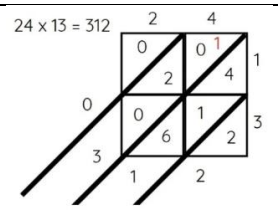
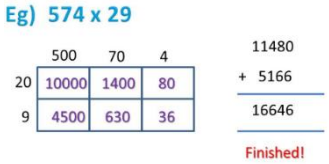
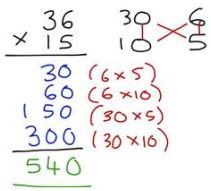
Year 8 Mathematics
Core
HT 1

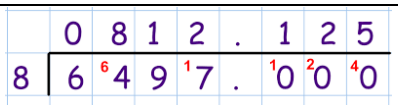
Number

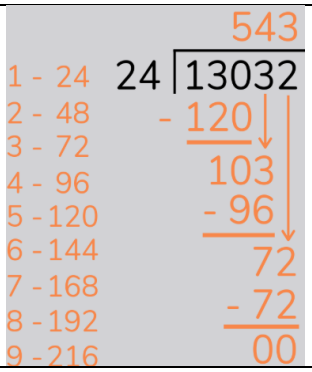
1.	Addition	To find the sum or total of two or more numbers.
2.	Subtraction	To find the difference between two numbers.
3.	Multiplication	Repeated addition of a number. Also called 'product'
4.	Division	The process of calculating the number of times one number is contained in another.
5.	Divisible	Can 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 

Times Tables

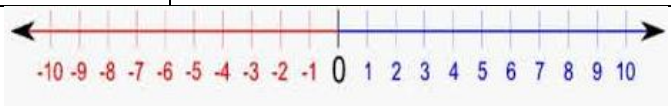
×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40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

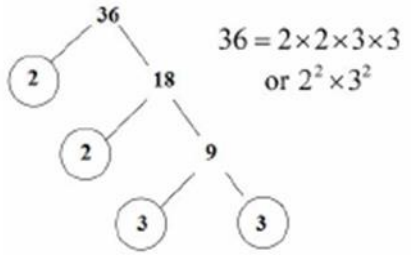
Divisibility Rules

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.	Operations	Symbols and words to show how to combine numbers.			
		×	Multiply	+	Add
		÷	Divide	−	Subtract

13.	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.	

14.	Order of operations	The order in which operations should be done.	B I DM AS	Brackets Indices Divide and Multiply Add and Subtract
15.	Negative number	A number that is less than zero.		
16.	Ascending order	A set of numbers arranged from smallest to biggest.		
17.	Descending order	A set of numbers arranged from biggest to smallest.		
18.	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: $1, 18$ $2, 9$ $3, 6$		
19.	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.		
20.	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.		
21.	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:		

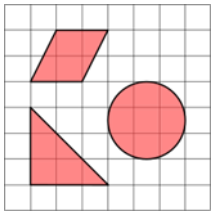
		$2, 3, 5, 7, 11, 13, 17, 19, 23, 29$
22.	Prime Factor	A factor which is a prime number. The prime factors of 18 are: $2, 3$
23.	Product of Prime Factors	Finding out which **prime numbers multiply** together to make the **original** number. Use a **prime factor tree.** Also known as 'prime factorisation'. 
24.	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…** $9^2 = 9 \times 9 = 81$
25.	Square Root	The **number you multiply by itself** to get another number. The reverse process of squaring a number. $\sqrt{36} = 6$ because $6 \times 6 = 36$
26.	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 $x = \pm 5$

