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GCSE

Mathematics A (1MA0)

Scheme of work

Edexcel GCSE in Mathematics A (1MA0)

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A PEARSON COMPANY

Introduction

This scheme of work is based upon a five term model over two years for both Foundation and Higher tier students.
It can be used directly as a scheme of work for the GCSE Mathematics A specification (1MA0).

The scheme of work is structured so each topic contains:

- Module number
- Recommended teaching time, though of course this is adaptable according to individual teaching needs
- Tier
- Contents, referenced back to the specification
- Objectives for students at the end of the module
- References to published textbook sections
- Ideas for differentiation and extension activities
- Notes for general mathematical teaching points and common misconceptions

Updates will be available via a link from the Edexcel mathematics website (www.edexcel.com).

References to Edexcel published student books for the course are given in brackets for each main teaching objective. For example (2.6) in a Foundation module references to GCSE Mathematics A Foundation Student Book, Chapter 2, Section 2.6.

This document is an Issue 2.

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Foundation course overview

The table below shows an overview of modules in the Linear Foundation tier scheme of work.

Teachers should be aware that the estimated teaching hours are approximate and should be used as a guideline only.

Module number	Title	Estimated teaching hours
1	Integers	7
2	Decimals	4
3	Coordinates	4
4	Angles, lines and triangles	6
5	Reading scales and converting units	5
6	Collecting data	4
7	Charts and graphs	5
8	Symmetry, Similarity and Congruence	4
9	Types of number	8
10	Introduction to algebra	4
11	Constructions	5
12	Patterns and sequences	5
13	Properties of quadrilaterals and parallel lines	5
14	Fractions	7
15	Pie charts	3
16	Fractions, decimals and percentages	4
17	Applications of percentages	5
18	Algebra using powers and brackets	4
19	Ratio and proportion	6
20	Linear equations and inequalities	6
21	Perimeter and area	7
22	3-D shapes	4
23	Real-life graphs	5
24	Straight line graphs	4
25	Compound measures	5
26	Timetables and distance-time graphs	5
27	Volume	5
28	Probability	9
29	Formulae	7
30	Angles properties of polygons	5
31	Transformations	6
32	Scatter graphs and correlation	5
33	Averages and range	7
34	Quadratic graphs	3
35	Trial and Improvement	3
36	Circles	5
37	Pythagoras' Theorem	5
	Total	**190 HOURS**

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2 Year SoW	Specification A - Linear	Foundation
Module 1 of 37	Contents: Integers	Time: 6 – 8 hours

SPECIFICATION REFERENCE

N b Order integers

N u Round numbers

N a Add, subtract, multiply and divide positive or negative integers

N q Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations

N v Use calculators effectively and efficiently

PRIOR KNOWLEDGE

- The ability to order numbers
- An appreciation of place value
- Experience of the four operations using whole numbers
- Knowledge of integer complements to 10 and to 100
- Knowledge of strategies for multiplying and dividing whole numbers by 2, 4, 5 and 10

OBJECTIVES	Lesson plans
• Use and order positive and negative numbers	(1.1–1.3, 1.7–1.9)
• Write numbers in words and write numbers from words	(1.2)
• Add and subtract integers, including negative numbers	(1.4, 1.9)
• Recall all multiplication facts to 10 × 10, and use them to derive quickly the corresponding division facts	(1 intro)
• Multiply or divide any number by powers of 10	(1.5)
• Multiply and divide positive and negative numbers	(1.5, 1.9)
• Use brackets and the hierarchy of operations (BIDMAS)	(9.4)
• Find reciprocals	(10.2)
• Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is undefined)	(10.2)
• Add, subtract, multiply and divide negative numbers	(1.7–1.9)
• Round whole numbers to the nearest: 10, 100, 1000, …	(1.6)
• Check calculations by rounding, eg $29 \times 31 \approx 30 \times 30$	(5.10)
• Check answers by inverse calculation, eg if $9 \times 23 = 207$ then $207 \div 9 = 23$	(5.11)

DIFFERENTIATION & EXTENSION

- Estimate answers to calculations involving the four rules of operation
- Directed number work with multi-step calculations
- Encourage effective use of a calculator
- Try investigations with digits 3, 7, 5 and 2 and challenge students to find the biggest number, smallest odd number, the largest sum or product etc

NOTES

- Present all working clearly
- For non-calculator methods, ensure that remainders are shown as evidence of working
- Show what is entered into your calculator, not just the answer
- Try different methods from traditional ones, eg Russian or Chinese methods for multiplication
- Incorporate Functional Elements whenever and wherever possible and always round measures to an appropriate degree of accuracy

Module 2 of 37	Contents: Decimals	Time: 3 – 5 hours

SPECIFICATION REFERENCE

N b Order decimals and integers

N a Add, subtract, multiply and divide any number

N j Use decimal notation and recognise that each terminating decimal is a fraction

N u Round numbers

PRIOR KNOWLEDGE

- The concept of a decimal
- The four operations

OBJECTIVES	Lesson plans
• Understand place value, identifying the values of the digits	(5.1)
• Write decimals in order of size	(5.2)
• Round decimals to the nearest integer a given number of decimal places or to one significant figure	(5.7–5.9)
• Add and subtract decimals	(5.3)
• Multiply and divide decimal numbers by integers and decimal numbers	(5.4–5.6)
• Know that, eg 13.5 ÷ 0.5 = 135 ÷ 5	(5.11)
• Check their answers by rounding, and know that, eg 9.8 × 17.2 ≈ 10 × 17	(5.10)

DIFFERENTIATION & EXTENSION

- Practise long multiplication and division without using a calculator
- Mental maths problems with negative powers of 10 eg 2.5 × 0.01, 0.001
- Directed number work with decimal numbers
- Use decimals in real-life problems as much as possible eg Best Buys
- Use functional examples such as entry into theme parks, cost of holidays, sharing the cost of a meal
- Money calculations that require rounding answers to the nearest penny
- Multiply and divide decimals by decimals with more than 2 d.p.
- Round answers to appropriate degrees of accuracy to suit the context of the question

NOTES

- Advise students not to round decimals, used in calculations, until stating in the final answer
- For non-calculator methods ensure that remainders are shown as evidence of working
- Students need to be clear about the difference between decimal places and significant figures
- Link decimals to Statistics and Probability, eg the mean should not be rounded, the probability of all events occurring is equal to 1

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Module 3 of 37	Contents: Coordinates	Time: 3 – 5 hours

SPECIFICATION REFERENCE

A k Use the conventions for coordinates in the plane and plot points in all four quadrants, including using geometric information

PRIOR KNOWLEDGE

- Directed numbers
- Parallel and perpendicular lines

OBJECTIVES	Lesson plans
• Use axes and coordinates to specify points in all four quadrants in 2-D	(15.1, 15.2)
• Identify points with given coordinates	(15.1, 15.2)
• Identify coordinates of given points (NB: Points may be in the first quadrant or all four quadrants)	(15.1, 15.2)
• Find the coordinates of points identified by geometrical information in 2-D	(15.1)
• Find the coordinates of the midpoint of a line segment, *AB*, given the coordinates of *A* and *B*	(15.3)

DIFFERENTIATION & EXTENSION

- There are plenty of sources of good material here such as animal pictures with coordinates, games like Connect 4 using coordinates
- This topic can be delivered in conjunction with the properties of quadrilaterals

NOTES

- Clear presentation of graphs with axes correctly labelled is important

Module 4 of 37	Contents: Angles, lines and triangles	Time: 5 – 7 hours

SPECIFICATION REFERENCE

GM a	Recall and use properties of angles at a point, angles at a point on a straight line (including right angles), perpendicular lines, and vertically opposite angles
GM b	Understand and use the angle properties of triangles and intersecting lines
GM t	Measure and draw lines and angles
GM u	Draw triangles and other 2-D shapes using a ruler and a protractor

PRIOR KNOWLEDGE

- An understanding of angles as a measure of turning
- The ability to use a ruler and a protractor

