GCSE

WJEC GCSE Mathematics and Numeracy (Double Award)

Approved by Qualifications Wales

Guidance for Teaching

Teaching from 2025

For award from 2026

Version 2 - September 2025

This Qualifications Wales regulated qualification is not available to centres in England.

Made for Wales.
Ready for the world.

WJEC would like to thank the students and teachers of Fitzalan High School, Cardiff and Llanwern High School, Newport for their participation in the creation of these covers.

SUMMARY OF AMENDMENTS

Version	Description	Page number
2	Strand 1.4.3 ‘convert numbers from one form into another’ added to Unit 1 and Unit 3	15
	Strand 1.9.7 ‘use surds in exact calculations’ content added to Unit 2	29

Contents

Introduction

The WJEC GCSE Mathematics and Numeracy (Double Award) has been approved by Qualifications Wales and is available to all centres in Wales. It will be awarded for the first time in November 2026, using grades A*A* to GG.

Aims of the Guidance for Teaching

The principal aim of the Guidance for Teaching is to support teachers in the delivery of WJEC GCSE Mathematics and Numeracy (Double Award) and to offer guidance on the requirements of the qualification and the assessment process. The Guidance for Teaching is **not intended as a comprehensive reference**, but as support for teachers to develop stimulating and exciting courses tailored to the needs and skills of their learners. The guide offers possible classroom activities and links to useful resources (including our own, freely available digital materials and some from external sources) to provide ideas for immersive and engaging lessons.

Additional ways that WJEC can offer support:

- sample assessment materials and mark schemes
- professional learning events
- examiners' reports on each unit
- direct access to the subject officer
- free online resources
- Exam Results Analysis
- Online Examination Review

Qualification Structure

WJEC GCSE Mathematics and Numeracy consists of three units. The qualification is unitised and does contain tiering. There are two tiers of entry for this qualification:

- Higher Tier: A* – D
- Foundation Tier: C – G

Learners may be entered at different tiers across units. All units are compulsory and there is no hierarchy to the order the units should be taught.

	Unit title	Type of Assessment	Weighting
Unit 1	Financial Mathematics and Other Applications of Numeracy	Written examination	30%
Unit 2	Non-calculator	Written examination	30%
Unit 3	Calculator-allowed	Written examination	40%

Assessment

Summary of Assessment

Unit 1: Financial Mathematics and Other Applications of Numeracy **Written examination** **Higher Tier: 1 hour 45 minutes (80 marks)** **Foundation Tier: 1 hour 30 minutes (65 marks)** **30% of qualification**
The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions. These questions may be set on any part of the subject content assigned to this unit. Questions will be set in personal and other real-world contexts. A calculator will be allowed in this paper.
Unit 2: Non-calculator **Written examination** **Higher Tier: 1 hour 45 minutes (80 marks)** **Foundation Tier: 1 hour 30 minutes (65 marks)** **30% of qualification**
The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions. These questions may be set on any part of the subject content assigned to this unit. The paper will include context-free questions and questions set in mathematical and other contexts. A calculator will **not** be allowed in this paper.
Unit 3: Calculator-allowed **Written examination** **Higher Tier: 2 hours (90 marks)** **Foundation Tier: 1 hour 45 minutes (75 marks)** **40% of qualification**
The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions which may be set on any part of the subject content assigned to this unit. The paper will include a mix of questions set in real-world and other contexts, and context-free questions. A calculator will be allowed in this paper.

Overview of Unit 1

Financial Mathematics and Other Applications of Numeracy
(30% of the qualification)

The purpose of this unit is to:
- introduce and develop learners’ understanding of topics and concepts relating to finance and to develop their financial literacy
- allow learners to use their knowledge and apply mathematical methods to personal and other real-world contexts, including those related to money and the workplace.

Calculator will be allowed in this examination.

Overview of Unit 2

Non-calculator
(30% of the qualification)

The purpose of this unit is to explore mathematical topics and concepts that don’t require the use of a calculator.

This unit contains all aspects of probability and has a significant focus on geometry.

Calculator will not be allowed in this examination.

Overview of Unit 3

Calculator-allowed
(40% of the qualification)

The purpose of this unit is to explore topics and concepts that:
- are more appropriately assessed with a calculator, or
- form the foundations for, or link to, topics that are more appropriately assessed with a calculator.

This unit contains the majority of topics covering the data handling aspects of statistics and has a significant focus on measures.

Calculator will be allowed in this examination.

Assessment Objectives and Weightings

AO1	**Recall and use their knowledge of the prescribed content:** • demonstrate conceptual understanding through remembering and using mathematical facts, relationships, concepts and techniques • follow direct instructions to solve problems involving routine procedures fluently.
AO2	**Select and apply mathematical methods:** • select and use the mathematics and resources needed to solve a problem fluently • select and apply mathematical methods to solve nonstandard or unstructured, multi-step problems fluently • make decisions when tackling a given task, for example, choosing how to display given information • communicate mathematically, using a wide range of mathematical language, notation and symbols to explain reasoning and to express mathematical ideas unambiguously.
AO3	**Demonstrate strategic competence by making connections between different aspects of mathematics and using mathematical skills in unfamiliar contexts:** • demonstrate strategic competence by interpreting and analysing problems and generating strategies to solve them • devise strategies to solve non-routine or unfamiliar problems, breaking them into smaller, more manageable tasks where necessary • construct arguments and proofs using logical reasoning and deduction • interpret findings or solutions in the context of the original problem • use inferences and deductions made from mathematical information to draw conclusions.

The table below shows the weighting of each assessment objective in each unit for the qualification as a whole, within a tolerance of +/- 5 percentage points for the overall weightings (the tolerance percentages are shown in brackets):

	AO1	AO2	AO3
Unit 1	35% (30-40%)	45% (40-50%)	20% (15-25%)
Unit 2	65% (60-70%)	15% (10-20%)	20% (15-25%)
Unit 3	50% (45-55%)	30% (25-35%)	20% (15-25%)

Specification and Assessment Pack

When we develop new qualifications, we produce the following documents:

- Specification – this covers all the information and skills that learners are expected to know by the end of their course.
- Assessment Pack – this contains the Sample Assessment Materials (SAMs) i.e.: sample exam papers and mark schemes

Command words

Learners should be made aware of:

- what command words are
- what each command word means
- what each command word assesses.

Command words are the words and phrases used in assessments that tell learners how they should answer the question or complete the task. Command words direct the learner through the question or task and indicate the nature of the response required.

4. Find the total cost of the fence panels needed for Mr Singh's garden.

Command word

Mark Schemes

Mark schemes and/or assessment criteria test the intended learning outcomes for a component. They describe the knowledge and skills (and possibly attitude) that a candidate is expected to demonstrate in their responses and they are then used in marking the work.

Objective based mark scheme:
For very short answer questions requiring one correct response.

<table>
<tr><th colspan="2">Question</th><th colspan="3">Answer</th><th>Total Mark</th></tr>
<tr><td rowspan="2">6</td><td rowspan="2">(b)</td><td colspan="3">The bakery provides a delivery service.

Delivery charges
For delivering a box of Welsh cakes:
Cost in pence = 15 × number of miles + 50

Jacob's grandmother lives 40 miles away from the bakery.

How much would it cost Jacob to have a box of Welsh cakes delivered to his grandmother?
Give your answer in pounds (£).</td><td>3</td></tr>
<tr><td>Answer
15 × 40 + 50
(£)6.5(0)</td><td>M1

A2</td><td colspan="2">Allow £6.50p or 6.5(0)

Award A1 for any of the following:
• 6.50p
• 650(p)
• £6.5p</td></tr>
</table>

Summary of changes

There are topics from the 2015 specifications that have been removed for this qualification.

The main topics are:
- interpreting and applying the transformation of functions in the context of their graphical representation, including y = f(x + a), y = f(kx), y = kf(x) and y = f(x) + a, applied to y = f(x)
- constructing using a ruler and a pair of compasses
- solving problems in the context of tiling patterns and tessellation
- distinguishing between formulae for length, area and volume by considering dimensions
- describing translations using column vectors
- drawing and interpreting graphs of y = ax + b + a/x and $y = k^x$ for integer values of x and simple positive values of k.

In addition to these, the following changes are also being introduced:
- the focus of teaching and learning will be on interpreting and using rather than drawing, in topics including nets, plans and elevations, and box and whisker diagrams
- all metric-imperial conversions will be given in question, so candidates will no longer be required to memorise some of these conversion factors.

Some topics in the specification have been extended from what was made explicit in the 2015 specifications. For example:
- solving quadratics and cubics graphically (section 2.4.10 of the specification)
- double inequalities (section 2.2.4 of the specification)
- the use of dotted lines in inequalities and regions questions (section 2.4.5 of the specification)

Please see the entries in the next section of this guidance for more information about specific topics.

Teacher Guidance

The examples provided in this document are intended to support teaching and learning by illustrating key concepts, strategies, or extreme cases. While they help to clarify the specification, they are not necessarily indicative of the types of questions that will necessarily appear in exams. These examples are meant to enhance understanding, and although similar questions could be asked in exams, there is no guarantee that they will. This guidance serves as a teaching tool and should not be used as a definitive guide to future exam content.

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.1 Number and rounding					
	Learners should be able to:				
1.1.1	read and write whole numbers of any magnitude expressed in figures or words		✓	✓	✓
1.1.2	round whole numbers to the nearest 10, 100, 1000, etc.		✓	✓	✓
1.1.3	understand place value of whole numbers and those written in decimal form		✓	✓	✓
1.1.4	round decimals to the nearest whole number or a given number of decimal places		✓	✓	✓
1.1.5	round numbers to a given number of significant figures		✓	✓	✓
1.1.6	understand, use and order directed numbers		✓	✓	✓

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.1.7	decide whether to round up or down, as appropriate, in a problem	For example: • 5 boxes are needed to carry 28 eggs when each box can hold 6 eggs. • 4 boxes will be filled when 28 eggs are placed in boxes that can each hold 6 eggs.	✓		✓
1.1.8	check methods and solutions using appropriate strategies	For example: • Substituting a solution of an equation into the original equation to check that it is correct. Note, it is important to check solutions in both equations when solving simultaneous equations. • Reverse procedures, such as expansion of expressions to check factorisation. • Checking the original quantity given the result of a proportional change (reverse percentages). • In addition to non-calculator strategies, it is important to check solutions when a calculator is allowed. • Estimating is a good method for checking solutions.	✓	✓	✓
1.1.9	estimate solutions to numerical calculations by approximating the numbers in the calculations	When estimating, learners should round to values so that calculations can be easily done mentally. Different strategies may be more appropriate, depending on the calculation, e.g. 1 significant figure: • 23×47 $[20 \times 50 = 1000]$ • $71 \div 19$ $[70 \div 20 = 3.5]$ • $\frac{596}{39.3 + 11.4}$ $\left[\frac{600}{40 + 10} = 12\right]$ In some questions, learners should round numbers to a greater degree of accuracy than 1 significant figure. For example: • Estimate 14 500 as a percentage of 19 000. An answer of 75% (using 15 000 and 20 000) is a more appropriate estimate than 50% (using 10 000 and 20 000). Other methods involving common factors, square numbers, etc.:		✓	

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		• To estimate $\frac{2440}{63}$, using $\frac{2400}{60}$ would be more appropriate than $\frac{2000}{60}$. • To estimate $\sqrt{52}$, using $\sqrt{49}$ may be more appropriate than $\sqrt{50}$.		✓	
1.2 Number properties including prime factor decomposition					
	Learners should know:				
1.2.1	the common properties of numbers, including knowledge of odd, even, integers, multiples, factors, primes	In examinations, common number properties can either be directly assessed (e.g. selecting numbers to fit given properties) or assessed indirectly, through assumed prior knowledge within other questions. Algebra could be used to explain or prove number properties. For example: • n represents a whole number. Is $2n + 3$ odd or even? • Explain why every term of the sequence $4n + 2$ is an even number. • For all integers, n, is $5n - 3$ odd, even, or sometimes odd and sometimes even? • Show that $3(2n + 3) - (2n + 7)$ is even for all integers, n. (Higher tier only.)	✓	✓	✓
1.2.2	the meaning of the terms square, square root, cube, and cube root		✓	✓	✓
1.2.3	the meaning of the term reciprocal	For example: • Write the reciprocal of 4 as a decimal. • Write the reciprocal of $3\frac{1}{2}$ as a fraction.		✓	✓
	Learners should be able to:				
1.2.4	express numbers as the product of their prime factors in index form			✓	

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.2.5	find the least common multiple (LCM) and highest common factor (HCF) using prime factor decomposition or other appropriate methods	Note that this topic could be applied to algebraic expressions.		✓	
1.2.6	use prime factor decomposition to help solve other numerical problems, including links to square numbers	For example: • What is the smallest whole number that $2^3 \times 5^4 \times 7^3$ needs to be divided by to give a square number? • Write down the square root of $2^4 \times 3^6 \times 7^4$ as a whole number.		✓	
1.3 Index laws including standard form					
	Learners should know:				
1.3.1	the notation for positive integral indices	For example: • 3×3 can be written as 3^2. • $10 \times 10 \times 10 \times 10 \times 10 \times 10$ can be written as 10^6.	✓	✓	✓
1.3.2	**the notation for zero and negative indices**	For example: • $5^0 = 1$ • 2^{-3} can be written as $\frac{1}{2^3}$.	✓	✓	✓
1.3.3	**the notation for fractional indices**	For example: $9^{\frac{1}{2}} = 3$ $64^{\frac{2}{3}} = 16$ $81^{-\frac{1}{2}} = \frac{1}{9}$ $\left(\frac{25}{16}\right)^{-\frac{3}{2}} = \frac{64}{125}$		✓	
	Learners should be able to:				

