Maths HT1
Knowledge Organiser
Year 8

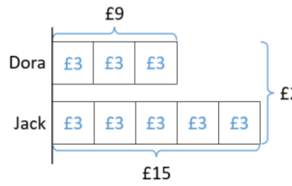
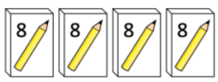
"Knowledge is Power"

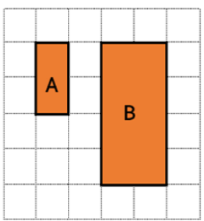
Francis Bacon 1597

Year 8 Knowledge Organiser: Maths HT1

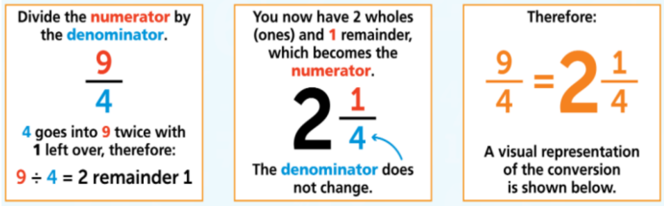
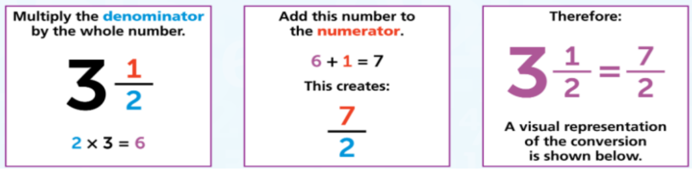
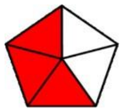
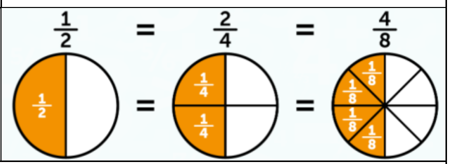
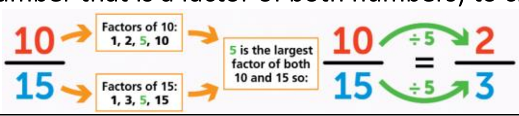
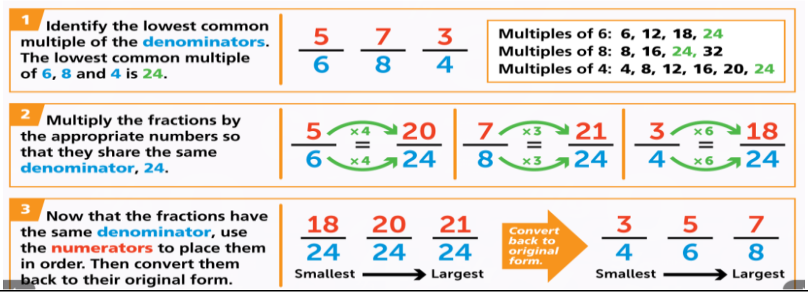
A. Key Terminology			Examples
1	**Number**	An arithmetical value, expressed by a word, symbol, or figure, representing a particular quantity	'Two' can be written as '2' or shown as 2 of something.
2	**Integer**	Whole numbers including zero. These can be positive or negative numbers. They cannot have a decimal or fraction.	-2, -1, 0, 1, 2, 3, …
3	**Positive number**	Any number above zero.	1, 2, 3, 4………
4	**Negative number**	Any number below zero. Always written with a negative sign in front of it.	-1, -2, -3, -4…….
5	**Decimal**	A number with a decimal point in it. Can be positive or negative.	0.2, -0.57, 1.23 etc.
6	**Operation**	In mathematics, an operation is a function which takes some input (or inputs) and produces an output. The most common operations are addition, subtraction, multiplication, and division.	$+, -, \times, \div$
7	**Inverse operation**	The operation that reverses the effect of another operation.	
8	**Addition**	Finding the total value of two or more numbers. To add. Other terms: plus, sum, total. Addition is the inverse operation of subtraction.	Symbol: $+$ 3 + 2 = 5
9	**Sum**	The sum is the result of adding two or more numbers.	The sum of 3 and 2 is 5
10	**Subtraction**	Subtraction is when you **find the difference** between two numbers. To subtract. Other terms: minus, take-away. Subtraction is the inverse operation of addition.	Symbol: $-$ $7 - 5 = 2$
11	**Find the difference**	The result of subtracting one number from another. Finding the distance between two numbers on a number line.	The difference between 17 and 23. $\mathbf{23 - 17 = 6.}$ The difference between them is 6.
12	**Multiplication**	Multiplication is the operation of scaling one number by another. Multiplication is the inverse operation of division.	Symbol: $\times$ $3 \times 11 = 33$
13	**Product**	Product is the result of multiplying two or more numbers.	The product of 4 and 5 is 20. $4 \times 5 = 20$
14	**Division**	Division can be sharing – the number to be divided is shared equally into the stated number of parts. Division is the inverse operation of multiplication.	Symbol: $\div$ $8 \div 4 = 2$
15	**is Equal to**	To be equal to, is to have the same value or amount.	Symbol: $=$ $2 \times 3 = 4 + 2$
16	**is Not equal to**	To be not equal to, is to not have the same value or amount. Also known as an **inequality**.	Symbol: $\neq$ $2 \times 5 \neq 11$
17	**Less than**	A value or amount that is less than another value or amount.	Symbol: $<$ $21 < 30$ *21 is less than 30*
18	**Greater than**	A value or amount that is greater than another value or amount.	Symbol: $>$ $30 > 21$ *30 is greater than 21*
19	**Factor**	Factors are numbers that divide exactly into another number.	The factors of 8 are: 1, 2, 4, 8.
20	**Multiple**	The result of multiplying a number with a whole number, multiples are really just extended times tables.	The multiples of 2 are: 2, 4, 6, 8…..and so on