OBJECTIVES	Lesson plans
• Measure and draw lines, to the nearest mm	(2 intro)
• Measure and draw angles, to the nearest degree	(2.5, 2.6)
• Estimate sizes of angles	(2.4)
• Recall and use properties of angles:	(2.1, 2.8)
○ angles at a point	
○ angles at a point on a straight line, including right angles	
○ vertically opposite angles	
• Find the size of missing angles at a point or at a point on a straight line	(2.8)
• Distinguish between acute, obtuse, reflex and right angles	(2.2)
• Name angles	(2.2)
• Give reasons for calculations	(2.8)
• Use geometric language appropriately	(chapter 2, chapter 7)
• Use letters to identify points, lines and angles	(2.3)
• Use two letter notation for a line and three letter notation for an angle	(2.3)
• Recall and use properties of perpendicular lines	(7.5)
• Mark perpendicular lines on a diagram	(7.5)
• Understand the proof that the angle sum of a triangle is 180°	(7.7)
• Understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices	(7.7)
• Distinguish between scalene, equilateral, isosceles and right-angled triangles	(2.7, 6.1)
• Understand and use the angle properties of triangles	(2.7, 6.1)
• Find a missing angle in a triangle, using the angle sum of a triangle is 180°	(2.7)
• Use the side/angle properties of isosceles and equilateral triangles	(2.7)
• Make accurate drawing of triangles and other 2-D shapes using a ruler and a protractor	(6.4)
• Make an accurate scale drawing from a diagram	(7.9)

DIFFERENTIATION & EXTENSION

- Explore other angle properties in triangles, parallel lines or quadrilaterals, in preparation for future topics

NOTES

- Make sure that drawings are neat, accurate and labelled
- Give students a lot of drawing practice, and encourage students to check their drawings
- Angles should be accurate to within 2° and lengths accurate to the nearest mm

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Module 5 of 37	Contents: Reading scales and converting units	Time: 4 – 6 hours

SPECIFICATION REFERENCE

GM o	Interpret scales on a range of measuring instruments, and recognise the inaccuracy of measurements
GM t	Measure and draw lines
GM p	Convert measurements from one unit to another
GM m	Use scale drawings

PRIOR KNOWLEDGE

- An awareness of the imperial system of measures
- Strategies for multiplying and dividing by 10 (for converting metric units)

OBJECTIVES

Lesson plans

- Construct scale drawings **(7.9)**
- Use and interpret scale drawings **(7.9)**
- Interpret scales on a range of measuring instruments including mm, cm, m, km, m*l*, c*l*, *l*,
- mg, g, kg, tonnes, °C **(11.1)**
- Indicate given values on a scale **(11.1)**
- Know that measurements using real numbers depend upon the choice of unit **(11.3)**
- Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction **(11.6)**
- Convert units within one system **(11.3, 11.4)**
- Convert metric units to metric units (Metric equivalents should be known) **(11.3)**
- Convert imperial units to imperial units (NB: Conversion between imperial units will be given) **(11.4)**
- Convert between metric and imperial measures **(11.4)**
- Know rough metric equivalents of pounds, feet, miles, pints and gallons, ie **(11.4)**

  Metric Imperial
  1 kg = 2.2 pounds
  1 litre = 1.75 pints
  4.5 *l* = 1 gallon
  8 km = 5 miles
  30 cm = 1 foot
- Estimate conversions **(11.4)**

DIFFERENTIATION & EXTENSION

- This could be made a practical activity, by collecting assorted everyday items and weighing and measuring to check the estimates of their lengths, weights and volumes
- Use the internet to find the weights, volumes and heights of large structures such as buildings, aeroplanes and ships
- Take the opportunity to do some real measuring/estimating around school
- Use conversions for height and weight of students, cars, bridges. Combine with simple scales such as 1 cm to 1 m for classrooms, playing fields, bedrooms and ask them to draw a plan of their ideal design for their bedrooms including the furniture

NOTES

- Measurement is essentially a practical activity
- Use a range of everyday objects to bring reality to lessons
- Use Functional Elements as a source of practical activities

Module 6 of 37	Contents: Collecting data	Time: 3 – 5 hours

SPECIFICATION REFERENCE

SP a	Understand and use statistical problem solving process (handling data cycle)
SP b	Identify possible sources of bias
SP c	Design an experiment or survey
SP d	Design data-collection sheets distinguishing between different types of data
SP e	Extract data from printed tables and lists
SP f	Design and use two-way tables for discrete and grouped data

PRIOR KNOWLEDGE

- An understanding of why data need to be collected
- Experience of simple tally charts
- Some idea about different types of graphs
- Experience of inequality notation

OBJECTIVES	Lesson plans
• Specify the problem and plan	(3.1)
• Decide what data to collect and what statistical analysis is needed	(3.1, 3.3)
• Collect data from a variety of suitable primary and secondary sources	(3.1, 3.2, 3.5)
• Use suitable data collection techniques	(3.1, 3.2, 3.4)
• Process and represent the data	(3.1, 3.2, 3.5)
• Interpret and discuss the data	(3.1, 3.2, 3.5)
• Understand how sources of data may be biased	(3.4)
• Identify which primary data they need to collect and in what format, including grouped data	(3.3)
• Consider fairness	(3.3)
• Understand sample and population	(3.4)
• Design a question for a questionnaire	(3.3)
• Criticise questions for a questionnaire	(3.3)
• Design and use data-collection sheets for grouped, discrete and continuous data	(3.2)
• Collect data using various methods	(3.2)
• Sort, classify and tabulate data and discrete or continuous quantitative data	(3.1, 3.2)
• Group discrete and continuous data into class intervals of equal width	(3.2)
• Extract data from lists and tables	(3.2, 3.5)
• Design and use two-way tables for discrete and grouped data	(3.5)
• Use information provided to complete a two way table	(3.5)

DIFFERENTIATION & EXTENSION

- Carry out a statistical investigation of their own, including designing an appropriate means of gathering the data
- Some guidance needs to be given to stop students choosing limited investigations, eg favourite football team

NOTES

- For Functional Elements activities, it is worth collecting data at different times of the day, eg to compare types of shopper in a centre. Get data from holiday brochures to compare resorts for temp, rainfall and type of visitor
- Emphasise the differences between primary and secondary data. Mayfield High data can be used as an example of secondary data
- Discuss sample size and mention that a census is the whole population. In the UK, the Census is held every year that ends in '1', so the next census is in 2011
- If students are collecting data as a group, then they should use the same procedure
- Emphasise that continuous data is data that is measured, eg temperature

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Module 7 of 37	Contents: Charts and graphs	Time: 4 – 6 hours

SPECIFICATION REFERENCE

SP g Produce charts and diagrams for various data types

SP i Interpret a wide range of graphs and diagrams and draw conclusions

SP l Compare distributions and make inferences

PRIOR KNOWLEDGE

- An understanding of why data need to be collected and some idea about different types of graphs

OBJECTIVES	Lesson plans
• Draw:	(12.1, 12.4–12.6, 16.5–16.6, 25.1)
○ Pictograms	(12.1)
○ Composite bar charts	(12.4)
○ Comparative and dual bar charts	(12.4)
○ Frequency polygons	(12.6)
○ Histograms with equal class intervals	(12.5)
○ Frequency diagrams for grouped discrete data	(16.5–16.6)
○ Line graphs	(25.1)
• Interpret:	(12.4, 12.6)
○ composite bar charts	(12.4)
○ comparative and dual bar charts	(12.4)
○ frequency polygons	(12.6)
• From pictograms, bar charts, line graphs and histograms with equal class intervals:	(12.1, 12.3–12.5, 25.1)
○ read off frequency values	
○ calculate total population	
○ find greatest and least values	
• Recognise simple patterns and characteristic relationships in bar charts,	
• line graphs and frequency polygons	(12.3–12.6, 25.1)
• Use dual or comparative bar charts to compare distributions	(12.4)

DIFFERENTIATION & EXTENSION

- Carry out a statistical investigation of their own and use an appropriate means of displaying the results
- Use a spreadsheet to draw different types of graphs
- Collect examples of charts and graphs in the media which have been misused, and discuss the implications

NOTES

- Reiterate that clear presentation with axes correctly labelled is important, and to use a ruler to draw straight lines
- Make comparisons between previously collected data
- Encourage student to work in groups and present their charts (useful display material for classrooms/corridors)
- Use Excel Graph wizard
- Consider Functional Elements by comparing rainfall charts, distributions of ages in cinemas etc

Module 8 of 37	Contents: Symmetry, Similarity and Congruence	Time: 3 – 5 hours

SPECIFICATION REFERENCE

GM e	Recognise reflection and rotation symmetry of 2-D shapes
GM f	Understand congruence and similarity

