Rayner Stephens

HIGH SCHOOL

# Curriculum

# Intent

*for*

# Maths

At Rayner Stephens High School, we believe that everyone can do maths. The intent of the mathematics curriculum is to provide students with a high-quality and ambitious curriculum which will allow all students to achieve their mathematical potential and prepare them well for everyday life and future employment. Through mathematics lessons, we promote mathematical thinking which will encourage students to develop conceptual understanding, to establish links between the different disciplines within maths and to provide the opportunity to apply this understanding to solve increasingly complex problems. In KS3, students are introduced to topics in mathematics using a concrete, pictorial, abstract approach to allow students to develop their fluency, reasoning and problem-solving skills. Topics are interleaved to allow students to improve their previous learning and allow them to develop application and skill links between the different areas of mathematics. In KS3, students are exploring topics in order to create the building blocks to prepare them for their GCSE studies in Years 10 and 11. Covering the disciplines of number, algebra, geometry, ratio, proportion, data handling and probability, students are given the opportunity to retrieve, affirm and extend their understanding as they progress on their mathematics journey through KS3 and KS4. Students will be encouraged to become fluent in the fundamentals, to be able to reason mathematically, by problem solving and be able to develop an argument or justification using mathematical language.

Rayner Stephens
HIGH SCHOOL

# Mathematics Learning Journey Higher Tier

welcome

## YEAR 7

Sequences

Understand and Use Algebraic Notation

Equality and Equivalence

Place Value and Ordering Integers and Decimals

Fraction, Decimal and Percentage Equivalence

Solving Problems with Addition and Subtraction

Solve Problems with Multiplication and Division

Fraction and Percentage of Amounts

Operations and Equations with Directed Number

-1 -1 -1 -1 +1

$\frac{6}{10} + 0.3$

Addition and Subtraction of Fractions

Measuring and Using Geometric Notation

Sets and Probability

Developing Geometric Reasoning

Prime Numbers and Proof

2 5 3 7

## YEAR 8

Operations and Equations with Directed Number

Solving problems with Multiplication and Division

Ratio and Scale

Addition and Subtraction of Fractions

Multiplicative change

Multiplying and dividing fractions

Working in the Cartesian Plane

Representing data

Tables and Probability

Brackets, Equations and Inequalities

Sequences

Indices

Fractions and Percentages

Standard Index form

## YEAR 9

Measuring Angles

Angle Rules

Angles in Polygons

Proportional Reasoning

Measurement

Area

Scale

Trigonometry

Pythagoras' Theorem

Forming and Solving Equations

Equations in context

Further Probability

Constructions

## YEAR 10

Frequency Trees

Two-way Tables

Estimation

Error Intervals

HCF and LCM

Product of Primes

Ratio

Fractions

Index Laws

Percentages

Sequences

Expanding Brackets

Solving Equations

Inequalities

Factorising

Forming and Solving

Changing the Subject

Standard Index Form

Angles Parallel Lines

Bearings

Graphs

Coordinate Geometry

Compound Measures

Circles

$A = \pi r^2$

Volume

Surface Area

Data Handling

Averages

Frequency Diagrams

Similar Shapes

Probability

Simultaneous Equations

## YEAR 11

Angles

Bearings

$a^2 + b^2 = c^2$

Pythagoras' Theorem

Trigonometry

Arcs and Sectors

Arcs and Sectors

Volume

Surface Area

Averages

Frequency Diagrams

Coordinate Geometry

Compound Measures

Similar Shapes in 2D and 3D

Proportion

Probability

Simultaneous Equations

Quadratics

Iteration

Data Handling and Histograms

Velocity Time Graphs

Circle Geometry

$x^2 + y^2 = r^2$

Circle Theorems

Functions

Transformation of Graphs

Algebraic Proof

Vectors

Revision

Paper 1 (Non-Calculator)
Paper 2 (Calculator)
Paper 3 (Calculator)

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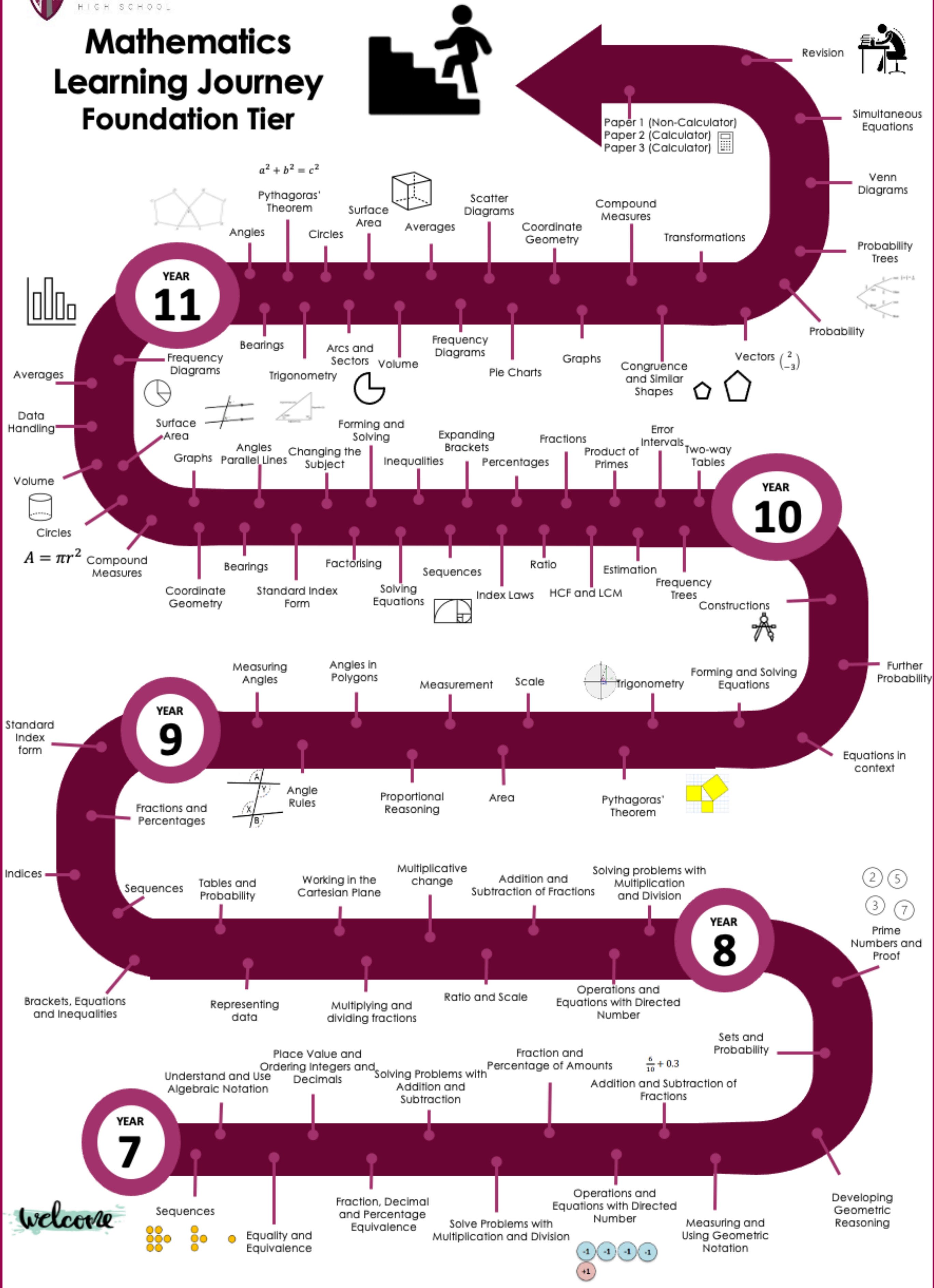
# Mathematics Learning Journey Foundation Tier