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.3.4	use the rules of indices to perform calculations with numbers written in index form for positive integral indices	For example: • Evaluate $3^2 \times 10^3$. • Write $3^2 \times 3^3$ or $5^5 \div 5^2$ or $(3^5)^4$ as a single power. • Evaluate $\frac{6^{31} \times 6^5}{6^{34}}$.		✓ ✓	
1.3.5	**use the rules of indices to perform calculations with numbers written in index form for positive, negative and fractional indices**	For example: • Evaluate $\frac{32^{\frac{1}{5}} \times 64^{\frac{1}{2}}}{2^{-7}}$. • Evaluate $(9^4)^2 \times 27^{-8}$. Give your answer in the form 3^n, where n is to be found.		✓	
1.3.6	**convert ordinary numbers into and out of standard form**	Note that we will be referring to numbers that are not in standard form as 'ordinary numbers' in exam questions. For example: Write the number 3×10^5 as an ordinary number.	✓	✓	✓
1.3.7	**use numbers written in standard form**		✓	✓	✓
1.4 Fractions, decimals, percentages and ratios					
	Learners should know:				
1.4.1	how to find equivalent fractions		✓	✓	✓
1.4.2	the equivalences between fractions, decimals and percentages		✓	✓	✓
	Learners should be able to:				
1.4.3	convert numbers from one form into another		✓	✓	✓

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.4.4	order and compare whole numbers, decimals, fractions and percentages	When ordering $\frac{8}{25}$, 0.3 and 29.5%, if deciding to convert to percentages, $\frac{32}{100}$ and $\frac{30}{100}$ are not enough. 32% and 30% need to be specifically written. Note that all workings must be shown in these questions. Unsupported answers (no workings) will not gain full credit.		✓	
1.4.5	simplify fractions	Simplify means simplify 'fully'. If asked to simplify an answer, an improper fraction (provided not equivalent to a whole number) will be sufficient as long as the numerator and denominator are as small as possible. For example: For $3\frac{2}{3}$, accept $\frac{11}{3}$ but not, for example, $1\frac{8}{3}$ or $\frac{22}{6}$ or $3\frac{4}{6}$. Remember to simplify improper fractions or mixed numbers • For $4\frac{1}{2} \times 2\frac{2}{3} = 12$, do not leave the answer as $\frac{72}{6}$ or $\frac{12}{1}$. • For $1\frac{5}{7} + 2\frac{11}{14} = 4\frac{1}{2}$ or $\frac{9}{2}$, do not leave the answer as $3\frac{21}{14}$.	✓	✓	✓
1.4.6	express one number as a fraction or percentage of another	Decimals are not accepted as numerators or denominators of fractions. Example: Express 32.5 as a fraction of 40 (non-calculator). $\frac{32.5}{40} = \frac{65}{80} = \frac{13}{16}$ Express 34 as a percentage of 40. Calculator: $\frac{34}{40} \times 100$ Non-calculator: $\frac{34}{40} = \frac{170}{200} = \frac{85}{100} = 85\%$ or $\frac{34}{40} \times 100\% = \frac{340}{4} = 85\%$	✓	✓	✓

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		When questions are in context, learners must interpret the situation carefully to ensure that the numerator and denominator used in the calculation are the correct values. In final answers, percentages must be written using the percentage symbol, not as fractions with denominators of 100, e.g. 30%, not $\frac{30}{100}$.	✓	✓	✓
1.4.7	find a fraction or percentage of a quantity	The method will depend on whether a calculator is allowed or not. For example: If a calculator is allowed, it is not efficient to find 36% by splitting it into a combination of 10%, 5% and 1%.	✓	✓	✓
1.4.8	calculate fractional and percentage changes (increase and decrease)	This is now only assessed on units where a calculator is allowed. So, non-calculator methods should not be used. For example: Sali buys a painting that has a value of £120. Its value 3 years later is £198. Calculate the percentage increase in the value of the painting. Calculation: $\frac{(198-120)}{120} \times 100 = 65\%$.	✓		✓
1.4.9	understand and use multipliers	For example: • Find 6% of 300: multiplier is 0.06 • Increase 300 by 6%: multiplier is 1.06 • Decrease 300 by 6%: multiplier is 0.94	✓		✓
1.4.10	solve problems with repeated proportional changes	For example: A company is set up with 500 workers. At the end of each year the company employs more workers. The number of additional workers employed at the end of each year is equal to two-fifths of the number of workers at the start of that year. How many people work for the company at the start of the fourth year?	✓		

<table>
<tr><th colspan="6">1. Number</th></tr>
<tr><th colspan="2">Strand</th><th>Teacher Guidance</th><th>U1</th><th>U2</th><th>U3</th></tr>
<tr><td>1.4.11</td><td>calculate using ratios in a variety of situations</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>1.4.12</td><td>solve numerical problems involving direct and inverse proportion</td><td>Water flowing through 8 identical pipes can fill 5 identical tanks in 24 minutes.
How long will it take for 4 of these pipes to fill 3 of these tanks?

Note, in this question, we could have added, ‘You can assume that all pipes deliver water at the same rate.’
However, assumptions like this might not be given in the question when it can easily be assumed by the learners.</td><td>✓</td><td></td><td></td></tr>
<tr><td>1.4.13</td><td>find the original quantity given the result of a proportional change</td><td>Learners could use ratio tables.
For example:
A jumper with 17% off now costs £41.50.
Calculate the original price of the jumper.

Most efficient calculation: 41.5 ÷ 0.83.

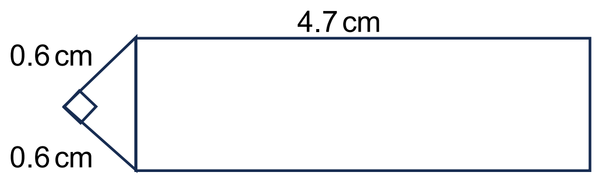
Note, if learners use ratio tables in their solution, they should show their calculations in the form of labelling alongside the table (e.g. ÷83, ×100).

<table>
<tr><th></th><th>%</th><th>£</th><th></th></tr>
<tr><td></td><td>83%</td><td>£41.50</td><td></td></tr>
<tr><td>÷83</td><td></td><td></td><td>÷83</td></tr>
<tr><td></td><td>1%</td><td>£0.50</td><td></td></tr>
<tr><td>×100</td><td></td><td></td><td>×100</td></tr>
<tr><td></td><td>100%</td><td>£50</td><td></td></tr>
</table>
</td><td>✓</td><td></td><td></td></tr>
</table>

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.5 Proficiency in calculations					
	Learners should be able to:				
1.5.1	understand and use number operations and the relationships between them, including inverse operations and the hierarchy of operations		✓	✓	✓
1.5.2	add, subtract, multiply and divide whole numbers, including large whole numbers	Non-calculator examples: • 12000 × 3000 • 280000 ÷ 400 • 123 × 45 (‘Long multiplication’ will be limited to 3 digits by 2 digits when numbers are not multiples of 10, 100, etc.) • 8465 ÷ 15 (limit the divisor to 2 non-zero digits when the calculation isn’t straightforward or initial simplification isn’t possible) We would not assess the following examples in an examination (in a non-calculator assessment): • 2357 × 235 • 9635 ÷ 235 However, we can expect learners to divide numbers when the calculation is straightforward, or when they can simplify their calculations before dividing, e.g. by first cancelling common factors. For example: • 250 ÷ 125 (= 2) • 2500 ÷ 375 (leads to 20 ÷ 3)	✓	✓	✓

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.5.3	add, subtract, multiply and divide decimals, fractions and negative numbers	This includes the addition, subtraction, multiplication and division of improper fractions and mixed numbers.	✓	✓	✓
1.5.4	understand and use operations written as number machines	This could include finding an input, output, or an operation within a number machine. Number machines can also be assessed with algebraic inputs and/or outputs.		✓	
1.5.5	use a calculator efficiently and effectively, including: • order of operations • addition, subtraction, multiplication and division • square, cube and other powers • square root and cube root • brackets • other appropriate functions • **standard form**.	Learners should be encouraged to show workings even when a calculator is used. They don't have to work out the answers without a calculator, just show their calculations.	✓		✓
1.5.6	**use the trigonometric functions on a calculator efficiently and effectively**	Candidates should check that their calculators are in the correct trigonometric mode (degrees), especially before examinations.			✓
1.6 Limits of accuracy					
	Learners should be able to:				
1.6.1	round an answer to a reasonable degree of accuracy in light of the context		✓		✓

1. Number

Strand		Teacher Guidance	U1	U2	U3
1.6.2	recognise that measurement is approximate and that a measurement expressed to a given unit is in possible error of half a unit	Formal knowledge of bounds is not needed. For example: A length is 7cm, correct to the nearest centimetre. Could the length be 7.2 cm?	✓		
1.6.3	**determine the upper and lower bounds of numbers expressed to a given degree of accuracy**	Understanding for example that the upper **bound** for 7 cm to the nearest cm is 7.5 cm as opposed to 7.4 cm or 7.49 cm. Note that whilst $7.4\dot{9}$ is technically the largest number that 7 could be, and will be accepted in examination questions, in a practical sense, this number is effectively the same as 7.5. So, we expect learners to use 7.5, as it's an easier number to calculate with.	✓		
1.6.4	**calculate the upper and lower bounds in the addition, subtraction, multiplication and division of numbers expressed to a given degree of accuracy**	• What is the maximum possible height of a stack of blocks if each block is measured correct to the nearest mm? • Will the books fit on the shelf if all measurements are correct to the nearest cm? • What is the maximum number of cakes that can be made from 1 kilogram of cake mix if the weighing scale is accurate to the nearest 10g?	✓		
	Learners should be aware that:				
1.6.5	premature rounding in problems involving multiple steps may affect the accuracy of the final answer	Learners should ensure that values in their working are given to a greater degree of accuracy than that to which the final answer is required i.e. they should not prematurely approximate values that will be used later in the question. Calculate the area of the rectangle in the shape below. Give your answer correct to 1 decimal place. 	✓		✓

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		Height of rectangle = $\sqrt{0.6^2 + 0.6^2} = 0.8$ (premature rounding) Area = 0.8 × 4.7 = 3.76 cm^2 = 3.8 cm^2, correct to 1 d. p.: INCORRECT Correct answer is 0.8485… × 4.7 = 3.988 cm^2 = 4.0 cm^2, correct to 1 d. p.	✓		✓
1.7 Extraction, interpretation and presentation of information					
	Learners should be able to:				
1.7.1	interpret and use mathematical information presented in written or visual form, including infographics, schedules, tables, timetables, calendars and charts	An infographic is a visual representation of information. Images are used to help make it faster and often easier to interpret information. For example, instead of the following text: According to an annual population survey, the percentage of employed people in Wales earning less than the real living wage is around 30.4%. …the following infographic could be used:  For more examples of infographics, please look at the new Blended Learning resource on the Resources website: [Educational Resources - WJEC]	✓		

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.7.2	create plans and schedules	For example: Mr Jones wants to update his bathroom. He needs the carpenter, plumber and electrician to work together for 3 days in January. • The electrician is available from the 10th to the 19th inclusive. • The plumber is available from the 2nd to the 15th inclusive. • The carpenter is available any day except for Saturdays, Sundays and Mondays. Find the 3 dates when Mr Jones can book the carpenter, plumber and electrician to work together. Use the calendar below.	✓ ✓		

January 2026

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

1.7.3	use, interpret and produce Venn diagrams	Set notation will not be assessed. Note that Venn diagrams could include sets that are subsets of others and disjoint sets (no common elements between the sets).	✓	✓	
1.8 Personal/household finance and enterprise					
	Learners should be able to:				
1.8.1	carry out calculations involving knowledge of money; pounds (£) and pence	Whilst finance is covered in depth in Unit 1, knowledge of money (e.g. pounds and pence) is also needed in Unit 2 and Unit 3, for questions set in simple contexts.	✓	✓	✓

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.8.2	understand the basic principles of personal/ household finance and enterprise in order to solve problems relating to, for example: • wages and salaries, including payslips • taxation, including income tax and National Insurance • savings and investments • loans/repayments • mortgages • appreciation/depreciation • budgeting • bank statements • utility bills • mobile phone and other bills • VAT • best buys • price comparison • finance schemes, including buying by instalments • discount/price increase • buying and selling • profit and loss • travel including foreign currencies, exchange rates and commission.	Note, in tax questions within assessments, whilst foreign currencies will still be used, pounds (£) will also be used, but the tax rates might not match the current UK tax rates. Mortgages serve as another context to practise financial skills, such as percentages and taxes. Students should have a basic understanding of repayment mortgages and be able to compare mortgage products or determine the required deposit amount. For more in-depth questions, such as calculating monthly payments, loan amounts needed for a specific monthly payment or the remaining balance on a loan, all necessary information will be provided within the questions. At foundation tier, working with percentages and an understanding of how to use simple formulae will be required. Complicated calculations, contexts or formulae will increase the difficulty of questions and could result in them being assessed at higher grades. Examples of terms that learners will be expected to be aware of: Profit and loss: profit, loss, costs, revenue, appreciation, depreciation. Income tax: income tax, personal allowance, taxable income, basic rate, higher rate, currency, National Insurance (NIC). Finance schemes: overdraft, credit, debit, loan, budget, payment plan, interest, mortgage, personal loan, repayments, lump sum, instalment, initial payment, insurance (e.g. house insurance), crowdfunding. Bills: direct debit, utility bills, meter readings, VAT, mobile phone bills, contracts, airtime, monthly payments, standing charge, kilowatt-hours.	✓		

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		Wages, salaries and payslips: salary, wage, payslip, gross pay, net pay, deductions, overtime, basic pay, pension (all that is required is a knowledge of what a pension is, **detailed knowledge is not required**). Savings and investments: saving, investment, deposit, savings account, current account, interest rate, percentages, compound interest, per annum, quarterly. Bank statements and budgeting: budget, standing order, balance, direct debit, debit, credit, money in, money out (some of these are repeated from above). Travel: currency, exchange rate, commission. The Money and Pensions Service (MaPS) have an online text book that would be very useful for teachers: https://www.young-enterprise.org.uk/your-money-matters-wales/ Please see Appendix A for more information about the Money and Pensions Service. WJEC Knowledge Organisers for personal/ household finance can be found here: Mathematics and Numeracy - Educational Resources - WJEC	✓		
1.8.3	recognise the difference between simple and compound interest and be able to perform calculations with both, using efficient calculation methods and including the use of multipliers	For example: • Find the total value of the investment at the end of 5 years if £300 is invested with a compound interest rate of 4.2%. Calculation: 300×1.042^5 • Find the compound interest earned if £300 is invested for 5 years at an annual rate of 4.2%. Calculation: $300 \times 1.042^5 - 300$	✓		

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
1.8.4	**perform calculations involving multiple rates**	For example: An investment of £3000. 3% decrease for 2 years followed by 5% increase for the next 6 years. Value of investment at the end of the 8 years = $3000 \times 0{\cdot}97^2 \times 1{\cdot}05^6$.	✓		
1.8.5	**calculate, use and apply Annual Equivalent Rate (AER) when comparing financial products**	AERs are used when financial products relate to saving money, e.g. savings accounts, ISAs, bonds. Example: **Banc y Seren**: Nominal interest rate of 1.93% per annum. Interest paid quarterly. **Banc yr Haul**: AER 1.94% By comparing the AERs of both accounts, which of these two banks gives the most interest per annum? Answer: Banc y Seren, as the AER formula gives AER = 1.944…%	✓		
1.8.6	**calculate, use and apply Annual Percentage Rate (APR) when comparing financial products, including mortgages**	APRs are used when financial products relate to borrowing money, e.g. loans, mortgages. In examination questions involving APRs (including mortgages), any formulae needed will be given in the question. For example: Carys is buying a new caravan, priced at £20 000. She is going to take out a loan to buy the caravan. The table below shows her finance options:	✓ ✓		

1. Number

Strand		Teacher Guidance	U1	U2	U3
		(see below)			

	Option A	Option B
Deposit	£0	£2000
Loan amount	£20 000	£18 000
Loan period	5 years	4 years
APR of the loan	3.3%	3.3%
Monthly repayment	£362.05	

The formula for calculating the monthly repayment is: $M = \frac{r \times L}{1-(1+r)^{-n}}$

where:

- M is the amount of each monthly repayment
- L is the loan needed
- r is the **monthly** interest rate as a decimal
- n is the number of **months** taken to pay back the loan.