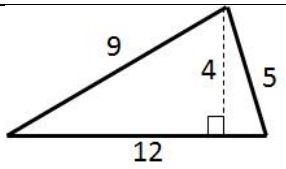
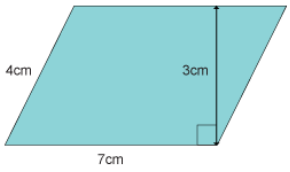
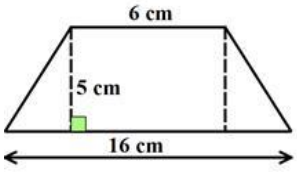
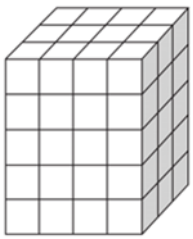
27.	Cube Number	The number you get when you **multiply a number by itself and itself again**. 1, 8, 27, 64, 125… $2^3 = 2 \times 2 \times 2 = 8$
28.	Cube Root	The **number you multiply by itself and itself again** to get another number. The reverse process of cubing a number. $\sqrt[3]{125} = 5$ because $5 \times 5 \times 5 = 125$
29.	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.
30.	Multiplication Index Law	When **multiplying** with the same base (number or letter), **add the powers**. $\boldsymbol{a^m \times a^n = a^{m+n}}$ $7^5 \times 7^3 = 7^8$ $a^{12} \times a = a^{13}$ $4x^5 \times 2x^8 = 8x^{13}$
31.	Division Index Law	When **dividing** with the same base (number or letter), **subtract the powers**. $\boldsymbol{a^m \div a^n = a^{m-n}}$ $15^7 \div 15^4 = 15^3$ $x^9 \div x^2 = x^7$ $20a^{11} \div 5a^3 = 4a^8$
32.	Brackets Index Laws	When raising a power to another power, multiply the powers together. $\boldsymbol{(a^m)^n = a^{mn}}$

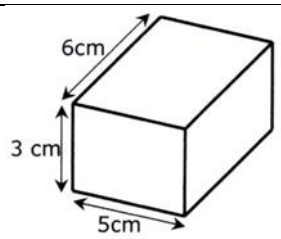
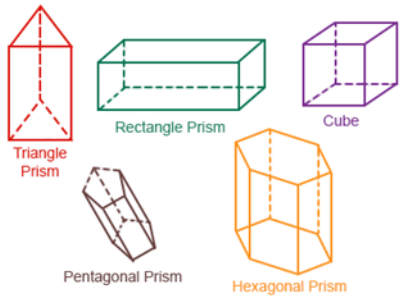
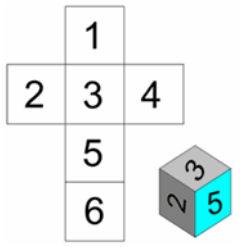
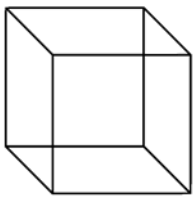
		$(y^2)^5 = y^{10}$ $(6^3)^4 = 6^{12}$ $(5x^6)^3 = 125x^{18}$
33.	Notable Powers	$\boldsymbol{p = p^1}$ $\boldsymbol{p^0 = 1}$ $99999^0 = 1$
34.	Combination	A collection of things, where the **order does not matter**. How many combinations of two ingredients can you make with apple, banana and cherry? Apple, Banana Apple, Cherry Banana, Cherry 3 combinations
35.	Permutation	A collection of things, where the **order does matter**. You want to visit the homes of three friends, Alex (A), Betty (B) and Chandra (C) but haven't decided the order. What choices do you have? ABC ACB BAC BCA CAB CBA
36.	Permutations with Repetition	When something has n different types, there are $\boldsymbol{n}$ **choices each time**. Choosing r of something that has n different types, the permutations are: $n \times n \times \ldots (r\ times) = \boldsymbol{n^r}$ How many permutations are there for a three-number combination lock? 10 numbers to choose from $\{1, 2, \ldots .10\}$ and we choose 3 of them → $10 \times 10 \times 10 = 10^3 = 1000$ permutations.

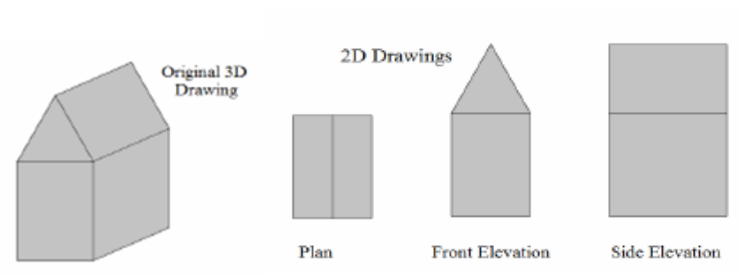
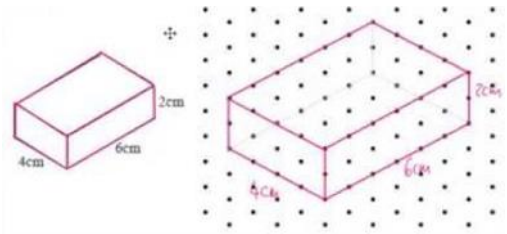
37.	Permutations without Repetition	We have to **reduce the number of available choices each time**. One you have chosen something, you cannot choose it again. How many ways can you order 4 numbered balls? $$4 \times 3 \times 2 \times 1 = 24$$
38.	Reciprocal	The reciprocal of a number is **1 divided 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 $$\frac{2}{3} \times \frac{3}{2} = 1$$