| Year 8 – Mathematics 2022-2023 | | | | | | |
|---|---|---|---|---|---|---|
| **Curriculum intent** | Through mathematics lessons we promote mathematical thinking to allow all students to achieve their mathematical potential and engage in the study of mathematics. Using a mastery style approach to mathematics allows all students to develop their fluency, reasoning and problem solving using the concrete, pictorial, abstract (CPA) approach. As students progress through their learning topics from previous learning with be interleaved into future learning so students develop application and skill links between different areas of mathematics.<br>In Year 8, students start their journey consolidating their knowledge of multiplication and division, considering both formal and mental methods to enable them to solve problems in a variety of ways. Moving on, students will further their understanding and become more confident with using directed numbers in a variety of numerical and algebraic applications to form a solid basis for further learning. Linking back to previous work on addition and subtraction from Year 7, students will further their knowledge using fractions and applying this to a variety of number types and using algebraic fractions. To complete the Autumn term, students will move on to ratio and proportion.<br>As Year 8 continues, students will continue to study multiplicative change before exploring and furthering understanding of multiplying and dividing fractions. As the spring terms continues, students will study the Cartesian Plane to notice the proportional relationships of line graphs and line segments. Completing the term, students will learn about different types of data and some statistical representations including scatter graphs and tables before moving on to studying probability.<br>In term 3, student will build upon their knowledge and apply it to indices calculations before moving on to further consolidate and expand their knowledge of fractions, decimals and percentages, before completing the year furthering their knowledge of standard index form. | | | | | |
| **Term** | **Autumn 1** | **Autumn 2** | **Spring 1** | **Spring 2** | **Summer 1** | **Summer 2** |
| **Knowledge** | • Solve problems with multiplication and division.<br>• Operations and equations with directed number. | • Addition and subtraction of fractions.<br>• Ratio and Scale.<br>• Multiplicative Change. | • Multiplicative Change. (cont.)<br>• Multiplying and dividing fractions. | • Working in the Cartesian Plane.<br>• Representing Data.<br>• Tables and Probability. | • Brackets, Equations and Inequalities.<br>• Sequences | • Indices<br>• Fractions and Percentages.<br>• Standard Index Form |
| **Term** | **Autumn 1** | **Autumn 2** | **Spring 1** | **Spring 2** | **Summer 1** | **Summer 2** |
| **Skills** | • Use the properties of multiplication and division, including the commutative associative laws of arithmetic<br>• Understand and use factors and multiples<br>• Multiply and divide integers and decimals by powers of 10 | • Understand representations of fractions<br>• Understand and use equivalent fractions.<br>• Convert between mixed numbers and fractions.<br>• Add and subtract proper fractions in any form. | • Explore relationships between similar shapes.<br>• Understand scale factors as multiplicative representations.<br>• Draw and interpret scale diagrams.<br>• Interpret maps using scale factors and ratios. | • Work with coordinates in all four quadrants.<br>• Identify and draw line that are parallel to the axes.<br>• Recognise and use the line $y = x$<br>• Recognise and use lines in the form $y = kx$<br>• Link $y = kx$ to direct proportion problems. | • Form algebraic expressions.<br>• Use directed number with algebra.<br>• Multiply out a single bracket.<br>• Factorise into a single bracket.<br>• Expand multiple single brackets and simplify.<br>• Expand a pair of binomials. | • Adding and subtracting expressions with indices.<br>• Simplify algebraic expressions by multiplying indices.<br>• Simplifying algebraic expressions by dividing indices.<br>• Using the addition and subtraction law for indices. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | • Convert between different metric units<br>• Use formal written methods for multiplication and division, applied to positive integers and decimals<br>• Understand and use order of operations<br>• Understand and use multiple representations of directed numbers<br>• Understand and use multiple representations of directed numbers<br>• Perform calculations that cross zero<br>• Complete calculations using all four operators involving direct numbers<br>• Use of a calculator with directed numbers<br>• Evaluate algebraic expressions involving directed numbers<br>• Understand and use two step equations<br>• Explore powers and roots. | • Add and subtract improper fractions and mixed numbers<br>• Use fractions in algebraic contexts<br>• Use equivalence to add and subtract decimals, percentages and fractions.<br>• Add and subtract simple algebraic fractions.<br>• Understand the meaning and representation of ratio and its notation.<br>• Solve problems involving the form 1:n or n:1.<br>• Solve proportional problems with two part ratios.<br>• Divide a value into given ratios<br>• Simplify ratios<br>• Express ratios is the form 1:n.<br>• Compare ratios and related fractions.<br>• Understand $\pi$ as the ratio between diameter and circumference.<br>• Understand the gradient of a line as a ratio.<br>• Solve problems involving direct proportion.<br>• Explore conversion graphs.<br>• Convert between currencies. | • Represent multiplication of fractions.<br>• Multiply a fraction by an integer.<br>• Find the product of a pair of unit fractions.<br>• Find the product of a pair of any fractions.<br>• Divide and integer by a fraction.<br>• Understand and use the reciprocal.<br>• Divide any pair of fractions.<br>• Multiply and divide improper and mixed fractions. | • Explore the gradient of the line $y = kx$<br>• Recognise and use lines of the form: $y = x + a$<br>• Explore graphs with negative gradient.<br>• Link graphs to linear sequences.<br>• Plot graphs of the form $y = mx + c$<br>• Explore non-linear graphs.<br>• Find the midpoint of a line segment.<br>• Draw and interpret scatter graphs.<br>• Understand and describe linear correlation.<br>• Draw and use line of best fit.<br>• Identify non-linear relationships.<br>• Identify different types of data.<br>• Read and interpret ungrouped and grouped frequency tables.<br>• Represent grouped discrete data.<br>• Represent continuous data grouped into equal classes.<br>• Represent data in two-way tables.<br>• Construct and find probabilities from sample space diagrams.<br>• Find probabilities from two-way tables and Venn diagrams. | • Solve equations including brackets.<br>• Form and solve equations with brackets.<br>• Understand and solve simple inequalities.<br>• Form and solve inequalities.<br>• Solve equations and inequalities with unknowns on both sides.<br>• Form and solve equations and inequalities with unknowns on both sides.<br>• Identify and use formulae, expressions, identities, and equations.<br>• Generate sequences given a rule in words.<br>• Generate sequences given a simple algebraic rule.<br>• Generate sequences given a complex algebraic rule.<br>• Find the rule for the nth term of a linear sequence.<br>• | • Exploring powers of powers.<br>• Convert fluently between key fractions, decimals and percentages.<br>• Calculate key fractions, decimals and percentages of an amount without a calculator.<br>• Calculate fractions decimals and percentages of an amount with a calculator.<br>• Convert between decimals and percentages greater than 100%<br>• Calculate percentage increase and decrease with a multiplier.<br>• Express one number as a fraction or percentage of another with and without a calculator.<br>• Work out percentage change.<br>• Choose appropriate methods to solve percentage problems.<br>• Find the original amount given a percentage.<br>• Investigate positive powers of 10.<br>• Work with numbers greater than 1 in standard form.<br>• Investigate negative powers of 10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | • Compare and order numbers in standard form.<br>• Calculate with numbers in standard form.<br>• Understand and use negative and fractional indices. |
| **Assessments** | 2 end of unit assessments. | 2 end of unit assessments. | 2 end of unit assessments. | 3 end of unit assessments. | 2 end of unit assessments. | 3 end of unit assessments. |
| **Enrichment** | • Make a how to use your calculator guide! It will come in helpful for future learning.<br>• You're planning an epic journey, use Google Earth to figure out where you will travel, and how far in total you will travel. Can you give distances in cm, m and km?<br>• Can you investigate average temperatures across the work, can you find very cold cities/places and compare them to very warm cities/places, Work out the differences.<br>• Try to keep practising your negative number skills! https://www.cimt.org.uk/projects/mepres/book7/bk7i15/bk7_15i1.htm & https://www.cimt.org.uk/projects/mepres/book7/bk7i15/bk7_15i2.htm | • Can you design a board game which tests your fraction arithmetic?<br>• How do prices differ in different countries? Try finding the price of an item in 4 different country and convert the currency into British Pound – which country is cheaper? | • Can you enlarge an image from a magazine by a scale factor? | • Looking at a newspaper or magazine, how many times do you see data displayed / represented?<br>• Learn about the Archimedean spiral and its links to the coordinates we have been learning about. https://nrich.maths.org/13746<br>• Can you make a treasure hunt using coordinates?<br>• Have you tried Desmos graphing tool? https://www.desmos.com/calculator Experiment with different equations to see how they appear on a Cartesian Plane. | • How did the machine guess your number? Can you work out the process it used? https://nrich.maths.org/7216<br>• Can you write a restaurant order for at least 8 friends using algebra and brackets? How could this help waiting staff? Are there any other real-life uses of brackets and algebraic expressions? | • Go shopping. Look around at the reductions in any shop – can you work out the percentage change?<br>• Can you design a poster to explain the laws of indices and standard form?<br>• Can you find the value of n using your knowledge of indices and algebra? https://nrich.maths.org/847 |

# Year 8 Maths - Autumn Term Knowledge Organiser - Solving Problems with multiplication and division

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Multiply | The result of multiplying a number by an integer. The times tables of a number |
| 2 | Product | The result of a multiplication calculation. |
| 3 | Multiples: | Found by multiplying any number by positive integers |
| 4 | Factor | Integers that multiply together to get another number. |
| 5 | Quotient | The result of a division |
| 6 | Divisor | The number we divide by |
| 7 | Mean | The average of the all values, whereby all of the values are added together and then divided by the number of values. |
| 8 | Equivalent | Something that is essentially the same or equal to something else |

