



# **YEAR 9 HAND BOOK**

## **2021-2022**



**Dudley**  
Academies Trust

**AUTUMN TERM**

INTRODUCTION TO YEAR 9	NUMBER	ASSESSMENT	DATA	DATA	ASSESSMENT	ALGEBRA BASICS
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**SPRING TERM**

GEOMETRY	ASSESSMENT	FDP	ASSESSMENT	MULTIPLICATIVE REASONING	MULTIPLICATIVE REASONING	ASSESSMENT	MULTIPLICATIVE REASONING
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SUMMER TERM

MULTIPLICATIVE REASONING	ASSESSMENT	MULTIPLICATIVE REASONING		QUADRATICS		ASSESSMENT	QUADRATICS
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## YEAR 9 NUMBER

### Objectives

Ia	Understand place value and work with small and large numbers (D)
Ib	Order positive and negative integers and decimals including the use of the symbols $<$ , $\leq$ , $>$ , $\geq$ , $=$ and $\neq$ (D/P/C)
Ic	Round to a specified number of decimal places or significant figures. (D/P)
	Estimate answers to one or two step calculations, including use of rounding numbers (D/P)
Id	Add, subtract, multiply and divide positive integers and decimals, including calculations involving money and inverse operations. Problem solving with decimals (D/P)
Ie	Add, subtract, multiply and divide negative number (in context, eg. temperature, overdraft) (D/P)
If	Apply order of operations (D/P)
Ih	Find square and cube roots (D/P)
Ii	Recognise powers of 2,3,4 and 5 (D)
Ig	Use and understand positive indices and roots (D/P)
If (H)	Use index laws for positive and negative powers (D/P/C)

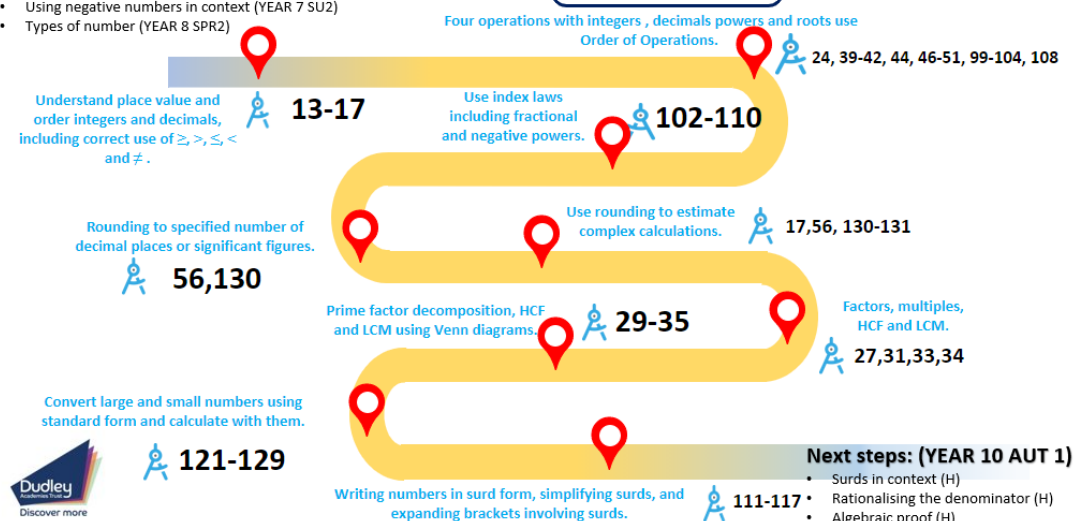
### SMAP



#### Prerequisite learning:

- Rounding whole numbers (YEAR 7 AUT1)
- Multiplying by powers of 10. (YEAR 7 AUT1)
- Comparing numbers using the value of each digit (YEAR 7 AU2)
- Using negative numbers in context (YEAR 7 SU2)
- Types of number (YEAR 8 SPR2)

All video clip references belong to  **hegartymaths**  
[www.hegartymaths.com](http://www.hegartymaths.com)

NUMBER



Ig (H)	Use index laws, including use of zero, fractional and negative powers (D/P)	<p><b>Prerequisite learning:</b></p> <ul style="list-style-type: none"> <li>Rounding whole numbers (YEAR 7 AUT1)</li> <li>Multiplying by powers of 10. (YEAR 7 AUT1)</li> <li>Comparing numbers using the value of each digit (YEAR 7 AU2)</li> <li>Using negative numbers in context (YEAR 7 SU2)</li> <li>Types of number (YEAR 8 SPR2)</li> </ul> <p>All video clip references belong to  <a href="https://www.hegartymaths.com">hegartymaths.com</a></p> <p>Four operations with integers, decimals powers and roots use Order of Operations.</p> <p>24, 39-42, 44, 46-51, 99-104, 108</p> <p>Understand place value and order integers and decimals, including correct use of <math>\geq</math>, <math>&gt;</math>, <math>\leq</math>, <math>&lt;</math> and <math>\neq</math>.</p> <p>13-17</p> <p>Use index laws including fractional and negative powers.</p> <p>102-110</p> <p>Rounding to specified number of decimal places or significant figures.</p> <p>56,130</p> <p>Use rounding to estimate complex calculations.</p> <p>17,56, 130-131</p> <p>Prime factor decomposition, HCF and LCM using Venn diagrams.</p> <p>29-35</p> <p>Factors, multiples, HCF and LCM.</p> <p>27,31,33,34</p> <p>Convert large and small numbers using standard form and calculate with them.</p> <p>121-129</p> <p>Writing numbers in surd form, simplifying surds, and expanding brackets involving surds.</p> <p>111-117</p> <p><b>Next steps: (YEAR 10 AUT 1)</b></p> <ul style="list-style-type: none"> <li>Surds in context (H)</li> <li>Rationalising the denominator (H)</li> <li>Algebraic proof (H)</li> </ul> <p> Discover more</p>
Ih (H)	Find the value of calculations using indices including fractional powers (D/P)	
Ik	Recognise and distinguish between factors and multiples (D/P)	
Il	Calculate the Highest Common Factor and Lowest Common Multiple of 2 or more numbers (D/P)	
Ii	Find the prime factor decomposition of positive integers – write as a product using index notation; (D/P)	
Im	Carry out prime factor decomposition and apply this to HCF and LCM using Venn diagrams. (D/P/C)	
Ik (H)	Convert large and small numbers into standard form and vice versa; Add, subtract, multiply and divide numbers in standard form (D/P/C)	
Il (H)	Write a number in surd form Simplifying surds Expand surds in brackets DO NOT including rationalising the denominator (D/P/C)	
Ij (H)	Find positive powers of positive and negative integers and fractions. Find roots of positive and negative integers (D/P)	

<b>Essential Language</b>	
Integer, Factor, Negative, Product, Multiples, Prime	
power, index, roots, BIDMAS, estimate, digit, decimal, operation, even, odd,	
prime factorisation, root, indices, significant figures, reciprocal, standard form, base 10, irrational, surds	
<b>PREQUISITE AND GREATER DEPTH EXEMPLIFICATION</b> <ul style="list-style-type: none"> <li>• Rounding whole numbers.</li> <li>• Types of number.</li> <li>• Multiplying by powers of 10.</li> <li>• Comparing numbers using the value of each digit.</li> <li>• Using negative numbers in context.</li> </ul> <p>Convince me that 8 is not prime.</p> <p>Given 5 digits, what are the largest or smallest answers when subtracting a two-digit number from a three-digit number?</p> <p>Given <math>2.6 \times 15.8 = 41.08</math>  What is <math>26 \times 0.158</math>?  What is <math>4108 \div 26</math></p> <p>Prove that the square root of 45 lies between 6 and 7.</p> <p>Work out the value of n in <math>40 = 5 \times 2^n</math>.</p>	<b>COMMON MISCONCEPTIONS:</b> <p>Stress the importance of knowing the multiplication tables to aid fluency.</p> <p>Students may write statements such as <math>150 - 210 = 60</math>.</p> <p>Significant figures and decimal place rounding are often confused.</p> <p>Some students may think <math>35\ 877 = 36</math> to two significant figures.</p> <p>The order of operations is often not applied correctly when squaring negative numbers, and many calculators will reinforce this misconception.</p> <p><math>10^3</math>, for example, is interpreted as <math>10 \times 3</math>.</p> <p>Many students think 1 is a prime number.</p> <p>Particular emphasis should be made on the definition of 'product' as multiplication as many students get confused and think it relates to addition.</p> <p>Significant figure and decimal place rounding are often confused.</p> <p>Some pupils may think <math>35\ 934 = 36</math> to two significant figures.</p> <p>The order of operations is often not applied correctly when squaring negative numbers, and many calculators will reinforce this misconception.</p> <p>Remind students that 1 is not a prime number with clear reasoning.</p> <p>Particular emphasis should be made on the definition of "product" as multiplication, as many students get confused and think it relates to addition.</p> <p>Remind students that a surd is an irrational number – when simplifying you must be able to recall square numbers fluently.</p>

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING:**

Phil states  $3.44 \times 10 = 34.4$  and Chris states  $3.44 \times 10 = 34.40$ . Who is correct?

Problems involving shopping for multiple items, such as: Rob purchases a magazine costing £2.10, a newspaper costing 82p and two bars of chocolate. He pays with a £10 note and gets £5.40 change. Work out the cost of one bar of chocolate

When estimating, students should be able to justify whether the answer will be an overestimate or underestimate

Which two digit number is special because adding the sum of its digits to the product of its digits gives me my original number?

Sharon says 108 is a prime number. Is she correct?

Questions that require multiple layers of operations such as: Pam writes down one multiple of 9 and two different factors of 40. She then adds together her three numbers. Her answer is greater than 20 but less than 30. Find three numbers that Jan could have written down

**MASTERY PEDAGOGY****RESOURCES TO SUPPORT LEARNING:**

Negative numbers in real life can be modelled by interpreting scales on thermometers using F and C.  
Money/coins

Pupils need to know how to enter negative numbers into their calculator.