Area and volume

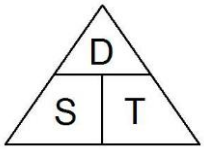
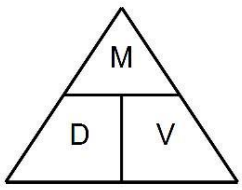
1.	Area	The amount of **space inside** a shape. Units include: mm^2, cm^2, m^2 
2.	Area of a Rectangle	**Length x Width**  $A = 36cm^2$
3.	Area of a Triangle	Base x Height ÷ 2

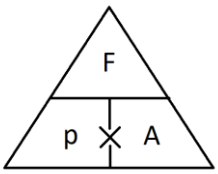
		 $A = 24cm^2$
4.	Area of a Parallelogram	**Base x Perpendicular Height** Not the slant height.  $A = 21cm^2$
5.	Area of a Trapezium	$$\frac{(\boldsymbol{a}+\boldsymbol{b})}{\boldsymbol{2}} \times \boldsymbol{h}$$ "Half the sum of the parallel side, times the height between them. That is how you calculate the area of a trapezium"  $A = 55cm^2$
6.	Volume	Volume is a measure of the amount of space inside a solid shape. Units: mm^3, cm^3, m^3 etc. 
7.	Volume of a Cube/Cuboid	$$\boldsymbol{V = Length \times Width \times Height}$$ $$\boldsymbol{V = L \times W \times H}$$ You can also use the Volume of a Prism formula for a cube/cuboid.

		 volume = 6 x 5 x 3 = 90 cm^3
8.	Prism	A prism is a 3D shape whose **cross section is the same** throughout. 
9.	Net	A pattern that you can **cut and fold** to make a **model** of a **3D shape**. 
10.	Properties of Solids	**Faces = flat surfaces** **Edges = sides/lengths** **Vertices = corners** A cube has 6 faces, 12 edges and 8 vertices. 
11.	Plans and Elevations	This takes 3D drawings and produces 2D drawings.

		Plan View: from **above** **Side Elevation**: from the **side** **Front Elevation**: from the **front** 
12.	Isometric Drawing	A method for visually **representing 3D objects in 2D**. 
13.	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
14.	Units of mass	Metric units of mass are milligrams, grams, kilograms and tonnes 1000mg = 1g 1000g = 1kg 1000kg = 1 tonne
15.	Units of length	Metric units of length are millimetres, centimetres, metres and kilometres 10mm = 1cm 100cm = 1m 1000m = 1km
16.	Units of area	Metric units of length are millimetres^2, centimetres^2, metres^2 and kilometres^2

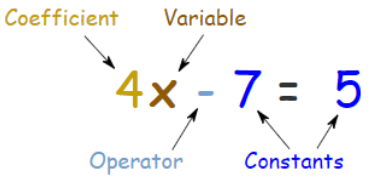
		$1cm^2 = 100mm^2$ $1m^2 = 1000cm^2$
17.	Units of volume	Metric units of length are millimetres^3, centimetres^3, metres^3 and kilometres^3 $1cm^3 = 1000mm^3$ $1m^3 = 1000000cm^3$
18.	Units of capacity	Metric units of capacity are millilitres, centilitres and litres 10ml = 1cl 1000ml = 100cl = 1l
19.	Capacity and volume conversions	$1cm^3 = 1ml$ $1000cm^3 = 1l$
20.	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** $1kilometres = 1000\ metres$ $1\ metre = 100\ centimetres$ $1\ centimetre = 10\ millimetres$ $1\ kilogram = 1000\ grams$
21.	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** $1lb = 16\ ounces$ $1\ foot = 12\ inches$ $1\ gallon = 8\ pints$

22.	Metric and Imperial Units	Use the **unitary method** to convert between metric and imperial units. $5\ miles \approx 8\ kilometres$ $1\ gallon \approx 4.5\ litres$ $2.2\ pounds \approx 1\ kilogram$ $1\ inch = 2.5\ centimetres$
23.	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. $D = S \times T = 4 \times 2 = 8\ miles$
24.	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.