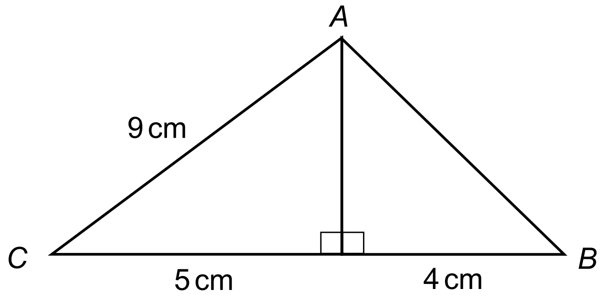
(a) Show that the monthly repayment for Option B is £400.81.
(b) How much money would be saved on paying back the loan if Option B is chosen rather than Option A?
Answer to (b): £484.12.

Note that in part (a), r is the APR divided by 12. So, the formula gives:

$$M = \frac{\frac{0.033}{12} \times 18000}{1 - \left(1+\frac{0.033}{12}\right)^{-4\times12}}$$

1.9 Rational and irrational numbers

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
	Learners should know:				
1.9.1	that recurring decimals are exact fractions, and that some exact fractions are recurring decimals	Identify fractions that are recurring decimals. Write $\frac{5}{18}$ as a recurring decimal.		✓	
	Learners should be able to:				
1.9.2	**convert recurring decimals to fractional form**	Fractions do not need to be simplified unless specified in the question. However, answers must not include a decimal within the fraction.		✓	
1.9.3	**distinguish between rational and irrational numbers**	Any number that can be written as a fraction is rational. Surds and π are irrational.		✓	
1.9.4	**manipulate and simplify numerical expressions involving surds**	This has been included in Unit 3 for when the question requires an answer to be left in surd form, e.g. as part of a question involving Pythagoras' theorem. Access to a calculator will enable learners to simplify any such surds.		✓	✓
1.9.5	**manipulate and simplify more complex numerical expressions involving surds, including multiplying expressions containing surds and simplifying fractions containing surds by division of common factors**	For example: • $\frac{\sqrt{6}}{\sqrt{18}} = \frac{\sqrt{2}\sqrt{3}}{\sqrt{2}\sqrt{9}} = \frac{\sqrt{3}}{3}$ • $\frac{(5-2\sqrt{3})(5+2\sqrt{3})}{\sqrt{13}} = \frac{25+10\sqrt{3}-10\sqrt{3}-4\sqrt{3}\sqrt{3}}{\sqrt{13}} = \frac{13}{\sqrt{13}} = \frac{\sqrt{13}\sqrt{13}}{\sqrt{13}} = \sqrt{13}$ Note that learners will not need to know multiplying techniques to rationalise denominators. The following questions could be asked in examinations. • Simplify $\frac{3}{\sqrt{3}}$ $\left(= \frac{\sqrt{3}\sqrt{3}}{\sqrt{3}} = \sqrt{3}\right)$ • Simplify $\frac{6}{\sqrt{2}}$ $\left(= \frac{3\sqrt{2}\sqrt{2}}{\sqrt{2}} = 3\sqrt{2}\right)$		✓ ✓	

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		However, we will NOT ask learners to simplify $\frac{3}{\sqrt{2}}$, for example, as the only way to simply this fraction is to multiply the numerator and denominator by $\sqrt{2}$.			
1.9.6	**use pi in exact calculations**	For example: A cylinder fits exactly inside a square-based cuboid. Find the ratio of the volume of the cylinder to the volume of the cuboid. Leave your answer in the form $\pi : a$, where a is an integer. Note: it is possible that an exact answer is needed even in Unit 3, especially if it is the answer to the first part of a question, where an approximate answer could result in premature rounding, which would lead to inaccuracy further on. For example: A sector of a circle with radius 5 cm has an area of 100 cm^2. Write the sector angle in terms of π. Hence, calculate the exact length of the arc of the sector.	✓		✓
1.9.7	**use surds in exact calculations**	Note that premature rounding in the first part of a question or solution could lead to inaccuracy further on. For example: Calculate the length of side AB. Give your answer in the form $a\sqrt{b}$, where b is as small as possible.  		✓	✓

1. Number					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		Note that this type of question can be asked on Unit 3, even though a calculator is allowed for this unit.			✓

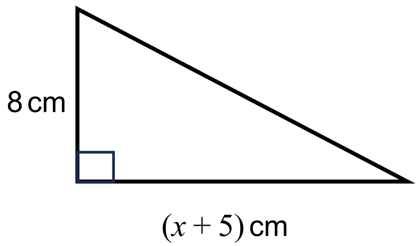
2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.1 Algebraic conventions and manipulation of expressions and formulae					
	Learners should be able to:				
2.1.1	understand the basic conventions of algebra	For example: • ab in place of $a \times b$ • $3a$ in place of $a + a + a$ or $3 \times a$ • y in place of $1y$ • a^2 in place of $a \times a$, • a^3 in place of $a \times a \times a$, • a^2b in place of $a \times a \times b$ • $\frac{a}{b}$ in place of $a \div b$ • coefficients written as fractions rather than as decimals • brackets, $3(a + b)$ as opposed to $3\times(a + b)$	✓	✓	✓
2.1.2	substitute positive and negative whole numbers, fractions and decimals into simple formulae and expressions written in words or in symbols		✓	✓	✓
2.1.3	recognise the definitions of the terms equation, expression and formula and be able to distinguish between them		✓	✓	✓
2.1.4	**recognise the definition of the term identity and be able to distinguish between identities, equations, expressions and formulae**	For example: • Show that $(5y + 1)(y - 4) + (2y - 3)^2 \equiv 9y^2 - 31y + 5$. • Find the values of a and b, when $x^2 - 3x - a \equiv (x + b)(x - 5)$ • Find the values of a and b, when $(3x + a)(bx + 1) \equiv 6x^2 - 5x - 4$.		✓	✓
2.1.5	form and simplify expressions		✓	✓	✓

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.1.6	collect like terms	For multiple variables, answers should be on the same line and connected with a + or –.	✓	✓	✓
2.1.7	expand expressions – single bracket	For example: $3(x+5)$ $2x(x-4)$ $3x(x+5)-2(x-3)$	✓	✓	✓
2.1.8	multiply and divide terms by applying rules of indices	For example: $t^9 \times t^3$ $y^8 \times y^{-3}$ $3w^5 \times 4w^6$ $14d^7 \div 2d^3$ $25ab^3 \times 3a^3b^5$ $(3a^3)^4$ $k^5 \div k^5$ $3p^6 \div 12p^4$		✓	✓
2.1.9	simplify algebraic fractions, including the addition and subtraction of fractions with constant terms as denominators	For example: $\frac{4g^7 \times 5g^6}{10g^2}$ $\frac{3x}{4}+\frac{5x}{7}$ $\frac{3x+2}{3}-\frac{2x-5}{5}$ $\frac{4m^3}{2m^8}$ When factorising is required, the common factor will not be more complicated than a number. For example: • $\frac{2x-4}{4x-10}$ (common factor of 2) • $\frac{3a+12}{6}$ (common factor of 3)		✓	✓
2.1.10	**simplify more complex algebraic fractions, including the addition and subtraction of fractions with linear expressions as denominators**	For example: • $\frac{6x^2-10x}{4x^2-8x}$ (common factor of $2x$) • $\frac{4}{3x}+\frac{2x}{7}$ • $\frac{5x}{2x+4}-\frac{2x+5}{3x-2}$ • $\frac{2x^2-7x-15}{4x^2-9}=\frac{x-5}{2x-3}$ (quadratic expression (see 2.1.15) / difference of two squares)		✓	✓

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.1.11	**expand two linear expressions in one or two variables**	For example: $(x + 3)(x - 5)$ $(3x + 5)(2x + 4)$ $(5x - 2y)(3x + 4y)$		✓	✓
2.1.12	**expand two expressions in one variable, where one is linear and the other is quadratic**	For example: $(3y^2 + 2y - 5)(2y + 4)$ Learners should be able to expand two linear expressions, resulting in a quadratic expression, and then multiply the result by a third linear expression. For example: $(3a + 2)(2a - 7)(a + 5)$ Note, these expansions will result in cubic expressions.		✓	✓
2.1.13	factorise linear or quadratic expressions that have at least one common factor	The common factor will not be more complicated than the equivalent of nx, where n is an integer. For example: $3a + 12$ $5x^2 - 3x$ $12d^2 - 9d$ $6a^2 + 9ab$ $2x^3 + 4x^2 - 8x$		✓	
2.1.14	**factorise more complex expressions by the extraction of common factors**	For example: • $5x^2y - 10xy^2$ • Factorise and simplify $2(x + 3)^9 - 5x(x + 3)^8$ • $18c^3 - 50cd^2$ (leading to the difference of two squares) • Factorise $10x^3 + 5x^2 - 5x$ (leading to a quadratic expression that factorises) Note that the instruction to 'factorise' will always mean to 'factorise fully' in examination questions.		✓	

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.1.15	**factorise quadratic expressions of the form $x^2 + ax + b$ and $ax^2 + bx + c$, including the difference of two squares**	For example: $c^2 + 5c - 6$ $3d^2 + 8d + 5$ $2x^2 - 13x - 24$ $8x^2 + 18x - 5$ $(2x + 3)^2 - 16$ Difference of two squares examples: $y^2 - 25$ $a^2 - b^2$ $25d^2 - 36g^2$ $8g^2 - 50h^2$		✓	
2.1.16	change the subject of a formula when the subject appears in one term	Examples that could be asked at foundation tier (making g the subject): $3g + 4 = h$ $h = \frac{g}{2} - 4$ $5(x + f) = 7f + 3$ $\frac{5}{g} = h$ $5g + h = 3 - 2g$ (the g terms can be collected) Examples at higher tier only (making x the subject): $a = \frac{x}{b} + c$ $d = \frac{7}{e + x}$ $k = \sqrt{mx}$ $n = \sqrt{7x - 5}$ $p = \sqrt[3]{5x - g}$ $A = x^2$ $h = px^2q$ $z^2 = x^2 + y^2$ $k^2 = px^3 + d$ Learners need to ensure that fraction lines and root lines are clear, i.e. the difference between: • $\sqrt{\frac{x + z}{y}}$ and $\frac{\sqrt{x + z}}{y}$ • $\sqrt{a + b - c}$ and $\sqrt{a + b} - c$ • $\frac{p + q}{r} + s$ and $\frac{p + q + s}{r}$ Learners should include the ± sign when taking a square root is involved. Use of the division symbol (÷) instead of fractions in final answers is penalised.		✓	

2. Algebra

Strand		Teacher Guidance	U1	U2	U3
2.1.17	**change the subject of a formula when the subject appears in more than one term**	Make g the subject of the following: • $5g + 4 = 3h + 2ag$ • $5(g + 4) = 3hg$ • $\sqrt{g^2h + 6} = 3g$ • $\sqrt{\frac{3d}{d+g}} = h$		✓	
2.2 Equations and inequalities – algebraic methods					
	Learners should be able to:				
2.2.1	form, manipulate and solve linear and other simple equations with whole number and fractional coefficients	Examples: • $4x – 6 = 14$ • $\frac{1}{2}(3x + 5) = 10$ • $4(x + 3) = 2x – 5$ • The area of the triangle below is 50 cm^2.  Form an equation, and solve it to find the value of x. Note that the last example above could only be assessed in Unit 3. Notes for examination questions:	✓	✓	✓

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		• When forming and solving an equation is required, full credit will not be awarded for a correct solution by trial and improvement. • When answers can be written as whole number answers, they must be written as whole numbers. Fractions or decimals are accepted when answers are not whole numbers. • Although embedded answers are accepted, candidates should be encouraged to use more formal methods, as embedded answers are often contradicted later and therefore gain no credit.	✓	✓	✓
2.2.2	**form, manipulate and solve more complex linear equations, including equations with more than one fractional term**	Examples: • $\frac{4x-1}{3}+\frac{2x+5}{4}=\frac{3}{2}$		✓	✓
2.2.3	form, manipulate and solve simple linear inequalities with whole number and fractional coefficients	Examples: • $3x-4>10$ • $2(3x+1)-4(2x-3)\leq 5$ • $\frac{1}{2}x+7\geq 11$ • Dafydd is going on holiday for a week. He plans to rent a car from a company that charges £75 a week plus 50p for each mile travelled. Dafydd has a budget of £200 to pay for the car rental. Form an inequality and solve it to find the maximum number of miles Dafydd can travel and still keep within his £200 budget. 75 + 0.5m ≤ 200 (leading to: m ≤ 250) Maximum number of miles is 250. Note that when forming and solving an inequality is required, full credit will not be awarded for a correct solution by trial and improvement.		✓	