Use the language of 'negative' number and not minus number to avoid confusion with calculations.

**TRANSFERABLE SKILLS- Content in other context  
SCIENCE**

EDEXCEL SCIENCE VERSION - We don't do EDEXCEL but might be useful

<https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf> Pages 41-42, 54-59

AQA Science- <https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF> Pages 3, 9-11

<https://www.stem.org.uk/triplescience/maths>

AQA - first link TEACHER TRAINING IN SCIENCE

<https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources>

**GEOGRAPHY**

EDEXCEL GEOGRAPHY LINK- <https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf> Pages 36-41

## YEAR 9 DATA

### Objectives

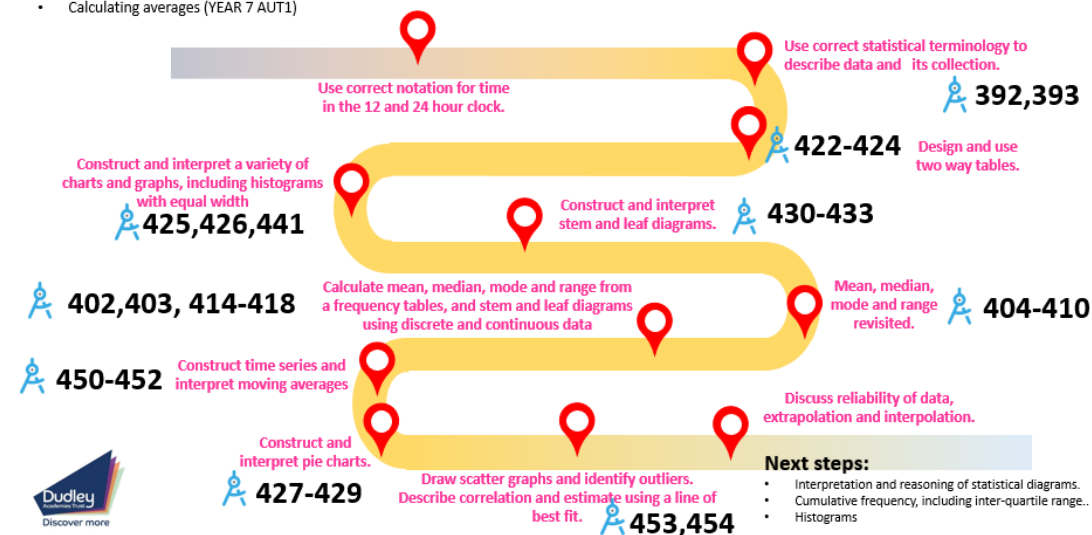
3a	Use suitable data collection techniques (data to be integer and decimal values) (D/P/C)
3b	Design and use data-collection sheets for grouped, discrete and continuous data, use inequalities for grouped data, and introduce $\leq$ and $\geq$ signs (D/P)
3c	Interpret and discuss the data (D/P)
3d	Sort, classify and tabulate data, both discrete and continuous quantitative data, and qualitative data (D/P)
3e	Construct tables for time-series data (D/P)
3f	Extract data from lists and tables (D/P)
3h	Use correct notation for time, 12- and 24-hour clock (D/P/C)
3i	Work out time taken for a journey from a timetable (D/P)
3j	Design and use two-way tables for discrete and grouped data (D/P)
3k	Use information provided to complete a two-way table (D/P)
3l	Calculate the total frequency from a frequency table (D/P)
3m	Read off frequency values from a table (D/P)

### SMAP

#### Prerequisite:

- Plotting coordinate points in all quadrants (YEAR 4-6)
- Simple frequency graphs and bar charts (YEAR 6, YEAR 7 AUT1)
- Calculating averages (YEAR 7 AUT1)

#### YEAR 9 AUT1/2: DATA



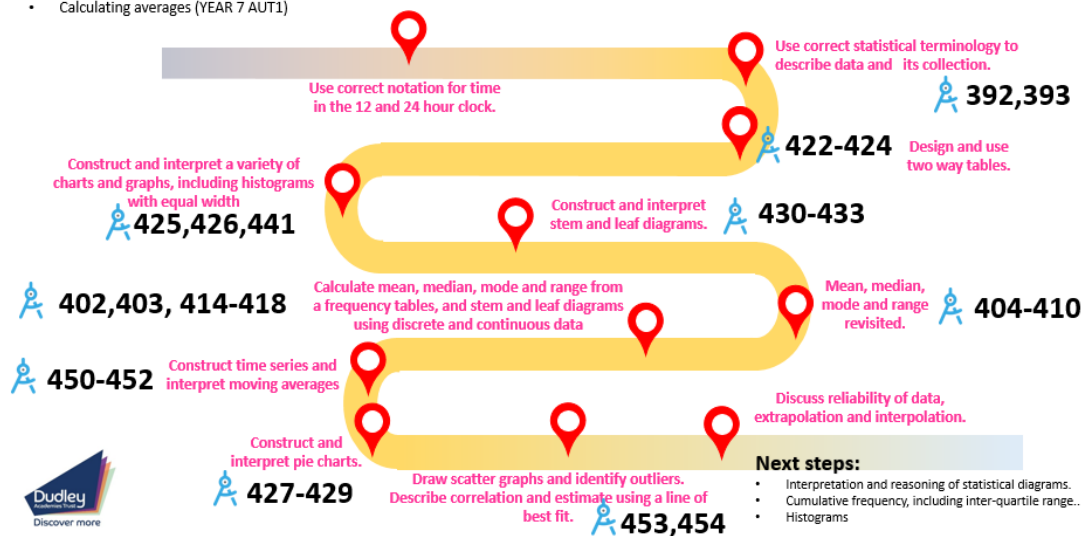


3n	Read off frequency values from a frequency table (D/P)
3o	Find greatest and least values from a frequency table (D/P)
3p	Identify the mode from a frequency table (D)
3q	Identify the modal class from a grouped frequency table (D/P)
3r	Plotting coordinates in first quadrant and read graph scales in multiples (D/P)
3s	Produce and interpret data shown in: <ul style="list-style-type: none"> <li>Pictograms</li> <li>composite bar charts (including the mode)</li> <li>dual/comparative bar charts for categorical and ungrouped discrete data</li> <li>bar-line charts</li> <li>vertical line charts</li> <li>line graphs</li> <li>line graphs for time-series data</li> <li>histograms with equal class intervals</li> <li>stem and leaf (including back-to-back) (Including the mode/median) (D/P/C)</li> </ul>
3t	Calculate total population and identify the greatest and least values from a bar chart or table (D/P)
3u	Recognise simple patterns, characteristics, relationships in bar charts and line graphs (D/P)
3v	Draw circles and arcs to a given radius (D)
3w	Know there are 360 degrees in a full turn, 180 degrees in a half turn, and 90 degrees in a quarter turn (D)

#### Prerequisite:

- Plotting coordinate points in all quadrants (YEAR 4-6)
- Simple frequency graphs and bar charts (YEAR 6, YEAR 7 AUT1)
- Calculating averages (YEAR 7 AUT1)

#### YEAR 9 AUT1/2: DATA

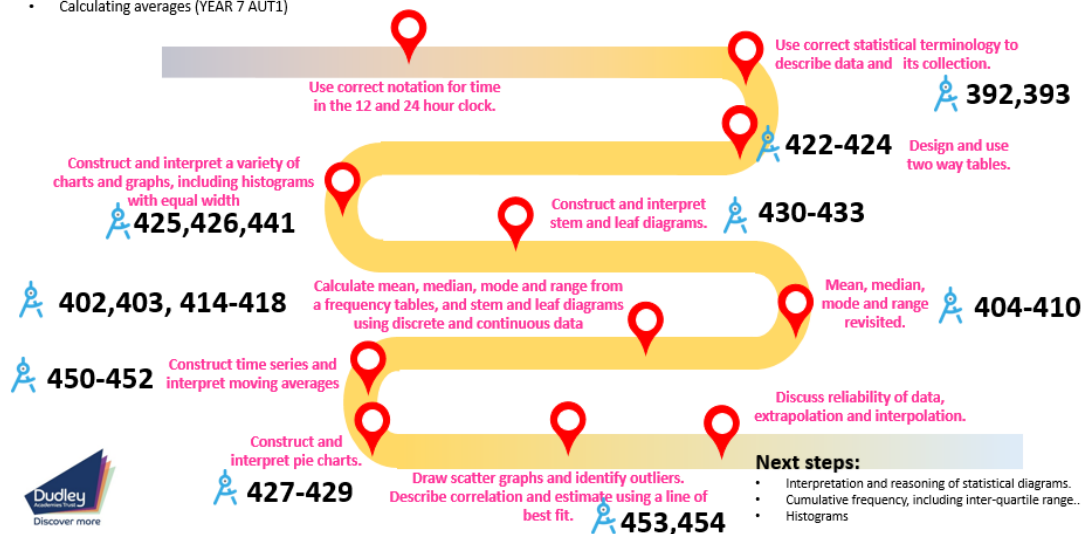


3x	Measure and draw angles, to the nearest degree (D/P)
3y	Interpret tables; represent data in tables and charts (D/P)
3z	Know which charts to use for different types of data sets (D)
3aa	Construct pie charts for categorical data and discrete/continuous numerical data (D/P)
3ab	Interpret simple pie charts using simple fractions and percentages; $\frac{1}{2}$ , $\frac{1}{4}$ and multiples of 10% sections (D/P)
3ac	From a pie chart: find the mode find the total frequency (D/P)
3ad	Understand that the frequency represented by corresponding sectors in two pie charts is dependent upon the total populations represented by each of the pie charts. (D/P)
3ae	Draw scatter graphs (D/P)
3af	Interpret points on a scatter graph (D/P)
3ag	Identify outliers and ignore them on scatter graphs (D/P/C)
3ah	Draw the line of best fit on a scatter diagram by eye, and understand what it represents (D/P)
3ai	Distinguish between positive, negative and no correlation using lines of best fit (D/P)
3aj	Use the line of best fit make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing (D/P/C)

