms are different.	$b + 2c = b + 2c$
22.	Subtracting different terms	Cannot combine if the terms are different.	$3c - 4 = 3c - 4$
23.	Multiplying different terms	Combine with no '×' sign	$d \times e = de$
24.	Multiplying different terms with coefficients	Combine with no '×' sign, multiply the coefficients	$2d \times 3e = d6e$
25.	Dividing different terms	Write as fractions with no '÷' sign	$3d \div e = \frac{3d}{e}$
26.	Dividing different terms with coefficients	Write as fractions with no '÷' sign, simplify the coefficients where possible.	$14d \div 7e = \frac{2d}{e}$
Expanding (single brackets)			
27.	Multiply all the terms inside the bracket, by the term on the outside.		
28.	$3(a + 4) = 3a + 12$	× | $2x$ | -3 $2x$ | $4x^2$ | $-6x$	$4x^2 - 6x$
Factorising (single brackets)			
29.	• Find the highest common factor of the terms • This goes outside the bracket • Divide each term by the factor to get the new terms inside the bracket • Always check by expanding your bracket	$2x + 4y$	$2(x + 2y)$
		$5x^2y - 10xy$	$5xy(x - 2)$
Expressions			
30.	Linear	Can be represented by a straight line No indices above 1	e.g. $2x + 2$
31.	Quadratic	An expression where the highest index is 2	e.g. $2x^2 + 2x + 2$

Year 9 Mathematics Foundation HT 3

3a. TABLES

1	TYPES OF DATA		
1a	Qualitative Data	Non-numerical data	i.e. Colour of car
1b	Quantitative Data	Numerical data	i.e. House number
1c	Discrete Data	Numerical data that CANNOT be shown in decimals	i.e. Number of children in a class
1d	Continuous Data	Numerical data that CAN be shown in decimals	i.e. The heights of children in a class
1e	Grouped Data	Numerical data given in intervals	i.e. Year group ranges: Year 7-9 Year 10-11 Year 12-13

2 Data Collection

Three Columns:
- Data values
- Tally
- Frequency (how many)

Colour of Car	Tally	Frequency
Red	IIII	4
White	~~IIII~~	5
Grey	III	3
Black	~~IIII~~ III	8
Blue	~~IIII~~ I	6

3 Mode

Most popular (i.e. most common colour of car is Black)

4a	24-hour clock	15:30 — Uses hours 00 (Midnight) to 23 (11 in the evening)
4b	12-hour clock	03:30 pm — Uses hours 01 to 12 with morning (AM) and afternoon/evening (PM)

5 Two-Way Tables

	Boys	Girls	TOTAL
Pet	9	4	13
No Pet	2	5	7
TOTAL	11	9	20

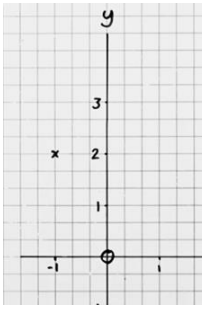
Two-way tables are a way of sorting data with two categories.

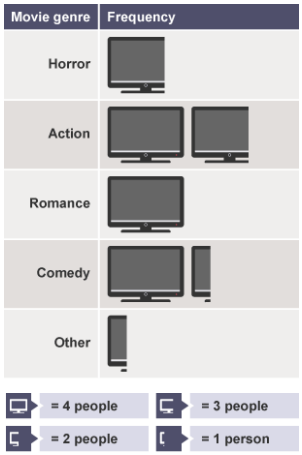
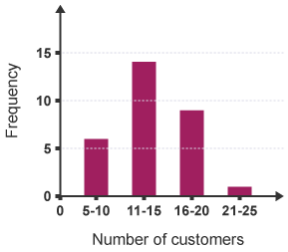
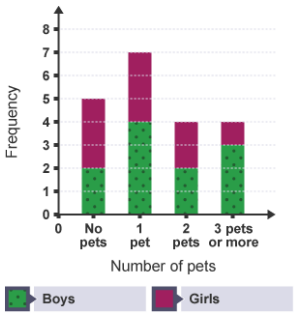
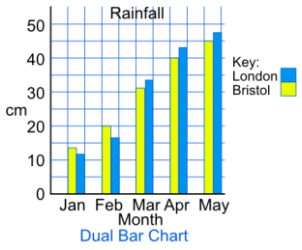
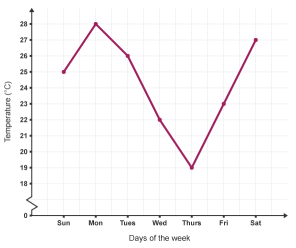
3b. Charts and Graphs

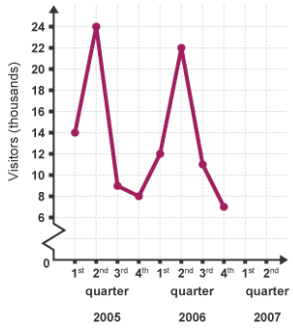
6 Plotting Points

Co-ordinates show an exact position

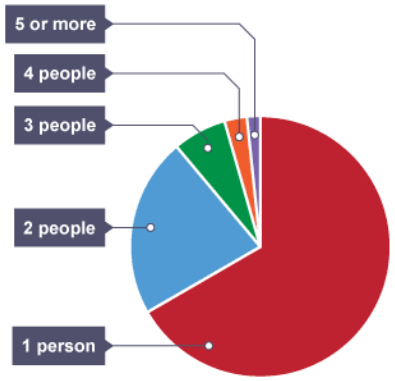
(x, y)



7	Pictograms		Used to show frequencies Pictures and images used to represent frequency A key at the bottom helps you interpret the diagram
8a	Bar Charts		Frequency on the vertical axis, and categories along the horizontal axis. Used to compare frequencies
8b	Composite Bar Chart		Frequency on the vertical axis, and categories along the horizontal axis. Two shades used to show difference in proportion between sub-groups (i.e. gender) Used to compare frequencies within sub-groups
8c	Comparative Bar Chart		Frequency on the vertical axis, and categories along the horizontal axis. Bars are next to each other and used to show difference in frequency between sub-groups (i.e. gender) Used to compare frequencies within sub-groups
9	Line Graph		A line graph is used to show a change or relationship between two variables. Once the points are plotted, they are joined with straight lines.