**9 Factors**

A number that divides exactly into another number without a remainder. It is useful to write factors in pairs

Factors of 10
1, 2, 5, 10

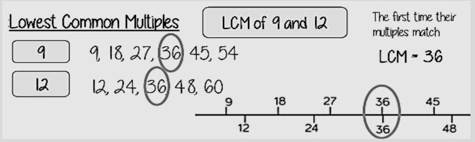
The number itself is always a factor

Factors of 4
1, 2, 4

Factors of 36
1, 2, 3, 4, 6, 9, 12, 18, 36

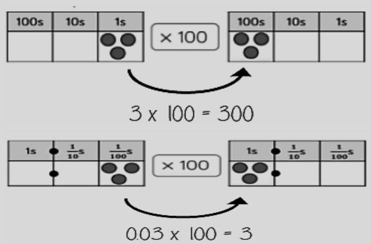
**10 Multiples**

The result of multiplying a number by an integer. The times tables of a number



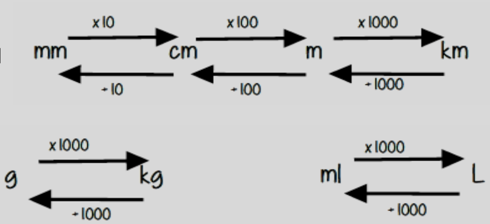

**11 Multiply and divide integers and decimals by powers of 10**

A number that divides exactly into another number without a remainder. It is useful to write factors in pairs



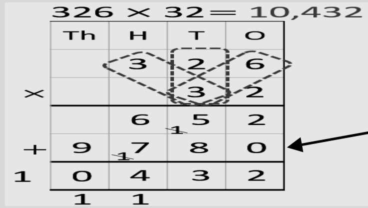

**12 Convert metric units**

When we convert from big unit to small unit we multiply and if we convert from small unit to big unit we divide.




**13 Use formal methods to multiply integers**

Long multiplication column




Make the unit 0 then carry on multiplying

**14 Use formal methods to multiply decimals**

Multiply 0.03 by 1.1= 0.033

Multiply 0.03 by 1.1= 0.033

the answer should have the same number of decimal places as are in both the numbers you are multiplying.

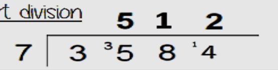
Multiply without decimal points: $3 \times 11 = 33$

0.03 has 2 decimal places, and 1.1 has 1 decimal place, so the answer has 3 decimal places: 0.033

**15 Use formal methods to divide integers and decimals.**

$3584 \div 7 = 512$

Short division



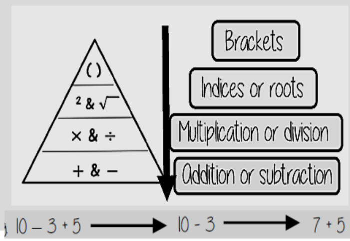

**Division with decimals**

The placeholder in division methods is essential –the decimal lines up on the dividend and the quotient

$24 \div 0.02 \rightarrow 24 \div 0.2 \rightarrow 240 \div 2$

All give the same solution as represent the same proportion .Multiply the values in proportion until the divisor becomes an integer.

**16 Order of operations**




Break down the calculation using the order of operations.

$6 \times 4 + 8 \times 2$

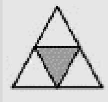
$24 + 16 = 40$

# Year 8 Maths Autumn Term Knowledge Organiser - Addition & subtraction of fractions

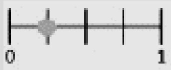
**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Denominator | The number below the line on a fraction. The number represent the total number of parts |
| 2 | Numerator | The number above the line on a fraction. The top number. Represents how many parts are taken. |
| 3 | Divide | To separate into parts |
| 4 | Greater than | To be more than or have more value than another number |
| 5 | Less than | To be smaller than or have a smaller value than another number. |
| 6 | Mixed number: | A number with an integer and a proper fraction |
| 7 | Improper fractions | A fraction where the numerator is greater than the denominator. |
| 8 | Unit fraction | A fraction where the numerator is one |
| 9 | Whole | An integer or when the numerator is the same value as the denominator. |
| 10 | Equivalent | Something that is essentially the same or equal to something else, but might have a difference in how it is represented. |

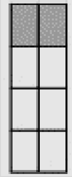
### 11 Representing Fractions



$\frac{1}{4}$ is represented in all the images







### 12 Add/Subtract unit fractions

With the same denominator ONLY the numerator is added or subtracted

$\frac{1}{12} + \frac{1}{12} - \frac{1}{12}$

$= \frac{2}{12}$

$\frac{1}{4} + \frac{1}{4}$



$= \frac{2}{4}$

### 13 Mixed numbers and fractions

An improper fraction has a numerator which is greater than the denominator. For example:

$\frac{7}{5}$ Improper fraction

A mixed number is made up of an integer and a proper fraction. For example:

$1\frac{2}{5}$ Mixed number

Fractions can be bigger than a whole

To convert between improper fractions and mixed numbers, we need to look at how many parts make up the whole.

The bar models show $\frac{13}{6}$.

There are 6 parts in the whole.

13 ÷ 6 = 2 remainder 1

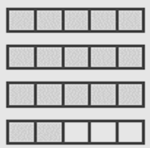
$\frac{13}{6} = 2\frac{1}{6}$

The bar models show $3\frac{2}{5}$.

There are 5 parts in the whole.

3 x 5 = 15

$\frac{15}{5} + \frac{2}{5} = \frac{17}{5}$



### 14 Adding or Subtracting Fractions

Find the LCM of the denominators to find a common denominator. Use equivalent fractions to change each fraction to the common denominator. Then just add or subtract the numerators and keep the denominator the same

$\frac{2}{3} + \frac{4}{5}$

Multiples of 3: 3, 6, 9, 12, 15..
Multiples of 5: 5, 10, 15..
LCM of 3 and 5 = 15

$\frac{2}{3} = \frac{10}{15}$

$\frac{4}{5} = \frac{12}{15}$

$\frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$

### 15 Understand and use equivalent fractions.

Equivalent fractions have different numerators and denominators but share the same value.

$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$

### 16 Add and subtract proper fractions and mixed numbers.

Use the bar models to help you work out the calculation.

$1\frac{1}{4} + \frac{3}{8} = 1\frac{2}{8} + \frac{3}{8} = 1 + \frac{5}{8} = 1\frac{5}{8}$

$1\frac{1}{4} + \frac{3}{8} = \frac{5}{4} + \frac{3}{8} = \frac{10}{8} + \frac{3}{8} = \frac{13}{8} = 1\frac{5}{8}$

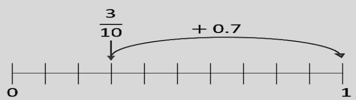
### 17 Use equivalence to add and subtract decimals and fractions

**Example:** Convert decimal to equivalent fraction 0.7 to 7/10 then add these fraction together.

$\frac{3}{10} + 0.7$

$0.3 + 0.7 = 1$

$\frac{3}{10} + \frac{7}{10} = \frac{10}{10} = 1$



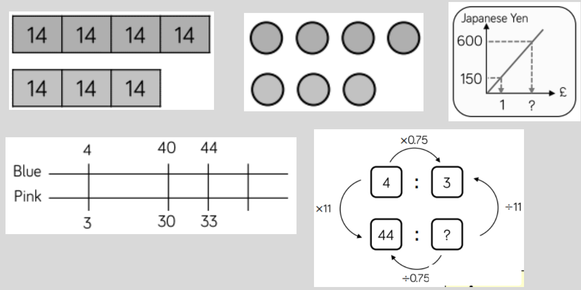
# Year 8 Mathematics Knowledge Organiser – Ratio and Scale

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Ratio | Used to compare values; says how much of thing there is, compared to another thing. |
| 2 | Proportion | When two ratios or fractions are equal to each other. |
| 3 | Multiplier | The number that we are multiplying by. |
| 4 | Placeholder | Something that holds a place in a number, e.g. zero. |
| 5 | Factors | Numbers that we can multiply together to get another number. Numbers that go into another number. |
| 6 | Equivalent | Having the same value. |
| 7 | Scale | The relationship/ratio between two sets of measurements. |
| 8 | Circumference | The perimeter (the distance around the outside) of a circle. |
| 9 | Diameter | The distance from one point on a circle to another point on a circle, through the centre. The longest distance across the circle. |

## 10 Representing Ratios

Ratios can be represented in many different ways:




## 11 Ratio Notation

Ratios are represented as numbers with colons in between, for example 3:1.
The order of the numbers in the ratio is always important; this tells us what the information is about.
Most ratios have two parts, but ratios can have more than two parts, for example 2:3:1.