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.2.4	**form, manipulate and solve linear inequalities where the variable appears on both sides of the inequality or where two separate inequalities are written as a double inequality**	Examples: • $3(2n + 1) \geq 3n - 8$ • $4 \leq 5n + 1 < 20$ • List the integer values of n that satisfy the inequality $2(n - 5) < 3n - 5 < 8 - n$ Answer: – 4, –3, –2, –1, 0, 1, 2, 3		✓	
2.2.5	**form, manipulate and solve by factorisation, quadratic equations of the form $x^2 + bx + c = 0$ or $ax^2 + bx + c = 0$**	Equations may first need to be formed from words or diagrams, or rearranged.		✓	
2.2.6	**form, manipulate and solve two simultaneous linear equations with whole number coefficients by algebraic methods**	Equations may first need to be formed from words or diagrams, or rearranged. A full algebraic method should be used, not trial and improvement. Learners may use the process of substitution or elimination and should be encouraged to check that their solution satisfies both original equations.		✓	
2.2.7	**solve equations involving fractions with linear denominators leading to quadratic or linear equations**	Examples: • $\frac{3(4x+1)}{2x+5} = 7$ • $\frac{3}{2x-7} = 5x$ • $\frac{2x+1}{3x+5} = \frac{x+1}{5x-7}$ • $\frac{3}{x} + \frac{2}{x+1} = \frac{5}{2}$ Note that the second and fourth examples above can only be assessed on Unit 3, as they cannot be solved by factorising.		✓	✓

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.2.8	**form, manipulate and solve by formula, quadratic equations of the form $x^2 + bx + c = 0$, or $ax^2 + bx + c = 0$**	For example: Solve the equation $7x(x + 3) + 1 = x(x + 2)$. You must use the quadratic formula and show all your working. Give your answers correct to 2 decimal places.			✓
2.2.9	solve a range of cubic equations by trial and improvement methods, justifying the accuracy of the solution	Trial and improvement will require confirmation of solutions, using a half-way test, for example. A complete method must be shown, and an unsupported answer will not be accepted.			✓
2.2.10	**construct and use equations that describe direct and inverse proportion**	Learners must state the formula once the constant of proportionality has been found.			✓
2.3 Sequences					
	Learners should be able to:				
2.3.1	recognise, describe and continue patterns in number	The pattern could be represented by diagrams.		✓	
2.3.2	describe, in words and symbols, the rule for the next term of a sequence			✓	
2.3.3	generate linear and non-linear sequences given the nth term rule	Examples The nth term of a sequence is $5n - 7$. What is the 11th term? Write down the first three terms of the sequence with the nth term represented by $n^2 + 11$.		✓	
2.3.4	find the nth term of a sequence, given numerically or diagrammatically, where the rule is linear	For example: • $3n - 4$ • $-5n + 7$		✓	

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		The nth term must be expressed in its simplest form.		✓	
2.3.5	**find the nth term of a sequence, given numerically or diagrammatically, where the rule is quadratic**	For example: • $n^2 + 2$ • $n^2 + 5n - 1$ • $3n^2 - 1$ Note that nth term expressions will be of the form $n^2 + an + b$ or $cn^2 + d$, where a, b or d could be = 0.		✓	
2.4 Coordinates, linear and non-linear graphs					
	Learners should be able to:				
2.4.1	use coordinates in 4 quadrants			✓	
2.4.2	draw, interpret, recognise and sketch the graphs of x = a, y = b, y = ax + b			✓	
2.4.3	know and use the form y = mx + c to represent a straight line where m is the gradient of the line, and c is the value of the y-intercept			✓	
2.4.4	draw and interpret quadratic graphs of the form $y = ax^2 + bx + c$, and draw the line y = k in order to solve $ax^2 + bx + c = k$	For example: Draw the graph of $y = 2x^2 + 5x - 4$ from a table. Draw the line $y = 5$ on the graph paper. Write down the values of x where the line $y = 5$ cuts the curve $y = 2x^2 + 5x - 4$. Example at higher tier only: By using the graph of $y = 2x^2 + 5x - 4$, solve the equation $2x^2 + 5x - 7 = 0$.		✓	

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		A ruler must not be used to join points – a smooth curve is needed. Also, there should be no flat line between two points that are at the same height.			
2.4.5	**use straight line graphs to locate regions given by inequalities**	Learners will need to understand that solid lines represent lines included in the regions, with the inequalities '$\leq$' or '$\geq$' used, and dotted lines represent lines not included in the regions, with the inequalities '<' or '>' used.		✓	
2.4.6	**identify the equations of lines parallel or perpendicular to a given line**	For example: • $y = 3x + 7$ is parallel to $2y = 6x - 5$ and $2y - 6x = 1$. • $y = 3x + 7$ is perpendicular to $y = -\frac{1}{3}x + 12$ and $3y + x = 7$.		✓	
2.4.7	**form, manipulate and solve two simultaneous linear equations with whole number coefficients by graphical methods**			✓	
2.4.8	**draw, interpret, recognise and sketch the graphs of** **$y = ax^2 + b$,** **$y = (ax + b)(cx + d)$,** **$y = a/x$, $y = ax^3$**	A sketch only requires the correct shape and orientation of the graph, and the key points of a graph, e.g. the intersection points with the coordinate axes.		✓	
2.4.9	**draw and interpret graphs of the form** **$y = ax^3 + b$ and** **$y = ax^3 + bx^2 + cx + d$**	A ruler must not be used to join points – a smooth curve is needed. Also, there should be no flat line between two points that are at the same height.		✓	
2.4.10	**use a graphical method to solve** **$ax^2 + bx + c = dx + e$ and** **$ax^3 + bx^2 + cx + d = ex + f$**	For example: The graph of $y = 3x^2 + 9x - 3$ can be used to solve $3x^2 + 5x - 8 = 0$ by drawing the line $y = 4x + 5$ and writing down the points of intersection. ($3x^2 + 9x - 3 = 4x + 5$ can be rearranged to become $3x^2 + 5x - 8 = 0$.)		✓	

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.4.11	**draw and interpret graphs when y is given implicitly in terms of x**	Examples: • Draw the line $x + y = 7$ • Draw the line $2x + y = 5$ • Show that the lines $y = 4x + 2$ and $2y - 8x = 7$ are parallel to each other • Identify the region given by $2y \leq x$.		✓	
2.5 Real-life graphs					
	Learners should be able to:				
2.5.1	draw and interpret the following graphs: • Conversion graphs • Travel graphs • Other graphs that describe real-life situations.		✓		
2.5.2	interpret graphical representation used in the media, recognising that some graphs may be misleading	See section 1.7.1 on infographics above.	✓		
2.5.3	**construct and use tangents to curves to estimate rates of change for non-linear functions, and use appropriate compound measures to express results, including finding velocity in distance-time graphs and acceleration in velocity-time graphs**				✓

2. Algebra					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
2.5.4	**interpret the meaning of the area under a graph, including the area under velocity-time graphs and graphs in other practical contexts**				✓
2.5.5	**use the trapezium rule to estimate the area under a curve**	Note that if the rate of change (gradient) of a curve is continually increasing or continually decreasing (e.g. a quadratic curve), learners will be expected to deduce whether their area is an underestimate or an overestimate.			✓

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.1 Geometric terms, vocabulary and properties of shape					
	Learners should know the following geometric terms, vocabulary and essential properties:				
3.1.1	Geometric terms, including: • point, line and plane • horizontal, vertical, diagonal • midpoint • parallel and perpendicular • clockwise and anticlockwise turns • acute, obtuse, reflex, right angle, straight angle, full turn • exterior, interior angles • faces, edges and vertices		✓	✓	✓
3.1.2	Vocabulary and essential properties of 2-D shapes, including: • triangles – scalene, isosceles, equilateral, right-angled • quadrilaterals – square, rectangle, parallelogram, rhombus, kite, trapezium • polygons – including pentagon, hexagon, octagon, regular and irregular • circles – radius, diameter, tangent, circumference, chord, arc, sector, segment.		✓	✓	✓
3.1.3	Vocabulary and essential properties of 3-D shapes including cube, cuboid, cylinder, prism, pyramid, cone, sphere, tetrahedron		✓	✓	✓

<table>
<tr><th colspan="6">3. Geometry and measures</th></tr>
<tr><th colspan="2">Strand</th><th>Teacher Guidance</th><th>U1</th><th>U2</th><th>U3</th></tr>
<tr><td colspan="6">3.2 Use of mathematical equipment for measurement and accurate drawing.</td></tr>
<tr><td colspan="6">Learners should be able to:</td></tr>
<tr><td>3.2.1</td><td>measure and accurately draw:
• a straight line
• a circle or arc of a circle
• an angle of any size.</td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>3.2.2</td><td>accurately draw, using a ruler and a protractor:
• an angle bisector
• a perpendicular line bisector
• 2-D shapes given side lengths and, if appropriate, angles (compasses will be required to draw triangles when three side lengths are known)
• the locus of a point which moves such that it satisfies certain conditions, including:
i. a given distance from a fixed point or line (compasses will be required)
ii. equidistant from two fixed points or lines.</td><td>The use of compasses is not necessary for bisecting angles, or drawing perpendicular bisectors, as formal constructions are no longer part of the specification. Compasses will not be required when drawing most shapes. However, they will be required for the accurate drawing of a triangle when only three side lengths are known. Compasses will also be required to draw circles or arcs of circles.

Note that, in examination questions, any valid method is allowed.</td><td></td><td></td><td>✓</td></tr>
<tr><td>3.2.3</td><td>solve problems involving intersecting loci in two dimensions – this will include the identification of regions that satisfy certain conditions</td><td>Any regions and / or points identified must be clearly indicated.

All lines and arcs must be of sufficient length to be able to select the correct region.</td><td></td><td></td><td>✓</td></tr>
</table>

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.3 Maps, scale drawings, bearings and 2-D representation of 3-D shapes					
	Learners should be able to:				
3.3.1	read and interpret scales	Learners should be familiar with a range of different scales, some of which include large numbers and decimals.	✓		✓
3.3.2	use and interpret maps		✓		✓
3.3.3	interpret and produce scale drawings; scales may be written in the form 1 cm represents 5 m, or 1:500		✓		✓
3.3.4	understand 3-figure bearings and use this knowledge to interpret and draw bearings		✓		✓
3.3.5	interpret plans and elevations of 3-D shapes	Learners will not need to draw.			✓
3.3.6	interpret 2-D representation of 3-D shapes on isometric paper	Learners will not need to draw. For example: Finding the volume of a cuboid drawn on isometric paper.			✓
3.3.7	interpret nets of 3-D shapes	Learners will not need to draw.			✓
3.4 Angle facts					
	Learners should be able to:				
3.4.1	recall and use the following angle properties: • Sum of angles at a point • Sum of angles on a straight line • Opposite angles at a vertex	Note that learners are expected to know standard angle notation for shapes that have vertices labelled, e.g. $B\hat{A}C$ for an angle or *AC* for a line. When reasons are required, it is expected that correct mathematical language should be used, for example, alternate angles, corresponding angles, etc.	✓	✓	✓

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
	• Alternate, corresponding and interior angles within parallel lines • Sum of angles in a triangle	When a reflex angle is required, this will be stated in the question. If the word reflex is not included, then learners should assume that the angle needed is between 0° and 180°.	✓	✓	✓
3.4.2	recall and use the following angle properties: • Angle properties of right-angled, isosceles and equilateral triangles • The exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices • Sum of angles in a quadrilateral • Angle properties of special quadrilaterals, including rectangles, parallelograms and kites			✓	✓
	Learners should be able to recall and use facts in relation to:				
3.4.3	Polygons: • Regular and irregular polygons • Sum of exterior angles of a polygon • Sum of an interior and exterior angle of a polygon • Sum of interior angles of a polygon	For example: • Find the size of an interior angle in a 15-sided regular polygon. • Find the sum of the interior angles of a 10-sided polygon.		✓	

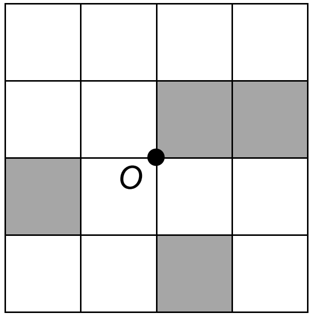
3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.4.4	**Circle theorems:** • **The tangent at any point on a circle is perpendicular to the radius at that point** • **The angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference** • **The angle subtended at the circumference by a semicircle is a right angle** • **Angles in the same segment are equal** • **Opposite angles of a cyclic quadrilateral sum to 180°** • **Alternate segment theorem** • **Tangents from an external point are equal in length**	When referring to angles and sides, it is expected that appropriate naming conventions are used, e.g. $B\hat{A}C$ for an angle or *AC* for a line. When reasons are asked for, all the key words from the relevant theorem must be given.		✓	
	Learners should be able to:				
3.4.5	**construct geometric proofs using angle properties and facts, including circle theorems**	When referring to angles and sides, it is expected that appropriate naming conventions will be used, e.g. $B\hat{A}C$ for an angle or *AC* for a line.		✓	
3.5 Units and measure					
	Learners should know and be able to use the following:				

3.5.1	Time: • Notation for 12- and 24-hour clock • Seconds in a minute, minutes in an hour, hours in a day, days in a week and months in a year	A mix of 24-hour clock and 12-hour clock notation will not be accepted. For example: 09:00 a.m. or 21:30 p.m. will be penalised if written as final answer. Learners need to know the decimal form for times, for example: • 6 minutes = 0.1 hours • 30 minutes = 0.5 hours • 15 minutes = 0.25 hours • 45 minutes = 0.75 hours Also, learners need to know that 20 minutes = $\frac{1}{3}$ hour, for example.	✓	✓	✓
3.5.2	Metric Units: • Standard metric units for length, mass and capacity and the relationships between them	Knowledge of ml, l, mm, cm, m, km, mg, g, kg and tonne is required.	✓	✓	✓
	Learners should be able to:				
3.5.3	carry out calculations involving time		✓	✓	✓
3.5.4	convert between units of time	Learners will need to give answers in a certain form, e.g. in hours and minutes, e.g. a final answer of 3.5 would not be accepted for 3 hours 30 minutes.	✓		✓
3.5.5	carry out calculations involving different time zones		✓		
3.5.6	make sensible estimates of metric measurements in everyday situations, recognising the appropriateness of units in different contexts		✓		✓