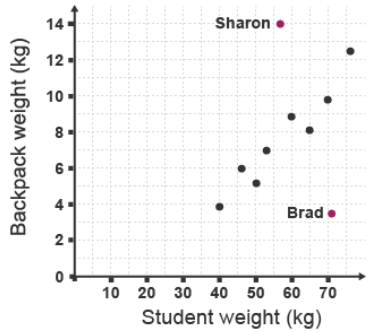
10	Time-Series		A time-series graph plots frequencies (vertical) axis against time (horizontal). It is used to spot trends over time. Time could be: weeks, months, quarters (3 months), years
11	Stem & Leaf Diagrams:	Key: 1 | 1 = 11 marks 0 | 9 1 | 1 6 7 8 2 | 1 2 7 7 8 8 9 3 | 0 0 1 5 6 7 8 9 4 | 0 1 2 5	A stem and leaf diagram shows numbers in a table format. It can be a useful way to organise data to find the median, mode and range of a set of data. Only one digit is allowed to be a 'leaf' There should be a key to help you interpret the diagram

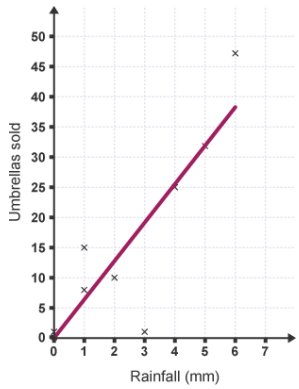
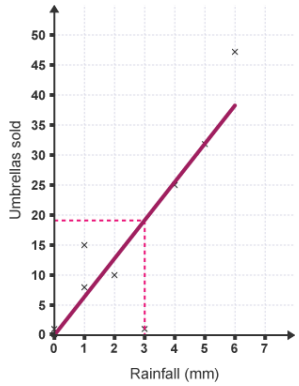
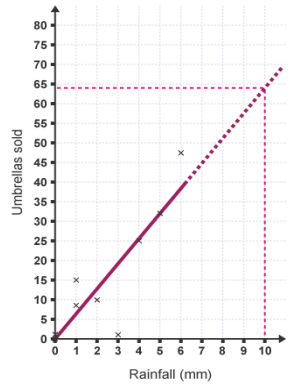
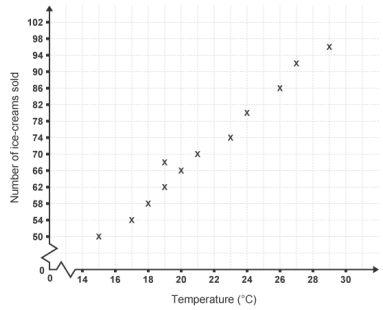
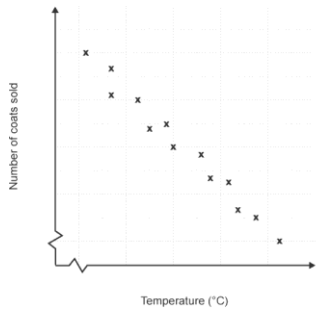
3c. Pie Charts

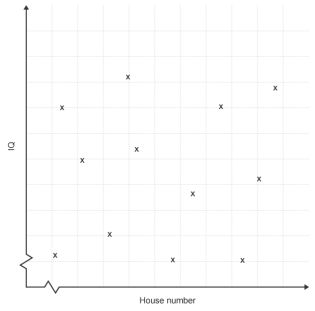
12	Pie Charts	A pie chart is a chart represented by a circle. It shows the proportion of each group at a glance. To find the angle: $\frac{frequency}{total} \times 360°$	

People travelling in a vehicle	Frequency	Calculation	Angle
1 person	120	$\frac{120}{180} \times 360°$	240°
2 people	40	$\frac{40}{180} \times 360°$	80°
3 people	13	$\frac{13}{180} \times 360°$	24°
4 people	5	$\frac{5}{180} \times 360°$	10°
5 or more	2	$\frac{2}{180} \times 360°$	4°
Total	**180**		

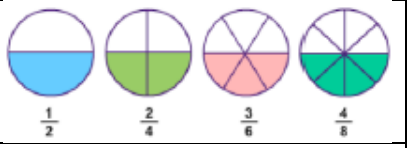
3d. SCATTER GRAPHS

13	Outliers		Outliers don't follow the trend

14	Line of Best Fit		A sensible straight line that goes as centrally as possible through the points plotted. It should also follow the same steepness of the crosses.	
15	Interpolate		Using a line of best fit to estimate data <u>WITHIN</u> our range <u>For example</u>: To estimate how many umbrellas are sold with 3mm rain. • Find where 3 mm of rainfall is on the graph. • Draw a line by going across from 3 mm and then down.	
16	Extrapolate		Continuing a line of best fit to estimate data <u>BEYOND</u> our range (not as reliable as interpolation) <u>For example</u>: To estimate how many umbrellas are sold with 10mm rain. • Continue the line of best fit. • Find where 10mm of rainfall is on the graph. • Draw a line by going across from 10mm and then down.	
17a	Positive Correlation		BOTH variables increase with each other	i.e. Ice creams sold vs Temperature
17b	Negative Correlation		ONE variable increases as the other decreases	i.e. Coats sold vs temperature