#### Prerequisite:

- Plotting coordinate points in all quadrants (YEAR 4-6)
- Simple frequency graphs and bar charts (YEAR 6, YEAR 7 AUT1)
- Calculating averages (YEAR 7 AUT1)

#### YEAR 9 AUT1/2: DATA

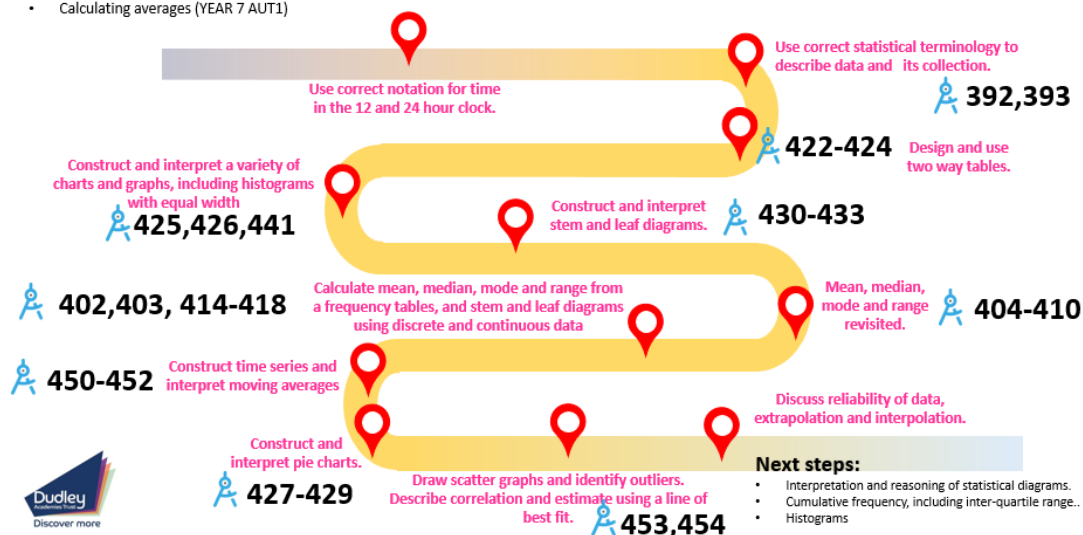


3ak	Use a line of best fit to predict values of a variable given values of the other variables (D/P)
3al	Interpret scatter graphs in terms of the relationship between two variable (D/P/C)
3am	Interpret correlation in terms of the problem (D/P/C)
3an	Understand that correlation does not imply causality (D)
3b (H)	Construct and interpret stem and leaf diagrams (including back to back stem and leaf diagrams). (not likely to appear so no more than one lesson to be spent on this) (D/P)
3c (H)	Find the mean, median, mode and range from stem and leaf diagrams (D/P)
3d (H)	Recap calculating the mean, median, mode and range from a list of discrete data (D/P)
3e (H)	Calculate mean, median, mode and range from a frequency table (discrete and continuous date) and compare two statistical distributions (D/P/C)
3f (H)	Produce and interpret frequency polygons (D/P)
3h (H)	Construct and interpret time series graphs and moving averages and understand when they are appropriate. Discuss trends. (D/P/C)

#### Prerequisite:

- Plotting coordinate points in all quadrants (YEAR 4-6)
- Simple frequency graphs and bar charts (YEAR 6, YEAR 7 AUT1)
- Calculating averages (YEAR 7 AUT1)

#### YEAR 9 AUT1/2: DATA



<b><u>Essential Language</u></b>	
Frequency, Table, Mean, Median, Mode, Range	
average, estimate continuous, data, positive, negative, sample, population, sort,	
discrete, continuous, qualitative, quantitative, scatter graph, line of best fit, correlation, stem and leaf, pie chart, frequency polygon, time series, trend, scatter diagram, correlation	
<p><b>PREQUISITE AND GREATER DEPTH EXEMPLIFICATION</b></p> <ul style="list-style-type: none"> <li>• Calculating averages.</li> <li>• Simple frequency graphs and bar charts.</li> <li>• Plotting coordinate points in the first quadrant.</li> </ul> <p>Given the mean, median and mode of five positive whole numbers, can you find the numbers?</p>	<p><b>COMMON MISCONCEPTIONS:</b></p> <p>Students struggle to make the link between what the data in a frequency table represents, so for example may state the 'frequency' rather than the interval when asked for the modal group.</p> <p>Same size sectors for different sized data sets represent the same number rather than the same proportion.</p> <p>Lines of best fit are often forgotten, but correct answers still obtained by sight. Interpreting scales of different measurements and confusion between x and y axes when plotting points. Students often forget the difference between continuous and discrete data.</p> <p>Often the <math>\sum(m \times f)</math> is divided by the number of classes rather than <math>\sum f</math> when estimating the mean.</p> <p>Lines of best fit are often forgotten, but correct answers still obtained by sight.</p>

<p><b>OPPORTUNITIES FOR REASONING/PROBLEM SOLVING:</b></p> <p>Misleading tables can provide an opportunity for students to critically evaluate the way information is presented. Misleading graphs or charts can provide an opportunity for students to critically evaluate the way information is presented.</p> <p>Students should be able to decide what the scales on any axis should be to be able to present information From inspection of a pie chart, students should be able to identify the fraction of the total represented and know when that total can be calculated and compared with another pie chart.</p> <p>Many real-life situations that give rise to two variables provide opportunities for students to extrapolate and interpret the resulting relationship (if any) between the variables.</p> <p>Students should be able to provide reasons for choosing to use a specific average to support a point of view.</p> <p>Choose which type of graph or chart to use for a specific data set and justify its use.</p> <p>Evaluate statements in relation to data displayed in a graph/chart.</p>	<p><b>MASTERY PEDAGOGY</b></p> <p><b>RESOURCES TO SUPPORT LEARNING:</b></p> <p><b>TRANSFERABLE SKILLS- Content in other context SCIENCE</b></p> <p>EDEXCEL SCIENCE VERSION - We don't do EDEXCEL but might be useful <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf</a> <b>Pages 60-66</b></p> <p>AQA Science- <a href="https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF">https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF</a></p> <p><a href="https://www.stem.org.uk/triplescience/maths">https://www.stem.org.uk/triplescience/maths</a> <a href="#">Mean, Mode and Median   STEM</a></p> <p>AQA - first link TEACHER TRAINING IN SCIENCE <a href="https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources">https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources</a></p> <p><b>GEOGRAPHY</b></p> <p>EDEXCEL GEOGRAPHY LINK- <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf</a> <b>Pages 4-17, 42-49</b></p>
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## YEAR 9 ALGEBRA BASICS

### Objectives

2a	Understand algebraic terms and symbols correctly e.g $a \times b$ is $ab$ , $a \times a \times a = a^3$ etc (D/P/C)
2c	Select an expression/equation/formula/identity from a list; (D/P/C)
2b	Simplify expressions by cancelling, e.g. $\frac{4x}{2} = 2x$ ; (D/P/C)
2d	Simplify expressions by collecting like terms with integer, fractional (same denominator) and surd coefficients (D/P/C)
2e	Use index notation and the index laws when multiplying or dividing algebraic terms; (D/P/C)
2f	Substitute positive and negative numbers into simple expressions (D/P/C)
2g	Expand a single bracket (D/P/C)
2h	Expand and simplify an expressions with 2 brackets (NOT double brackets) (D/P/C)
2i	Factorise into a single bracket by taking out common factors (including powers) (D/P/C)
2d (H)	Expand and simplify expressions with single and two brackets. Work up to expansion of triple brackets, including negatives e.g $(2x - y)(3x - 5)$ and $(5x - 3)^2$ and $(2x + 6)(3x - 4)(x - 5)$ (D/P/C)
2f (H)	Find the difference of 2 squares and factorise quadratic expressions up to including expressions with a co-efficient (D/P/C)

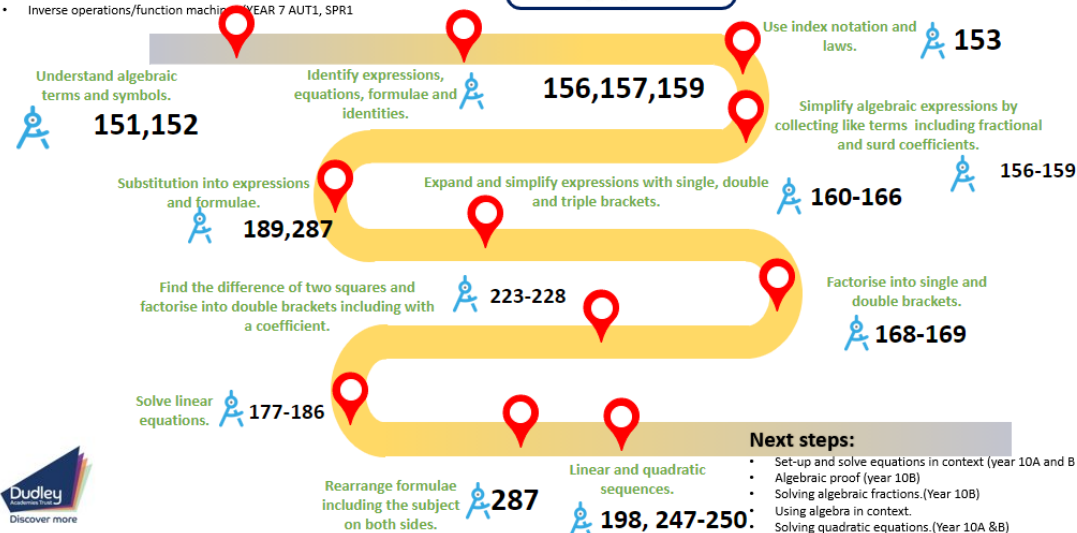
### SMAP

#### Prerequisite learning:

- Factors and multiples (YEAR 7 AUT2 NUMBER)
- Order of operations (YEAR 8 SU1 NUMBER)
- Equivalent expressions (YEAR 7 AUT1, YEAR 8 AUT1, YEAR 9 SPR1)
- Inverse operations/function machines (YEAR 7 AUT1, SPR1)