PRIOR KNOWLEDGE

- Basic idea of shape

OBJECTIVES	Lesson plans
• Recognise reflection symmetry of 2-D shapes	(6.7)
• Identify and draw lines of symmetry on a shape	(6.7)
• Recognise rotation symmetry of 2-D shapes	(6.8)
• Identify the order of rotational symmetry of a 2-D shape	(6.8)
• Draw or complete diagrams with a given number of lines of symmetry	(6.7)
• Draw or complete diagrams with a given order of rotational symmetry	(6.8)
• Understand congruence	(6.3)
• Identify shapes which are congruent	(6.3)
• Understand similarity	(6.3)
• Identify shapes which are similar, including all circles or all regular polygons with equal number of sides	(6.3, 7.3)
• Recognise that all corresponding angles in similar shapes are equal in size when the corresponding lengths of sides are not equal in size	(23.5)

DIFFERENTIATION & EXTENSION

- Investigate Rangoli Patterns, which is a good source of display work
- Ask students to find their own examples of symmetry, similarity and congruence in real-life

NOTES

- Equations of lines of symmetry are covered later in course
- Reinforce accurate drawing skills and measurement
- Use tracing paper or mirrors to assist with symmetry questions

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Module 9 of 37	Contents: Types of number	Time: 7 – 9 hours

SPECIFICATION REFERENCE

N c	Use the concepts and vocabulary of factor (divisor), multiple, common factor, Highest Common Factor (HCF), Lowest Common Multiple (LCM), prime number and prime factor decomposition
N d	Use the terms square, positive and negative square root, cube and cube root
N e	Use index notation for squares, cubes and powers of 10
N f	Use index laws for multiplication and division of integer powers

PRIOR KNOWLEDGE

- Number complements to 10 and multiplication/division facts
- Recognise basic number patterns
- Experience of classifying integers

OBJECTIVES

	Lesson plans
• Recognise even and odd numbers	(1.10)
• Identify factors, multiples and prime numbers	(1.10)
• Find the prime factor decomposition of positive integers	(1.10)
• Find the common factors and common multiples of two numbers	(1.10–1.11)
• Find the Lowest common multiple (LCM) and Highest common factor (HCF) of two numbers	(1.11)
• Recall integer squares up to 15 × 15 and the corresponding square roots	(1.12, 5.5)
• Recall the cubes of 2, 3, 4, 5 and 10	(1.12, 5.5)
• Find squares and cubes	(1.12, 5.5)
• Find square roots and cube roots	(1.12, 5.5)
• Use index notation for squares and cubes	(9.1)
• Use index notation for powers of 10	(9.1)
• Find the value of calculations using indices	(9.1–9.2)
• Use index laws to calculate with squares and cubes	(9.1–9.2)

DIFFERENTIATION & EXTENSION

- Calculator exercise to check factors of larger numbers
- Further work on indices to include negative and/or fractional indices
- Use prime factors to find LCM
- Use a number square to find primes (sieve of Eratosthenes)
- Calculator exercise to find squares, cubes and square roots of larger numbers (using trial and improvement)

NOTES

- All of the work in this module can be easily reinforced by using it as ‘starters’ or ‘plenaries’
- Calculators should be used only when appropriate
- There are plenty of investigative work using squares like ‘half time’ scores
- For extension, work could introduce simple ideas on standard form

Module 10 of 37	Contents: Introduction to algebra	Time: 3 – 5 hours

SPECIFICATION REFERENCE

A a	Distinguish the different roles played by letter symbols in algebra, using the correct notation
A b	Distinguish in meaning between the words ‘equation’, ‘formula’ and ‘expression’
A c	Manipulate algebraic expressions by collecting like terms

PRIOR KNOWLEDGE

- Experience of using a letter to represent a number
- Ability to use negative numbers with the four operations

OBJECTIVES

	Lesson plans
• Use notation and symbols correctly	(4.1, 4.4)
• Write an expression	(4.2, 4.8)
• Simplify algebraic expressions in one or more like terms, by adding and subtracting like terms	(4.3)
• Understand the difference between the word ‘equation’, ‘formula’, and ‘expression’	(4.8)
• Simplify expressions	(4.4, 4.5)

DIFFERENTIATION & EXTENSION

- Look at patterns in games like ‘frogs’, eg Total moves = $R \times G + R + G$
- Look at methods to understand expressions, eg there are ‘b’ boys and ‘g’ girls in a class, what is the total ‘t’ number of students in the class
- Further work, such as collecting like terms involving negative terms, collecting terms where each term may consist of more than one letter, eg $3ab + 4ab$

NOTES

- Emphasise correct use of symbolic notation, eg $3x$ rather than $3 \times x$
- Present all work neatly and use the appropriate algebraic vocabulary

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Module 11 of 37	Contents: Constructions	Time: 4 – 6 hours

SPECIFICATION REFERENCE

GM v	Use straight edge and a pair of compasses to carry out constructions
GM w	Construct loci

PRIOR KNOWLEDGE

- Knowledge of types of triangle
- Knowledge of the difference between a line and a region

OBJECTIVES	Lesson plans
• Use straight edge and a pair of compasses to do standard constructions such as:	(6.4, 18.1–18.3)
○ Construct a triangle	(6.4)
○ Construct an equilateral triangle	(18.1)
○ Understand, from the experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not	(6.4)
○ Construct the perpendicular bisector of a given line	(18.1)
○ Construct the perpendicular from a point to a line	(18.1)
○ Construct the bisector of a given angle	(18.1)
○ Construct angles of 60°, 90°, 30°, 45°	(18.1)
○ Draw parallel lines	(6.4)
○ Construct diagrams of everyday 2-D situations involving rectangles, triangles, perpendicular and parallel lines	(18.1–18.3)
• Draw and construct diagrams from given instructions:	(18.2, 18.3)
○ A region bounded by a circle and an intersecting line	(18.3)
○ A given distance from a point and a given distance from a line	(18.2)
○ Equal distances from 2 points or 2 line segments	(18.2)
○ Regions which may be defined by ‘nearer to’ or ‘greater than’	(18.3)
○ Find and describe regions satisfying a combination of loci	(18.3)

DIFFERENTIATION & EXTENSION

- Try to do this module as practically as possible using real life situations, eg horses tethered to ropes, mobile phone masts etc
- Use the internet to source ideas for this module
- Use loci problems that require a combination of loci

NOTES

- All constructions should be presently neatly and accurately
- A sturdy pair of compasses is essential
- Construction lines should not be erased as they carry valuable method marks
- All lines should be correct to within 2 mm and angles correct to 2°

Module 12 of 37	Contents: Patterns and sequences	Time: 4 – 6 hours

SPECIFICATION REFERENCE

A i	Generate terms of a sequence using term-to-term and position to-term definitions of the sequence
A j	Use linear expressions to describe the *n*th term of an arithmetic sequence

PRIOR KNOWLEDGE

- Know about odd and even numbers
- Recognise simple number patterns, eg 1, 3, 5, ...
- Writing simple rules algebraically
- Raise numbers to positive whole number powers
- Substitute into simple expressions

OBJECTIVES	Lesson plans
• Recognise and generate simple sequences of odd or even numbers	(13.1)
• Find the missing numbers in a number pattern or sequence	(13.1–13.3)
• Find the *n*th term of a number sequence	(13.3)
• Use the *n*th number of an arithmetic sequence	(13.3)
• Find whether a number is a term of a given sequence	(13.4)
• Continue a sequence derived from diagrams	(13.1)
• Use a calculator to produce a sequence of numbers	(13.1–13.3)

DIFFERENTIATION & EXTENSION

- Match-stick problems
- Use practical real life examples like ‘flower beds’
- Sequences of triangle numbers, Fibonacci numbers etc
- Extend to quadratic sequences whose nth term is $an^2 + b$ and link to square numbers

NOTES

- Emphasise good use of notation $3n$ means $3 \times n$
- When investigating linear sequences, students should be clear on the description of the pattern in words, the difference between the terms and the algebraic description of the nth term

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Module 13 of 37	Contents: Properties of quadrilaterals and parallel lines	Time: 4 – 7 hours

SPECIFICATION REFERENCE

GM d	Recall the properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus
GM b	Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals
GM r	Understand and use bearings

PRIOR KNOWLEDGE

- Know that angles in a triangle add up to 180°
- Know that angles at a point on a straight line sum to 180°
- Know that a right angle = 90°