## 12 Solving Problems in the Ratio 1:n

The ratio 1:n means any ratio beginning with 1, followed by any number, for example 1:1, 1:4, 1:200 etc.
n can be any number, including decimals, but for this topic, n will always be an **integer** (a whole number).

## 13 Dividing Values into Given Ratios

We can use a bar model to help us understand how to divide values into a given ratio.

<u>Example</u>
Share £56 in the ratio 2:5.


There are 7 parts altogether, so we can share the £56 into these 7 parts by doing 56 ÷ 7 = 8.

Now we know that 1 part = £8, we can work out how much 2 parts are (2 x 8 = £16) and how much 5 parts are (5 x 8 = £40).

We can check our answer is correct by adding together our amounts and seeing if we get our original value: 16 + 40 = 56, so we are correct.

## 14 Expressing Ratios in Simplest Form

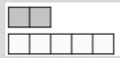
We can simplify ratios by finding **factors** in all parts of the ratio.

<u>Example</u>
Simplify the ratio 12:18.
We know the highest **factor** of both 12 and 18 is 6, so we can divide both numbers by 6.
12 ÷ 6 = 2
18 ÷ 6 = 3
So, the simplified ratio is 2:3.
(Remember, the order is important, this shouldn't change!)

## 15 Comparing Ratios and Fractions

We can use representations (like those in section 8) to help us compare ratios and fractions.

<u>Example</u>



| | *Ratio* | *Fraction* |
|---|---|---|
| | Red : Yellow | $\frac{2}{7}$ are red |
| | 2 : 5 | $\frac{5}{7}$ are yellow |

## 16 Understanding π as a Ratio

π is a number that represents the ratio of the **circumference** of a circle to the **diameter** of a circle, so $\pi = \frac{C}{d}$.
This can be rearranged to find the formula for the **circumference** of a circle: $C = \pi \times d$.
We can substitute values of the **diameter** into this formula to calculate the **circumference** of any circle.

<u>Example</u>
The radius of a circle is 8m. Find the circumference.
C = π x 8 = 25.132… m$^2$

## 17 Understanding Gradient as a Ratio

**Gradient (or slope)** describes how steep a line is.
We can calculate the gradient of a line using the ratio of width : height of a triangle.
Once we make the width equal 1, the height tells us the gradient of the line.

<u>Example</u>
Here the width : height ratio is 2:4.
This can be simplified to 1:2.
The width is 1, and the height is 2, so the gradient is 2.

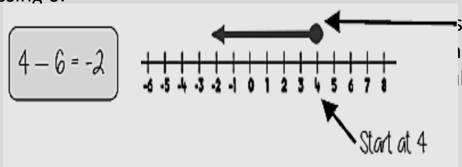
# Year 8 Maths - Knowledge Organiser - Operations and equations with directed number - Autumn Term

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Positive | A value greater than zero. |
| 2 | Negative: | A value less than zero. |
| 3 | Ascending | An arrangement of values from smallest to largest. |
| 4 | Descending | An arrangement of values from largest to smallest. |
| 5 | Increase | To become greater in value. |
| 6 | Decrease | To become less in value. |
| 7 | Add | To bring two or more numbers together. |
| 8 | Subtract | To take away a number(s) from another number. |
| 9 | Minus | To take away a number(s) from another number. (The same as to subtract.) |
| 10 | Zero Pair | When a set of two numbers that sum zero. |
| 11 | Square Root | A factor of a number that, when multiplied by itself, gives the original number, eg 4 is the square root of 16. |
| 12 | Power | A base number raised to an exponent, where the base number is the factor that is multiplied by itself and the exponent denotes the number of times the base number is multiplied. |

**13** Understand and use representations of directed numbers

Number lines are useful to help you visualise the calculation crossing 0.




se the number
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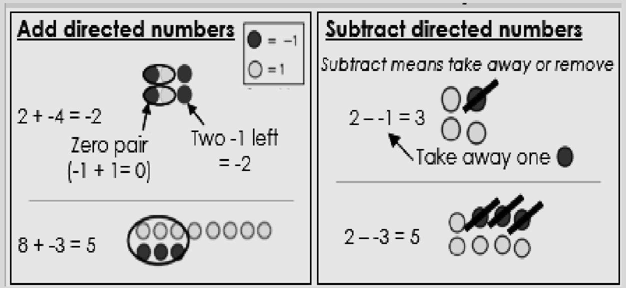
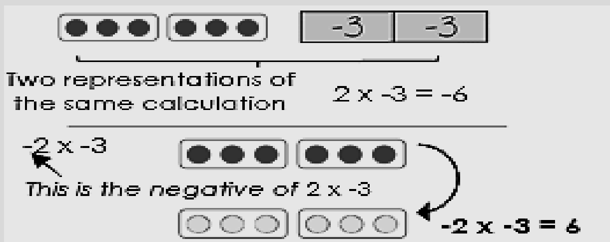
btraction of 6

**14** Add and subtracting negative numbers




**15** Multiply and Divide directed numbers




**16** Evaluate algebraic expressions

With negative numbers the brackets are important so that it performs -4 x -4

Substituted accurately and maintained the correct order of calculations throughout.

a = 5 b = -4

$a^2 = 5^2$ $b^2 = (-4)^2$

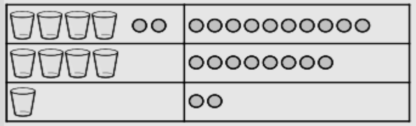
$a^2 = 25$ $b^2 = 16$

Brackets around negative substitutions helps remove calculation errors

2a –b = 2 x 5 –(-4) =
10 + 4 = 14

**17** Solve two-step equations

Use the bar model to write an equation and solve it to find the unknown value.
How does the diagram connect to the calculation?



$$\begin{aligned} 4x + 2 &= 10 \\ -2 \quad & \quad -2 \\ 4x &= 8 \\ \div 4 \quad & \quad \div 4 \\ x &= 2 \end{aligned}$$

**18** Roots of positive numbers

**Understanding square roots**

A square number comes from multiplying a number by itself.

4 x 4 =16 therefore 16 is a square number.
16 though also has another square root, this is because:
-4 x -4 =16
Every number has a positive and negative square root.

**What is the inverse of squaring a number?**

The inverse of squaring a number is to find the square root of a number.

$4^2 = 16$ $(-4)^2 = 16$

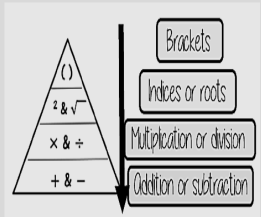
$\sqrt{16} = 4$ and $-4$

Remember square root have a positive and negative e value.


$\sqrt{10}$
3.162277 ...

**19** Order of Operations (BIDMAS)

This is the order in which we do calculations:
Brackets
Indices
Division or Multiplication
Addition or Subtraction



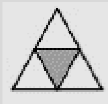

REMEMBER
If you have a calculation that only has addition and subtraction, you go from left to right. The same applies if you only have division or multiplication.

# Year 8 Maths Autumn Term Knowledge Organiser - Addition & subtraction of fractions

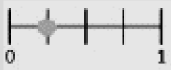
**Key Vocabulary:**

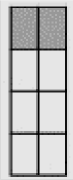
| | | |
|---|---|---|
| 1 | Denominator | The number below the line on a fraction. The number represent the total number of parts |
| 2 | Numerator | The number above the line on a fraction. The top number. Represents how many parts are taken. |
| 3 | Divide | To separate into parts |
| 4 | Greater than | To be more than or have more value than another number |
| 5 | Less than | To be smaller than or have a smaller value than another number. |
| 6 | Mixed number: | A number with an integer and a proper fraction |
| 7 | Improper fractions | A fraction where the numerator is greater than the denominator. |
| 8 | Unit fraction | A fraction where the numerator is one |
| 9 | Whole | An integer or when the numerator is the same value as the denominator. |
| 10 | Equivalent | Something that is essentially the same or equal to something else, but might have a difference in how it is represented. |

**11 Representing Fractions**



$\frac{1}{4}$ is represented in all the images

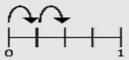


**12 Add/Subtract unit fractions**

With the same denominator ONLY the numerator is added or subtracted

$\frac{1}{12} + \frac{1}{12} - \frac{1}{12}$  $= \frac{2}{12}$

$\frac{1}{4} + \frac{1}{4}$  $= \frac{2}{4}$


**13 Mixed numbers and fractions**

An improper fraction has a numerator which is greater than the denominator. For example:

$\frac{7}{5}$ Improper fraction

A mixed number is made up of an integer and a proper fraction. For example:

$1\frac{2}{5}$ Mixed number

Fractions can be bigger than a whole

To convert between improper fractions and mixed numbers, we need to look at how many parts make up the whole.