17c	No Correlation		NO relationship between variables	i.e. IQ and House Number
18	Causation	If one variable causes a change in the other. • i.e. an increase temperature <u>WILL</u> cause an increase ice cream sales • i.e. the number of bee stings <u>WILL NOT</u> cause an increase in ice cream sales (although both will increase in hot weather)		

Fractions

1.	Fraction	Part of a whole	
2.	Numerator	The number on the top of the fraction	$\frac{numerator}{denominator}$
3.	Denominator	The number on the bottom of the fraction	
4.	Equivalent fractions	Fractions that have the same value but look different.	
5.	Improper fraction	A fraction where the numerator is larger than the denominator.	e.g. $\frac{4}{3}$
6.	Mixed number	A number made from integer and fraction parts.	e.g. $2\frac{2}{3}$
7.	Unit fraction	A fraction that has a numerator of 1	
8.	Reciprocal	The reciprocal of a number is 1 divided by the number.	e.g. the reciprocal of 3 is $\frac{1}{3}$
		Dividing by a number is the same as multiplying by its reciprocal	e.g. $\times$ by $\frac{1}{3}$ is the same as $\div$ by 3

Fractions - processes

9.	Simplifying fractions	Divide the numerator and denominator by the HCF.	$\frac{24}{30} = \frac{4}{5}$
10.	Finding equivalent fractions	Multiply the numerator and denominator by the same number	$\frac{4}{8}$ $\times 2 = 8$ $\times 2 = 16$
11.	Comparing fractions	Write them with a common denominator	
12.	Fraction of an amount	Amount divided by the denominator then multiplied by the numerator	e.g. $\frac{5}{7}$ of 42 $42 \div 7 \times 5 = 30$

13.	Multiply fractions	Multiply the numerators and multiply the denominators	$\frac{6}{7}\times\frac{4}{5}=\frac{6\times4}{7\times5}=\frac{24}{35}$
14.	Divide fractions	• Flip the second fraction (find the reciprocal). • Change the divide to multiply. • Multiply the fractions.	$\frac{4}{7}\div\frac{5}{6}=\frac{4}{7}\times\frac{6}{5}=\frac{4\times6}{7\times5}=\frac{24}{35}$
15.	Add or subtract fractions	• Write as fractions with a common denominator. • Add or subtract the numerators	$\frac{2}{8}+\frac{1}{6}=\frac{6}{24}+\frac{4}{24}=\frac{10}{24}=\frac{5}{12}$
16.	Convert improper fractions to mixed numbers	• Divide the numerator by the denominator • The answer gives the whole number part. • The remainder becomes the numerator of the fraction part with the same denominator.	$\frac{43}{6}=7\frac{1}{6}$
17.	Convert mixed numbers to improper fractions	• Multiply the denominator by the whole number part. • Add the numerator to this. • Put the answer to this back over the denominator	$7\frac{1}{6}=\frac{6\times7+1}{6}=\frac{43}{6}$

Percentages

18.	Percentage	Means 'out of 100'	
19.	Multiplier	A decimal you multiply by to represent a percentage	
		To use a multiplier to find a percentage, divide your percentage by 100, then multiply the amount by this value.	
20.	Percentage increase	Calculate the percentage and add onto the original	
		Or use a multiplier	$amount\times\frac{100+\%\ increase}{100}$
21.	Percentage decrease	Calculate the percentage and subtract from the original	
		Or use a multiplier	$amount\times\frac{100-\%\ increase}{100}$
22.	Percentage change	$\frac{Change}{Original}\times100$	
23.	Express one number as a percentage of another	$\frac{Number\ 1}{Number\ 2}\times100$	

24.	Reverse percentage	Use when asked to find the priginal amount after a percentage increase or decrease. Original Value x Multiplier = New Value $\text{Original Value} = \frac{\text{New Value}}{\text{Multiplier}}$	
25.	Interest	A fee paid for borrowing money or money earnt through investing.	
26.	Simple interest	Interest that is calculated as a percentage of the original	I = Prt I – Interest P – Original amount r – interest rate t - time
27.	Compound interest	When interest is calculate on the original amount and any previous interest OR $Original \times Multiplier^{time}$	$P\left(1+\frac{R}{100}\right)^{n}$ P – Original amount R – Interest rate n – the number of interest periods (e.g. yrs)
28.	Tax	A financial charge placed on sales or savings by the government e.g. VAT	
29.	Loss	Income minus all expenses, resulting in a negative value	
30.	Profit	Income minus all expenses, resulting in a positive value	
31.	Depreciation	A reduction in the value of a product over time	
32.	Annual	Means yearly	
33.	Per annum	Means per year	
34.	Salary	A fixed regular payment, often paid monthly	

FDP Conversions

35.	Percentage to decimal	Divide by 100
36.	Decimal to percentage	Multiply by 100
37.	Fraction to percentage	Find an equivalent fraction with 100 as the denominator
38.	Percentage to fraction	Write as a fraction over 100 then simplify
39.	Fraction to decimal	Carry out division or convert to a percentage first
40.	Decimal to fraction	Use place value to find the denominator and simplify or convert to a percentage first.