OBJECTIVES

	Lesson plans
• Recall the properties and definitions of special types of quadrilaterals, including symmetry properties	(6.2)
• List the properties of each, or identify (name) a given shape	(6.2)
• Draw sketches of shapes	(6.2)
• Name all quadrilaterals that have a specific property	(6.2)
• Identify quadrilaterals from everyday usage	(6.2)
• Classify quadrilaterals by their geometric properties	(6.2)
• Understand and use the angle properties of parallel lines	(7.5)
• Mark parallel lines on a diagram	(7.5)
• Find missing angles using properties of corresponding and alternate angles	(7.6)
• Understand and use the angle properties of quadrilaterals	(7.1)
• Use the fact that angle sum of a quadrilateral is 360°	(7.1)
• Give reasons for angle calculations	(chapter 7)
• Use three figure-bearings to specify direction	(7.8)
• Mark on a diagram the position of point *B* given its bearing from the point *A*	(7.8)
• Give a bearing between the points on a map or scaled plan	(7.8)
• Given the bearing of point *A* from point *B*, work out the bearing of *B* from *A*	(7.8)

DIFFERENTIATION & EXTENSION

- Practical activities help with the understanding of the properties and proofs – games like ‘Guess who I am?’
- Use the angle properties of triangles to find missing angles in combinations of triangles and rectangles
- Explore other properties in triangles, quadrilaterals and parallel lines

NOTES

- All diagrams should be presently neatly and accurately
- Students should have plenty of practice drawing examples to illustrate the properties of various shapes
- For bearings and scaled drawings, angles should be correct to 2° and lines accurate to 2 mm

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Module 14 of 37	Contents: Fractions	Time: 6 – 8 hours

SPECIFICATION REFERENCE

N h	Understand equivalent fractions
N h	Simplify a fraction by cancelling all common factors
N i, a	Add, subtract, multiply and divide fractions
N b	Order rational numbers
N j	Use decimal notation and understand that decimals and fractions are equivalent
N k	Recognise that recurring decimals are exact fractions, and that some exact fractions are recurring decimals
N o	Write one number as a fraction of another

PRIOR KNOWLEDGE

- Multiplication facts
- Ability to find common factors
- A basic understanding of fractions as being 'parts of a whole unit'
- Use of a calculator with fractions

OBJECTIVES	Lesson plans
• Visualise a fraction diagrammatically	(8.1)
• Understand a fraction as part of a whole	(8.1)
• Recognise and write fractions in everyday situations	(8.1)
• Find fractions of amounts	(8.5)
• Write a fraction in its simplest form and find equivalent fractions	(8.2)
• Compare the sizes of fractions using a common denominator	(8.3)
• Add and subtract fractions by using a common denominator	(8.7)
• Write an improper fraction as a mixed number	(8.4)
• Convert between fractions and decimals	(8.8, 10.1)
• Multiply and divide fractions	(8.5–8.6)
• Write one number as a fraction of another	(8.1)

DIFFERENTIATION & EXTENSION

- Careful differentiation is essential as this topic is dependent on the student's ability
- Relate simple fractions to percentages and vice versa
- Work with improper fractions and mixed numbers, eg divide 5 pizzas between 3 people
- Solve word problems involving fractions and in real life problems, eg finding a perimeter from a shape with fractional side lengths
- Link fractions with probability questions

NOTES

- Regular revision of fractions is essential
- Demonstrate how to use the fraction button on a calculator, in order be able to check solutions
- Use real-life examples whenever possible

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Module 15 of 37	Contents: Pie charts	Time: 3 – 4 hours

SPECIFICATION REFERENCE

SP g	Draw and produce pie charts
SP i	Interpret pie charts
SP l	Compare distributions and make inferences

PRIOR KNOWLEDGE

- Measuring and drawing angles
- Fractions of simple quantities

OBJECTIVES — Lesson plans

- Represent data in a pie chart — (12.2)
- Interpret data in a pie chart — (12.2)
- Understand that the frequency represented by corresponding sectors in two pie charts is dependent upon the total populations represented by each of the pie charts — (12.2)
- From pie charts — (12.2)
    - find the total frequency
    - find the size of each category

DIFFERENTIATION & EXTENSION

- Use this module to revise frequency and tally tables
- Practise the ability to divide by 20, 30, 40, 60 etc
- This can be delivered as a practical module that could lead to wall display- remind about bias, eg only asking their friends which band they like
- Compare pie charts for, eg boys and girls, to identify similarities and differences
- Ask students to combine two pie charts

NOTES

- Angles for pie charts should be accurate to within 2°

Module 16 of 37	Contents: Fractions, decimals and percentages	Time: 3 – 5 hours

SPECIFICATION REFERENCE

N l	Understand that 'percentage' means 'number of parts per 100' and use this to compare proportions
N o	Interpret fractions, decimals and percentages as operators
N v	Use calculators effectively and efficiently

PRIOR KNOWLEDGE

- Four operations of number
- The concepts of a fraction and a decimal
- Number complements to 10 and multiplication tables
- Awareness that percentages are used in everyday life

OBJECTIVES	Lesson plans
• Understand that a percentage is a fraction in hundredths	(19.1)
• Convert between fractions decimals and percentages	(19.1)
• Write one number as a percentage of another number	(19.4)
• Calculate the percentage of a given amount	(19.2)
• Use decimals to find quantities	(19.3–19.4)

DIFFERENTIATION & EXTENSION

- Consider fractions percentages of amounts, eg 12.5% = 0.125 = $\frac{1}{8}$
- Consider percentages which convert to recurring decimals (eg $33\frac{1}{3}$%), and situations which lead to percentages of more than 100%
- Use fraction, decimal and percentage dominos or follow me cards.
- Investigate into the many uses made of percentages, particularly in the media
- Practise the ability to convert between different forms

NOTES

- Use Functional Elements questions using fractions, eg $\frac{1}{4}$ off the list price when comparing different sale prices
- Keep using non-calculator methods, eg start with 10%, then 1% in order to required percentages

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Module 17 of 37	Contents: Applications of percentages	Time: 4 – 6 hours

SPECIFICATION REFERENCE

N l	Understand that ‘percentage’ means ‘number of parts per 100’ and use this to compare proportions
N m	Use percentages
N o	Interpret fractions, decimals and percentages as operators
N v	Use calculators effectively and efficiently

PRIOR KNOWLEDGE

- Four operations of number
- The concepts of a fraction and a decimal
- Number complements to 10 and multiplication tables
- Awareness that percentages are used in everyday life

OBJECTIVES	Lesson plans
• Use percentages to solve problems	(19.2–19.4)
• Convert between fractions, decimals and percentages	(19.1)
• Find a percentage of a quantity in order to increase or decrease	(19.3)

• Use percentages in real-life situations:
  ○ VAT
  ○ value of profit or loss
  ○ simple interest
  ○ income tax calculations
	(19.2)

• Use percentages as multipliers	(19.3)

DIFFERENTIATION & EXTENSION

- Use a mixture of calculator and non-calculator methods
- Use ideas for wall display, students make up their own poster to explain say a holiday reduction
- Use functional skills questions to look at questions in context
- Combine multipliers to simplify a series of percentage changes
- Problems which lead to the necessity of rounding to the nearest penny, eg real-life contexts
- Investigate comparisons between simple and compound interest calculations

NOTES

- Use plenty of practical examples that can be linked to Functional Elements, eg VAT calculations

Module 18 of 37	Contents: Algebra using powers and brackets	Time: 3 – 5 hours

SPECIFICATION REFERENCE

N f	Use the index laws for multiplication and division of integer powers
A c	Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors

PRIOR KNOWLEDGE

- Squares and cubes
- Experience of using a letter to represent a number
- Ability to use negative numbers with the four operations

OBJECTIVES

	Lesson plans
• Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, and of powers of a power	(9.2)
• Multiply a single algebraic term over a bracket	(4.6, 9.5)
• Write expressions using squares and cubes	(4.4)
• Use simple instances of index laws	(9.3)
• Factorise algebraic expressions by taking out common factors	(4.7, 9.6)

DIFFERENTIATION & EXTENSION

- Use various investigations leading to generalisations, eg:
- Indices – cell growth, paper folding
- Brackets – pond borders $4n + 4$ or $4(n + 1)$
- Football league matches $n^2 – n$ or $n(n – 1)$

NOTES

- Use everyday examples that lead to generalisations

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Module 19 of 37	Contents: Ratio and proportion	Time: 5 – 7 hours

SPECIFICATION REFERENCE

N p	Use ratio notation, including reduction to its simplest form and its various links to fraction notation
N t	Divide a quantity in a given ratio
GM m	Use and interpret maps and scale drawings
N q	Understand and use number operations and inverse operations