The bar models show $\frac{13}{6}$.

There are 6 parts in the whole.

13 ÷ 6 = 2 remainder 1

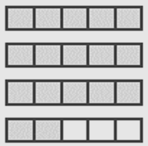
$\frac{13}{6} = 2\frac{1}{6}$

The bar models show $3\frac{2}{5}$.

There are 5 parts in the whole.

3 x 5 = 15

$\frac{15}{5} + \frac{2}{5} = \frac{17}{5}$



**14 Adding or Subtracting Fractions**

Find the LCM of the denominators to find a common denominator. Use equivalent fractions to change each fraction to the common denominator. Then just add or subtract the numerators and keep the denominator the same

$\frac{2}{3} + \frac{4}{5}$

Multiples of 3: 3, 6, 9, 12, 15..
Multiples of 5: 5, 10, 15..
LCM of 3 and 5 = 15

$\frac{2}{3} = \frac{10}{15}$

$\frac{4}{5} = \frac{12}{15}$

$\frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$

**15 Understand and use equivalent fractions.**

Equivalent fractions have different numerators and denominators but share the same value.

$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$

**16 Add and subtract proper fractions and mixed numbers.**

Use the bar models to help you work out the calculation.

$1\frac{1}{4} + \frac{3}{8} = 1\frac{2}{8} + \frac{3}{8} = 1 + \frac{5}{8} = 1\frac{5}{8}$

$1\frac{1}{4} + \frac{3}{8} = \frac{5}{4} + \frac{3}{8} = \frac{10}{8} + \frac{3}{8} = \frac{13}{8} = 1\frac{5}{8}$

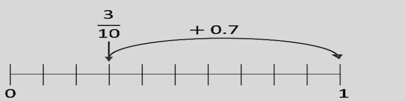
**17 Use equivalence to add and subtract decimals and fractions**

**Example:** Convert decimal to equivalent fraction 0.7 to 7/10 then add these fraction together.

$\frac{3}{10} + 0.7$

$0.3 + 0.7 = 1$

$\frac{3}{10} + \frac{7}{10} = \frac{10}{10} = 1$



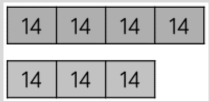
# Year 8 Mathematics Knowledge Organiser – Ratio and Scale

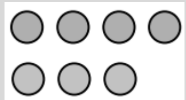
**Key Vocabulary:**

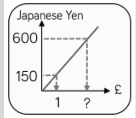
| | | |
|---|---|---|
| 1 | Ratio | Used to compare values; says how much of thing there is, compared to another thing. |
| 2 | Proportion | When two ratios or fractions are equal to each other. |
| 3 | Multiplier | The number that we are multiplying by. |
| 4 | Placeholder | Something that holds a place in a number, e.g. zero. |
| 5 | Factors | Numbers that we can multiply together to get another number. Numbers that go into another number. |
| 6 | Equivalent | Having the same value. |
| 7 | Scale | The relationship/ratio between two sets of measurements. |
| 8 | Circumference | The perimeter (the distance around the outside) of a circle. |
| 9 | Diameter | The distance from one point on a circle to another point on a circle, through the centre. The longest distance across the circle. |

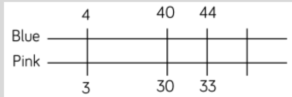
## 10 Representing Ratios

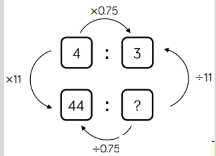
Ratios can be represented in many different ways:






## 11 Ratio Notation

Ratios are represented as numbers with colons in between, for example 3:1.
The order of the numbers in the ratio is always important; this tells us what the information is about.
Most ratios have two parts, but ratios can have more than two parts, for example 2:3:1.

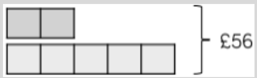
## 12 Solving Problems in the Ratio 1:n

The ratio 1:n means any ratio beginning with 1, followed by any number, for example 1:1, 1:4, 1:200 etc.
n can be any number, including decimals, but for this topic, n will always be an **integer** (a whole number).

## 13 Dividing Values into Given Ratios

We can use a bar model to help us understand how to divide values into a given ratio.

<u>Example</u>
Share £56 in the ratio 2:5.




There are 7 parts altogether, so we can share the £56 into these 7 parts by doing 56 ÷ 7 = 8.

Now we know that 1 part = £8, we can work out how much 2 parts are (2 x 8 = £16) and how much 5 parts are (5 x 8 = £40).

We can check our answer is correct by adding together our amounts and seeing if we get our original value: 16 + 40 = 56, so we are correct.

## 14 Expressing Ratios in Simplest Form

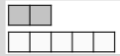
We can simplify ratios by finding **factors** in all parts of the ratio.

<u>Example</u>
Simplify the ratio 12:18.
We know the highest **factor** of both 12 and 18 is 6, so we can divide both numbers by 6.
12 ÷ 6 = 2
18 ÷ 6 = 3
So, the simplified ratio is 2:3.
(Remember, the order is important, this shouldn't change!)

## 15 Comparing Ratios and Fractions

We can use representations (like those in section 8) to help us compare ratios and fractions.

<u>Example</u>



| | *Ratio* | *Fraction* |
|---|---|---|
| | Red : Yellow | $\frac{2}{7}$ are red |
| | 2 : 5 | $\frac{5}{7}$ are yellow |

## 16 Understanding π as a Ratio

π is a number that represents the ratio of the **circumference** of a circle to the **diameter** of a circle, so $\pi = \frac{C}{d}$.
This can be rearranged to find the formula for the **circumference** of a circle: $C = \pi \times d$.
We can substitute values of the **diameter** into this formula to calculate the **circumference** of any circle.

<u>Example</u>
The radius of a circle is 8m. Find the circumference.
C = π x 8 = 25.132… $m^2$

## 17 Understanding Gradient as a Ratio

**Gradient (or slope)** describes how steep a line is.
We can calculate the gradient of a line using the ratio of width : height of a triangle.
Once we make the width equal 1, the height tells us the gradient of the line.

<u>Example</u>
Here the width : height ratio is 2:4.
This can be simplified to 1:2.
The width is 1, and the height is 2, so the gradient is 2.

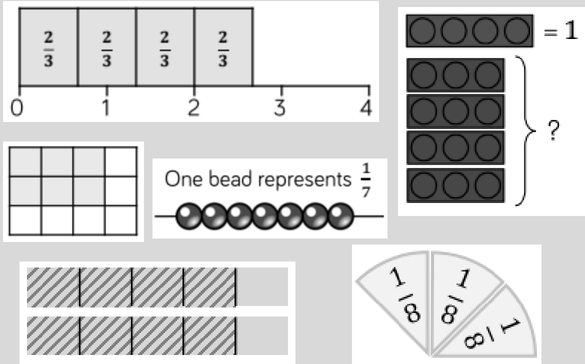
# Year 8 Spring Term KS3 Mathematics Knowledge Organiser – Multiplying and Dividing Fractions

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Unit Fraction | A fraction with 1 as its numerator, and an integer (whole number) as its denominator. E.g. ¼ |
| 2 | Numerator | The top number in a fraction. |
| 3 | Denominator | The bottom number in a fraction. |
| 4 | Product | The answer when two or more values are multiplied together. |
| 5 | Whole | All of something. A thing that is complete in itself. |
| 6 | Non-unit Fraction | A fraction where the numerator is greater than 1. E.g. ¾ |
| 7 | Commutative | An operation is commutative when you can change the order of the calculation and still get the same answer. Both addition and multiplication are commutative. |
| 8 | Quotient | The answer we get after we divide one number by another. |
| 9 | Reciprocal | The reciprocal of a number is always 1 divided by the number. E.g. the reciprocal of 2 is ½. When we multiply a number by its reciprocal, we get 1. E.g. 2 x ½ = 1. |

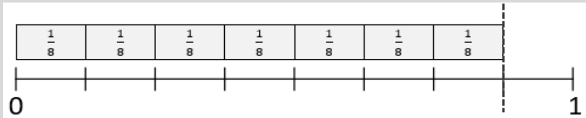
## 10 Representing Fraction Multiplication

Fraction multiplication can be represented in many different ways, using the idea of repeated addition as well as pictures/physical objects and bar models.