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.5.7	convert between the following metric and Imperial units: km - miles; cm, m - inches, feet; kg - lb; grams - ounces; litres - pints, gallons – the appropriate metric to imperial equivalences will be given to learners	In examination questions, if metric to imperial conversions or vice versa are needed, learners will be given, and expected to use, the relevant conversion factors in the question.	✓		
3.5.8	recall and use compound measures for speed and fuel consumption. Units include: m/s, km/h, mph and mpg		✓		✓
3.5.9	recall and use other compound measures, including density, population density and flow rates. Units include kg/m^3, g/cm^3, population per km^2, m^3 per hour, litres per second				✓
3.5.10	**convert between units of area and volume**		✓		✓
3.6 Perimeter, area and volume					
	Learners should be able to calculate the following for 2-D and 3-D shapes:				
3.6.1	2-D shapes: • Estimate of the area of an irregular shape drawn on a square grid • Perimeter and area of a square, rectangle, triangle, parallelogram, trapezium, circle, semicircle and a composite shape	Exact answers including π may be required at higher tier only (see 1.9.6).	✓		✓
3.6.2	**2-D shapes:** • **Length of a circular arc** • **Area of a sector and a segment**	Exact answers might be asked for at higher tier.			✓

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.6.3	3-D shapes: • Surface area, cross-sectional area, volume and capacity of a cube, cuboid, prism, and a composite solid • Cross-sectional area, volume and capacity of a cylinder • **Surface area of a cylinder** • **Surface area, volume and capacity of a sphere, cone, pyramid and a compound solid**	Learners will need to know that the volume of a pyramid is $\frac{1}{3}$ of the volume of a prism with the same base area and height.	✓		✓
3.7 Pythagoras' theorem and trigonometry					
	Learners should be able to:				
3.7.1	use Pythagoras' theorem in 2-D, including reverse problems	Exact answers including surds may be required at higher tier only (see 1.9.7).			✓
3.7.2	**use Pythagoras' theorem in 3-D, including reverse problems**	Exact answers including surds may be required (see 1.9.7).			✓
3.7.3	**use trigonometric relationships in right-angled triangles to solve problems, including those involving bearings and angles of elevation and depression**				✓
3.7.4	**calculate a side or an angle of a right-angled triangle in 2-D and 3-D**				✓
3.7.5	**extend trigonometry to angles of any size**				✓

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.7.6	**apply knowledge of trigonometry with angles of any size to the solution of problems in 2-D or 3-D, including appropriate use of the sine rule and cosine rule**				✓
3.7.7	**use the formula: area of a triangle = ½absinC**				✓
3.7.8	**sketch, understand the behaviour of, and use the graphs of trigonometric functions**	Solutions of trigonometric equations, such as $\cos x = -0.73$, will be asked for in a given range.			✓
3.8 Position, symmetry and transformations					
	Learners should be able to:				
3.8.1	find coordinates identified by given geometrical information including: • the midpoint of a line • the fourth vertex of a parallelogram • location determined by distance from a given point and angle made with a given line.			✓	
3.8.2	describe and draw shapes with line symmetry			✓	
3.8.3	draw lines of symmetry on a shape			✓	

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.8.4	understand order of rotational symmetry and describe and draw shapes with rotational symmetry	Drawing of simple shapes or completing a shape on a grid could be required. For example: Shade the least number of squares for the shape to have rotational symmetry of order 2, about *O*. 		✓	
3.8.5	describe and draw the following transformations: • reflection in a given line • rotation of 90º or 180º, clockwise or anticlockwise, using a centre of rotation • translation with direction and distance of horizontal and vertical movement • enlargement with positive integer or a positive, fractional scale factor, and a centre of enlargement • **enlargement with a negative scale factor and centre of enlargement.**	For enlargement, at both tiers, the centre of enlargement could be placed outside or inside the shape, or at the edge of the shape. For translation, use and knowledge of column vectors is not expected.		✓	

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.8.6	**describe and draw two successive transformations**	Learners should know and use the fact that two successive transformations can often be described as a single transformation. For example: An enlargement with scale factor −2 is equivalent to a rotation of 180° followed by an enlargement with scale factor 2. Note that when a question asks for the description of a **single** transformation, full credit will not be given for a combination of transformations (even if they are correct).		✓	
3.9 Similar shapes and congruence					
	Learners should be able to:				
3.9.1	identify congruent and similar shapes				✓
3.9.2	use the knowledge that, for two similar 2-D or 3-D shapes, one is an enlargement of the other				✓
3.9.3	**use the knowledge that, in similar shapes, corresponding dimensions are in the same ratio**				✓
3.9.4	**use the knowledge that, in similar and congruent shapes, corresponding angles are equal**	Similarity does not imply congruence (two similar shapes could be different enlargements of each other). However, congruence implies similarity (they are exactly the same size).			✓
3.9.5	**use the relationships between the ratios of lengths, areas, volumes and capacities of similar shapes**				✓

3. Geometry and measures					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
3.9.6	**understand and use the following conditions to prove the congruence of triangles using formal arguments:** • **side-side-side (SSS)** • **side-angle-side (SAS)** • **angle-angle-side (AAS)** • **right angle-hypotenuse-side (RHS).**	When referring to angles and sides, it is expected that appropriate naming conventions are used.			✓

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
4.1 Data handling cycle – collection methods					
	Learners should be able to:				
4.1.1	understand and use the statistical problem solving process: specify the problem/planning; collect, process and represent data; interpret and discuss results, including limitations of data and anomalies		✓		✓
4.1.2	specify and test hypotheses, taking account of the limitations of the data available		✓		✓
4.1.3	design and criticise questions for a questionnaire, including notions of fairness and bias		✓		✓
4.1.4	consider the effect of sample size and other factors that affect the reliability of data and conclusions drawn		✓		✓
4.1.5	understand and use tallying methods				✓
4.1.6	understand and use frequency tables				✓
4.1.7	sort, classify and tabulate qualitative (categorical) data, discrete or continuous quantitative data.				✓
4.1.8	group discrete or continuous data into class intervals of equal or unequal widths		✓		✓

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
4.1.9	**specify the data needed and consider potential sampling methods**		✓		
4.1.10	**understand, describe and use different sampling techniques – i.e. random, systematic and stratified sampling**	In systematic sampling, the first item can be selected at random anywhere from the whole population. It does not have to be picked from the first batch of values. If the first item is not from the first batch of values, the full sample should be generated by cycling back to the start of the population when the end is reached.	✓		
4.2 Data handling cycle – represent, interpret and display results					
	Learners should be able to:				
4.2.1	construct and interpret pictograms, bar charts and pie charts for qualitative data and for discrete quantitative data	For bar charts, the frequency scale must be uniform and start at 0.	✓		✓
4.2.2	construct and interpret vertical line diagrams for discrete data	The horizontal scale must be uniform, but it does not have to start at 0.	✓		✓
4.2.3	construct line graphs for the values of a variable at different points in time; understand that intermediate values in a line graph may or may not have meaning		✓		✓
4.2.4	construct scatter diagrams for data on paired variables				✓

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
4.2.5	draw 'by eye' a line of 'best fit' and understand and interpret what this represents. In questions where the mean point has been given, calculated or plotted, candidates will be expected to draw the line of 'best fit' through that point	For example: A scatter graph shows marks of 10 students in two tests, chemistry and physics. The mean chemistry mark is 52. The total of all the physics marks is 560. Plot the mean point and use this point to draw a line of best fit. If the line of best fit is expected to go through the mean point, a tighter tolerance will apply for the position of the line. The line of best fit should be drawn with a ruler and follow the general trend of the data points. The line should roughly pass through the middle of all the points, with some points above the line and some points below. The length of the line must be at least the distance from the first to last point on the diagram. Learners will be expected to make predictions from the line of best fit, but also realise when it is not appropriate to do so. They should also be aware that some points may not follow the same pattern as the rest.			✓
4.2.6	interpret and draw conclusions from scatter diagrams; use terms such as positive correlation, negative correlation, little or no correlation	Examination questions could ask for the type of correlation, and some questions could ask to explain what the correlation means in the context of the question. If an explanation is asked for, then explicit reference must be made to the variables in the question. Responses such as 'as one goes up and so does the other' will not be awarded marks.			✓
4.2.7	appreciate that correlation does not imply causality				✓
4.2.8	find the mean, median, mode and range of a list of values	Problem-solving questions could also be asked, in which the mean, mode, median and range are given, and the numbers are to be found.			✓

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		For example: List five single-digit numbers that have a median, mode, mean and range all equal to 5. Candidates should be aware that the total of the unknown numbers can be calculated from the mean.			
4.2.9	construct and interpret grouped frequency diagrams and frequency polygons	Frequency polygons connect the midpoints of the top of the bars in a grouped frequency diagram. The frequency scale must be uniform and start at 0. The horizontal scale must be uniform, but it does not have to start at 0.			✓
4.2.10	find the mean, median, mode and range for a discrete (ungrouped) frequency distribution				✓
4.2.11	find an estimate for the mean of a grouped frequency distribution	Learners need to understand that estimates are asked for because midpoints of groups are used, as opposed to actual (raw) data. In other words, exact means cannot be calculated, as all the data values are not known.			✓
4.2.12	**find an estimate for the median of a grouped frequency distribution**	For example: Find an estimate for the median of the following grouped frequency distribution, where t is time in seconds: (see table below) Solution: Total frequency = 36.			✓

Time	$50 \leq t < 54$	$54 \leq t < 58$	$58 \leq t < 62$	$62 \leq t < 70$
Frequency	4	16	12	4

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		The median time is the 18th value, which is in the group $54 \le t < 58$ seconds. The 18th value is (18 – 4) / 16 of the way up from 54. = 14/16 of the way up from the lower bound of the group. *(Note that the '4' in the calculation is the total frequency of all groups lower than the group the median is in.)* Therefore, the estimate of the median value is 54 + (14/16) x 4 = 57.5. Note that the calculation is similar when we use the 18.5th person, which is strictly more correct. The median then is 57.625. However, as we're *estimating* the median, and there isn't a significant difference between the two answers, particularly when the total frequency is large, using 18 is easier and is acceptable in examination questions. Note that the data could be presented in a histogram instead of in a grouped frequency table.			
4.2.13	determine the modal category for qualitative data and modal class for grouped data				✓
4.2.14	determine the group containing the median for grouped data				✓
4.2.15	select, calculate and estimate appropriate measures of central tendency (i.e. the mean, median or the mode)	Learners should understand when one or more of the mean, median or mode is not an appropriate measure of central tendency. For example, the mean may not be an appropriate measure if the data is skewed and/or the data has one or more outliers. **Learners are not expected to know the meaning of the words 'skew' and 'outlier'.**			✓

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
4.2.16	compare data distributions using one measure of central tendency and/or one measure of spread	Learners should understand the following, and be able to make informed decisions on: • spread: using range / interquartile range, and link with consistency • advantages of using the interquartile range rather than the range (at higher tier only) • whether one data distribution may seem 'better' when considering an average, yet the other data distribution may seem 'better' when considering the spread.			✓
4.2.17	**select, calculate and estimate appropriate measures of spread, including the range and interquartile range applied to discrete, grouped and continuous data**				✓
4.2.18	**construct and interpret cumulative frequency tables and diagrams, including estimating the median, interquartile range and other percentages**	Learners will need to be able to compare cumulative frequency distributions, e.g. using the median and interquartile range.			✓
4.2.19	**interpret and use box-and-whisker diagrams to compare distributions**	Learners will **not** be expected to draw box and whisker diagrams. Box-and-whisker diagrams show summary statistics and are an alternative representation to cumulative frequency graphs. Learners will need to be able to compare two or more box-and-whisker diagrams or one data set represented by a box-and-whisker diagram and one represented by a cumulative frequency diagram.			✓
4.2.20	**construct and interpret histograms with unequal class widths, including calculating the median and other percentages of the distribution**	For example: Learners will need to be able to find the value that 40% of the population exceeded.			✓

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
		See section 4.2.12 regarding estimating the median (and other percentages) from histograms.			
4.2.21	recognise that graphs may be misleading	Typical examples include: • graph not drawn with all given data • y-axis not starting at 0 • inconsistent scale on y-axis • groups too big for grouped data	✓		✓
4.2.22	look at data to find patterns and exceptions		✓		✓
4.2.23	draw inferences and conclusions from summary measures and data representations, relate results back to the original problem		✓		✓
4.3 Probability – single event/experiment					
	Learners should know:				
4.3.1	the vocabulary of probability, including notions of uncertainty and risk			✓	
4.3.2	the meaning of the terms 'fair', 'an even chance', 'certain', 'likely', 'unlikely' and 'impossible'	Learners need to know that they only use these terms when ‘chance’ not ‘probability’ is required. They should not use these terms when the question asks for a numerical value (a probability).		✓	
4.3.3	that the probability scale extends from 0 to 1			✓	
4.3.4	that probabilities may be expressed as fractions, decimals or percentages	Unless the question specifically asks, it is not necessary to simplify fractions. However, decimals are not accepted as numerators or denominators of fractions. Note, ‘2 in 15’ or ‘2 out of 15’ will not be accepted for $\frac{2}{15}$.		✓	