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#### YEAR 9 SPR1 ALGEBRA BASICS



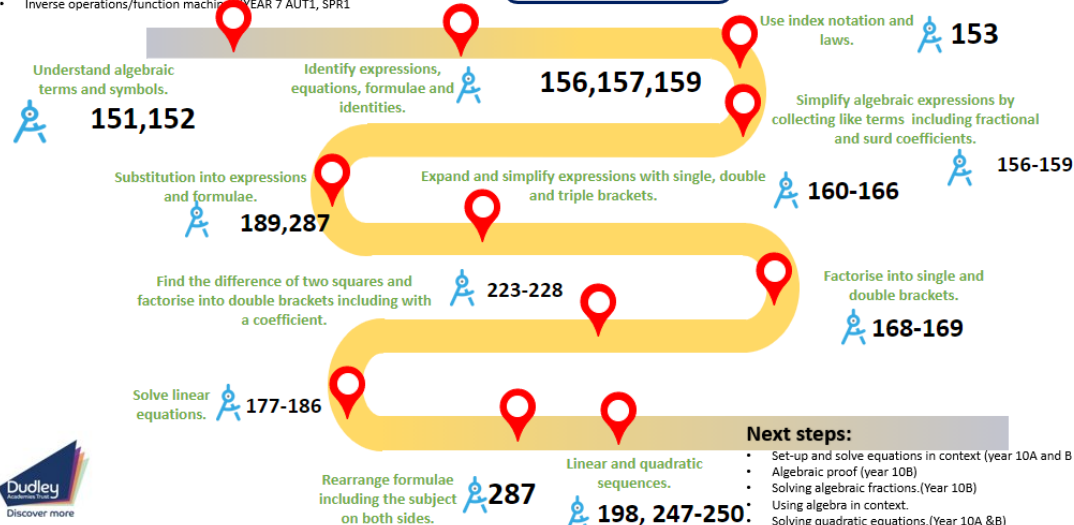
2g (H)	Solve linear equations with unknowns on both sides, with integer or fractional coefficients, including equations which contain brackets and equations which have negative or fractional solutions (D/P/C)
2h (H)	Rearrange formula, including cases where the subject is on both sides (D/P/C)
2i (H)	Substitute into functions $f(x)$ and work out composite functions $fg(x)$ using correct notation. Find the inverse of a function (D/P/C)
2j	Calculate terms in linear sequences using the $n$ th term. Find the $n$ th term of a sequence. Include Fibonacci. (D/P/C)
2k (H)	Calculate terms in quadratic sequences and find the $n$ th term of a quadratic sequence. (D/P/C)
2l (H)	Find simple geometric progressions. (D/P/C)

#### Prerequisite learning:

- Factors and multiples (YEAR 7 AUT2 NUMBER)
- Order of operations (YEAR 8 SU1 NUMBER)
- Equivalent expressions (YEAR 7 AUT1, YEAR 8 AUT1, YEAR 9 SPR1)
- Inverse operations/function machines (YEAR 7 AUT1, SPR1)

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#### YEAR 9 SPR1 ALGEBRA BASICS



<b>Essential Language:</b>	
Simplify, expand, substitute, term, integer, factorise	
equation, formula, identity,	
fractional, index	
<p><b>PREQUISITE AND GREATER DEPTH EXEMPLIFICATION</b></p> <ul style="list-style-type: none"> <li>• Factors and multiples.</li> <li>• Equivalent expressions</li> <li>• Inverse operations/function machines</li> <li>• Order of operations (BIDMAS).</li> </ul> <p>Understand <math>6x + 4 \neq 3(x + 2)</math>.  Argue mathematically that <math>2(x + 5) = 2x + 10</math>.  Given a sequence, 'which is the 1st term greater than 50?</p>	<p><b>COMMON MISCONCEPTIONS:</b></p> <p>Any poor number skills involving negatives and times tables will become evident.  <math>3(x + 4) = 3x + 4</math>.  The convention of not writing a coefficient with a single value, i.e. <math>x</math> instead of <math>1x</math>, may cause confusion.  Some students may think that it is always true that <math>a = 1</math>, <math>b = 2</math>, <math>c = 3</math>  If <math>a = 2</math> sometimes students interpret <math>3a</math> as <math>32</math>.  Making mistakes with negatives, including the squaring of negative numbers.  When expanding two linear expressions, poor number skills involving negatives and times tables will become evident.  Hierarchy of operations applied in the wrong order when changing the subject of a formula.  <math>a^0 = 0</math>.  Students believe that <math>3xy</math> and <math>5yx</math> are different "types of term" and cannot be "collected" when simplifying expressions.  Not using brackets with negative numbers on a calculator.  Not writing down all the digits on the display.  Students struggle to relate the position of the term to "n".</p>



<p><b>OPPORTUNITIES FOR REASONING/PROBLEM SOLVING:</b></p> <p>Forming expressions and forming and solving equations using area and perimeter of 2D shapes</p> <p>.Evaluate statements about whether or not specific numbers or patterns are in a sequence and justify the reasons.</p> <p>Be able to solve problems involving sequences from real-life situations, such as:</p> <ul style="list-style-type: none"> <li>• 1 grain of rice on first square, 2 grains on second, 4 grains on third, etc (geometric progression), or person saves £10 one week, £20 the next, £30 the next, etc;</li> <li>• What is the amount of money after x months saving the same amount, or the height of tree that grows 6 m per year;</li> </ul>	<p><b>MASTERY PEDAGOGY</b></p> <p><b>RESOURCES TO SUPPORT LEARNING:</b></p> <p>Students should be encouraged to use their calculator effectively</p> <p>Algebra Tiles</p> <p><b>TRANSFERABLE SKILLS- Content in other context</b> <b>SCIENCE</b></p> <p>EDEXCEL SCIENCE VERSION - We don't do EDEXCEL but might be useful  <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf</a> <b>Pages 37-40</b></p> <p>AQA Science- <a href="https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF">https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF</a> Pages 3-4</p> <p><a href="https://www.stem.org.uk/triplescience/maths">https://www.stem.org.uk/triplescience/maths</a> <a href="#">Algebra</a>   <a href="#">STEM</a></p> <p>AQA - first link TEACHER TRAINING IN SCIENCE  <a href="https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources">https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources</a></p> <p><b>GEOGRAPHY</b></p> <p>EDEXCEL GEOGRAPHY LINK- <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf</a></p>
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## YEAR 9 GEOMETRY

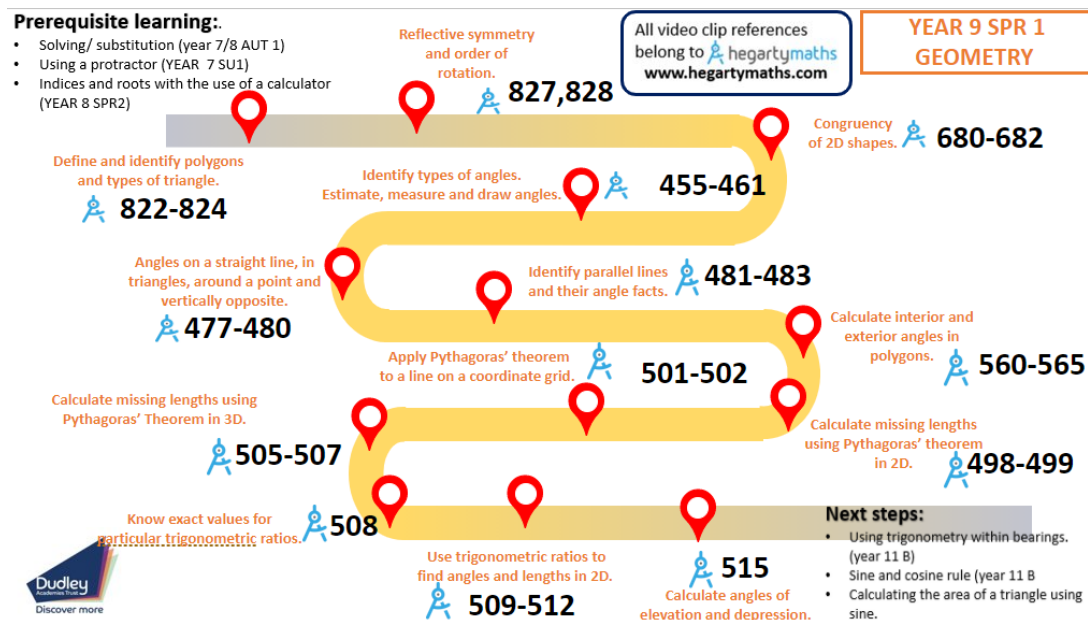
### Objectives

6a	Reflective symmetry (draw other side of a vertical / horizontal / diagonal mirror line) (D/P)
6b	Identify the number of lines of symmetry in a 2D shape (D/P)
6c	Find the order of rotation in 2D shapes (D/P)
6d	Recognise types of angles – acute / obtuse / right / reflex (D)
6e	Estimate, measure and draw angles (D/P)
6f	Concepts of congruency and recognise congruent shapes by eye (D)
6g	Geometry rules for angles on a line, in a triangle, quadrilateral, around a point and vertically opposite angles (D)
6h	Understand and use the angle properties of parallel lines and find missing angles using the properties of alternate, corresponding vertically opposite and allied. (D/P)
6i	Define and name polygons and distinguish between scalene, equilateral, isosceles and right-angle triangles (D)
6j	Calculate interior and exterior angles of n sided polygons (D/P)

### SMAP

#### Prerequisite learning:

- Solving / substitution (year 7/8 AUT 1)
- Using a protractor (YEAR 7 SU1)
- Indices and roots with the use of a calculator (YEAR 8 SPR2)