Basics to memorise

41.	Fraction	$\frac{1}{100}$	$\frac{1}{10}$	$\frac{1}{8}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$

	Decimal	0.01	0.1	0.125	0.2	0.25	$0.\dot{3}$	0.5	$0.\dot{6}$	0.75
	Percentage	1%	10%	12.5%	20%	25%	$33.\dot{3}\%$	50%	$66.\dot{7}\%$	75%

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Equations

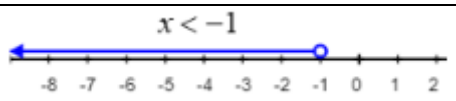
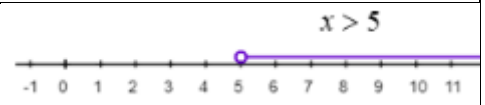
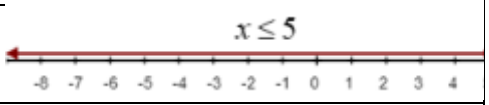
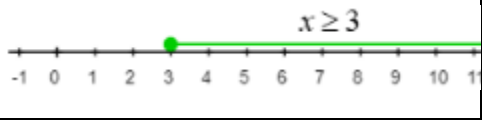
1.	Equation	Contains an 'equals' sign Has at least one variable	e.g. $3y - 3 = 12$
2.	Linear	Produces a straight line graph No indices above 1	
3.	Term	One part of an expression/equation/formula Can involve multiplying and dividing coefficients and variables Separated from other terms by addition and subtraction	e.g. $4c$ $\frac{w}{5}$
4.	Expression	One or a group of terms. Can include variables, constants, operators and grouping symbols. No 'equals' sign	e.g. $3y - 3$ $3y^2 + y^3$
5.	Formula	A special type of equation that shows the relationship between a set of variables	
6.	Identity	An equation that is true no matter what values are chosen, ≡	e.g. $3y \equiv 2y - y$ for any value of y.
7.	Unknown	A letter representing a number	
8.	Solve	TO find the value of the unknown	
9.	Inverse operations	The operation used to reverse the original operation + and − are inverse / × and ÷ are inverse Finding the square root is the inverse of finding the square of a number. Finding the cube root is the inverse of finding the cube of a number.	

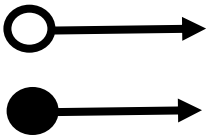
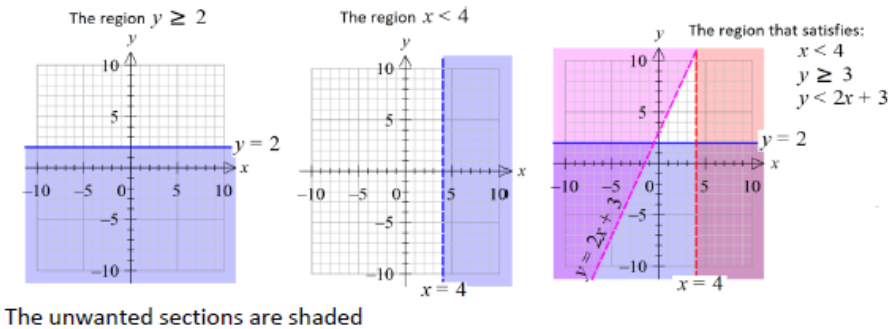
Solving equations

10.	To solve equations we need to use inverse operations	
11.	What ever you do to one side of the equals sign you must do the same to the other	
12.	One step	$x + 4 = 7$ → (-4) (-4) → $x = 11$ $x - 5 = 12$ → $(+5)$ $(+5)$ → $x = 17$ $3x = 18$ → $(\div 3)$ $(\div 3)$ → $x = 1$ $\frac{x}{4} = 6$ → $(\times 4)$ $(\times 4)$ → $x = 24$

13.	Two step	Requires the use of two inverse operations	$2x - 7 = 19$ $2x = 26$ $x = 13$
14.	With brackets	Expand the brackets first $5(2x + 1) = 35$ $10x + 5 = 35$ $10x = 30$ $x = 3$	OR if possible divide by the number outside of the bracket first $4(2x + 4) = 20$ $2x + 4 = 5$ $2x = 1$ $x = \frac{1}{2}$
15.	Unknowns on both sides	Start by eliminating the unknown from one of the signs.	$5x + 2 = 3x - 8$ $2x + 2 = -8$ $2x = -10$ $x = -5$
16.	With fractions	Eliminate any terms that are being added or subtracted separate from the fraction first. $\frac{f}{5} + 2 = 8$ $\frac{f}{5} = 6$ $f = 30$	If everything is part of the fraction then multiply by the denominator first. $\frac{f+2}{5} = 8$ $f + 2 = 40$ $f = 38$

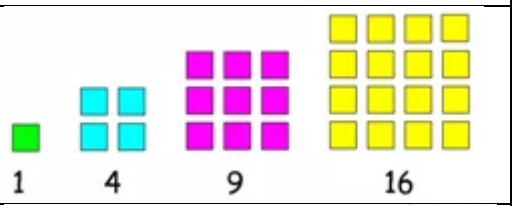
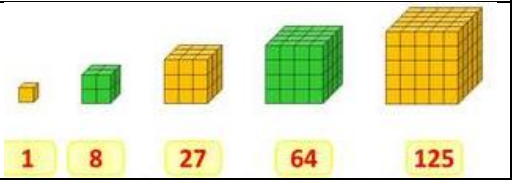
Inequalities

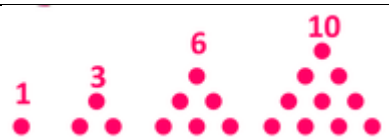
17.	Inequality	The relationship between two expressions that are not equal	
18.	=	Equal to	
19.	≠	Not equal to	
20.	<	Less than	
21.	>	Greater than	
22.	≤	Less than or equal to	
23.	≥	Greater than or equal to	