Year 8 Knowledge Organiser: Maths HT1

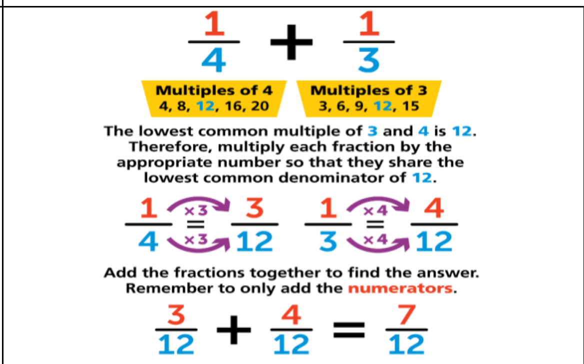
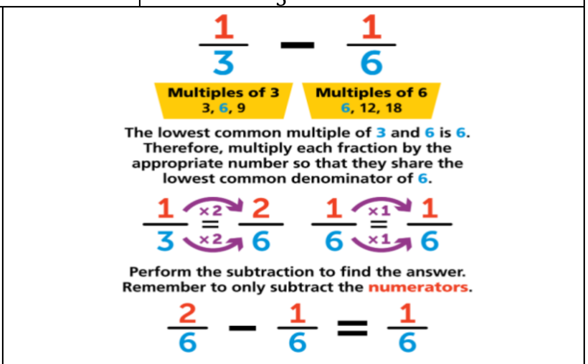
B. Ratio and Scale			Examples
1	**Ratio**	A ratio is a way of comparing two or more quantities. A ratio must be written in the correct order, with the quantity mentioned first written first.	The ratio of boys to girls in a class is 2: 3. For every 2 boys there are 3 girls. The ratio of boys to girls is 2:3 and NOT 3:2. However, we could write the ratio as girls to boys which would be 3:2
2	**Simplifying ratios**	Ratios can be simplified by dividing each part of the ratio by the same number. To fully simplify a ratio, find the highest common factor of both numbers, then divide each part of the ratio by the highest common factor.	Ratio is 10: 15 Highest common factor of 10 and 15 is 5. Divide both parts by 5 i.e., divide 10 by 5 (=2), and divide 15 by 5 (=3) The simplified ratio is 2:3
4	**Ratios as Fractions**	Ratios can be converted to fractions. Add together the parts of the ratio to calculate the total parts. The denominator of the fraction is the total parts.	The ratio of pears to apples to oranges is 3: 5: 2 To calculate fraction of fruit that is oranges, the total number of fruits is the total parts and becomes the denominator i.e., $3 + 5 + 2 = 10$ The ratio value of oranges is the numerator. The fraction of fruit which is oranges is: $\frac{2}{10} = \frac{1}{5}$
5	**Ratio in the form $1 : n$**	Ratios can be written in the form of 1 part to n parts.	Write the ratio of red to blue in the form $1 : n$ For every 4 red there are 12 blue: Red : Blue $\div 4$ 4 : 16 $\div 4$ 1 : 4
6	**Dividing in a given ratio**	Ratios can be used to divide an amount into a given ratio. The process to calculate the amount for each part of the ratio is to: • Add the numbers in the ratio to calculate the total number of parts, • Find the value of one part by dividing the total amount by the number of parts, • Multiply the value of one part by the numbers in the ratio to calculate the value of each of the ratio parts.	Dora and Jack share £24 in the ratio 3 : 5 How much money do they each receive?  Calculations Total parts = 3 + 5 = 8 £24 ÷ 8 = £3 1 part = £3 3 parts = £3 x 3 = £9 5 parts = £3 x 5 = £15 Dora gets £9 and Jack gets £15
7	**Given one part, calculate the value of another part and the total**	If the value of one part of a ratio is known, the value of the other parts of the ratio and the total sum of the ratio can be calculated.	Rosie and Dora share some money in the ratio 1 : 3 If Dora gets £60, how much does Rosie get?  Calculations £60 ÷ 3 = £20 1 part = £20 4 parts = 4 × £20 = £80 Rosie gets £20. The total amount shared is £80
8	**Scale up a ratio**	A ratio can be scaled up	Pencils come in boxes of 8  How many pencils are there in 4 boxes? 32  $\times 4$ 1 : 8 $\times 4$ 4 : 32