12a	Understand, recall and use Pythagoras' Theorem in 2D, (D/P)	<div> <p><b>Prerequisite learning:</b></p> <ul style="list-style-type: none"> <li>Solving/ substitution (year 7/8 AUT 1)</li> <li>Using a protractor (YEAR 7 SU1)</li> <li>Indices and roots with the use of a calculator (YEAR 8 SPR2)</li> </ul> </div> <div> <p>Reflective symmetry and order of rotation. <b>827,828</b></p> <p>Define and identify polygons and types of triangle. <b>822-824</b></p> <p>Identify types of angles. Estimate, measure and draw angles. <b>455-461</b></p> <p>Angles on a straight line, in triangles, around a point and vertically opposite. <b>477-480</b></p> <p>Identify parallel lines and their angle facts. <b>481-483</b></p> <p>Apply Pythagoras' theorem to a line on a coordinate grid. <b>501-502</b></p> <p>Calculate missing lengths using Pythagoras' Theorem in 3D. <b>505-507</b></p> <p>Calculate interior and exterior angles in polygons. <b>560-565</b></p> <p>Calculate missing lengths using Pythagoras' theorem in 2D. <b>498-499</b></p> <p>Know exact values for particular trigonometric ratios. <b>508</b></p> <p>Use trigonometric ratios to find angles and lengths in 2D. <b>509-512</b></p> <p>Calculate angles of elevation and depression. <b>515</b></p> <p><b>Next steps:</b></p> <ul style="list-style-type: none"> <li>Using trigonometry within bearings. (year 11 B)</li> <li>Sine and cosine rule (year 11 B)</li> <li>Calculating the area of a triangle using sine.</li> </ul> <p><b>YEAR 9 SPR 1 GEOMETRY</b></p> <p>All video clip references belong to <a href="https://www.hegartymaths.com">hegartymaths</a> <a href="https://www.hegartymaths.com">www.hegartymaths.com</a></p> <p><b>680-682</b></p> <p><b>515</b></p> <p><b>509-512</b></p> <p><b>508</b></p> <p><b>505-507</b></p> <p><b>501-502</b></p> <p><b>481-483</b></p> <p><b>477-480</b></p> <p><b>455-461</b></p> <p><b>498-499</b></p> <p><b>560-565</b></p> <p><b>822-824</b></p> <p><b>827,828</b></p> <p><b>680-682</b></p> <p><b>515</b></p> <p><b>509-512</b></p> <p><b>508</b></p> <p><b>505-507</b></p> <p><b>501-502</b></p> <p><b>481-483</b></p> <p><b>477-480</b></p> <p><b>455-461</b></p> <p><b>498-499</b></p> <p><b>560-565</b></p> <p><b>822-824</b></p> <p><b>827,828</b></p> <p><b>680-682</b></p> <p><b>515</b></p> <p><b>509-512</b></p> <p><b>508</b></p> <p><b>505-507</b></p> <p><b>501-502</b></p> 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12i	Find angles of elevation and depression, rounding answers to appropriate degree of accuracy (D/P/C)	
5h	To know the exact values of $\sin \theta$ and $\cos \theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and $90^\circ$ (D)	
<b>Essential Language:</b> angle, length, polygon, estimate, parallel, calculate		
Reflection, rotation, symmetry, estimation, interior, exterior, right angle, accuracy, Triangle,		
congruency, acute, reflex, obtuse, scalene, isosceles, equilateral, alternate, corresponding, Pythagoras' Theorem, sine, cosine, tan, trigonometry, opposite, hypotenuse, adjacent, ratio, elevation, depression,		
<b>PREQUISITE AND GREATER DEPTH EXEMPLIFICATION</b>  <ul style="list-style-type: none"><li>Using a protractor.</li><li>Indices and roots with the use of a calculator.</li><li>Rearranging formulae.</li></ul> Derive the angle properties of regular polygons. Given the size of its exterior angle, how many sides does the polygon have? Does 2, 3, 6 give a right angled triangle? Justify when to use Pythagoras' Theorem and when to use trigonometry.		<b>COMMON MISCONCEPTIONS:</b>  Students may believe, incorrectly, that perpendicular lines have to be horizontal/vertical or all triangles have rotational symmetry of order 3. Some students will think that all trapezia are isosceles, or a square is only square if 'horizontal', or a 'non-horizontal' square is called a diamond. Some students may think that the equal angles in an isosceles triangle are the 'base angles'. Incorrectly identifying the 'base angles' (i.e. the equal angles) of an isosceles triangle when not drawn horizontally. Students may believe, incorrectly, that all polygons are regular. Pupils may believe, incorrectly, that: <ul style="list-style-type: none"><li>perpendicular lines have to be horizontal/vertical;</li><li>all triangles have rotational symmetry of order 3;</li><li>all polygons are regular.</li></ul>

	<p>Incorrectly identifying the ‘base angles’ (i.e. the equal angles) of an isosceles triangle when not drawn horizontally.</p> <p>Answers in Pythagoras trigonometry may be displayed on a calculator in surd form.</p> <p>Students forget to square root their final answer or round their answer prematurely</p>
<p><b>OPPORTUNITIES FOR REASONING/PROBLEM SOLVING:</b></p> <p>Multi-step “angle chasing” style problems that involve justifying how students have found a specific angle.</p> <p>Geometrical problems involving algebra whereby equations can be formed and solved allow students the opportunity to make and use connections with different parts of mathematics.</p> <p>What is the same, and what is different between families of polygons?</p> <p>Problems whereby students have to justify the number of sides that a regular polygon has given an interior or exterior angle.</p> <p>Combined triangle problems that involve consecutive application of Pythagoras’ Theorem or a combination of Pythagoras’ Theorem and the trigonometric ratios.</p> <p>In addition to abstract problems, students should be encouraged to apply Pythagoras’ Theorem and/or the trigonometric ratios to real-life scenarios that require them to evaluate whether their answer fulfils certain criteria, e.g. the angle of elevation of 6.5 m ladder cannot exceed <math>65^\circ</math></p>	<p><b>MASTERY PEDAGOGY</b></p> <p><b>RESOURCES TO SUPPORT LEARNING:</b></p> <p><b>TRANSFERABLE SKILLS- Content in other context</b></p> <p><b>SCIENCE</b></p> <p>EDEXCEL SCIENCE VERSION - We don’t do EDEXCEL but might be useful  <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf</a> <b>Pages 44-53</b></p> <p>AQA Science- <a href="https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF">https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF</a></p> <p><a href="https://www.stem.org.uk/triplescience/maths">https://www.stem.org.uk/triplescience/maths</a></p> <p>AQA - first link TEACHER TRAINING IN SCIENCE  <a href="https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources">https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources</a></p> <p><b>GEOGRAPHY</b></p> <p>EDEXCEL GEOGRAPHY LINK- <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf</a> <b>Pages 29-35</b></p>

## YEAR 9 FDP and RATIO/ PROPORTION

### Objectives

4a	Use diagrams to describe shaded parts of a diagram and compare the size of fractions (D/P)
4b	Write a fraction in its simplest form and find equivalent fractions (D/P)
4c	Convert between mixed numbers and improper fractions (D/P)
4d	Add and subtract fractions, including mixed numbers, including where only one of the denominators need to be changed, and where both need to be changed. (D/P/C)
4e	Multiply and divide fractions by an integer and including mixed numbers (D/P/C)
4f	Order fractions with the same denominator and different denominators (D/P)
4g	Find fractions of an amount, or measurement and apply this to finding the size of a category from a pie chart using fractions (D/P)
4h	Express a number as a percentage of another number (D/P)
4g	Calculate percentage increase or decrease, including the use of a multiplier (calculator) (D/P)
4i	Find a percentage of a quantity with and without a calculator, including the use of multipliers to increase or decrease (D/P/C)

### SMAP

#### Prerequisite:

- Place value (YEAR 7 AUT1)
- Multiplication and division (YEAR 7AUT1/2)
- Ordering integers on number lines. (YEAR 7 SU2)
- Percentage as an amount out of 100. (YEAR 8 AUT1)


All video clip references belong to  **hegartymaths**  
[www.hegartymaths.com](http://www.hegartymaths.com)

### SPRING 2: FDP / RATIO AND PROPORTION

Shading fractions, Equivalence and simplifying of fractions.

 57-59, 61


Four operations with mixed and improper fractions.

 65-66, 67-70

Convert between improper fractions and mixed numbers.

 63-64

 60 Compare and order fractions.

Find fractions of an amount.  77


Calculate a percentage of an amount and percentage change.

 84-92


 93-94 Calculate simple and compound interest.

Reverse percentages.  96

Convert between fractions, decimals and percentages and compare them.

 73-76, 82-83

Divide into a given ratio and solve when one part is known.

 332-337

#### Next steps:

- Convert recurring decimals to fractions (YEAR 10 AUT1)
- Percentage profit and loss (YEAR 10 AUT1)
- Using ratio to divide amounts in context. (YEAR 10 SPR1)

Convert fractions to recurring decimals.

 53-54

Simplify ratios, write as fractions.