24.	Inclusive	Gives a finites rnage of solutions	e.g. $3 < x \leq 8$
25.	Exclusive	Gives an infinite range of solutions	e.g. $x > 5$ $-4 \leq x$
26.	Integer	A whole number that can be positive negative or zero	
27.	Solve	Inequalities are solved in the same way as solving equations	
		Only exception: if you multiply or divide by a negative number you must swap the sign e.g. less than to greater than	
28.	List integers solutions	Give the integers that satisfy the inequality	
		e.g. x > 6 integer solutions are 6, 7, 8....	
		e.g. -5 < x ≤ 5 integer solutions are -4, -3, -2, -1, 0, 1, 2, 3, 4, 5	
29.	Represent on a number line	An empty circle shows the value is not included	
		A shaded circle shows the value is included	
		An arrow shows that the solution continues to infinity	
30.	Inequalities on graphs	 The unwanted sections are shaded	
		Dashed lines are used to represent < or >	
		Solid line is used to represent $\leq$ *or* $\geq$	
Sequences			
31.	Sequence	An order pattern of numbers or diagrams	
32.	Term	One of the numbers or diagrams in a sequence	
33.	Term to term rule	The rule for moving from one term to the next in a sequence	
34.	Formula	A rule written to describe a realtionship between twp quantities	
35.	Arithmetic sequence	A sequence where the term to term rule is to addd or subtract the same amount each time	

36.	Quadratic sequence	A sequence where the term to term rule is changing by the same amount each time
		The second difference is a constant amount.
37.	Geometric sequence	A sequence where the term to term rule is to multiply by the same amount each time
38.	Common ratio	The value a geometric sequence is multiplied by from one term to the next
		Denoted by the letter r
39.	Series	The sum of the terms in a sequence
40.	Position to term rule	The rule for finding any value of a sequence
41.	nth term rule for an arithmetic sequence	The rule to find any term in a sequence of numbers
		• Find the common difference between the terms • This becomes you coefficient of n (this is the times table the sequenc is linked to) • The number you need to add or subtract to get to the second term becomes the second term in the nth term rule 6, 10, 14, 18, 22 (+4 +4 +4 +4) The sequence increases by 4, so the nth term starts with 4n Now compare the sequence to the 4 times table 6, 10, 14, 18, 22 (+2 +2 +2 +2 +2) Each term is 2 bigger than the 4 times table 4, 8, 12, 16, 20 So the nth term is 4n + 2
42.	nth term for a geometric sequence	• Divide the second sequence by the first to find the common ratio, r • The nth term is ar^{n-1} where a is the first term and n is the term position in the sequence
43.	Finite	Has a final point
44.	Infinite	Carries on forever
45.	Ascending	Increases
46.	Descending	Decreases
47.	Linear function	An aruthmetic sequence that can be represented by a straight line graph

Special Sequences

48.	Square numbers	1, 4, 9, 16, 25, 36, 49, 64, 81, 100	
49.	Cube numbers	1, 8, 27, 64, 125	

50.	Triangular numbers	1, 3, 6, 10, 15, 21, 28	
51.	Fibonacci sequence	A sequence where each term is the sum of the two previous terms	
		e.g. 1, 1, 2, 3, 5, 8, 13, 21…	

Kettering Science Academy Maths

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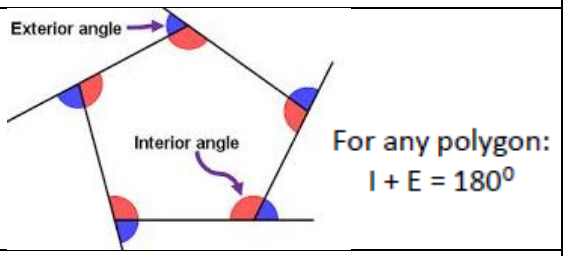
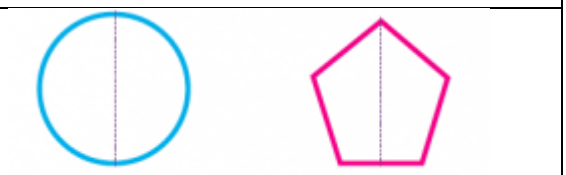
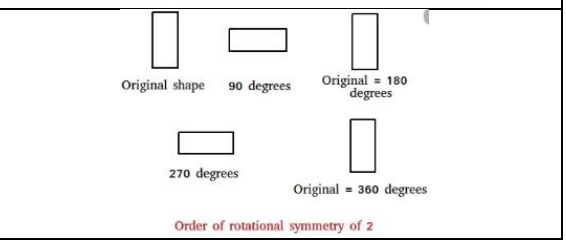
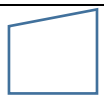
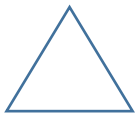
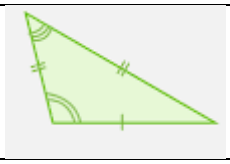
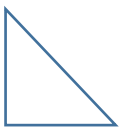
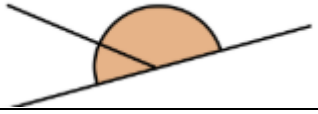
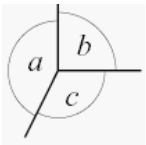
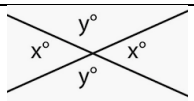
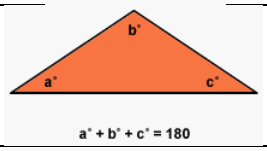
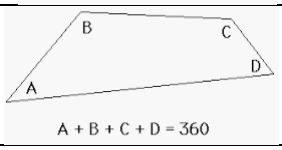
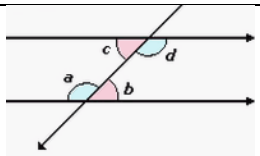
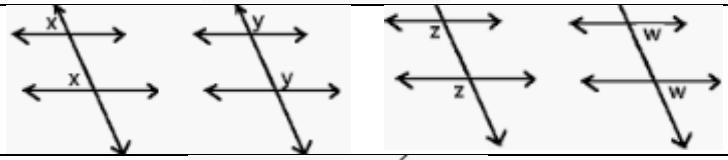
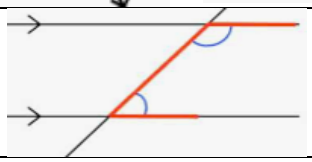
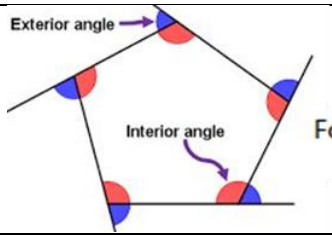
Shapes and angles - definitions