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
4.3.5	that the total probability of all the possible outcomes of an experiment is 1			✓	
	Learners should be able to:				
4.3.6	calculate theoretical probabilities based on equally likely outcomes			✓	
4.3.7	estimate the probability of an event as the proportion of times it has occurred – link to experimental evidence and relative frequency			✓	
4.3.8	draw and interpret a graphical representation of relative frequency against the number of trials and understand that the long-term stability of relative frequency is expected			✓	
4.3.9	compare an estimated probability from experimental results with a theoretical probability			✓	
4.3.10	understand and use the expected number of successes of an event when an experiment is repeated, and events are equally likely	Note that examination questions could involve the profit or loss made from a game being played multiple times, for example. The calculations involving profit and loss in these questions are considered to be '…calculations involving knowledge of money' (1.8.1), and they are not considered to be of the same complexity as the calculations involving profit and loss required in section 1.8.2 of the specification, where work with percentages and other skills are needed. For example: The probability of a player winning a game is 0.4. It costs 50p to play the game, and the prize for winning the game is £2. Calculate the expected profit or loss when 35 games are played.		✓	

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
4.4 Probability – more than one event/experiment					
	Learners should know:				
4.4.1	that if A and B are mutually exclusive events, then the probability of A or B occurring is P(A) + P(B)			✓	
4.4.2	that if A and B are independent events, then the probability of A and B occurring is P(A) x P(B)	Note that learners need to understand the formula for independent events at foundation tier. On foundation tier, it is used in simple tree diagram questions, but also in questions that do not involve tree diagrams. For example: Two unbiased 6-sided dice are rolled at the same time. Calculate the probability that: (a) both dice land on a six (b) the first dice lands on a 3 and the second dice lands on a 5. Note that in the above example, asking for the probability that 'one dice lands on a 3 and the other dice lands on a 5' would be too demanding for foundation tier, as it involves different permutations. However, it **could** be asked at foundation tier if the question was set up using a tree diagram or a sample space diagram, such as a two-way table of outcomes.		✓	
4.4.3	identify all the outcomes of a combination of experiments, including lists, sample space diagrams, tree diagrams and Venn diagrams	Examples could include identifying outcomes for up to 3 events as follows: • different combinations of starter, main course and dessert • a tree diagram with three sets of branches • a Venn Diagram with 3 sets. Note that at foundation tier, examination questions on tree diagrams will be relatively simple. We will not expect candidates to find P(B) when P(A) × P(B) is known, and we will not expect candidates to calculate complicated additions of probabilities, e.g. in tree diagrams with three sets of branches.		✓	

4.Statistics and Probability					
Strand		**Teacher Guidance**	**U1**	**U2**	**U3**
4.4.4	recognise when the addition of probabilities for mutually exclusive events and the multiplication of probabilities for two independent events is needed			✓	
4.4.5	**recognise when problems involve three independent events, and be able to calculate the required probabilities**	Learners need to be able to calculate the probability of three independent events from different experiments. For example: • a dice, a coin and a spinner • choosing 3 counters from a bag, with replacement. • rolling 3 dice or spinning 3 spinners • choosing 3 grains of rice from a bag of rice, without replacement (as the number of grains is large, the events can be considered to be independent). For example: Three unbiased 6-sided dice are rolled at the same time and their scores are added together. What is the probability that the total score is 4?		✓	
4.4.6	**recognise when problems involve two or three dependent events, and be able to calculate the required probabilities, including sampling without replacement**	Examples: A bag contains 7 red counters and 3 green counters. Two counters are taken from the bag at random without replacement. What is the probability that at least 1 red counter is chosen? Ten cards are labelled from 1 to 10. Three cards are chosen at random without replacement. Calculate the probability that: (a) all three chosen cards have odd numbers on them (b) no more than one of the chosen cards has an even number on it.		✓	

Learning Experiences

Learners should be encouraged to consider the following learning experiences and skills to further develop their understanding, appreciation and awareness of the subject content. Information in the table below provides opportunities for teachers to integrate the learning experiences into delivery.

<table>
<tr><th>Learning Experience</th><th colspan="2">Exemplification of Learning Experience</th></tr>
<tr><td>1. Develop their integral skills and cross-curricular skills in literacy and digital competency</td><td colspan="2">Exemplification of this learning experience can be found in the opportunities for embedding elements of the Curriculum for Wales section found later in this guidance.</td></tr>
<tr><td>2. Work both independently and collaboratively</td><td colspan="2">The ability to work independently is crucial to all learners tracking their own progress through this specification. Independent work encourages learners to take ownership of their own studies, leading to a better understanding and retention of mathematical concepts. Habits formed during GCSE Mathematics and Numeracy can ease transition to further and higher education, where self-directed study is crucial. Equally, mathematics is a subject in which collaborative discussion of solutions, misconceptions and approaches is hugely impactful on progress. Both independent and collaborative learning are imperative in supporting the development of learners' mathematical fluency, conceptual understanding, logical reasoning, strategic competence and communication with symbols.

Problem style questions which require multiple steps to solve are effective in promoting collaborative learning. Learners can work in groups to discuss strategies, divide tasks, and come up with solutions together.</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Examples</td></tr>
<tr><td>2.4.2
Draw, interpret, recognise and sketch the graphs of x=a, y=b, y=ax+b

3.8.5
Describe/draw a reflection in a given line</td><td>A useful approach to independent learning is to provide learners with the tools they need to complete a 'prep' style activity, aimed at securing a sound knowledge of the building blocks needed to access a lesson in the future. For example, learners could be tasked with completing an independent learning activity on identifying the equations of horizontal and vertical lines (2.4.2) in advance of a lesson on transformations (3.8.5).</td></tr>
</table>

	4.1.2 Specify and test hypotheses, taking account of the limitations of the data available.	There are opportunities in 4.1.2 to independently plan and test a hypothesis. Learners could use their own area of interest to devise a hypothesis and questionnaire. Collaboratively, they can trial and criticise each other's questions, testing them for fairness and bias, and developing their conceptual understanding.
3. Make appropriate connections with other parts of the curriculum in order to appreciate the role mathematics plays in other subject areas	Making links and showing the usefulness of mathematics in other subject areas is an invaluable tool when adding substance and relevance to a topic or task.	
	Examples	
	1.4.6 Express one number as a fraction or percentage of another	Learners could use recent census data to compare and contrast. For example, learners could find and summarise data such as the percentages of the population in manufacturing in mathematics, whilst drawing conclusions in geography lessons about the changes in Wales' employment/job structure and suggesting possible reasons why this has happened.
	3.5.8 Recall and use compound measures for speed and fuel consumption Units include: m/s, km/h, mph and mpg	Learners could use data from a sports day or a series of physical education lessons to measure distances and calculate average speed using compound measures (3.5). Using this data and their findings, they could then analyse performance and make predictions. This task not only promotes healthy living but also demonstrates how mathematics is intertwined with everyday activities.
	3.8.3 Draw lines of symmetry on a shape 3.2 Use of mathematical equipment for measurement and accurate drawing	Learners could explore concepts like symmetry and rotational symmetry (3.8) whilst undertaking a geometric art project. They could use rulers, compasses and protractors to draw precise shapes and patterns (3.2).

<table>
<tr><td>4. Gain awareness and appreciation of some of the different careers and work-related areas that draw upon mathematics</td><td colspan="2">Insight into the use of mathematics ‘post school’ can engage and inspire learners to pursue the subject further. Talks from famous mathematicians, local universities, careers advisors, and local parents and businesses who have had successful careers using mathematics can be very useful. This area is discussed in the opportunities for embedding elements of the Curriculum for Wales section of this guidance.</td></tr>
<tr><td rowspan="4">5. Access rich tasks that invoke curiosity, build resilience and require Learners to be resourceful</td><td colspan="2">Deeper understanding of a mathematics concept is aided through rich tasks that invoke curiosity, encouraging inquisitive learners to consider ‘What if?’</td></tr>
<tr><td colspan="2">Examples</td></tr>
<tr><td>1.8
Personal/household finance and enterprise</td><td>Learners could use the internet to research and present the best option of mobile phone plan given a certain desired criteria for an individual which could include:
• minutes/texts/data required
• strength of signal in geographic location
• additional benefits.</td></tr>
<tr><td>4.3.10
Understand and use the expected number of successes of an event when an experiment is repeated, and events are equally likely</td><td>The area of personal finance and enterprise could be linked to probability by developing a game for attendees to a local fair or fete. Calculating a theoretical probability and refining the expected money raised whilst considering the popularity of the game could be a classroom activity that builds resilience and curiosity.</td></tr>
</table>

<table>
<tr><td rowspan="5">6. Undertake practical work that allows Learners to apply their mathematical skills inside and outside of the classroom setting</td><td colspan="2">Practical work both in and outside the classroom setting can improve engagement in mathematics lessons and provide learners with a different approach and a hook on which to recall previous knowledge and skills. There are many ways in which to achieve this.</td></tr>
<tr><td colspan="2">Examples</td></tr>
<tr><td>1.6
Recognise that measurement is approximate and that a measurement expressed to a given unit is in possible error of half a unit

4.2.16
compare data distributions using one measure of central tendency and/or one measure of spread</td><td>Learners could use stopwatches to time the flight of bottle rockets promoting discussion over limits in accuracy.

This task could be developed to calculate averages and ranges to compare distributions.</td></tr>
<tr><td>3.1
Geometric terms, vocabulary and properties of shape

3.4.3
Regular and irregular polygons</td><td>Learners could use measuring tools, ropes and stakes to construct various geometric shapes and structures. In this task learners would collaborate to create polygons or three-dimensional structures like pyramids or tetrahedrons.</td></tr>
<tr><td>3.7.3
Use trigonometric relationships in right angled triangles to solve problems, including those involving bearings and angles of elevation and depression</td><td>Learners could explore local architecture to study symmetry, shape, and angles. They could undertake a nature walk to learn about geometry and measurement. For example, using trigonometry to estimate the height of trees or using a cm square grid to estimate the area of a leaf.</td></tr>
</table>

<table>
<tr>
<td rowspan="3">7. Access digital technologies to enhance digital understanding and strengthen mathematical and numeracy skills</td>
<td colspan="2">Digital technologies are incredibly effective in providing speed and clarity for a variety of visual representations in mathematics, thereby improving engagement in lessons and strengthening numeracy skills.

Learners could use video editing software to develop topic guides for their peers/younger year groups. Planning and developing effective resources, they would work in groups to teach and explain a key concept/method to a learner in key stage three. These videos could be edited and uploaded as a learning tool.

Further examples of this nature are in the digital competence area of the opportunities for embedding elements of the Curriculum for Wales section in this guidance.</td>
</tr>
<tr>
<td colspan="2">Example</td>
</tr>
<tr>
<td>2.2
Equations and inequalities – algebraic methods</td>
<td>Graphing software could be used to develop fluency and a deeper understanding of the connections between algebra and geometry when exploring the visuality of finding the roots of a quadratic equation.</td>
</tr>
<tr>
<td rowspan="3">8. Encounter familiar, unfamiliar and complex problems</td>
<td colspan="2">Due to the nature of the subject area, learners will encounter mathematical challenges throughout the specification. Opportunities to learn from errors and mistakes, overcome misconceptions, and solve mathematical problems in a range of real-life authentic contexts are pivotal to their progress.

Learners need to have the opportunity to investigate how to solve problems, in new and varied contexts, and discuss, questions and generate their own ideas or alternative strategies on how to solve them.

In mathematics lessons, this can be achieved through blending different areas of mathematics into the same task.</td>
</tr>
<tr>
<td colspan="2">Example</td>
</tr>
<tr>
<td>2.2
Equations and inequalities – algebraic methods

3.6
Perimeter, area and volume</td>
<td>Learners could use algebra to form and solve an equation which is then used to find the area of a compound shape.</td>
</tr>
</table>

Opportunities for embedding elements of the Curriculum for Wales

Cross-cutting themes			
Local, National & International Contexts	The specification for teaching GCSE Mathematics and Numeracy provides rich opportunities to connect learners to local, national and international contexts, enhancing both their understanding and application of mathematical concepts. Teachers can draw on local real-life information that is relevant and relatable to their learners, such an analysing community data, house prices, traffic patterns, population demographics and budgeting for local projects. National and international contexts can be explored by linking mathematical content to locations, maps, landmarks, architecture, travel, medicine, computing, health, demographics, economy, finance and climate.		
	Specification Reference	**Amplification**	**Example(s)**
	3.3.2	Use and interpret maps	Using maps of the UK, learners can explore distances between cities, understanding the scale and how to calculate real distances using scale factors. For example, if a map has a scale of 1:50,000, learners can calculate the actual distance between two towns/cities. Learners could calculate the bearing from London to Cardiff, helping them grasp the concept of direction over larger distances. Global maps introduce learners to distance calculations between countries or major cities. This can lead to discussions about international travel and geography.
	3.5.5	Carry out calculations involving different time zones	Learners can carry out calculations in different time zones and compare international times with their local time. Learners can carry out calculations to explore the impact times zones have on international business connections.
	4.2.8	Find the mean, median, mode and range of a list of values	Learners can use measures of mean, median, mode and range through the context of comparing average house prices and how they vary across different local neighbourhoods.

<table>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">Sustainability</td><td colspan="3">Integrating sustainability into teaching GCSE Mathematics and Numeracy will enrich mathematical learning and provide learners with the skills and knowledge to tackle real-world issues and develop a deeper understanding of both mathematics and sustainability. It will allow learners to enhance their analytical skills and foster a sense of responsibility for the environment.

Sustainability can be explored when contextualising the teaching of a range of mathematical topics. Learners can calculate costs and analyse data on topics such as climate change, population growth, energy consumption, renewable energy, waste and recycling, carbon footprint and environmental health. Learners can read, interpret and analyse graphs and charts, examine trends of data and make predictions on the impact of sustainable topics. When teaching the topic of population density, its impact on sustainability can be explored. The specification allows schools the flexibility to create their own contextual scenarios to explore sustainability.</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example(s)</td></tr>
<tr><td>1.8.2</td><td>Understand the basic principles of personal/ household finance and enterprise in order to solve problems relating to, for example:
• wages and salaries, including payslips
• taxation, including income tax and National Insurance
• savings and investments
• loans/repayments
• mortgages
• appreciation/depreciation
• budgeting
• bank statements
• utility bills
• mobile phone and other bills
• VAT</td><td>Learners can carry out calculations involving renewable energy such as calculating the monthly costs, cost effectiveness and payback time of renewable energy sources to reduce household bills.</td></tr>
</table>

		• best buys • price comparison • finance schemes, including buying by instalments • discount/price increase • buying and selling • profit and loss • travel including foreign currencies, exchange rates and commission.	
	2.1.2	Substitute positive and negative whole numbers, fractions and decimals into simple formulae and expressions written in words or in symbols	Learners can calculate initial costs of renewable energy sources versus long-term savings from energy efficiency using algebraic formula. Evaluating the financial benefits of sustainable practices using formulas to project savings over time and returns on investments.
	3.6.1	Perimeter and area of a square, rectangle, triangle, parallelogram, trapezium, circle, semicircle and a composite shape	The perimeter, area, surface area, measurements and cost savings can be calculated on environmentally friendly buildings. Measurements and surface areas can be calculated on sustainable resources such as solar panels and dimensions of wind turbines.