 329-330



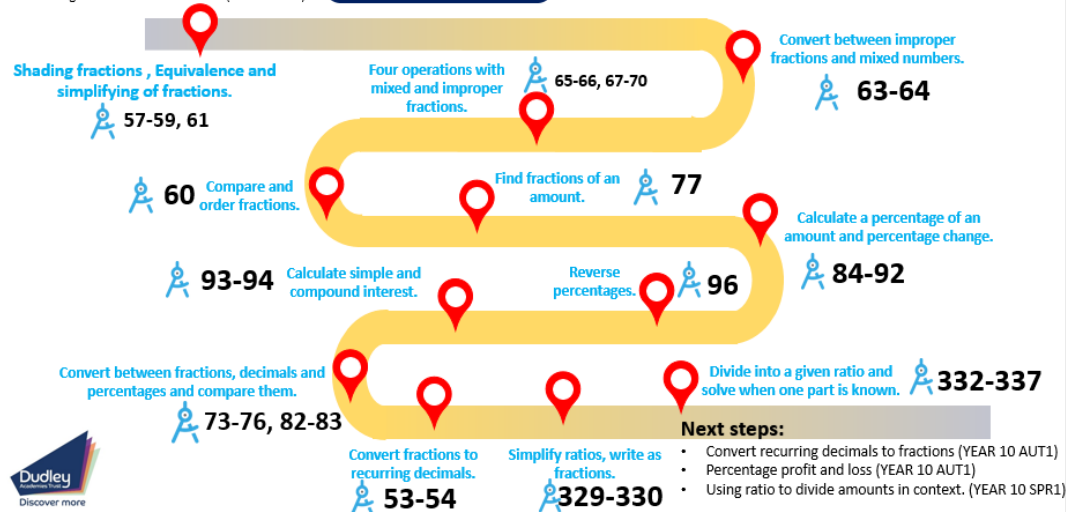
4i	Reverse Percentages with and without a calculator (D/P/C)
4l	Calculate simple and compound interest (D/P/C)
4m	Understand percentages greater than 100% (D)
4n	Recognise terminating and recurring decimals (D)
4j	Convert between fractions, decimals and percentages and order these. (D/P/C)
4k	Convert a fraction to a recurring decimal and vice versa (D/P)
4l	Find the reciprocal of an integer, decimal or fraction (D/P)
4m	Write a ratio as a fraction and understand how to write this in its simplest form, including 3-part ratios (D/P)
4n	Divide a given quantity into two or more parts (D/P)
4o	Use a ratio to find one quantity when the other is known and solve harder ratio problems including best buy and recipe type context (D/P/C)
4p	Basic Direct and Inverse proportion (D/P/C)

#### Prerequisite:

- Place value (YEAR 7 AUT1)
- Multiplication and division (YEAR 7AUT1/2)
- Ordering integers on number lines. (YEAR 7 SU2)
- Percentage as an amount out of 100. (YEAR 8 AUT1)

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#### SPRING 2: FDP / RATIO AND PROPORTION



**Essential Language:**

Decimal, percentage, addition, division, fraction, share

improper, integer, VAT, multiplier, mixed, increase, decrease, profit, loss, percentage, increase, decrease,

terminating, recurring, reciprocal, termination, multiplier, ratio, proportion,

**PREQUISITE AND GREATER DEPTH EXEMPLIFICATION**

- Place value.
- Percentage as an amount out of 100.
- Multiplication and division.
- Ordering integers on number lines.

Calculate:  $\frac{1}{2} \times \frac{6}{7}$ ,  $\frac{3}{5} \div 3$ .

Write terminating decimals (up to 3 d.p.) as fractions.

Convert between fractions, decimals and percentages,  
common ones such as  $\frac{1}{2}$ ,  $\frac{1}{10}$ ,  $\frac{1}{4}$ ,  $\frac{3}{4}$  and  $\frac{n}{10}$ .

**COMMON MISCONCEPTIONS:**

The larger the denominator the larger the fraction.

Incorrect links between fractions and decimals, such as thinking that

$\frac{1}{5} = 0.15$ ,  $5\% = 0.5$ ,  $4\% = 0.4$   $0.2 = \frac{1}{2}$ , etc.

Students think it is not possible to have a percentage greater than 100%.

Students often identify a ratio-style problem and then divide by the number given in the question, without fully understanding the question.



<p><b>OPPORTUNITIES FOR REASONING/PROBLEM SOLVING:</b></p> <p>Questions that involve rates of overtime pay including simple calculations involving fractional (<math>&gt;1</math>, e.g. 1.5) and hourly pay.</p> <p>Working out the number of people/things where the number of people/things in different categories is given as a fraction, decimal or percentage.</p> <p>Sale prices offer an ideal opportunity for solving problems allowing students the opportunity to investigate the most effective way to work out the “sale” price.</p> <p>Problems that involve consecutive reductions such as: Sale Prices are 10% off the previous day’s price. If a jacket is £90 on Monday, what is the price on Wednesday?</p> <p>Calculate original values and evaluate statements in relation to this value justifying which statement is correct.</p> <p>In a youth club the ratio of the number of boys to the number of girls is 3 : 2 . 30% of the boys are under the age of 14 and 60% of the girls are under the age of 14. What percentage of the youth club is under the age of 14?</p>	<p><b>MASTERY PEDAGOGY</b></p> <p><b>RESOURCES TO SUPPORT LEARNING:</b></p> <p>Demonstrate how to use the fraction button on the calculator.</p> <p><b>TRANSFERABLE SKILLS- Content in other context</b> <b>SCIENCE</b></p> <p>EDEXCEL SCIENCE VERSION - We don’t do EDEXCEL but might be useful  <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf</a> Pages 29-35, 41-42</p> <p>AQA Science- <a href="https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF">https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF</a></p> <p><a href="https://www.stem.org.uk/triplescience/maths">https://www.stem.org.uk/triplescience/maths</a> <a href="#">Ratios, fractions, decimals and percentages   STEM</a></p> <p>AQA - first link TEACHER TRAINING IN SCIENCE  <a href="https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources">https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources</a></p> <p><b>GEOGRAPHY</b></p> <p>EDEXCEL GEOGRAPHY LINK- <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf</a> Pages 20-27</p>
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## YEAR 9 MULTIPLICATIVE REASONING

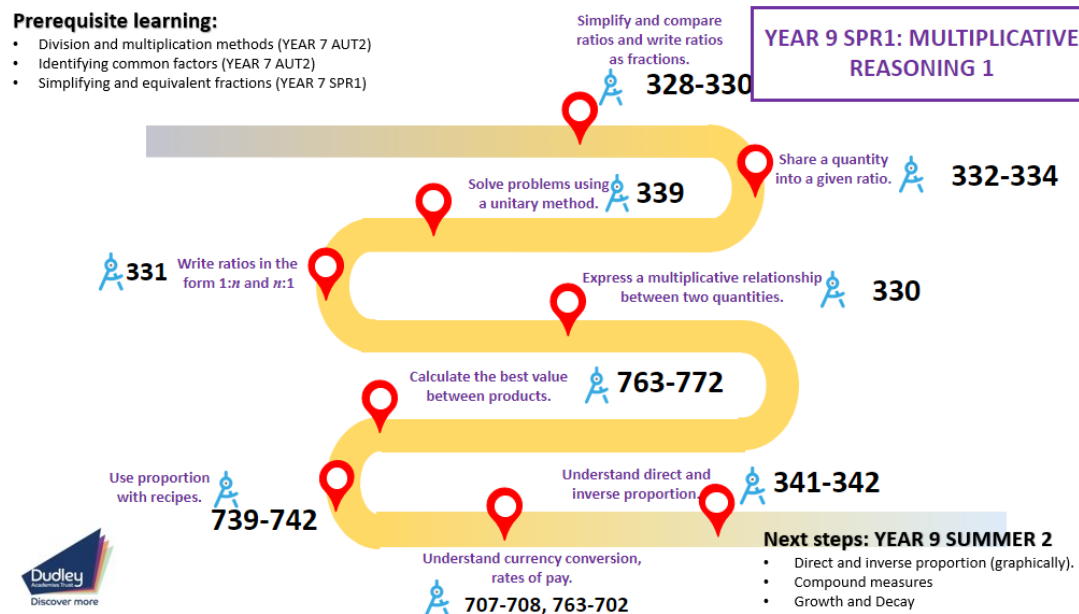
### Objectives

I Ia	Write ratios in their simplest form (D/P)
I Ib	Write/interpret a ratio to describe a situation N/A (D)
I Ic	Understand and express the division of a quantity into a number of parts as a ratio (D/P)
I Id	Share a quantity in a given ratio including three-part ratios (D/P)
I Ie	Solve a ratio problem in context: <ul style="list-style-type: none"> <li>➤ use a ratio to find one quantity when the other is known</li> <li>➤ use a ratio to compare a scale model to a real-life object</li> <li>➤ use a ratio to convert between measures and currencies</li> <li>➤ problems involving mixing, e.g. paint colours, cement and drawn conclusions (D/P/C)</li> </ul>
I If	Compare ratios N/A (D/P)
I Ig	Write ratios in form $l : m$ or $m : l$ N/A (D/P)
I Ih	Write a ratio as a fraction (D/P)
I Ii	Write a ratio as a linear function N/A (D/P/C)
I Ij	Write lengths, areas and volumes of two shapes as ratios in simplest form (D/P/C) N/A

### SMAP

#### Prerequisite learning:

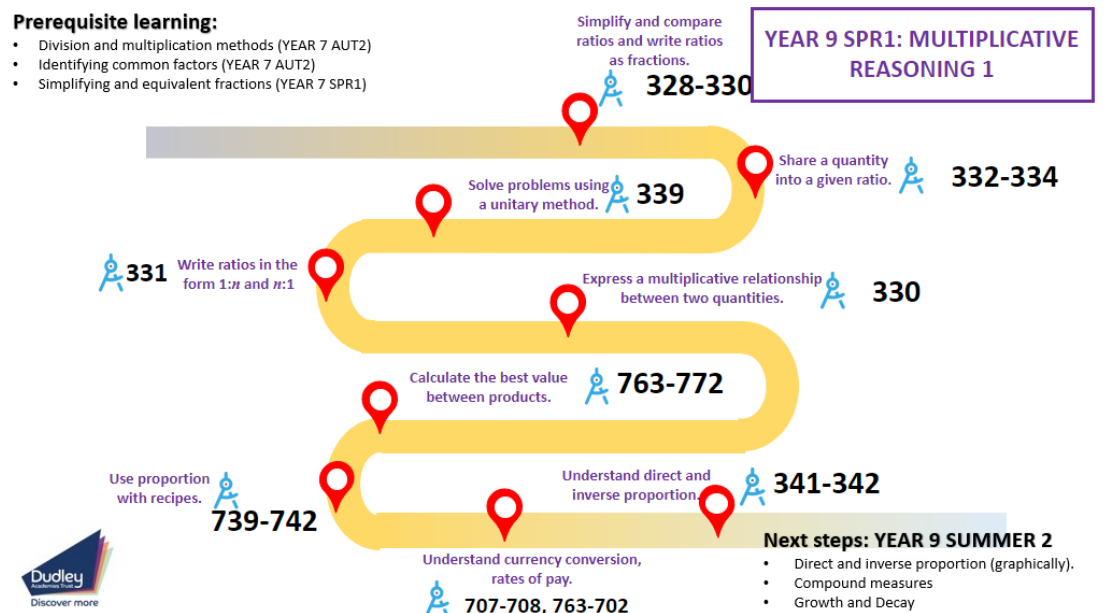
- Division and multiplication methods (YEAR 7 AUT2)
- Identifying common factors (YEAR 7 AUT2)
- Simplifying and equivalent fractions (YEAR 7 SPR1)