1.	Angle	A measure of turn, measured in degrees ◦	
2.	Protractor	Instrument used to measure the size of an angle	
3.	Acute angle	An angle less than 90◦	
4.	Right angle	A 90◦ angle	
5.	Obtuse angle	An angle more than 90◦ but less than 180◦	
6.	Reflex angle	An angle more than 180◦	
7.	Parallel lines	Lines that are equal distance apart that will never meet even when extended	
8.	Perpendicular lines	Lines that intersect at a right angle	
9.	Polygon	A 2D shape with straight lines only	
10.	Regular polygon	A polygon where: All sides are the same length All angles are the same size	
11.	Interior angles (I)	An angle inside a polygon	
12.	Exterior angles (E)	An angle outside a polygon	
13.	Congruent	Shapes that are the same shapes and size, they are identical.	
14.	Similar	Shapes that are the same shape but are different sizes	
15.	Bisect	Cut in half	
16.	Tessellate	Fit together without leaving gaps	
17.	Symmetry	A shape has symmetry if a central line is drawn to show both sides are exactly the same. We call these lines of symmetry	
18.	Rotational symmetry	A shape has rotational symmetry when it looks the same after some rotation of less than a full turn	

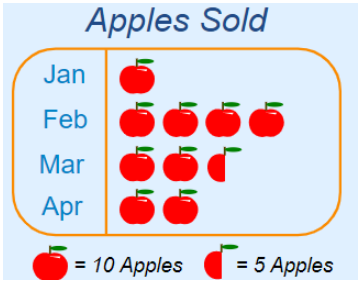
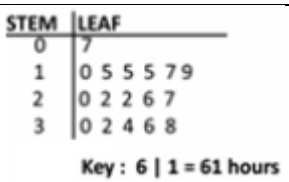
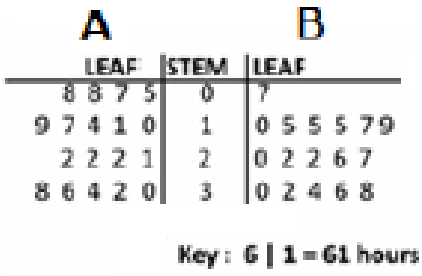
Quadrilaterals (4 sided shapes)				
19.	Square		4 equal sides 4 equal angles 2 pairs of parallel sides Diagonals cross at right angles	4 lines symmetry Rotational symmetry order 4
20.	Rectangle		2 pairs of equal sides 4 right angles 3 pairs of parallel sides	2 lines of symmetry Rotational symmetry order 2
21.	Rhombus		4 equal sides 2 pairs of equal angles 2 pairs of parallel sides Diagonals cross at right angles	2 lines of symmetry Rotational symmetry order 2
22.	Parallelogram		2 pairs of equal sides 2 pairs of equal angles 2 pairs of parallel sides	0 lines of symmetry Rotational symmetry order 2
23.	Kite		2 pairs of equal sides 1 pair of equal angles 2 pairs of parallel sides Diagonals cross at right angles	1 line of symmetry Rotational symmetry order 1
24.	Trapezium		One pair of parallel lines	
25.	Isosceles trapezium		1 pair of parallel sides 1 pair of equal sides 2 pairs of equal angles	1 line of symmetry Rotational symmetry order 1
Triangles (3 sided shapes)				
26.	Equilateral		3 equal sides 3 equal angles	3 lines of symmetry Rotational symmetry order 3
27.	Isosceles		2 equal sides 2 equal angles	1 line of symmetry Rotational symmetry order 1
28.	Scalene		No equal sides No equal angles	
29.	Right-angled		1 right angle Can be scalene or isosceles	
Basic angle rules				
30.	Angles on a straight line add to 180°			

31.	Angles around a point add up to 360◦	
32.	Vertically opposite angles are equal	
33.	Angles in a triangle add to 180◦	
34.	Angles in a quadrilateral add up to 360◦	
Angles on parallel lines		
35.	Alternate angles are equal	
36.	Corresponding angles are equal	
37.	Co-interior angles add up to 180◦	
Angles in polygons		
38.	Interior and exterior angles add to give 180◦	 For any polygon: $I + E = 180^0$
39.	Sum of interior angles	For a ‘n’ sided polygon Sum of interior angles = 180 x (n-2)
40.	Size of one interior angle	For a ‘n’ sided polygon Interior angle = $\frac{180\ x\ (n-2)}{n}$
41.	Sum of exterior angles	For all polygons, sum of exterior angles = 360◦
42.	Regular polygons	Exterior angle = 360 ÷ number of sides
		Number of sides = 360 ÷ exterior angle