<table>
<tr><td rowspan="4">Human Rights Education and Diversity</td><td colspan="3">Incorporating Human Rights Education and Diversity into the teaching of GCSE Mathematics and Numeracy can be achieved by delivering the specification in a way that is inclusive to all learners in the classroom and representative of the diverse backgrounds and lives of the broad range of learners in Wales. Mathematical topics such as analysing data, interpreting graphical information, percentages and ratio can be connected to human rights issues such as poverty, wealth, gender inequality, health care and access to education.</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example(s)</td></tr>
<tr><td>1.4.11</td><td>Calculate using ratios in a variety of situations</td><td>Calculations involving ratios can be used to compare human rights issues such as:
• gender inequality in education in certain countries
• access to clean drinking water in a certain region
• percentage of a population who earn below the living wage.</td></tr>
<tr><td>1.8.2</td><td>Understand the basic principles of personal/ household finance and enterprise in order to solve problems relating to, for example:
• wages and salaries, including payslips
• taxation, including income tax and National Insurance
• savings and investments
• loans/repayments
• mortgages
• appreciation/depreciation
• budgeting
• bank statements
• utility bills
• mobile phone and other bills</td><td>Gender equality can be explored when looking at the potential earnings of female football players who have played in the World Cup compared to male football players of the same level. The gender earning gap can be compared across other sports such as tennis to see if the earning gap is greater in some sports compared to others.</td></tr>
</table>

		• VAT • best buys • price comparison • finance schemes, including buying by instalments • discount/price increase • buying and selling • profit and loss • travel including foreign currencies, exchange rates and commission.	
	4.2.8	Find the mean, median, mode and range of a list of values	Calculate the mean, median and mode using population data and use this to open discussion on demographics.

<table>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">Careers and Work-Related Experiences</td><td colspan="3">Incorporating Careers and Work-Related Experiences into the teaching of GCSE Mathematics and Numeracy can help learners see the relevance of mathematical concepts in various professional fields and prepare them for future career paths.

When teaching topics such as calculating salaries and foreign currency, they can be set in real-life scenarios and linked to a wide range of careers including careers abroad. Understanding the financial issues related to preparing for a career, by considering factors such as university costs and student loans, can develop learners' understanding of the financial commitments for future career goals.

Time keeping and time management can be linked to the working day and the interpretation of schedules, timetables and charts can support learners' understanding of time management for future career pathways such as office work, medical professions, teaching and shift work.

Learners will study how to collect, read, interpret and analyse data which are valuable skills for future careers such as in data, statistical and financial analysts. Studying topics such as probability will help prepare learners for future careers such as an actuary, statistician, data scientist, risk analyst and market research analyst.</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example(s)</td></tr>
<tr><td>1.8.2</td><td>Understand the basic principles of personal/ household finance and enterprise in order to solve problems relating to, for example:
• wages and salaries, including payslips
• taxation, including income tax and National Insurance
• savings and investments
• loans/repayments
• mortgages
• appreciation/depreciation
• budgeting</td><td>Learners have the opportunity to combine several mathematical concepts such as percentages, interest rates and compound interest when studying loans/repayments. Learners can explore types of loans, e.g. mortgages, car loans and student loans, focussing on the role of interest, the repayment process, monthly repayments, the total cost of the loan and what Is financially manageable in the expected salaries of a career. These mathematical skills can also be linked to careers such as banking, accounting and investment analysis.</td></tr>
</table>

		• bank statements • utility bills • mobile phone and other bills • VAT • best buys • price comparison • finance schemes, including buying by instalments • discount/price increase • buying and selling • profit and loss • travel including foreign currencies, exchange rates and commission.	
	2.1.2	Substitute positive and negative whole numbers, fractions and decimals into simple formulae and expressions written in words or in symbols	Learners can use algebraic formulae to explore how doctors and nurses calculate medication doses based on a patient’s mass.
	3.3.3	Interpret and produce scale drawings; scales may be written in the form 1 cm represents 5 m, or 1:500	Learners can solve problems using scale diagrams, time, money and geometry, and link these to architecture, engineering, construction and design. Learners could explore how architects use mathematical concepts to design buildings, produce scale drawings, project cost analysis and project timelines.
	3.7.3	**Use trigonometric relationships in right-angled triangles to solve problems, including those involving bearings and angles of elevation and depression**	Clinometers can be used in teaching for learners to apply trigonometry to real objects, for example they could calculate the height of their own school building, local community architecture and other local buildings. Learners can calculate roof angles and beam lengths and ensure there are right angles in walls and floors (Pythagoras proof). This will allow learners to link mathematical concepts and see their importance in ensuring buildings are structurally sound.

Cross-curricular Skills – Literacy			
Listening	Listening skills are crucial in mathematics lessons and are intrinsically linked to progress. When teachers give instructions for activities and explain methods, learners need to listen carefully to understand what is expected of them and to grasp the explanations effectively. Learners also benefit through listening to their peers' ideas and arguments. This helps them build on others' thoughts, ask relevant questions and contribute meaningfully to classroom discussion. Listening effectively to a teacher's feedback is also crucial so that learners can close a gap in understanding, be aware of their strengths and to identify their areas of development. Good listening skills improve the ability to communicate effectively in both personal and professional settings. These skills will continue to benefit learners when they leave school, allowing them to understand others more effectively, to respond appropriately and to build stronger relationships.		
	Specification Reference	**Amplification**	**Example(s)**
	2.5.2	Interpret graphical representation used in the media, recognising that some graphs may be misleading	Think-pair-share activities are useful in developing a learner's listening skills, and this concept lends itself perfectly to that type of task. Learners could be presented with two contradictory arguments, both supported by data shown on a graph. Learners would then listen to each other before presenting their own argument and eventually discovering how some graphs can be misleading.
	3.4.4	**Circle theorems: The tangent at any point on a circle is perpendicular to the radius at that point**	Listening skills are important when discovering circle theorems, particularly the very distinct vocabulary associated with the topic. A useful starter activity would be to discuss with a partner how to correctly label parts of a circle. Online software is a useful tool for exploring and discovering circle theorems. Working in pairs, learners could investigate and listen to each other's findings before formalising the rules.

<table>
<tr><th colspan="4"></th></tr>
<tr><td rowspan="4">Reading</td><td colspan="3">Reading skills are very important and have a significant impact on learner achievement in mathematics lessons. Firstly, the ability to read and understand a variety of mathematical vocabulary can be fundamental to a learner’s success. For example, words like product, difference, volume and base can be confusing without proper context. Learners need to be able to interpret worded questions, scan questions for key information, and infer and deduce the best approach to answering a question.

Fostering strong reading skills in mathematics lessons not only aids in comprehension but also enhances critical thinking and problem-solving abilities. These skills are essential in many professions and can foster a habit of continuous learning. In everyday life, learners will often need to be able to read information from a variety of sources including tables and graphs for example, to organise a schedule or plan a trip.</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example(s)</td></tr>
<tr><td>1.7.1</td><td>Interpret and use mathematical information presented in written or visual form, including infographics, schedules, timetables, calendars and charts</td><td>Use of local bus/train timetables is a very engaging way to interest learners and develop their reading skills. Planning journeys and trips with given criteria and deadlines will help them locate and retrieve key information in order to be successful.

For more examples of infographics, please look at the new Blended Learning resource on the Resources website: Educational Resources - WJEC</td></tr>
<tr><td>4.2.6</td><td>Interpret and draw conclusions from scatter diagrams: use terms such as positive correlation, negative correlation, little or no correlation</td><td>The ability to read graphs, but also to infer and deduce connections between variables is an important skill. Using knowledge of correlation, learners could be given a mix and match style activity to identify which mixed up pairs of variables could match different correlations.</td></tr>
</table>

Speaking	The specification content enables learners to verbally present their thoughts, strategies, reasoning and justifications to peers and teachers using subject specific language, in a classroom environment. When learners articulate their mathematical thinking, their depth of knowledge expands. Discussing both their problems and solutions helps learners clarify their thoughts and identify any misconceptions. Oracy skills can also help to foster a collaborative learning environment. Learners can work together to solve problems, share strategies and learn from each other. Throughout life, the ability to speak effectively will improve a learners' ability to participate in discussions, ask questions and seek feedback. Strong oracy skills improve the ability to communicate effectively in various settings, from personal relationships to professional environments. Speaking skills allow learners explore and debate different perspectives, understand the consequences of actions and make informed, ethical choices.		
	Specification Reference	**Amplification**	**Example(s)**
	4.1.3	Design and criticise questions for a questionnaire, including notions of fairness and bias	Learners can develop both their speaking and their thinking skills when designing questionnaires and trialling them by reading them aloud. Their peers will critique the questions they are asked and suggest improvements to make the survey more efficient and free from bias.
	4.2.19	**Interpret and use box and whisker diagrams to compare distributions**	Learners could be given a selection of box and whisker diagrams to compare different distributions before presenting their findings to their peers. Whole class questioning on this topic is useful to probe the depth of their understanding of the limitations and usefulness of the charts.

Writing	Writing skills play a crucial role in mathematics lessons, helping learners to articulate their understanding and thought processes. This is evident when they solve problems and write their steps to reach the solution. In worded questions, learners demonstrate their understanding through their written work using the correct vocabulary and units, but also by communicating effectively and organising their work sensibly. These skills assessed formally in questions that award marks for organising, communicating and writing accurately (OCW). These are lifelong skills; writing is fundamental to effective communication which is crucial in both personal and professional settings.		
	Specification Reference	**Amplification**	**Example(s)**
	1.7.2	Create plans and schedules	A useful task to develop writing skills in mathematics would be to put together a bullet point itinerary for a day at a local beach to include travel plans to get there, an activity whilst there and budgeting. This could then be presented to a younger learner to check for clarity and accuracy.
	2.2.1	Form, manipulate and solve linear and other simple equations with whole number and fractional coefficients	Learners could be asked to apply their knowledge of the perimeter of shapes to form and solve equations in terms of x. This develops their writing skills to organise their work and communicate clearly.

<table>
<tr><th colspan="4">Cross-curricular Skills – Numeracy</th></tr>
<tr><td rowspan="5">Developing Mathematical Proficiency</td><td colspan="3">Central to the specification is an ambition to develop learners into efficient, fluent mathematicians who can apply their skills in unfamiliar contexts across the curriculum and in many different real-life situations. Numeracy skills are at the core of the specification and as such, amplifications and examples are evident throughout. AO3 also requires learners to demonstrate strategic competence, which contributes to 20% of the assessment. Mathematical proficiency is crucial in life outside the classroom and life after school, having fluency and accuracy in calculations is important regardless of the path a learner decides to take. The structured approach of this specification ensures that learners not only learn mathematical concepts but also understand their applications, thereby developing a well-rounded mathematical proficiency.</td></tr>
<tr><th>Specification Reference</th><th>Amplification</th><th>Example(s)</th></tr>
<tr><td>1.2</td><td>Number properties including prime factor decomposition</td><td>• Knowledge of prime factors, multiples, and properties of numbers helps in simplifying and solving complex problems.</td></tr>
<tr><td>1.8</td><td>Personal/household finance and enterprise</td><td>• Topics like budgeting, taxation and loans teach learners to manage personal finances effectively, which is a crucial life skill.</td></tr>
<tr><td>2.1</td><td>Algebraic conventions and manipulation of expressions and formulae</td><td>• Skills in forming, simplifying, and manipulating algebraic expressions are crucial for solving equations and understanding functions.</td></tr>
</table>

<table>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="4">Understanding the number system helps us to represent and compare relationships between numbers and quantities</td><td colspan="3">The specification ensures that learners develop a deep understanding of the number system and the ability to represent and compare relationships between numbers and quantities, which are essential skills for both academic success and practical life. Naturally, these skills are widespread throughout the specification and the examples below show a snapshot of where they are present.</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example(s)</td></tr>
<tr><td>1.6</td><td>Limits of accuracy</td><td>Understanding how to round numbers and use significant figures helps learners represent quantities accurately and compare them in a meaningful way.</td></tr>
<tr><td>1.4.2</td><td>The equivalences between fractions, decimals, percentages and ratios</td><td>Skills in simplifying fractions and comparing whole numbers, decimals, fractions, and percentages enable learners to analyse and compare different quantities effectively.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="4">Learning about geometry helps us understand shape, space and position and learning about measurement helps us quantify in the real world</td><td colspan="3">The specification provides a structured approach to teaching geometry, helping learners understand shape, space, and position. This ensures that learners develop a comprehensive understanding of geometry and measurement, enabling them to apply these skills effectively in real-world situations.</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example(s)</td></tr>
<tr><td>3.3</td><td>Maps, scale drawings, bearings and 2-D representation of 3-D shapes</td><td>Learners read and interpret scales and maps, and produce scale drawings, which are practical skills for navigation and planning.</td></tr>
<tr><td>3.8</td><td>Position, symmetry and transformations</td><td>Understanding symmetry and performing transformations like reflection, rotation, and enlargement helps in design and pattern recognition.</td></tr>
</table>

Learning that statistics represent data and that probability models chance help us make informed inferences and decisions	The specification ensures that learners develop a comprehensive understanding of how statistics and probability can be used to represent data, model chance, and make informed inferences and decisions. As with the above examples, this is only a snapshot of the coverage present in this specification.		
	Specification Reference	**Amplification**	**Example(s)**
	4.1	Data handling cycle – collection methods	Learners are able to specify problems, plan data collection and use various methods to gather data. This includes designing questionnaires and understanding sampling techniques (random, systematic, stratified). Skills in sorting, classifying, and tabulating data, as well as grouping data into class intervals, help learners organise and make sense of raw data.
	4.3.8	Draw and interpret a graphical representation of relative frequency against the number of trials and understand that the long-term stability of relative frequency is expected	Estimating probability based on experimental results and comparing it with theoretical probability teaches learners about the variability and reliability of experimental data.