PRIOR KNOWLEDGE

- Using the four operations
- Ability to recognise common factors
- Knowledge of fractions

OBJECTIVES	Lesson plans
• Understand what is meant by ratio and use ratios	(24.1–24.2)
• Write a ratio in its simplest form and find an equivalent ratio	(24.1)
• Solve a ratio problem in context, eg recipes	(24.2–24.4)
• Share a quantity in a given ratio	(24.3)
• Interpret map/model scales as a ratio	(7.9, 24.2)
• Solve problems involving money conversions, eg £'s to Euros etc	(24.4)

DIFFERENTIATION & EXTENSION

- Consider maps: draw a plan of the school
- Further problems involving scale drawing, eg find the real distance in metres between two points on 1 : 40000 map
- Plan a housing estate with variety of different sized houses
- Currency calculations using foreign exchange rates
- Harder examples involving multi-stage problems
- Link ratios and proportion to Functional Elements, eg investigate the proportion of different metals in alloys, the ingredients needed for recipes for fewer or more people, mixing cement, planting forests, comparing prices of goods here and abroad, Best buy type questions

NOTES

- Students often find ratios with 3 parts difficult

Module 20 of 37	Contents: Linear equations and inequalities	Time: 5 – 7 hours

SPECIFICATION REFERENCE

A d	Set up and solve simple equations
N q	Understand and use number operations and the relationships between them including inverse operations and the hierarchy of operations
A g	Solve linear inequalities in one variable and represent the solution set on a number line

PRIOR KNOWLEDGE

- Experience of finding missing numbers in calculations
- The idea that some operations are reverse to each other
- An understanding of balancing
- Experience of using letters to represent quantities
- Be able to draw a number line
- An understanding of fractions and negative numbers

OBJECTIVES

	Lesson plans
• Set up simple equations	(21.1)
• Rearrange simple equations	(21.2)
• Solve simple equations	(21.1, 21.2)
• Solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation	(21.5–21.7)
• Solve linear equations which include brackets, those that have negative signs occurring anywhere in the equation, and those with a negative solution	(21.4, 21.6, 21.7)
• Solve linear equations in one unknown, with integer or fractional coefficients	(21.3–21.7)
• Use linear equations to solve word problems	(21.7)
• Solve simple linear inequalities in one variable, and represent the solution set on a number line	(21.10–21.11)
• Use the correct notation to show inclusive and exclusive inequalities	(21.9–21.11)

DIFFERENTIATION & EXTENSION

- Derive equations from practical situations (such as finding unknown angles in polygons or perimeter problems)
- Solve equations where manipulation of fractions (including negative fractions) is required

NOTES

- Remind students about work on linear patterns and sequences
- Students need to realise that not all equations should be solved by ‘trial and improvement’ or by observation. The use of a formal method of solving equations is very important
- Remind students of the need to set their work out clearly, keeping the equal signs in line

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Module 21 of 37	Contents: Perimeter and area	Time: 6 – 8 hours

SPECIFICATION REFERENCE

GM x	Calculate perimeters and areas of shapes made from triangles and rectangles
GM n	Understand the effect of enlargement for perimeter and area of shapes
GM p	Convert between units and area measures

PRIOR KNOWLEDGE

- Names of triangles, quadrilaterals
- Knowledge of the properties of rectangles, parallelograms and triangles
- Concept of perimeter and area
- Units of measurement
- Four operations of number

OBJECTIVES	Lesson plans
• Measure shapes to find perimeters and areas	(14.1, 14.3)
• Find the perimeter of rectangles and triangles	(14.1)
• Find the perimeter of compound shapes	(14.1)
• Find the area of a rectangle and triangle	(14.2, 14.3)
• Recall and use the formulae for the area of a triangle, rectangle and a parallelogram	(14.3)
• Calculate areas of compound shapes made from triangles and rectangles	(14.4)
• Find the area of a trapezium	(14.3)
• Solve a range of problems involving areas including cost of carpet type questions	(14.4)
• Convert between metric units of area	(20.7)
• Understand how enlargement changes areas	(20.6)

DIFFERENTIATION & EXTENSION

- Further problems involving combinations of shapes
- Use practical examples from functional papers on topics such as returfing a garden, carpeting a room, laying carpet tiles on a floor
- Perimeter questions could use skirting board, wallpaper, planting a border of a garden

NOTES

- Discuss the correct use of language and units, particularly when method marks are for the correct unit of measure
- Ensure that students can distinguish between perimeter and area
- Practical examples help to clarify the concepts, eg floor tiles etc

Module 22 of 37	Contents: 3-D shapes	Time: 3 – 5 hours

SPECIFICATION REFERENCE

GM k	Use 2-D representations of 3-D shapes
GM x	Calculate the surface area of a 3-D shape

PRIOR KNOWLEDGE

- The names of standard 2-D and 3-D shapes

OBJECTIVES

	Lesson plans
• Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone	(20.1)
• Know the terms face, edge and vertex	(20.1)
• Use 2-D representations of 3-D shapes	(20.1–20.3)
• Use isometric grids	(20.2)
• Draw nets and show how they fold to make a 3-D solid	(20.2)
• Understand and draw front and side elevations and plans of shapes made from simple solids	(20.3)
• Given the front and side elevations and the plan of a solid, draw a sketch of the 3-D solid	(20.3)
• Find the surface area of a 3-D shape	(20.5)

DIFFERENTIATION & EXTENSION

- Make solids using equipment such as clixi or multi-link
- Draw on isometric paper shapes made from multi-link
- Build shapes using cubes from 2-D representations
- Euler's theorem
- A useful topic for a wall display-pupils tend to like to draw 3-D shapes and add interest by using a mixture of colours in the elevations

NOTES

- Accurate drawing skills need to be reinforced
- Some students find visualising 3-D object difficult, so using simple models will help

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Module 23 of 37	Contents: Real-life graphs	Time: 4 – 6 hours

SPECIFICATION REFERENCE

A r	Construct linear functions from real-life problems and plot their corresponding graphs
A s	Discuss, plot and interpret graphs including non-linear) modelling real situations

PRIOR KNOWLEDGE

- Experience at plotting points in all quadrants
- Experience at labelling axes and reading scales

OBJECTIVES	Lesson plans
• Draw graphs representing 'real' examples like filling a bath/containers	(22.1–22.3)
• Interpret and draw linear graphs, including conversion graphs, fuel bills etc	(22.1–22.3)
• Solve problems relating to mobile phone bills with fixed charge and price per unit	(22.1–22.3)
• Interpret non-linear graphs	(22.1–22.3)

DIFFERENTIATION & EXTENSION

- Use open ended questions that test student awareness of what intersections mean, eg mobile phone bills
- Use spreadsheets to generate straight-line graphs and pose questions about gradient of lines
- Use ICT packages or graphical calculators to draw straight line graphs and quadratic graphs

NOTES

- Clear presentation is important with axes clearly labelled
- Students need to be able to recognise linear graphs and also be able to recognise when their graph is incorrect
- Link graphs and relationships in other subject areas, eg science, geography
- Students should have plenty of practice interpreting linear graphs for Functional Elements problems

Module 24 of 37	Contents: Straight line graphs	Time: 3 – 5 hours

SPECIFICATION REFERENCE

A l	Recognise and plot equations that correspond to straight-line graphs in the coordinate plane, including finding gradients

PRIOR KNOWLEDGE

- Experience at plotting points in all quadrants
- Substitution into simple formulae

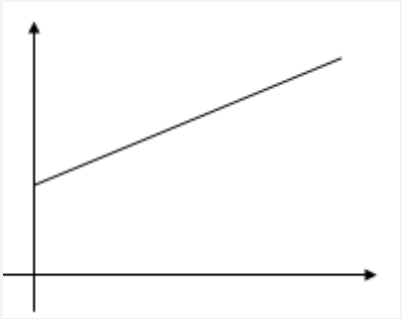
OBJECTIVES	Lesson plans
• Draw, label and put suitable scales on axes	(15.1, 15.2)
• Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane	(15.5, 15.6)
• Plot and draw graphs of functions	(15.5, 15.6)
• Plot and draw graphs of straight lines of the form $y = mx + c$, when values are given for m and c	(15.6)
• Find the gradient of a straight line from a graph	(15.7)
• Interpret gradients from real life graphs	(22.1–22.3)

DIFFERENTIATION & EXTENSION

- Plot graphs of the form $y = mx + c$ where pupil has to generate their own table and set out their own axes
- Use a spreadsheet to generate straight-line graphs, posing questions about the gradient of lines
- Use a graphical calculator or graphical ICT package to draw straight-line graphs
- Use some examples from the last module to interpret gradient and intercept:

For hire of a skip the intercept is delivery charge and the gradient is the cost per day.