		Interior angle = 180 – exterior angle

Statistics and sampling: definitions					
1.	Primary	Data that is collector by the researcher first hand			
2.	Secondary	Data that is collected by someone other than the user			
3.	Qualitative	Data described by words		e.g. favourite colour	
4.	Quantitative	Data that is categorised by numbers, can be discrete or continuous		e.g. height, shoe size	
5.	Discrete	Can be counted, can only have a finite number of possible values		e.g. number of people in a class	
6.	Continuous	Can be measured, can have an infinite number of possible values within a given range		e.g. height, weight, time, distance	
7.	Population	The whole group			
8.	Census	A survey of the whole population			
9.	Sample	A selection of the whole population			
10.	Survey	A tool used to gather information from individuals			
11.	Bias	Prejudice or favour shown for one person, group, thing or opinion over another.		e.g. asking people leaving a library whether they enjoyed reading	
12.	Random sample	Every member of the population has an equal chance of being selected.			
13.	Inequality signs	< less than	> greater than	≤ less than or equal to	≥ greater than or equal to
14.	Frequency	How often something occurs			
15.	Estimate	Find a value close to the correct answer if you were to calculate accurately			
16.	Interval	What is between two values of points		e.g. all the numbers between 0 and 10	
17.	Midpoint	The middle or half way point of an interval		e.g. the midpoint of all the umbers between 0 and 10 is 5	
Measures of central tendency and spread					
18.	Central tendency	A calculated central value of a set of numbers		Mean, median and mode are measures of central tendency	
19.	Spread	Describes how similar or varied a set of values are		Range and interquartile range are measures of spread	
20.	Mean	Add up all the mounts then divide by how many there are.			
21.	Median	Put values in order and locate the middle value			

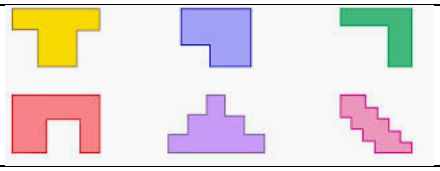
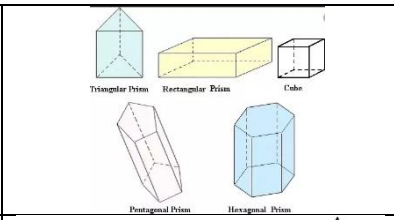
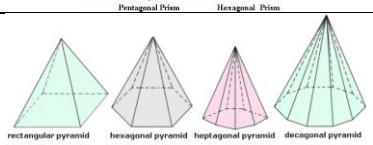
22.	Mode	The value that occurs most often i.e. has the highest frequency.	
23.	Range	The biggest value minus the smaller value	
24.	Outlier	An extreme data value that doesn't fit with the overall trend or pattern	
Advantages and disadvantages of averages			
26.	Average	Advantages	Disadvantages
	Mean	Every value is included	Affected by extreme values
	Median	Not affected by extreme values	May not change if a data value changes
	Mode	Easy to find; not affected by extreme values; can be used with non-numerical data	There may not be a mode
Averages from frequency tables			
27.	Modal class	The class with the highest frequency	
28.	Median	If the total frequency is n, then the median lies in the class with the $\frac{n+1}{2}$th value in it.	
29.	Mean from a frequency table Times → Add ↓↓ Divide ←	No of make-up items in handbags No of Items x / Freq f / f x x 1 / 7 / 1x7 =7 2 / 2 / 2x2 =4 3 / 1 / 3x1 =3 4 / 4 / 4x4 =16 5 / 2 / 5x2 =10 16 / 40	Mean = $\frac{40}{16}$ =2.5
30.	Estimated mean from a grouped frequency table Times → Add ↓↓ Divide ←	Class Interval / Mid-point / Frequency / Mid-point × Frequency $140 \le h < 150$ / 145 / 6 / 145 × 6 = 870 $150 \le h < 160$ / 155 / 16 / 155 × 16 = 2480 $160 \le h < 170$ / 165 / 21 / 165 × 21 = 3465 $170 \le h < 180$ / 175 / 8 / 175 × 8 = 1400 Totals / 51 / 8215	Mean = 8215 ÷ 51 =161.07843... = 161.08 (2dp)
31.	Estimate of range from grouped frequency table	The maxiumum possible value minus the smallest possible value.	

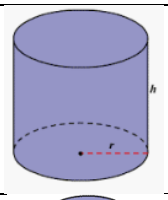
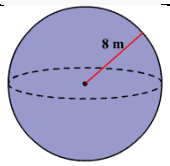
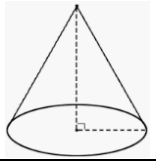
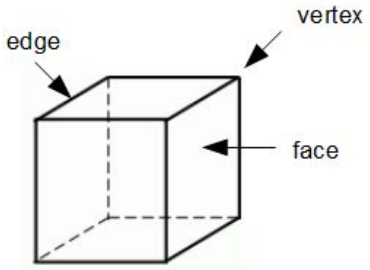
Averages from charts/graphs			
32.	Bar chart	A chart to display discrete data where the height of the bar shows the frequency. 	Mean: 23 ÷ 10 = 2.3 Median: 2.5 Mode : 3 Range: 4-1 = 3
33.	Pictogram	A chart that uses pictures to represent quantities. Must include a key. 	Mean: 95÷4 = 23.75 Median: 22.5 Range: 30
34.	Stem and leaf diagram	 A diagram that shows groups of data arranged by place value. 'Leaves' should be in order. Must have a key.	Mean: 385÷17 = 22.6 Median: 22 Mode: 15 Range: 38-7 = 31
35.	Back to back stem and leaf	Compares two sets of results. Must have a key. 	Set A Mean: 356÷18 = 19.8 Median: 20 Mode: 22 Range: 38-5 = 33 Set B Mean: 385÷17 = 22.6 Median: 22 Mode: 15 Range: 38-7 = 31