## 11 Multiplying a Fraction by an Integer

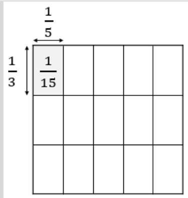
We can use a number line to understand how to multiply a fraction by an integer. For example: $7 \times \frac{1}{8} = \frac{7}{8}$.




## 12 Finding the Product of Unit Fractions

We can use a grid to understand how to find the product of a pair of unit fractions. Remember, each side of the original grid has a unit length of 1.

For example: $\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$

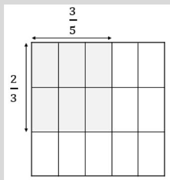



## 13 Finding the Product of Any Fractions

We can continue to use a grid to understand how to find the product of any fractions. We should remember to simplify if possible.

For example: $\frac{3}{5} \times \frac{2}{3} = \frac{6}{15} = \frac{2}{5}$

One way to quickly multiply fractions is to multiply the numerators and multiply the denominators.

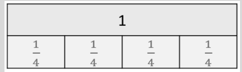



## 14 Dividing an Integer by a Fraction

We can use bar models to understand how to divide an integer by a fraction, e.g. $1 \div \frac{1}{4} = 4$.

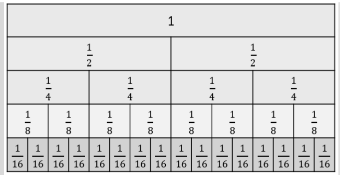
We can link dividing by a fraction with multiplying by an integer to help us understand the relationship between the two.

For example: $3 \div \frac{1}{4} = 12$ **and** $3 \times 4 = 12$.




## 15 Dividing a Fraction by a Unit Fraction

We can use a fraction wall to help us divide a fraction by a unit fraction. Think about how many unit fractions we would need to make the original fraction. E.g. $\frac{1}{2} \div \frac{1}{16} = 8$.




## 16 Understanding and Using the Reciprocal

We need to know that:

- ❑ The reciprocal of a number is always 1 divided by the number.
- ❑ Division is the same as multiplying by the reciprocal.
- ❑ A number multiplied by its reciprocal is always 1.

For example: $7 \div \frac{1}{5} = 35$ **and** $7 \times 5 = 35$.

## 17 Dividing any Pair of Fractions

Now that we know dividing by a number is the same as multiplying by it's reciprocal, we can apply this to divide any pair of fractions.

For example:

$5 \div \frac{2}{3} = 5 \times \frac{3}{2} = \frac{15}{2} = 7\frac{1}{2}$

$\frac{5}{9} \div \frac{2}{3} = \frac{5}{9} \times \frac{3}{2} = \frac{15}{18} = \frac{5}{6}$

## 18 Multiplying and Dividing Improper and Mixed Fractions

When multiplying mixed numbers, we can convert them into improper fractions first before multiplying the numerators and denominators, then simplifying.

Another way would be to use a grid method, splitting up the mixed number into integers and fractions, e.g. $2\frac{4}{5} \times 1\frac{6}{11}$

| × | 2 | $\frac{4}{5}$ |
|---|---|---|
| 1 | 2 | $\frac{4}{5}$ |
| $\frac{6}{11}$ | $\frac{12}{11}$ | $\frac{24}{55}$ |

## 19 Multiplying and Dividing Algebraic Fractions

Although we are using algebra, multiplying and dividing algebraic fractions follow the same rules as numerical fractions.

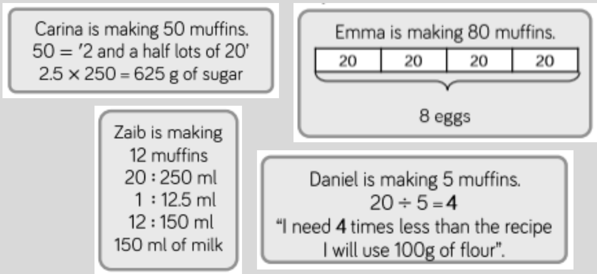
# Year 8 Spring Term Mathematics Knowledge Organiser – Multiplicative Change

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Proportion | When two ratios or fractions are equal to each other. |
| 2 | Ratio | Used to compare values; says how much of thing there is, compared to another thing. |
| 3 | Variable | A symbol for a value we do not know yet, usually a letter like x or y.<br>E.g. in x + 2 = 6, x is the variable. |
| 4 | Conversion | Changing a value or expression from one form to another. |
| 5 | Approximation | A result that is not exact, but close enough to be used. |
| 6 | Estimation | Finding a value that is close enough to the right answer, usually with some thought or calculation involved. |
| 7 | Exchange rate | Tells us the value of one currency (type of money in a particular country) in terms of another currency. |
| 8 | Corresponding | Referring to two (or more) things that appear in the same place, in two similar situations. |
| 9 | Similar | Two shapes are similar when one can become the other after a resize, flip, slide or turn. |
| 10 | Scale factor | The ratio between corresponding measurements of an object and a representation of that object. |

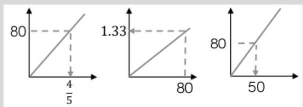
## 11 Direct Proportion

Two things are directly proportional if: as one amount increases (or decreases), the other amount increases (or decreases) at the same rate.
We can use lots of different methods to solve problems with direct proportion, such as bar models, ratios, fractions and the unitary method (finding the value of one).




## 12 Conversion Graphs

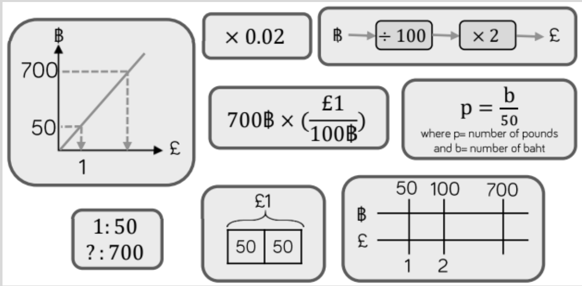
Conversion graphs can be used to convert between many different things, for example: currency, temperature, weights, distances, time, numbers etc.
It is important to label the axes on a conversion graph and to make sure the scale is going up in equal amounts.




## 13 Converting between Currencies

We can convert between currencies using lots of different methods.

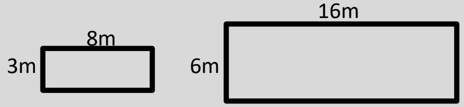
Example
1 British pound (£) is approximately 50 Thai Baht (฿). Convert 700฿ into pounds.



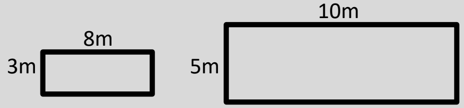

## 14 Ratio between Similar Shapes

Corresponding lengths on similar shapes are always in the same ratio.

Example




3m : 6m
8m : 16m
These lengths are in ratio so the rectangles are similar.




3m : 5m
8m : 10m
These lengths are not in ratio, so the rectangles are not similar.

## 15 Understanding Scale Factors

A scale factor tells us the ratio between corresponding measurements of an actual object and a copy of the object.
If the scale factor is bigger than 1, the copy will be larger.
If the scale factor is less than 1 (e.g. ½), the copy will be smaller.

## 16 Drawing and Interpreting Scale Diagrams

Scale diagrams (or drawings) are used to represent a smaller or larger object, shape or image.
The scale used will depend on the reduction or enlargement of the object.
Some common scale ratios that are used:

- A medium sized wall map of the World (1:30,000,000 which represents 1cm to 300km)
- A road map for motorists (1:250,000 which represents 1cm to 2.5km)
- An Ordnance survey map for walkers or hikers (1:25,000 which represents 1cm to 250m)
- An architects drawing (1:100 which represents 1cm to 1m)

## 17 Interpreting Maps with Scale Factors

We can use scale factors to interpret maps.

Example
If the scale is 1:25,000, this means 1cm on the map is 25,000cm in real life.