Charge in £'s



Time in days

Find the equation of a straight line through two points

NOTES

- Careful annotation should be encouraged. Label the coordinate axes and write the equation of the line on the graph
- Cover horizontal and vertical line graphs as students often forget these ($x = c$ and $y = c$)
- Link graphs and relationships in other subject areas, eg science and geography
- Interpret straight line graphs in Functional Elements
- Link conversion graphs to converting metric and imperial units and equivalents

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Module 25 of 37	Contents: Compound measures	Time: 4 – 6 hours

SPECIFICATION REFERENCE

GM s	Understand and use compound measures
N u	Approximate to specified or appropriate degree of accuracy
GM p	Convert between speed measures

PRIOR KNOWLEDGE

- Knowledge of metric units, eg 1 m = 100 cm
- Know that 1 hour = 60 mins, 1 min = 60 seconds
- Experience of multiplying by powers of 10, eg 100 × 100 = 10 000

OBJECTIVES

	Lesson plans
• Use the relationship between distance, speed and time to solve problems	(11.5)
• Convert between metric units of speed, eg km/h to m/s	(11.5)

DIFFERENTIATION & EXTENSION

- Convert imperial units to metric units, eg mph into km/h which would remind students that 5 miles = 8 km
- Ask students to convert a 100 m time of 10 secs into miles per hour

NOTES

- Measurement is a practical activity
- All working out should be shown with multiplication or division by powers of 10
- Use the distance/speed/time triangle (i.e. Drink Some Tea)

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Module 26 of 37	Contents: Timetables and Distance-time graphs	Time: 4 – 6 hours

SPECIFICATION REFERENCE

GM o	Interpret scales on a range of measuring instruments, and recognise the inaccuracy of measurements
SP e	Extract data from printed tables and lists
A s	Interpret graphs (including non-linear) that model real-life situations
A s	Interpret and draw distance-time graphs

PRIOR KNOWLEDGE

- Knowledge of metric units, eg 1 m = 100 cm
- Know that 1 hour = 60 mins, 1 min = 60 seconds
- Know how to find speed
- Know how to read scales, draw and interpret graphs

OBJECTIVES	Lesson plans
• Read times and work out time intervals	(11.2)
• Convert between 12–hour and 24–hour hour clock times	(11.2)
• Read bus and train timetables and plan journeys	(11.2)
• Draw distance time graphs	(22.3)
• Interpret distance time graphs and solve problems	(22.3)

DIFFERENTIATION & EXTENSION

- Make up a graph and supply the commentary for it
- Use timetables to plan journeys

NOTES

- Clear presentation with axes labelled correctly is important
- Interpret straight line graphs for Functional Elements problems

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Module 27 of 37	Contents: Volume	Time: 4 – 6 hours

SPECIFICATION REFERENCE

GM aa	Calculate volumes of right prisms and shapes made from cubes and cuboids
GM n	Understand the effect of enlargement for perimeter, area and volume of shapes and solids
GM p	Convert between metric volume measures, including cubic centimetres and cubic metres

PRIOR KNOWLEDGE

- Concept of volume
- Concept of prism
- Experience of constructing cubes or cuboids from multi link

OBJECTIVES	Lesson plans
• Find volumes of shapes by counting cubes	(20.4)
• Recall and use formulae for the volume of cubes and cuboids	(20.4)
• Calculate the volumes of right prisms and shapes made from cubes and cuboids	(20.4)
• Convert between units of volume and capacity (1 m/ = 1cm³)	(20.7)
• Understand how enlargement affects volume	(20.6)

DIFFERENTIATION & EXTENSION

- Look at 'practical' examples with fish tanks/ filling containers, find the number of small boxes fitting into a large box
- Further problems involving a combination of shapes
- Cylinders are left until later in the course

NOTES

- Discuss the correct use of language and units. Remind students that there is often a mark attached to writing down the correct unit
- Use practical problems to enable the students to understand the difference between perimeter, area and volume
- Use Functional Elements problems, eg filling a water tank, optimisation type questions etc

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Module 28 of 37	Contents: Probability	Time: 8 – 10 hours

SPECIFICATION REFERENCE

SP m	Understand and use the vocabulary of probability and the probability scale
SP n	Understand and use estimates or measures of probability from theoretical models (including equally likely outcomes), or from relative frequency
SP o	List all outcomes for single events, and for two successive events, in a systematic way and derive relative probabilities
SP p	Identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1
SP s	Compare experimental data and theoretical probabilities
SP t	Understand that if they repeat an experiment, they may − and usually will − get different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics

PRIOR KNOWLEDGE

- Fractions, decimals and percentages
- Ability to read from a two-way table

OBJECTIVES	Lesson plans
• Distinguish between events which are: impossible, unlikely, even chance, likely, and certain to occur	(26.1)
• Mark events and/or probabilities on a probability scale of 0 to 1	(26.1)
• Write probabilities in words, fractions, decimals and percentages	(26.1, 26.2)
• Find the probability of an event happening using theoretical probability	(26.2, 26.3)
• Find the probability of an event happening using relative frequency	(26.5)
• Estimate the number of times an event will occur, given the probability and the number of trials	(26.7)
• Use theoretical models to include outcomes using dice, spinners, coins	(26.2)
• List all outcomes for single events systematically	(26.2, 26.4)
• List all outcomes for two successive events systematically	(26.4)
• Use and draw sample space diagrams	(26.4)
• Add simple probabilities	(26.3)
• Identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1	(26.3)
• Use 1 − *p* as the probability of an event not occurring where *p* is the probability of the event occurring	(26.3)
• Find a missing probability from a list or table	(26.3, 23.6)
• Compare experimental data and theoretical probabilities	(26.5)
• Compare relative frequencies from samples of different sizes	(26.5)

DIFFERENTIATION & EXTENSION

- Use this as an opportunity for practical work
- Experiments with dice and spinners
- Show sample space for outcomes of throwing two dice (36 outcomes)
- Use ‘the horse race’/drawing pins/let students make their own biased dice and find experimental probability

NOTES

- Students should express probabilities as fractions, percentages or decimals
- Probabilities written as fractions do not need to be cancelled to their simplest form

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Module 29 of 37	Contents: Formulae	Time: 6 – 8 hours

SPECIFICATION REFERENCE

A f	Derive a formula
A f	Substitute numbers into a formula
A f	Change the subject of a formula

PRIOR KNOWLEDGE

- Understanding of the mathematical meaning of the words ‘expression’, ‘simplifying’, ‘formulae’ and ‘equation’
- Experience of using letters to represent quantities
- Substituting into simple expressions using words
- Using brackets in numerical calculations and removing brackets in simple algebraic expressions

OBJECTIVES

	Lesson plans
• Derive a simple formula, including those with squares, cubes and roots	(28.4)
• Use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols	(28.1, 28.3, 28.4)
• Substitute numbers into a formula	(28.1, 28.3–28.5)
• Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$	(28.2–28.5)
• Change the subject of a formula	(28.6)
• Find the solution to a problem by writing an equation and solving it	(28.4)

DIFFERENTIATION & EXTENSION

- Use negative numbers in formulae involving indices
- Various investigations leading to generalisations, eg the painted cube, Frogs, Pond Borders
- Relate to topic on graphs of real life functions
- More complex changing the subject, moving onto higher tier work
- Apply changing the subject to physics formulae, eg speed, density, equations of motion

NOTES

- Emphasise the need for good algebraic notation
- Show a linear equation first and follow the same steps to rearrange a similarly structured formula
- Link with Functional Elements problems in everyday problems
- Link with formulae for area and volume

Module 30 of 37	Contents:	Time: 4 – 6 hours

SPECIFICATION REFERENCE

GM c	Calculate and use the sums of the interior and exterior angles of polygons
GM v	Use straight edge and a pair of compasses to carry out constructions