Kettering Science Academy Maths

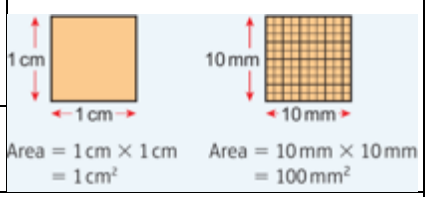
Year 9 Mathematics Foundation HT 6

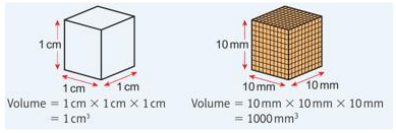
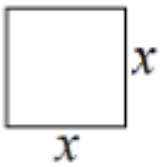
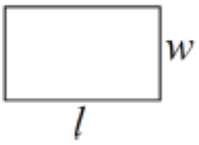
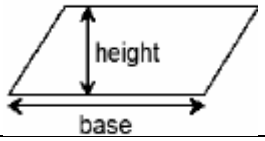
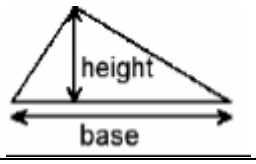
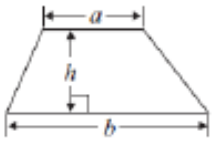
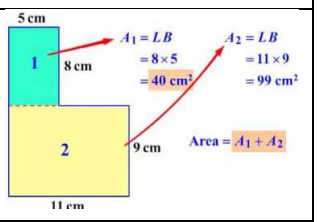
2D and 3D shapes: definitions

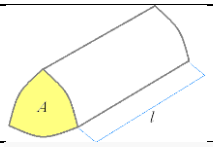
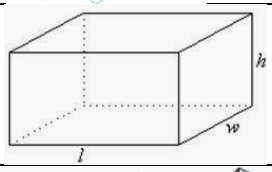
1.	Dimension	The size of something in a particular direction e.g. height, depth, length, width	
2.	2D shape	A shape that has length/height and a width but no depth	
3.	3D shape	A shape that depth as well as length/height and width	
4.	Polygon	A 2D shape with straight lines only	
5.	Regular polygon	A polygon where: All sides are the same length All angles are the same size	
6.	Compound shape	A shape made up of two or more simple shapes	
7.	Rectilinear shape	A shape where all of its sides meet at right angles	
8.	Perimeter	The distance around the outside of a 2D shape	
9.	Area	The space inside a 2D shape	
10.	Surface area	The total area of all the faces of a 3D shape	
11.	Volume	The space inside a 3D shape	
12.	Capacity	The amount of fluid a 3D object can hold	
13.	S.I. Units	Standard units of measurement used by scientists across the world	
14.	Metric units	Standard units of measurement that vary by powers of 10	
15.	Imperial units	Older units of measurement, some of which are still common e.g. miles, gallons	
16.	Cross section	The shape we get when cutting straight through a 3D shape	
17.	Prism	A 3D shape that has a constant cross section through its length	
18.	Pyramid	A 3D shape with a polygon as its base and triangular sides that meet at the top	

19.	Cylinder	A prism with two circular ends connected by a curved surface	
20.	Sphere	A 3D shape where all points on the surface are the same distance from the centre	
21.	Spherical	Means in the shape of a sphere	
22.	Cone	A 2D shape that has a circular base joined to a point by a curved side	
23.	Face	A flat surface of a 3D shape (can be curved)	
24.	Edge	A line segment where two faces meet	
25.	Vertex	A point where two or more edges meet	
26.	Vertices	Plural of vertex	

Measures

27.	Units of time	Standard units of time are seconds, minutes, hours, days, years			
		60 seconds = 1 minute	60 minutes = 1 hour	24 hours = 1 day	365 days = 1 year
28.	Units of mass	Metric units of mass are milligrams, grams, kilograms and tonnes			
		1000mg = 1g	1000g = 1kg	1000kg = 1 tonne	
29.	Units of length	Metric units of length are millimetres, centimetres, metres and kilometres			
		10mm = 1cm	100cm = 1m	1000m = 1km	
30.	Units of area	Metric units of length are millimetres^2, centimetres^2, metres^2 and kilometres^2			
		$1cm^2 = 100mm^2$			
		$1m^2 = 1000cm^2$			
31.	Units of volume	Metric units of length are millimetres^3, centimetres^3, metres^3 and kilometres^3			

		$1cm^3 = 1000mm^3$	
		$1m^3 = 1000000cm^3$	
32.	Units of capacity	Metric units of capacity are millilitres, centilitres and litres	
		$10ml = 1cl$	$1000ml = 100cl = 1l$
33.	Capacity and volume conversions	$1cm^3 = 1ml$	$1000cm^3 = 1l$
2D Shapes			
34.	Square	Area = $l \times w$ or l^2 as length and width are equal	
35.		Perimeter = $l + l + l + l$ or $4l$	
36.	Rectangle	Area = $l \times w$	
37.		Perimeter = $l + l + w + w$ or $2l + 2w$	
38.	Parallelogram	Area = $b \times h$	
39.	Triangle	Area = $\frac{b \times h}{2}$ or $\frac{1}{2} \times b \times h$	
40.	Trapezium	Area = $\frac{a+b}{2} \times h$ or $\frac{1}{2}(a + b) \times h$	
41.	Compound shape	To find the area, split up into simple shapes, find each area and add together. To find the perimeter, find any missing sides than add all the sides together.	
3D shapes: volume			

42.	**Prism**	**Volume** = $area\ of\ cross\ section\ \times length$	
43.	**Cuboid**	**Volume** = $area\ of\ cross\ section\ \times length$ **Volume** = $length\ \times width\ \times height$	
44.	**Triangular prism**	**Volume** = $area\ of\ cross\ section\ \times length$ **Volume** = $\frac{1}{2}\ \times base\ \times height\ \times length$