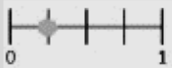
# Year 8 Maths Summer Term Knowledge Organiser - Addition & Subtraction of Fractions

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Denominator | The number below the line on a fraction. The number represent the total number of parts |
| 2 | Numerator | The number above the line on a fraction. The top number. Represents how many parts are taken. |
| 3 | Divide | To separate into parts |
| 4 | Greater than | To be more than or have more value than another number |
| 5 | Less than | To be smaller than or have a smaller value than another number. |
| 6 | Mixed number: | A number with an integer and a proper fraction |
| 7 | Improper fractions | A fraction where the numerator is greater than the denominator. |
| 8 | Unit fraction | A fraction where the numerator is one |
| 9 | Whole | An integer or when the numerator is the same value as the denominator. |
| 10 | Equivalent | Something that is essentially the same or equal to something else, but might have a difference in how it is represented. |

## 11 Representing Fractions

$\frac{1}{4}$ is represented in all the images




## 12 Add/Subtract unit fractions

With the same denominator ONLY the numerator is added or subtracted

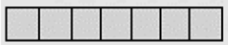
$\frac{1}{12}+\frac{1}{12}-\frac{1}{12}$  $=\frac{2}{12}$

$\frac{1}{4}+\frac{1}{4}$  $=\frac{2}{4}$

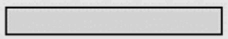


## 13 Mixed numbers and fractions

An improper fraction has a numerator which is greater than the denominator. For example:

 $\frac{7}{5}$ Improper fraction

A mixed number is made up of an integer and a proper fraction. For example:

 $1\frac{2}{5}$ Mixed number

Fractions can be bigger than a whole

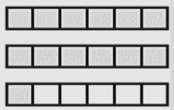
To convert between improper fractions and mixed numbers, we need to look at how many parts make up the whole.

The bar models show $\frac{13}{6}$.

There are 6 parts in the whole.

$13 \div 6 = 2$ remainder 1

$\frac{13}{6} = 2\frac{1}{6}$

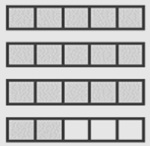


The bar models show $3\frac{2}{5}$.

There are 5 parts in the whole.

$3 \times 5 = 15$

$\frac{15}{5} + \frac{2}{5} = \frac{17}{5}$



## 14 Adding or Subtracting Fractions

Find the LCM of the denominators to find a common denominator. Use equivalent fractions to change each fraction to the common denominator. Then just add or subtract the numerators and keep the denominator the same

$\frac{2}{3}+\frac{4}{5}$

Multiples of 3: 3, 6, 9, 12, 15..
Multiples of 5: 5, 10, 15..
LCM of 3 and 5 = 15

$\frac{2}{3}=\frac{10}{15}$

$\frac{4}{5}=\frac{12}{15}$

$\frac{10}{15}+\frac{12}{15}=\frac{22}{15}=1\frac{7}{15}$

## 15 Understand and use equivalent fractions.

Equivalent fractions have different numerators and denominators but share the same value.

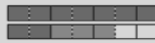
$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$

## 16 Add and subtract proper fractions and mixed numbers.

Use the bar models to help you work out the calculation.

$1\frac{1}{4}+\frac{3}{8}=1\frac{2}{8}+\frac{3}{8}=1+\frac{5}{8}=1\frac{5}{8}$

$1\frac{1}{4}+\frac{3}{8}=\frac{5}{4}+\frac{3}{8}=\frac{10}{8}+\frac{3}{8}=\frac{13}{8}=1\frac{5}{8}$



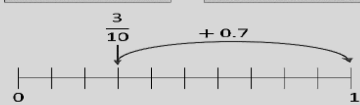
## 17 Use equivalence to add and subtract decimals and fractions

**Example:** Convert decimal to equivalent fraction 0.7 to 7/10 then add these fraction together.

$\frac{3}{10}+0.7$

$0.3+0.7=1$

$\frac{3}{10}+\frac{7}{10}=\frac{10}{10}=1$



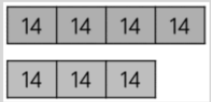
# Year 8 Mathematics Knowledge Organiser – Ratio and Scale

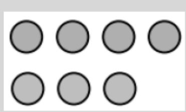
**Key Vocabulary:**

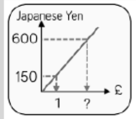
| | | |
|---|---|---|
| 1 | Ratio | Used to compare values; says how much of thing there is, compared to another thing. |
| 2 | Proportion | When two ratios or fractions are equal to each other. |
| 3 | Multiplier | The number that we are multiplying by. |
| 4 | Placeholder | Something that holds a place in a number, e.g. zero. |
| 5 | Factors | Numbers that we can multiply together to get another number. Numbers that go into another number. |
| 6 | Equivalent | Having the same value. |
| 7 | Scale | The relationship/ratio between two sets of measurements. |
| 8 | Circumference | The perimeter (the distance around the outside) of a circle. |
| 9 | Diameter | The distance from one point on a circle to another point on a circle, through the centre. The longest distance across the circle. |

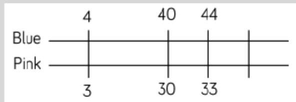
## 10 Representing Ratios

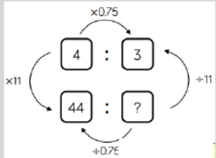
Ratios can be represented in many different ways:






## 11 Ratio Notation

Ratios are represented as numbers with colons in between, for example 3:1.

The order of the numbers in the ratio is always important; this tells us what the information is about.

Most ratios have two parts, but ratios can have more than two parts, for example 2:3:1.

## 12 Solving Problems in the Ratio 1:n

The ratio 1:n means any ratio beginning with 1, followed by any number, for example 1:1, 1:4, 1:200 etc.

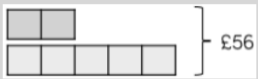
n can be any number, including decimals, but for this topic, n will always be an **integer** (a whole number).

## 13 Dividing Values into Given Ratios

We can use a bar model to help us understand how to divide values into a given ratio.

<u>Example</u>

Share £56 in the ratio 2:5.




There are 7 parts altogether, so we can share the £56 into these 7 parts by doing 56 ÷ 7 = 8.

Now we know that 1 part = £8, we can work out how much 2 parts are (2 x 8 = £16) and how much 5 parts are (5 x 8 = £40).

We can check our answer is correct by adding together our amounts and seeing if we get our original value: 16 + 40 = 56, so we are correct.

## 14 Expressing Ratios in Simplest Form

We can simplify ratios by finding **factors** in all parts of the ratio.

<u>Example</u>

Simplify the ratio 12:18.

We know the highest **factor** of both 12 and 18 is 6, so we can divide both numbers by 6.

12 ÷ 6 = 2

18 ÷ 6 = 3

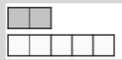
So, the simplified ratio is 2:3.

(Remember, the order is important, this shouldn't change!)

## 15 Comparing Ratios and Fractions

We can use representations (like those in section 8) to help us compare ratios and fractions.

<u>Example</u>



| | *Ratio* | *Fraction* |
|---|---|---|
| | Red : Yellow | $\frac{2}{7}$ are red |
| | 2 : 5 | $\frac{5}{7}$ are yellow |

## 16 Understanding π as a Ratio

π is a number that represents the ratio of the **circumference** of a circle to the **diameter** of a circle, so $\pi = \frac{C}{d}$.

This can be rearranged to find the formula for the **circumference** of a circle: $C = \pi \times d$.

We can substitute values of the **diameter** into this formula to calculate the **circumference** of any circle.

<u>Example</u>

The radius of a circle is 8m. Find the circumference.

C = π x 8 = 25.132... $m^2$

## 17 Understanding Gradient as a Ratio

**Gradient (or slope)** describes how steep a line is.

We can calculate the gradient of a line using the ratio of width : height of a triangle.

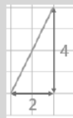
Once we make the width equal 1, the height tells us the gradient of the line.

<u>Example</u>

Here the width : height ratio is 2:4.

This can be simplified to 1:2.

The width is 1, and the height is 2, so the gradient is 2.



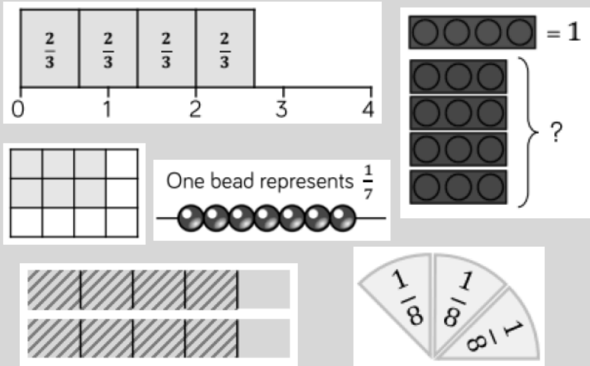
# Year 8 Summer Term KS3 Mathematics Knowledge Organiser – Multiplying and Dividing Fractions

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Unit Fraction | A fraction with 1 as its numerator, and an integer (whole number) as its denominator. E.g. ¼ |
| 2 | Numerator | The top number in a fraction. |
| 3 | Denominator | The bottom number in a fraction. |
| 4 | Product | The answer when two or more values are multiplied together. |
| 5 | Whole | All of something. A thing that is complete in itself. |
| 6 | Non-unit Fraction | A fraction where the numerator is greater than 1. E.g. ¾ |
| 7 | Commutative | An operation is commutative when you can change the order of the calculation and still get the same answer. Both addition and multiplication are commutative. |
| 8 | Quotient | The answer we get after we divide one number by another. |
| 9 | Reciprocal | The reciprocal of a number is always 1 divided by the number. E.g. the reciprocal of 2 is ½. When we multiply a number by its reciprocal, we get 1. E.g. 2 x ½ = 1. |

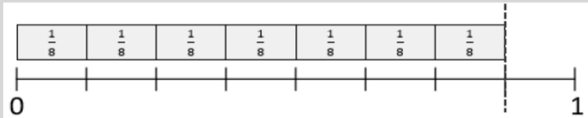
## 10 Representing Fraction Multiplication

Fraction multiplication can be represented in many different ways, using the idea of repeated addition as well as pictures/physical objects and bar models.