Digital Competence			
Interacting and Collaborating	The Digital Competency Framework (DCF) emphasises the importance of interacting and collaborating skills, which can be highly effective in mathematics lessons.		
	Specification Reference	**Amplification**	**Example(s)**
	1.4.1	How to find equivalent fractions	Learners could undertake a project whereby they plan and produce video walkthroughs of how to use and manipulate fractions paying particular attention to purpose and audience – one video would be pitched at primary school children and one at parents. Learners could contribute and collaborate on the project via an online shared folder and email.
	1.4.7	Find a fraction or percentage of a quantity	Learners can upload their own workings/solutions/methods for finding a fraction or percentage to online collaboration software. This work can be commented on by their peers and opportunities for 'What if?' and minimally different questions could be explored as a group.
Producing	The producing element of the DCF focuses on the cyclical process of planning, creating, evaluating and refining digital content.		
	Specification Reference	**Amplification**	**Example(s)**
	2.3.1	Recognise, describe and continue patterns in number	Learners could use video editing and graphing software to make digital content exploring patterns between numbers and sequences.

	4.2.11 and 4.2.8	Find the mean, median, mode and range of a list of values Find an estimate for the mean of a grouped frequency distribution.	Learners could use a spreadsheet to analyse data from a statistical project. Testing a hypothesis, they could use the software to write cell formulae to calculate averages, then interpret their results and make conclusions.
Data and Computational Thinking	Data and computational thinking are integral to modern mathematics education, helping learners develop critical skills for analysing information and solving complex problems.		
	Specification Reference	**Amplification**	**Example(s)**
	1.4.9	Understand and use multipliers	Learners have the opportunity to breakdown problems and create and use algorithms to be followed for computations. This can be seen in several areas of the specification. For example, in 1.4.9, extending to 1.4.13 learners could develop a set strategy and process for using a multiplier correctly.
	2.2.9	Solve a range of cubic equations by trial and improvement methods, justifying the accuracy of the solution	A useful task for learners is to use their calculator efficiently when substituting values into a trial and improvement problem. Accuracy and process must be followed to overcome issues with the order of operations and negative numbers. Extension opportunities could use graphing software to visualise the roots of the equation in question.

Integral Skills			
Creativity and Innovation	Integrating opportunities for learners to be creative and innovative into the teaching of GCSE Mathematics and Numeracy will enhance learners' problem-solving skills. Exploring mathematics in real-life contexts can create opportunities that foster creativity, innovation, curiosity and inquisitiveness. Learners can make links across subject disciplines and develop a depth of knowledge. Giving learners open-ended or challenging problems will allow them to think creatively, explore different strategies and develop their reasoning and communication skills. Combining multiple mathematical topic areas to create mathematical problems will encourage learners to think creatively about what they know, what they need to find out and what mathematical strategies they then need to apply in order to solve the problem.		
	Specification Reference	**Amplification**	**Example(s)**
	1.8.2	Understand the basic principles of personal/ household finance and enterprise in order to solve problems relating to, for example: • wages and salaries, including payslips • taxation, including income tax and National Insurance • savings and investments • loans/repayments • mortgages • appreciation/depreciation • budgeting • bank statements • utility bills • mobile phone and other bills • VAT • best buys • price comparison • finance schemes, including buying by instalments • discount/price increase	Learners can explore how ticket pricing strategies e.g. early purchase discounts, group booking offers or paying by instalments impact the sale of tickets, and analyse optimal ticket pricing strategies for high levels of ticket sales. Learners can combine their knowledge on finance and statistics to evaluate the statistical data for ticket sales to a music festival over a three-year period and identify trends.

		• buying and selling • profit and loss • travel including foreign currencies, exchange rates and commission.	
	3.6.1	Perimeter and area of a square, rectangle, triangle, parallelogram, trapezium, circle, semicircle and a composite shape	Learners can use their knowledge of area, perimeter and scale drawing to design and build a new playground for a local council within a given budget. Learners can be given a set of dimensions and a number of items they need to include e.g. swing, slide, circular sandpit. Learners can explore how they would maximise the space available and consider factors such as percentage of grassed area/rubberised flooring. Learners could extend their thinking by working within a budget and considering additional potential costs.
	3.7.3	**Use trigonometric relationships in right-angled triangles to solve problems, including those involving bearings and angles of elevation and depression**	Learners could explore the construction of a slide for example, by calculating its vertical height if the slide's slanting length is a given measurement, and the angle it makes with the ground is 30 degrees**.** Learners can explore the factors that would need to change in order for the vertical height to increase or decrease.

Critical Thinking and Problem Solving

Critical Thinking and Problem Solving are skills that can be developed and enhanced through the teaching and learning of GCSE Mathematics and Numeracy. This can be achieved by offering opportunities for learners to engage in numerical reasoning, logical reasoning, justifications, proof of relationships, critical thinking and problem solving.

Learners have opportunities to investigate how to solve problems, in new, varied and real-life contexts, and discuss, question, and generate their own ideas or alternative strategies on how to solve them. These skills can be applied to all areas of mathematics outlined in the specification. Real-life problems require learners to apply mathematical concepts to practical scenarios, often with no obvious starting point. Learners have to think critically about the methods they choose to solve problems.

Many GCSE Mathematics and Numeracy problems require learners to use multiple steps or combine various mathematical concepts to reach a solution. This builds problem-solving resilience and encourages logical reasoning as learners break down complex problems into manageable parts.

Specification Reference	Amplification	Example(s)
2.2.6	**Form, manipulate and solve two simultaneous linear equations with whole number coefficients by algebraic methods**	Solving a worded simultaneous equation requires learners to first identify that simultaneous equations are the mathematical concept that needs to be applied, then set up the equations from the problem and subsequently use an algebraic method to solve the equations and find the unknown variables. They must think critically about how to simplify and manipulate the equations effectively.
3.4.5	**Circle theorems:** • **The tangent at any point on a circle is perpendicular to the radius at that point** • **The angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference**	Questions on circle theorems require critical thinking and problem-solving to break down complex problems and to recognise patterns and relationships. Learners will need to apply multiple theorems in a logical sequence. They will need to make decisions on relationships and facts such as whether specific lines are equal in length or whether certain points lie on the circumference. Some problems may require learners to draw additional lines and think creatively about how to modify the diagram to unlock solutions.

		• **The angle subtended at the circumference by a semicircle is a right angle** • **Angles in the same segment are equal** • **Opposite angles of a cyclic quadrilateral sum to 180°** • **Alternate segment theorem** • **Tangents from an external point are equal in length**	
	3.6.1	Perimeter and area of a square, rectangle, triangle, parallelogram, trapezium, circle, semicircle and a composite shape	Learners need to think critically and problem solve to find the area of a shaded region or composite shape with unknown lengths. In order to find the area of the shaded region, learners could calculate a missing length using reverse area strategies. Learners could be asked to find the area and perimeter of a semi-circle or quarter of a circle and think critically about what calculations they would need to carry out.
	3.7.3	**Use trigonometric relationships in right-angled triangles to solve problems, including those involving bearings and angles of elevation and depression**	Learners will need to apply critical thinking and problem-solving strategies to multi-step questions involving multiple triangles that require the use trigonometry or Pythagoras to find unknown angles or lengths. Learners need to know what formulae are required, and how to use substitution and algebraic manipulation strategies. Learners need to think strategically about the order they need to carry out calculations and look at the sensibility of the calculations at each step.

Planning and Organisation

Planning and Organisation are essential skills that can be developed through the teaching of GCSE Mathematics and Numeracy. These skills enable learners to approach problems systematically. Integrating opportunities for planning and organisation into lessons, teachers can help learners become more independent and efficient.

Encouraging learners to break down complex problems into smaller, manageable steps and plan their approach before solving them will develop their planning and organisational skills. When tackling a complex question, learners can first write down a plan outlining the steps they will take, the theorems or methods they will apply, and the order in which they will proceed. This builds on their ability to organise their thoughts and systematically work through problems. Learners need to know how to organise their work clearly, showing all steps of their calculations or reasoning to avoid careless mistakes.

Through learning how to interpret timetables, charts, calendars and schedules, and create plans and schedules learners are supported to develop their own planning and organisation skills.

Specification Reference	Amplification	Example(s)
1.7.1	Interpret and use mathematical information presented in written or visual form, including infographics, schedules, tables, timetables, calendars and charts	Interpreting infographics, schedules, tables, timetables, calendars, charts can all be linked to daily, weekly, monthly and annual planning in careers and work-related experiences.
1.7.2	Create plans and schedules	Learners could create a schedule for a list of daily and weekly tasks and think about time management, deadlines and forward planning.
2.1.13	Factorise linear or quadratic expressions that have at least one common factor	Algebraic factorisation requires careful organisation and planning where learners must first recognise the type of factorisation required. This initial step involves thinking ahead and choosing the correct method based on the structure of the algebraic expression. Learners often need to organise the expression so that common factors or relationships are easier to identify.

			For more complex expressions, such as those involving higher powers or multiple variables, learners must carefully plan their sequence of steps, this may involve rearranging formulae and applying multiple factorisation techniques in a logical order.
Personal Effectiveness	Key personal and social skills such as independence, emotional intelligence, discussion, debate, learning through mistakes and identifying areas for improvement can be cultivated when teaching GCSE Mathematics and Numeracy. These skills can be developed through thoughtful teaching strategies, such as problem solving activities, growth mindset tasks that emphasise the importance of effort, persistence and learning through mistakes, learner error analysis, pair and group work, maths debates and discussions, group investigations and exploratory problems, learner led feedback, self-evaluation and goal setting. Financial mathematics provides learners with content that is meaningful and purposeful for their future lives, teaching learners the skills to become confident and independent in managing their own personal finance. The nature of mathematics gives learners ample opportunities to evaluate their ‘errors’ and see them as learning opportunities by identifying areas for improvement. As learners develop their mathematical fluency with the specification content, they will become more confident and independent in dealing with mathematical problems.		

	Specification Reference	Amplification	Example(s)
	1.8.2	Understand the basic principles of personal/ household finance and enterprise in order to solve problems relating to, for example: • wages and salaries, including payslips • taxation, including income tax and National Insurance • savings and investments • loans/repayments • mortgages • appreciation/depreciation • budgeting • bank statements • utility bills • mobile phone and other bills • VAT • best buys • price comparison • finance schemes, including buying by instalments • discount/price increase • buying and selling • profit and loss • travel including foreign currencies, exchange rates and commission.	Learners can be given a piece of work on personal or household finance that has been answered incorrectly with common mistakes and misconceptions. For example, utility bills, where some learners have a common error of not converting from pence to pounds during their calculations leading to place value errors. Ask learners to identify whether the answers are correct/incorrect, identify where errors have been made and encourage discussion on how the answers can be corrected. Learners can provide advice and feedback on the work corrected to ensure that problems are successfully solved in the future. This helps develop a culture that mistakes are opportunities for growth and a normal part of the learning process.

	2.2.2	**form, manipulate and solve more complex linear equations, including equations with more than one fractional term**	After solving a set of fractional linear equations, teachers could provide opportunities for learners to evaluate their own work through self-assessment. Learners can review their answers, reflecting on their strengths and areas for development. Learners can identify and discuss which steps they got wrong, why the error occurred and how they could correct it in future problems. This promotes reflective thinking, independence, discussion and a culture of learning from mistakes to gain a deeper understanding.

Appendix A – Money and Pensions Service (MaPS)

Link	Descriptor
https://www.young-enterprise.org.uk/your-money-matters-wales/	This link takes you to the textbook, the teacher's guide and lesson PowerPoints. This is all also available in Welsh. The student facing Textbook includes guidance on issues such as: • Saving and spending • Borrowing • Good and bad debt • Risk and rewards • Insurance • Investments • Future planning around student loans • Tax and national insurance To provide additional support to teachers there is an accompanying Teacher's Guide contained within the download which will highlight areas of good practice, provide examples of curriculum integration and showcase additional external support that schools could use to enrich their financial education provision.
Financial education supporting material for schools in Wales | Money and Pensions Service (maps.org.uk)	This supporting material can be used by schools in Wales to help improve the financial education they deliver to children and young people. Endorsed by the Welsh Government, the material explores how learning about money fits into the Curriculum for Wales. It sets out the steps schools can take to improve and enhance their provision and highlights the services and resources schools can use to support them.
https://hwb.gov.wales/repository/resource/f56baae0-39fb-423e-996c-6b3b315f1bd6/overview	The toolkit provides links to relevant parts of the Curriculum for Wales and offers prompts and signposts to resources relevant to financial literacy. It offers ideas of how to support the design and quality assurance of a purpose-led offer of financial literacy as part of school curriculum. It is not a checklist for curriculum design but provides useful prompts to consider as part of your curriculum journey and what you might do next.

https://e-learning.y-e.org.uk/	The free to access e-learning professional learning course is available in both Welsh and English and aligns with the current and new Curriculum for Wales. The course aims to build teachers' knowledge and confidence in delivering effective financial education to learners and is targeted to educators working with young people at the point of transition from primary to secondary school. Funded by MaPS and delivered by Young Money with support from the regional consortia.
Money Mapping resource	This free bilingual resource engages learners (9–12-year-olds) in financial capability by using real-life and relevant contexts, it can be used to encourage investigation skills and problem solving, providing discussion opportunities around a number of financial themes such as making choices, attitudes, value for money and risk. Developed to align with the Curriculum for Wales, the resource can be delivered to support Areas of Learning and Experience in order to facilitate development towards the Four Purposes. The accompanying PowerPoint can be used to support teachers' delivery to their classes.

Important Dates

First Teaching of WJEC GCSE subject	September 2025
First assessment for Unit 1	Summer 2026
First assessment for Unit 2	Summer 2026
First assessment for Unit 3	November 2026
First Certification	November 2026