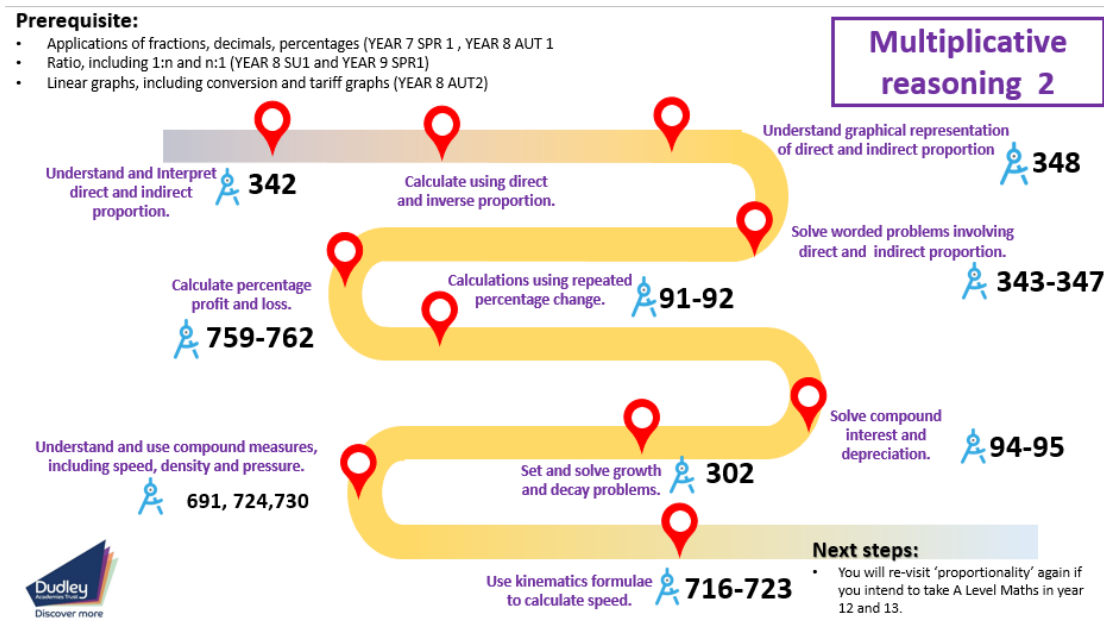
I1k	Express a multiplicative relationship between two quantities as a ratio or a fraction, e.g. when A:B are in the ratio 3:5, A is $\frac{3}{5}$ B. When $4a = 7b$ , then $a = \frac{7b}{4}$ or a:b is 7:4 (D/P/C)
I1l	Understand and use proportion as equality of ratios (D/P/C)
I1m	Solve proportion problems using the unitary method N/A (D/P/C)
I1n	Work out which product is the better buy and consider rates of pay (D/P/C)
I1o/q	Scale up recipes/ Find amounts for 3 people when amount for 1 given (D/P/C)
I1p	Convert between currencies (D/P/C)
I1r	Recognise when values are in direct proportion by reference to the graph form, and use a graph to find solutions the value of k in $y = kx$ (D/P)
I1s	Understand direct proportion ---> relationship $y = kx$ (D/P)
I1u	Solve word problems involving direct and inverse proportion (D/P/C)
I1t	Understand inverse proportion: as x increases, y decreases (inverse graphs done in later unit) (D/P)
I1h	Calculate an unknown quantity from quantities that vary in direct or inverse proportion (D/P/C)

#### Prerequisite learning:

- Division and multiplication methods (YEAR 7 AUT2)
- Identifying common factors (YEAR 7 AUT2)
- Simplifying and equivalent fractions (YEAR 7 SPR1)



I lj	Set up and use equations to solve word and other problems involving direct proportion (this is covered in more detail in unit I9) (D/P/C)
I lk	Relate algebraic solutions to graphical representation of the equations (D/P/C)
I ll	Recognise when values are in inverse proportion by reference to the graph form (D/P/C)
I lm	Set up and use equations to solve word and other problems involving inverse proportion, and relate algebraic solutions to graphical representation of the equations (D/P/C)
I ld	Work out the multiplier for repeated proportional change as a single decimal number (D/P)
I le	Represent repeated proportional change using a multiplier raised to a power, use this to solve problems involving compound interest and depreciation (D/P/C)
I lf	Understand and use compound measures $D=sxt$ , $F=Ma$ etc <ul style="list-style-type: none"> <li>➤ convert between metric speed measures</li> <li>➤ convert between density measures</li> <li>➤ convert between pressure measures</li> </ul> (D/P/C)
I lg	Use kinematics formulae from the formulae sheet to calculate speed, acceleration, etc (with variables defined in the question) (D/P/C)



<b>Essential Language:</b>	
share, parts, compare, unitary, Ratio, proportion,	
fraction, graphical, linear, density, mass, pressure, acceleration, velocity, inverse, direct, volume, speed, distance, time,	
function, direct proportion, inverse proportion, proportional change, compound measure, constant of proportionality	
<p><b>PREQUISITE AND GREATER DEPTH EXEMPLIFICATION</b></p> <ul style="list-style-type: none"> <li>• Division and multiplication methods.</li> <li>• Identifying common factors.</li> <li>• Simplifying and equivalent fractions.</li> <li>• Applications of fractions, decimals, percentages.</li> <li>• Ratio, including 1:n and n:1.</li> <li>• Linear graphs, including conversion and tariff graphs.</li> </ul> <p>Express the statement 'There are twice as many girls as boys' as the ratio 2 : 1 or the linear function <math>y = 2x</math>, where <math>x</math> is the number of boys and <math>y</math> is the number of girls.</p> <p>If it takes 2 builders 10 days to build a wall, how long will it take 3 builders?</p> <p>Scale up recipes and decide if there is enough of each ingredient.</p> <p>Given two sets of data in a table, are they in direct proportion?</p> <p>Change <math>\text{g/cm}^3</math> to <math>\text{kg/m}^3</math>, <math>\text{kg/m}^2</math> to <math>\text{g/cm}^2</math>, <math>\text{m/s}</math> to <math>\text{km/h}</math></p>	<p><b>COMMON MISCONCEPTIONS:</b></p> <ul style="list-style-type: none"> <li>▪ Using a ratio to find one quantity when the other is known often results in students 'sharing' the known amount</li> </ul>

<p><b>OPPORTUNITIES FOR REASONING/PROBLEM SOLVING:</b></p> <p>Problems involving sharing in a ratio that include percentages rather than specific numbers, such as: In a youth club the ratio of the number of boys to the number of girls is 3 : 2. 30% of the boys are under the age of 14, and 60% of the girls are under the age of 14. What percentage of the youth club is under the age of 14?</p> <p>Problems in context, such as scaling a recipe, or diluting lemonade or chemical solutions, will show how proportional reasoning is used in real-life contexts.</p> <p>Speed/distance type problems that involve students justifying their reasons why one vehicle is faster than another.</p> <p>Calculations involving value for money are a good reasoning opportunity that utilise different skills.</p> <p>Working out best value of items using different currencies given an exchange rate.</p>	<p><b>MASTERY PEDAGOGY</b></p> <p><b>RESOURCES TO SUPPORT LEARNING:</b></p> <p><b>TRANSFERABLE SKILLS- Content in other context</b> <b>SCIENCE</b></p> <ul style="list-style-type: none"> <li>• EDEXCEL SCIENCE VERSION - We don't do EDEXCEL but might be useful <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf</a> Pages 19, 34-35, 41</li> </ul> <p>AQA Science- <a href="https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF">https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF</a></p> <p><a href="https://www.stem.org.uk/triplescience/maths">https://www.stem.org.uk/triplescience/maths</a> <a href="#">Proportional reasoning   STEM</a></p> <p>AQA - first link TEACHER TRAINING IN SCIENCE <a href="https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources">https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources</a></p> <p><b>GEOGRAPHY</b></p> <p>EDEXCEL GEOGRAPHY LINK- <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf</a> Pages 18, 25-27</p>
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## YEAR 9 QUADRATICS