C. Multiplicative Change			Examples
1	**Direct proportion**	Two quantities are in direct proportion if they increase or decrease in the same ratio, or at the same rate.	Pencils come in boxes of 8. How many pencils are in 10 boxes: X10 1 box = 8 pencils X10 10 boxes = 80 pencils
2	**Unitary method**	Unitary method for proportion is to calculate the value of one in order to then work out the value of a different amount.	Ronnie buys 18 identical t-shirts costing a total of £36. How much would 5 t-shirts cost? Use the unitary method, calculate the cost of 1 t-shirt, then calculate the cost of 5 t-shirts. $\div 18$ 18 t-shirts = £36 $\div 18$ 1 t-shirt = £2 $\times 5$ 5 t-shirts = £10 $\times 5$
3	**Non-unitary method**	Non-unitary method for proportion is to calculate the value of an amount which isn't one in order to work out the value of a different amount.	Sally buys 14 identical t-shirts costing a total of £8. How much would 35 t-shirts cost? $\div 2$ 14 t-shirts = £8 $\div 2$ 7 t-shirts = £4 $\times 5$ 35 t-shirts = £20 $\times 5$
4	**Conversion Graphs**	Conversion graphs are used to change one unit into another. For example, changing between miles and kilometres or pounds sterling to a foreign currency. These units are directly proportional.	 This conversion graph can be used to convert between Pounds (£) and Euros (€)
5	**Converting Currency**	Direct proportion can be used to convert between different currencies.	The currency in Hong Kong is the Hong Kong Dollar (HK$). We can buy HK$10.28 for £1. How much can we buy with £30? $\times 30$ £1 = HK$10.28 $\times 30$ £30 = HK$308.4
6	**Scale Factor**	Scale factor is the number used to multiply the dimensions of one object by to get an object that looks the same, but it is larger or smaller than the original object.	 • If **A** is the original shape, what has happened to create **B**? • Each side has doubled in length, so it has been multiplied by 2. • This means **A** has been enlarged by a **scale factor of 2.**
7	**Scale Drawings**	Scale drawings represent real objects with accurate lengths reduced or enlarged by a given scale factor.	The plan of a room is drawn at a scale of 1:50, this means that the room is 50 times bigger in real life than in the drawing. If one side of the room is 200 cm in real life, on the scale drawing it will be $200 \div 50 = 4$, so it will be 4cm.

Year 8 Knowledge Organiser: Maths HT1

	D. Fractions: key facts and terminology		Examples
1	**Fraction**	Part of a whole and represented as $\frac{numerator}{denominator}$ The result of dividing one integer by a second (non-zero) integer.	$\frac{5}{8} = 5 \div 8$
2	**Denominator**	The bottom number is called the denominator. It shows how many equal parts the item is divided into.	$\frac{5}{8}$ the 8 is the denominator
3	**Numerator**	The top number is called the numerator. It shows how many equal parts there are.	$\frac{5}{8}$ the 5 is the numerator
4	**Proper fraction**	The numerator is smaller than the denominator.	$\frac{5}{8}$
5	**Improper fraction**	Improper fractions have a numerator that is greater than or equal to the denominator.	$\frac{9}{8}$
6	**Mixed number**	Mixed numbers contain a whole number and a fractional part.	$1\frac{1}{8}$
7	**Improper fractions to mixed numbers**		
8	**Mixed numbers to improper fractions**		
9	**Representing fractions**	Fractions can also be represented as a diagram or in words.	 5 parts in total, 3 parts are red $\frac{3}{5}$
10	**Equivalent Fractions**	Equivalent fractions have different numerators and denominators but are equal in value. They are created by multiplying or dividing both numbers in the fraction by the same number.	
11	**Simplifying fractions**	To simplify a fraction the numerator and denominator must be divided by their highest common factor (the largest whole number that is a factor of both numbers) to create like fractions. 	
12	**Ordering fractions**	To order fractions with the same denominator, use the numerators to place them in order. If they do not have the same denominator, change the fractions to the same denominator, use the numerators to place them in order, then convert back to the original form. 	