PRIOR KNOWLEDGE

- Angles on straight lines, at a point and in simple shapes

OBJECTIVES	Lesson plans
• Calculate and use the sums of the interior angles of polygons	(7.2)
• Use geometrical language appropriately and recognise and name pentagons, hexagons, heptagons, octagons and decagons	(7.2)
• Know, or work out, the relationship between the number of sides of a polygon and the sum of its interior angles	(7.2)
• Know that the sum of the exterior angles of any polygon is 360°	(7.3)
• Calculate the size of each exterior/interior angle of a regular polygon	(7.2, 7.3)
• Construct a regular hexagon inside a circle	(18.1)
• Understand tessellations of regular and irregular polygons	(7.4)
• Tessellate combinations of polygons	(7.4)
• Explain why some shapes tessellate and why other shapes do not	(7.4)

DIFFERENTIATION & EXTENSION

- Study Escher drawings (possibly cross curricular with Art)
- Ask students to design their own tessellation, and explain why their shapes tessellate

NOTES

- All diagrams should be neatly presented
- Use of tracing paper helps with tessellations
- Consider real-life examples of tessellations

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Module 31 of 37	Contents: Transformations	Time: 5 – 7 hours

SPECIFICATION REFERENCE

GM I	Describe and transform 2-D shapes using single or combined rotations, reflections, translations or enlargements by a positive scale factor
GM I	Distinguish properties that are preserved under particular transformations

PRIOR KNOWLEDGE

- Recognition of basic shapes
- An understanding of the concept of rotation, reflection and enlargement
- Coordinates in four quadrants
- Equations of lines parallel to the coordinate axes and $y = \pm x$

OBJECTIVES	Lesson plans
• Describe and transform 2-D shapes using single rotations	(23.3)
• Understand that rotations are specified by a centre and an (anticlockwise) angle	(23.3)
• Find the centre of rotation	(23.3)
• Rotate a shape about the origin, or any other point	(23.3)
• Describe and transform 2-D shapes using single reflection	(23.4)
• Understand that reflections are specified by a mirror line	(23.4)
• Identify the equation of a line of symmetry	(23.4)
• Describe and transform 2-D shapes using single translations	(23.2)
• Understand that translations are specified by a distance and direction (using a vector)	(23.2)
• Translate a given shape by a vector	(23.2)
• Describe and transform 2-D shapes using enlargements by a positive scale factor	(23.5)
• Understand that an enlargement is specified by a centre and a scale factor	(23.5)
• Scale a shape on a grid (without a centre specified)	(23.5)
• Draw an enlargement	(23.5)
• Enlarge a given shape using (0, 0) as the centre of enlargement	(23.5)
• Enlarge shapes with a centre other than (0, 0)	(23.5)
• Find the centre of enlargement	(23.5)
• Recognise that enlargements preserve angle but not length	(23.5)
• Identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides	(23.5)
• Describe and transform 2-D shapes using combined rotations, reflections, translations, or enlargements	(23.6)
• Understand that distances and angles are preserved under rotations, reflections and translations, so that any shape is congruent under any of these transformations	(23.2–23.4)
• Describe a transformation	(23.2–23.6)

DIFFERENTIATION & EXTENSION

- Use squared paper to enlarge cartoon characters to make a display

NOTES

- Emphasise that students should describe transformations fully
- Diagrams should be drawn in pencil
- Tracing paper can be useful for rotations

Module 32 of 37	Contents: Scatter graphs and correlation	Time: 5 – 6 hours

SPECIFICATION REFERENCE

SP g, i	Draw and interpret scatter diagrams
SP k	Recognise correlation and draw and/or use lines of best fit by eye, understanding what these represent
SP j	Look at data to find patterns and exceptions

PRIOR KNOWLEDGE

- Plotting coordinates and scale
- An understanding of the concept of a variable
- Recognition that a change in one variable can affect another
- Linear graphs

OBJECTIVES	Lesson plans
• Draw and interpret a scatter graph	(25.2)
• Look at data to find patterns and exceptions	(25.2–25.5)
• Distinguish between positive, negative and zero correlation using lines of best fit	(25.3–25.4)
• Interpret correlation in terms of the problem	(25.3–25.4)
• Understand that correlation does not imply causality	(25.3)
• Draw lines of best fit by eye and understand what it represents	(25.4)
• Use a line of best fit to predict values of one variable given values of the other variable	(25.5)

DIFFERENTIATION & EXTENSION

- Vary the axes required on a scatter graph to suit the ability of the class
- Carry out a statistical investigation of their own including; designing an appropriate means of gathering the data, and an appropriate means of displaying the results, eg height and length of arm
- Use a spreadsheet, or other software, to produce scatter diagrams/lines of best fit
- Investigate how the line of best fit is affected by the choice of scales on the axes, eg use car data with age and price of the same make of car

NOTES

- Statistically, the line of best fit should pass through the coordinate representing the mean of the data
- Label all axes clearly and use a ruler to draw all straight lines
- Remind student the line of best fit does not necessarily go through the origin of the graph

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Module 33 of 37	Contents: Averages and Range	Time: 6 – 8 hours

SPECIFICATION REFERENCE

SP h	Calculate median, mean, range, mode and modal class
SP l	Compare distributions and make inferences
SP u	Use calculators efficiently and effectively, including statistical functions
SP g	Draw ordered stem and leaf diagrams
SP i	Draw conclusions from graphs and diagrams

PRIOR KNOWLEDGE

- Midpoint of a line segment
- Addition and subtraction
- Different statistical diagrams

OBJECTIVES	Lesson plans
• Calculate the mean, mode, median and range for discrete data	(16.1, 16.3)
• Calculate the mean, mode, median and range from an ordered stem and leaf diagram	(16.4)
• Draw and interpret an ordered stem and leaf diagram	(16.4)
• Calculate the modal class and the interval containing the median for continuous data	(16.6)
• Calculate the mean, median and mode from a frequency table	(16.5)
• Estimate the mean of grouped data using the mid-interval value	(16.7)
• Compare the mean and range of two distributions	(16.3)
• Recognise the advantages and disadvantages between measures of average	(16.2)
• Calculate the mean of a small data set, using the appropriate key on a scientific calculator	(16.1)

DIFFERENTIATION & EXTENSION

- Find the mean for grouped continuous data with unequal class intervals
- Collect continuous data and decide on appropriate (equal) class intervals; then find measures of average
- Use the statistical functions on a calculator or a spreadsheet to calculate the mean for continuous data

NOTES

- Ask class to do their own survey with data collection sheets, eg to find the average number of children per family in the class
- The internet and old coursework tasks are a rich source of data to work with, eg *Second-Hand Car Sales*, *Mayfield High* data etc

Module 34 of 37	Contents: Quadratic Graphs	Time: 2 – 4 hours

SPECIFICATION REFERENCE

A t	Generate points and plot graphs of simple quadratic functions, and use these to find approximate solutions
N v	Use calculators effectively and efficiently

PRIOR KNOWLEDGE

- Squaring negative numbers
- Substituting numbers into algebraic expressions
- Plotting points on a coordinate grid
- Experience of dealing with algebraic expression with brackets – BIDMAS

OBJECTIVES

	Lesson plans
• Substitute values of x into a quadratic function to find the corresponding values of y	(22.4)
• Draw graphs of quadratic functions	(22.4)
• Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function	(22.5)

DIFFERENTIATION & EXTENSION

- Draw simple cubic and $\frac{1}{x}$ graphs
- Solve simultaneous equations graphically including a quadratic graph and a line
- Solve simple projectile problems

NOTES

- The graphs of quadratic functions should be drawn freehand, and in pencil. Turning the paper often helps
- Squaring negative integers may be a problem for some

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Module 35 of 37	Contents: Trial and Improvement	Time: 3 – 4 hours

SPECIFICATION REFERENCE

A h	Use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them
N u	Round to a specified or appropriate degree of accuracy
N v	Use calculators effectively and efficiently

PRIOR KNOWLEDGE

- Substituting numbers into algebraic expressions
- Dealing with decimals on a calculator
- Comparing/ordering decimals

OBJECTIVES — Lesson plans

- Solve algebraic equations involving squares and cubes, eg $x^3 + 3x = 40$ using trial and improvement **(21.8)**
- Solve real-life problems on areas and volumes, eg the length of a rectangular room is 2 m longer than the width. If the area is 30 m², find the width **(21.8)**

DIFFERENTIATION & EXTENSION

- Can look at various calculator functions like ‘square root’ and ‘cube root’
- Solve equations of the form $\frac{1}{x} = x^2 - 5$

NOTES

- Students should be encouraged to use their calculator efficiently by using the ‘replay’ or ANS/EXE function keys
- Students to take care when entering negative values to be squared
- Students should write down all the digits on their calculator display and only round the final answer to the required degree of accuracy