		$V = M \div D = 2 \div 8 = 0.25m^3$
25.	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 $F = P \times A = 10 \times 6 = 60\ N$

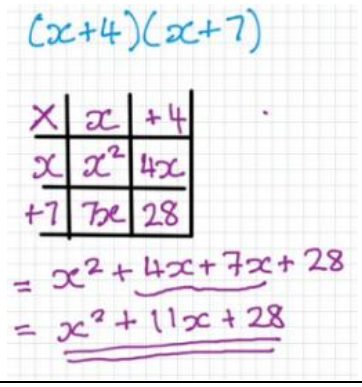
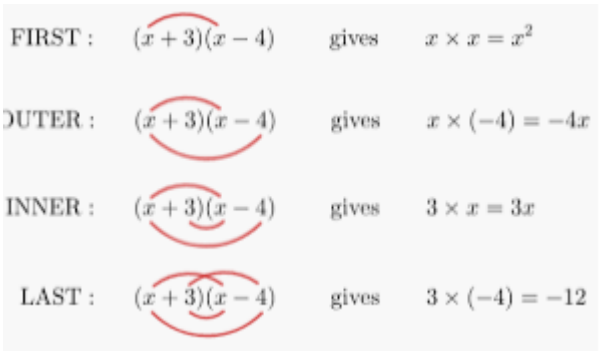
Year 8 Mathematics Core HT 2

Expressions and equations 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	$2x + 4y$	$2(x + 2y)$
		$5x^2y - 10xy$	$5xy(x - 2)$

Expanding double brackets

30.	Everything in the first bracket must be multiplied by everything in the second	
31.	Grid method  	FOIL method 

Factorising a quadratic expression

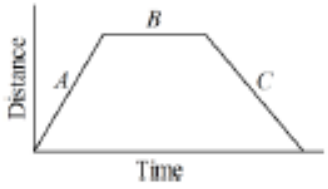
32.	Factorising a quadratic in the form of $ax^2 + bx + c$	Multiply to 5 Factorise $x^2 + 5x + 6$ ← Add to 6 2 and 3 add to 5 2 and 3 multiply to 6 $(x + 2)(x + 3)$ Check: $(x + 2)(x + 3) = x^2 + 5x + 6$
33.	Difference of two squares	A special type of quadratic which only has two terms. One term is subtracted from the other $x^2 - 25 = x^2 - 5^2 = (x + 5)(x - 5)$ $y^2 - 49 = y^2 - 7^2 = (y + 7)(y - 7)$ $a^2 - 16 = a^2 - 4^2 = (a + 4)(a - 4)$

Equations

34.	To solve equations we need to use inverse operations
35.	What ever you do to one side of the equals sign you must do the same to the other

36.	One step	$x+4 = 7$ $(-4) \quad (-4)$ $x = 11$ $x-5 = 12$ $(+5) \quad (+5)$ $x = 17$ $3x = 18$ $(\div 3) \quad (\div 3)$ $x = 1$ $\frac{x}{4} = 6$ $(\times 4) \quad (\times 4)$ $x = 24$	
37.	Two step	Requires the use of two inverse operations	$2x - 7 = 19$ $2x = 26$ $x = 13$
38.	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 $4(2x + 4) = 20$ $2x + 4 = 5$ $2x = 1$ $x = \frac{1}{2}$
39.	Unknowns on both sides	Start by eliminating the unknown from one of the signs.	$5x + 2 = 3x - 8$ $2x + 2 = -8$ $2x = -10$ $x = -5$
40.	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. $\frac{f+2}{5} = 8$ $f + 2 = 40$ $f = 38$

Real life graphs		
41.	Steady speed	Travelling the same distance each minute
42.	Velocity	Speed in a particular direction
43.	Rate of change	Shows how a variable changes over time
44.	Acceleration	How fast velocity changes; measured in m/s^2 or km/s^2 etc

Distance - Time graphs		
45.	Represent a journey	 A = steady speed, B = no movement, C = steady speed back to start
46.	Vertical axis represents the distance from the starting point	
47.	Horizontal axis represents the time taken	
48.	Straight lines mean constant speed	
49.	Horizontal lines mean no movement	
50.	Gradient = speed	
51.	Average speed = $=\frac{total\ distance}{total\ time}$	