## 11 Multiplying a Fraction by an Integer

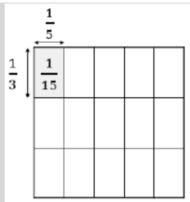
We can use a number line to understand how to multiply a fraction by an integer. For example: $7 \times \frac{1}{8} = \frac{7}{8}$.



## 12 Finding the Product of Unit Fractions

We can use a grid to understand how to find the product of a pair of unit fractions. Remember, each side of the original grid has a unit length of 1.

For example: $\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$

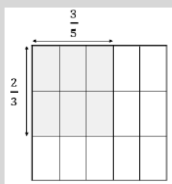


## 13 Finding the Product of Any Fractions

We can continue to use a grid to understand how to find the product of any fractions. We should remember to simplify if possible.

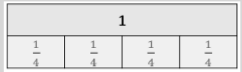
For example: $\frac{3}{5} \times \frac{2}{3} = \frac{6}{15} = \frac{2}{5}$

One way to quickly multiply fractions is to multiply the numerators and multiply the denominators.



## 14 Dividing an Integer by a Fraction

We can use bar models to understand how to divide an integer by a fraction, e.g. $1 \div \frac{1}{4} = 4$.

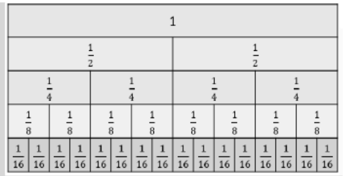


We can link dividing by a fraction with multiplying by an integer to help us understand the relationship between the two.

For example: $3 \div \frac{1}{4} = 12$ and $3 \times 4 = 12$.

## 15 Dividing a Fraction by a Unit Fraction

We can use a fraction wall to help us divide a fraction by a unit fraction. Think about how many unit fractions we would need to make the original fraction. E.g. $\frac{1}{2} \div \frac{1}{16} = 8$.



## 16 Understanding and Using the Reciprocal

We need to know that:

- The reciprocal of a number is always 1 divided by the number.
- Division is the same as multiplying by the reciprocal.
- A number multiplied by its reciprocal is always 1.

For example: $7 \div \frac{1}{5} = 35$ and $7 \times 5 = 35$.

## 17 Dividing any Pair of Fractions

Now that we know dividing by a number is the same as multiplying by it's reciprocal, we can apply this to divide any pair of fractions.

For example:

$5 \div \frac{2}{3} = 5 \times \frac{3}{2} = \frac{15}{2} = 7\frac{1}{2}$

$\frac{5}{9} \div \frac{2}{3} = \frac{5}{9} \times \frac{3}{2} = \frac{15}{18} = \frac{5}{6}$

## 18 Multiplying and Dividing Improper and Mixed Fractions

When multiplying mixed numbers, we can convert them into improper fractions first before multiplying the numerators and denominators, then simplifying.

Another way would be to use a grid method, splitting up the mixed number into integers and fractions, e.g. $2\frac{4}{5} \times 1\frac{6}{11}$

| $\times$ | 2 | $\frac{4}{5}$ |
|---|---|---|
| 1 | 2 | $\frac{4}{5}$ |
| $\frac{6}{11}$ | $\frac{12}{11}$ | $\frac{24}{55}$ |

## 19 Multiplying and Dividing Algebraic Fractions

Although we are using algebra, multiplying and dividing algebraic fractions follow the same rules as numerical fractions.

# Year 8 Summer Term Mathematics Knowledge Organiser – Multiplicative Change

**Key Vocabulary:**

| | | |
|---|---|---|
| 1 | Proportion | When two ratios or fractions are equal to each other. |
| 2 | Ratio | Used to compare values; says how much of thing there is, compared to another thing. |
| 3 | Variable | A symbol for a value we do not know yet, usually a letter like x or y. E.g. in x + 2 = 6, x is the variable. |
| 4 | Conversion | Changing a value or expression from one form to another. |
| 5 | Approximation | A result that is not exact, but close enough to be used. |
| 6 | Estimation | Finding a value that is close enough to the right answer, usually with some thought or calculation involved. |
| 7 | Exchange rate | Tells us the value of one currency (type of money in a particular country) in terms of another currency. |
| 8 | Corresponding | Referring to two (or more) things that appear in the same place, in two similar situations. |
| 9 | Similar | Two shapes are similar when one can become the other after a resize, flip, slide or turn. |
| 10 | Scale factor | The ratio between corresponding measurements of an object and a representation of that object. |

**11 Direct Proportion**

Two things are directly proportional if: as one amount increases (or decreases), the other amount increases (or decreases) at the same rate.
We can use lots of different methods to solve problems with direct proportion, such as bar models, ratios, fractions and the unitary method (finding the value of one).

Carina is making 50 muffins.
50 = '2 and a half lots of 20'
2.5 × 250 = 625 g of sugar

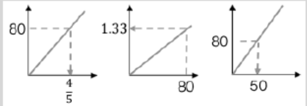
Emma is making 80 muffins.
| 20 | 20 | 20 | 20 |
8 eggs

Zaib is making 12 muffins
20 : 250 ml
1 : 12.5 ml
12 : 150 ml
150 ml of milk

Daniel is making 5 muffins.
20 ÷ 5 = **4**
"I need **4** times less than the recipe I will use 100g of flour".

**12 Conversion Graphs**

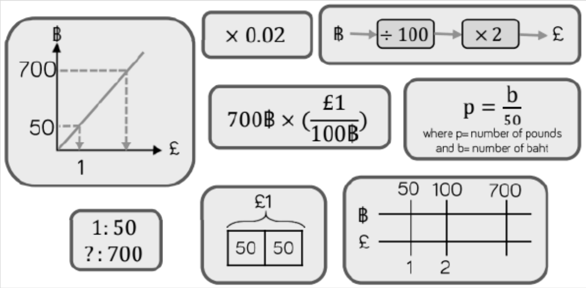
Conversion graphs can be used to convert between many different things, for example: currency, temperature, weights, distances, time, numbers etc.
It is important to label the axes on a conversion graph and to make sure the scale is going up in equal amounts.




**13 Converting between Currencies**

We can convert between currencies using lots of different methods.

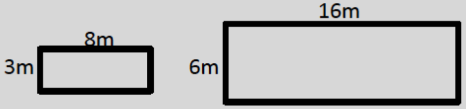
Example
1 British pound (£) is approximately 50 Thai Baht (฿). Convert 700฿ into pounds.



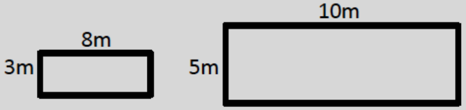

**14 Ratio between Similar Shapes**

Corresponding lengths on similar shapes are always in the same ratio.

Example




3m : 6m
8m : 16m
These lengths are in ratio so the rectangles are similar.




3m : 5m
8m : 10m
These lengths are not in ratio, so the rectangles are not similar.

**15 Understanding Scale Factors**

A scale factor tells us the ratio between corresponding measurements of an actual object and a copy of the object.
If the scale factor is bigger than 1, the copy will be larger.
If the scale factor is less than 1 (e.g. ½), the copy will be smaller.

**16 Drawing and Interpreting Scale Diagrams**

Scale diagrams (or drawings) are used to represent a smaller or larger object, shape or image.
The scale used will depend on the reduction or enlargement of the object.
Some common scale ratios that are used:
- A medium sized wall map of the World (1:30,000,000 which represents 1cm to 300km)
- A road map for motorists (1:250,000 which represents 1cm to 2.5km)
- An Ordnance survey map for walkers or hikers (1:25,000 which represents 1cm to 250m)
- An architects drawing (1:100 which represents 1cm to 1m)

**17 Interpreting Maps with Scale Factors**

We can use scale factors to interpret maps.

Example
If the scale is 1:25,000, this means 1cm on the map is 25,000cm in real life.