Year 8 Knowledge Organiser: Maths HT1

	E. Fractions: Four operations		Examples
1	**Expressing as a fraction**	Write the first number or amount as the numerator, and the second as the denominator. Simplify if possible.	Write 5 as a fraction of 15. $\frac{5}{15} = \frac{1}{3}$
2	**Fraction of an amount**	To find a fraction of an amount: • Divide the amount by the denominator (bottom number) • Multiply the answer by the numerator (top number)	What is $\frac{4}{5}$ of £30? • Divide £30 by 5 = 6 • So $\frac{1}{5}$ of £30 is £6 • To find $\frac{4}{5}$ multiply £6 by 4 = £24
3	**Add and subtract fractions**		
4	**Add and subtract mixed numbers**	When adding or subtracting with mixed numbers, change the mixed numbers into improper fractions, complete the calculation. Simplify if possible.	$2\frac{1}{3} - 1\frac{5}{6}$ $= \frac{7}{3} - \frac{11}{6} =$ $= \frac{14}{6} - \frac{11}{6} = \frac{3}{6} = \frac{1}{2}$
5	**Multiply fractions**	To multiply fractions, multiply the numerators and the denominators. Simplify if possible.	$\frac{1}{2} \times \frac{2}{3} = \frac{2}{6} = \frac{1}{3}$
6	**Multiply fraction by an integer**	• To multiply a fraction by an integer, first convert the integer into a fraction, then complete the multiplication calculation. • To convert an integer into a fraction, write the integer as the numerator, and 1 as the denominator. • For example, to write 4 as a fraction it would be $\frac{4}{1}$	$\frac{1}{5} \times 4$ $= \frac{1}{5} \times \frac{4}{1}$ $= \frac{4}{5}$
7	**Reciprocal**	The reciprocal of a number is the number you would have to multiply it by to get the answer 1. **Reciprocal of an integer**: convert the integer into a fraction and then turn the fraction upside down. **Reciprocal of a fraction**: turn the fraction upside down	The reciprocal of 2: • $2 \times \frac{1}{2} = 1$, so reciprocal is $\frac{1}{2}$ Method: • Convert 2 into a fraction $\frac{2}{1}$ • Turn the fraction upside down • Reciprocal of 2 is $\frac{1}{2}$ The reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$
8	**Divide fractions**	To divide fractions, we convert the calculation into a multiplication calculation. The first fraction is multiplied by the reciprocal of the second fraction.	$\frac{2}{3} \div \frac{1}{2} = \frac{2}{3} \times \frac{2}{1} = \frac{4}{3} = 1\frac{1}{3}$
9	**Divide fraction by an integer**	To divide a fraction by an integer, first convert the integer into a fraction, then complete the division calculation.	$\frac{1}{2} \div 3 = \frac{1}{2} \div \frac{3}{1}$ $= \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

E. Measures of Location			Examples
1	**Average**	An average is a measure of the middle value of a date set. There are three main types of averages: mean, mode and median.	
2	**Mean**	The mean is the sum of the value divided by the number of values: $Mean = \frac{Sum\ of\ values}{Number\ of\ values}$	Sam scored the following marks in 3 Maths tests: 87%, 72%, 91% His mean mark was: $\frac{87+77+91}{3} = \frac{255}{3} = 85\%$
3	**Mode**	The most common or frequent value from a set of data. The value that occurs the most often. A data set can have **no** mode. A data set can have more than one mode. A data set that has two modes is **bimodal**.	Mode of this data set is 7: 3, 3, 6, **7**, **7**, **7**, 8, 9, 10
4	**Median**	The median is the 'middle value' when a data set is arranged in order of size.	Data set: 9, 5, 15, 6, 8 Ordered data set: 5, 6, **8**, 9, 15 Middle value is: 8 Median of data set is 8
5	**Median**	A data set with an odd number of data values will only have one 'middle value'.	
6	**Median**	A data set with an even number of data values will have two 'middle values'. To calculate the median value the mean of the two 'middle values' must be calculated.	Data set: 12, 2, 6, 10, 8, 4 Ordered data set: 2, 4, **6, 8**, 10, 12 Middle values are: 6, 8 Mean of middle values is: $\frac{6+8}{2} = \frac{14}{2} = 7$ Middle value is: 7 Median of data set is 7
7	**Range**	The range is not an average, but a measure of the spread of the values in a data set. The range of a data set is calculated by subtracting the smallest value in the data set from the largest value.	Data set: 14, 16, 16, 17, 19 Smallest value: 14 Largest value: 19 Range: 19 – 14 = 5 Range of data set is 5.