### Objectives

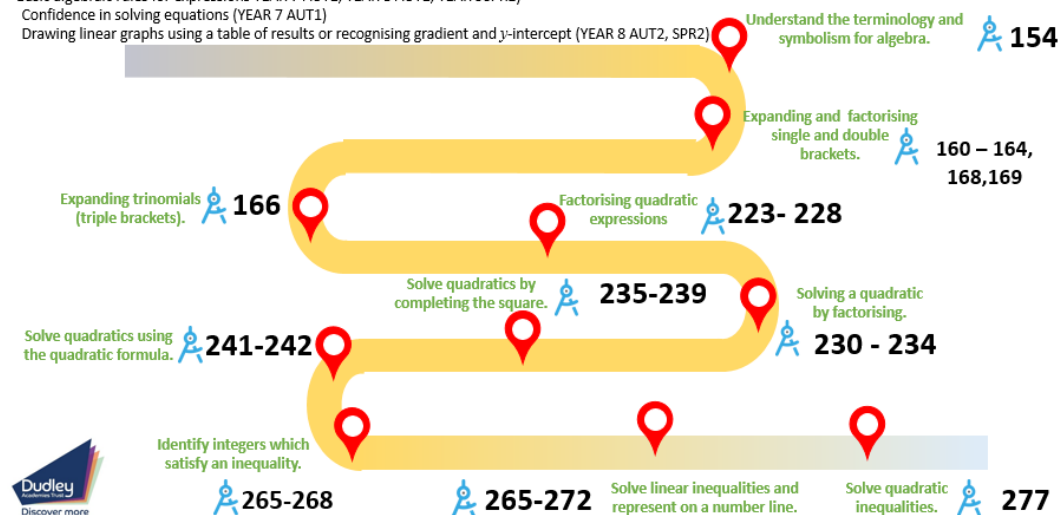
16a	Define a 'quadratic' expression and know the difference between an identity, expression, equation and formula. Understand the not equal ( $\neq$ ) to symbol Recap from unit 2 (D)
16b	Recap expansion of $x(x+3)$ etc (D/P)
16c/d	Expansion of double brackets (D/P)
16e	Square a linear expression, e.g. $(x + 1)^2$ ; (D/P)
16f	Factorise a linear expression (D/P)
16g	Factorise quadratic expressions of the form $x^2 + bx + c$ including those that need rearranging (D/P/C)
16h	Factorise a quadratic expression $x^2 - a^2$ using the difference of two squares; (D/P)
16i	Solve quadratic equations by factorising; (D/P/C)
16j	Generate points and plot graphs of simple quadratic functions, (D/P)
16k	Identify the line of symmetry of a quadratic graph; (D/P)
16l	Solve quadratic equations in the form $x^2 + bx + c = 0$ graphically (D/P/C)
16m	Identify and interpret roots, intercepts and turning points of quadratic graphs. (D/P/C)
9a	Recap factorising quadratic expressions in the form $ax^2 + bx + c$ , including equations that need rearranging (D/P/C)

### SMAP

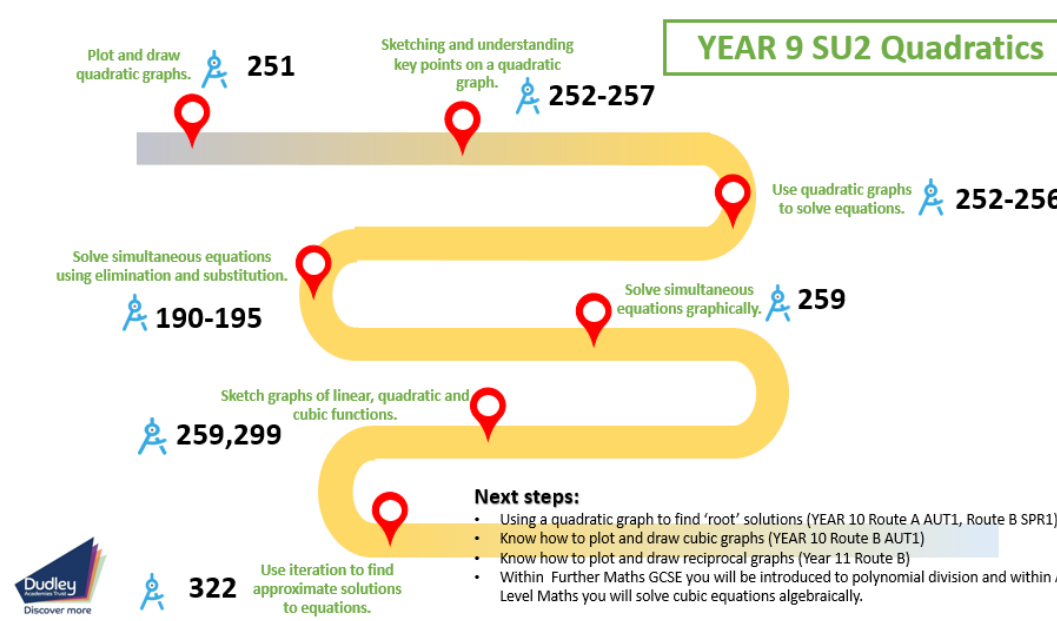
#### Prerequisite:

- Knowing what 'sum' and 'product' means (YEAR 5, YEAR 7 AUT1)
- Powers and roots (Year 8 SPR2 NUMBER)
- Basic algebraic rules for expressions YEAR 7 AUT1, YEAR 8 AUT1, YEAR 9SPR1)
- Confidence in solving equations (YEAR 7 AUT1)
- Drawing linear graphs using a table of results or recognising gradient and y-intercept (YEAR 8 AUT2, SPR2)

#### YEAR 9 SPR2/ SU2 Quadratics1



9b	Solve quadratics by completing the square (D/P)
9c	Solve quadratic equations by using the quadratic formula (D/P)
9d	Write down whole number values that satisfy an inequality and use the correct notation to show inclusive and exclusive inequalities. (D/P)
9e	Solve linear inequalities with one unknown and unknowns on both sides and represent the solution set on a number line (D/P/C)
9f	Solve simultaneous equations using elimination and substitution, including when both need multiplying (D/P/C)
9g	Solve simultaneous equations when one is a quadratic (D/P/C)
9h	Understand how to solve $x^2 + y^2 = r^2$ (D/P)
9i	Use iteration to find approximate solutions to equations for quadratic, cubic and higher. (D/P)



**YEAR 9 SU2 Quadratics**

Plot and draw quadratic graphs. 251

Sketching and understanding key points on a quadratic graph. 252-257

Use quadratic graphs to solve equations. 252-256

Solve simultaneous equations using elimination and substitution. 190-195


Solve simultaneous equations graphically. 259

Sketch graphs of linear, quadratic and cubic functions. 259,299

Use iteration to find approximate solutions to equations. 322

**Next steps:**

- Using a quadratic graph to find 'root' solutions (YEAR 10 Route A AUT1, Route B SPR1)
- Know how to plot and draw cubic graphs (YEAR 10 Route B AUT1)
- Know how to plot and draw reciprocal graphs (Year 11 Route B)
- Within Further Maths GCSE you will be introduced to polynomial division and within A Level Maths you will solve cubic equations algebraically.

 Discover more

**Essential Language:**

Factor, estimate, solve, rearrange, simplify, expression

graphical, algebraic, solution, root, linear, Sketch, graph, curve, bracket, circle,

Quadratic, cubic, function, factorising, simultaneous equation, factorise, coefficient, simultaneous, inequality, completing the square, factorise, surd, sets, union, intersection



<p><b>PREQUISITE AND GREATER DEPTH EXEMPLIFICATION</b></p> <ul style="list-style-type: none"> <li>• Squared numbers, including integers and decimals.</li> <li>• Basic algebraic rules for expressions.</li> <li>• Knowing what 'sum' and 'product' means.</li> <li>• Confidence in solving equations.</li> <li>• Drawing linear graphs using a table of results or recognising gradient and y-intercept</li> </ul>	<p><b>COMMON MISCONCEPTIONS:</b></p> <p>x terms are sometimes be 'collected' with <math>x^2</math>.</p> <p>Squaring negative numbers can be a problem.</p> <p>When squaring a linear expression, students may only square the two terms in the bracket. Emphasise the need to rewrite the expression as two brackets and then to expand.</p> <p>Missing out the negative sign when writing negative intercepts. It is important that students check for this mistake.</p> <p>Students often confuse being asked to factorise and being asked to solve. When estimating values from a graph, it is important that students understand it is an 'estimate'</p> <p>It is important to stress that when expanding quadratics, the x terms are also collected together.</p> <p>Quadratics involving negatives sometimes cause numerical errors.</p> <p>Using the formula involving negatives can result in incorrect answers.</p> <p>If students are using calculators for the quadratic formula, they can come to rely on them and miss the fact that some solutions can be left in surd form.</p> <p>When solving inequalities students often state their final answer as a number quantity, and exclude the inequality or change it to <math>=</math>.</p> <p>Some students believe that <math>-6</math> is greater than <math>-3</math>.</p> <p>Solutions can be written as final answers in surd form.</p> <p>Students may not have a secure understanding of the fact that a square always has two roots. A brief class discussion can help.</p> <p>Students may not be clear about which set includes the value in question and which one doesn't, e.g. the difference between <math>&gt; 4</math> and <math>\geq 4</math>.</p> <p>Some students may exchange an inequality sign for an equals sign when solving inequalities, then forget to change it back. Discourage students from changing the sign.</p>
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<p><b>OPPORTUNITIES FOR REASONING/PROBLEM SOLVING:</b></p> <p>Visual proof of the difference of two squares.</p> <p>Matching graphs with their respective functions.</p> <p>Match equations to their graphs and to real-life scenarios.</p> <p>“Show that”-type questions will allow students to show a logical and clear chain of reasoning.</p> <p>Problems that require students to set up and solve a pair of simultaneous equations in a real-life context, such as 2 adult tickets and 1 child ticket cost £28, and 1 adult ticket and 3 child tickets cost £34. How much does 1 adult ticket cost?</p> <p>Problems that require student to justify why certain values in a solution can be ignored.</p>	<p><b>MASTERY PEDAGOGY</b></p> <p><b>RESOURCES TO SUPPORT LEARNING:</b>  <b>Mathsbot</b>  Efficient use of the calculator.</p> <p><b>TRANSFERABLE SKILLS- Content in other context</b>  <b>SCIENCE</b></p> <p>EDEXCEL SCIENCE VERSION - We don't do EDEXCEL but might be useful  <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf</a> <b>Pages 37-38</b></p> <p>AQA Science- <a href="https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF">https://filestore.aqa.org.uk/resources/science/AQA-MATHS-IN-SCIENCE-FACTSHEET-PTT.PDF</a> <b>Pages 3, 4, 13</b></p> <p><a href="https://www.stem.org.uk/triplescience/maths">https://www.stem.org.uk/triplescience/maths</a> <a href="#">Algebra</a>   <a href="#">STEM</a></p> <p>AQA - first link TEACHER TRAINING IN SCIENCE  <a href="https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources">https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources</a></p> <p><b>GEOGRAPHY</b></p> <p>EDEXCEL GEOGRAPHY LINK- <a href="https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf">https://qualifications.pearson.com/content/dam/pdf/GCSE/Geography-A/2016/teaching-and-learning-materials/Edexcel-2016-GCSE-Geography-A-B-Maths-for-Geographers.pdf</a></p>
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