Module 36 of 37	Contents: Circles	Time: 4 – 6 hours

SPECIFICATION REFERENCE

GM i	Distinguish between the centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
GM z	Find circumferences and areas of circles
N u	Round to a specified or appropriate degree of accuracy
N v	Use calculators effectively and efficiently
GM v	Draw circles and arcs to a given radius
GM aa	Find the volume of a cylinder
GM z	Find the surface area of a cylinder

PRIOR KNOWLEDGE

- The ability to substitute numbers into formulae

OBJECTIVES	Lesson plans
• Recall the definition of a circle and identify and draw parts of a circle	(6.5–6.6)
• Draw a circle given its radius or diameter	(6.6)
• Find circumferences of circles and areas enclosed by circles	(17.1–17.2)
• Recall and use the formulae for the circumference of a circle and the area enclosed by a circle	(17.1–17.2)
• Use π ≈ 3.142 or use the π button on a calculator	(17.1–17.3)
• Find the perimeters and areas of semicircles and quarter circles	(17.3)
• Find the surface area and volume of a cylinder	(20.4–20.5)

DIFFERENTIATION & EXTENSION

- Use more complex 2-D shapes, eg (harder) sectors of circles
- Approximate π as $\frac{22}{7}$
- Work backwards to find the radius/diameter given the circumference/area
- Apply to real life contexts with laps of running tracks and average speeds
- Make a label for a can
- Harder problems involving multi-stage calculations
- Define a circle by using the language of loci

NOTES

- All working should be clearly and accurately presented
- Use a pencil to draw all diagrams
- A sturdy pair of compasses is essential

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Module 37 of 37	Contents: Pythagoras' theorem	Time: 4 – 5 hours

SPECIFICATION REFERENCE

Gm g	Understand, recall and use Pythagoras' theorem in 2-D
A k	Calculate the length of a line segment
N u	Round to specified or appropriate degrees of accuracy
N v	Use calculators effectively and efficiently

PRIOR KNOWLEDGE

- Knowledge of square and square roots
- Knowledge of types of triangle

OBJECTIVES	Lesson plans
• Understand and recall Pythagoras' Theorem	(27.1–27.4)
• Use Pythagoras' theorem to find the hypotenuse	(27.1)
• Use Pythagoras' theorem to find the length of a side	(27.2)
• Use Pythagoras' theorem to find the length of a line segment from a coordinate grid	(27.4)
• Apply Pythagoras' theorem to practical situations	(27.1–27.2)

DIFFERENTIATION & EXTENSION

- See exemplar question involving times taken to cross a field as oppose to going around the edge.
- Try to find examples with ladders on walls, area of a sloping roof etc
- Introduce 3-D Pythagoras (moving towards Higher Tier)

NOTES

- A useful way of remembering Pythagoras' Theorem is; *'Square it, square it, add/subtract it, square root it'*
- Students should not forget to state units for the answers

Foundation course objectives (1MA0)

Number

N a	Add, subtract, multiply and divide any positive and negative integers
N b	Order decimals and integers
N b	Order rational numbers
N c	Use the concepts and vocabulary of factor (divisor), multiple, common factor, Highest Common Factor (HCF), Least Common Multiple (LCM), prime number and prime factor decomposition
N d	Use the terms square, positive and negative square root, cube and cube root
N e	Use index notation for squares, cubes and powers of 10
N f	Use index laws for multiplication and division of integer powers
N h	Understand equivalent fractions
N h	Simplify a fraction by cancelling all common factors
N i, a	Add, subtract, multiply and divide fractions
N j	Use decimal notation and recognise that each terminating decimal is a fraction
N j	Use decimal notation and understand that decimals and fractions are equivalent
N k	Recognise that recurring decimals are exact fractions, and that some exact fractions are recurring
N l	Understand that 'percentage' means 'number of parts per 100' and use this to compare proportions
N m	Use percentages
N m	Write one number as a fraction of another
N o	Interpret fractions, decimals and percentages as operators
N p	Use ratio notation, including reduction to its simplest form and its various links to fraction notation
N q	Understand and use number operations and inverse operations
N q	Understand and use number operations and the relationships between them including inverse operations and the hierarchy of operations
N t	Divide a quantity in a given ratio
N u	Round numbers
N u	Round to specified or appropriate degrees of accuracy
N v	Use calculators effectively and efficiently

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Algebra

A a	Distinguish the different roles played by letter symbols in algebra
A b	Distinguish the meaning between the words ‘equation’, ‘formula’ and ‘expression’
A c	Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors
A d	Set up and solve simple equations
A f	Derive a formula
A f	Substitute numbers into a formula
A f	Change the subject of a formula
A g	Solve linear inequalities in one variable and represent the numbers on a number line
A h	Use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them
A i	Generate terms of a sequence using term-to-term and position to-term definitions of the sequence
A j	Use linear expressions to describe the *n*th term of an arithmetic sequence
A k	Calculate the length of a line segment
A k	Use the conventions for coordinates in the plane and plot points in all four quadrants, including using geometric information
A l	Recognise and plot equations that correspond to straight-line graphs in the coordinate plane, including finding gradients
A r	Construct linear functions from real-life problems and plot their corresponding graphs
A s	Discuss plot and interpret graphs (including non linear) that model real situations
A s	Draw and interpret distance time graphs
A t	Generate points and plot graphs of simple quadratic functions, and use these to find approximate solutions

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Geometry and Measures

GM a	Recall and use properties of angles at a point, angles on a straight line (including right angles), perpendicular lines, and vertically opposite angles
GM b	Understand and use the angle properties of triangles and intersecting lines
GM b	Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals
GM c	Calculate and use the sums of the interior and exterior angles of polygons
GM d	Recall the properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus
GM e	Recognise reflection and rotation symmetry of 2-D shapes
GM f	Understand congruence and similarity
Gm g	Understand, recall and use Pythagoras' theorem in 2-D
GM i	Distinguish between the centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
GM k	Use 2-D representations of 3-D shapes
GM l	Describe and transform 2-D shapes using single or combined rotations, reflections, translations, or enlargements by a positive scale factor
GM l	Distinguish properties that are preserved under particular transformations
GM m	Use and interpret maps and scale drawings
GM n	Understand the effect of enlargement for perimeter, area and volume of shapes and solids
GM o	Interpret scales on a range of measuring instruments, and recognise the inaccuracy of measurements
GM o	Use correct notation for time 12- and 24- hour clock
GM p	Convert measurements from one unit to another
GM p	Convert between units and area measures
GM p	Convert between speed measures
GM p	Convert between volume measures, including cubic centimetres and cubic metres
GM r	Understand and use bearings
GM s	Understand and use compound measures
GM t	Measure and draw lines and angles
GM w	Construct loci
GM u	Draw triangles and other 2-D shapes using a ruler and protractor
GM v	Use straight edge and a pair of compasses to carry out constructions
GM v	Draw circles and arcs to a given radius
GM x	Calculate perimeters and areas of shapes made from triangles and rectangles
GM x	Calculate the surface area of a 3-D shape
GM z	Find circumferences and areas
GM z	Find the surface area of a cylinder
GM aa	Calculate volumes of right prisms and shapes made from cubes and cuboids
GM aa	Find the volume of a cylinder

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Statistics and Probability

SP a	Understand and use statistical problem solving process (handling data cycle)
SP b	Identify possible sources of bias
SP c	Design an experiment or survey
SP d	Design data-collection sheets distinguishing between different types of data
SP e	Extract data from printed tables and lists
SP e	Read timetables
SP e	Extract data from timetables and lists
SP f	Design and use two-way tables for discrete and grouped data
SP g	Draw charts and diagrams for various data types
SP g	Draw and produce pie charts
SP g	Produce ordered stem and leaf diagrams
SP g, i	Draw and interpret scatter diagrams
SP h	Calculate median, mean, range, mode and modal class
SP i	Interpret pie charts
SP i	Interpret a wide range of graphs and diagrams and draw conclusions
SP i	Draw conclusions from graphs and diagrams
SP j	Look at data to find patterns and exceptions
SP k	Recognise correlation and draw and/or use lines of best fit by eye, understanding what these represent
SP l	Compare distributions and make inferences
SP m	Understand and use the vocabulary of probability and the probability scale
SP n	Understand and use estimates or measures of probability from theoretical models (including equally likely outcomes), or from relative frequency
SP o	List all outcomes for single events, and for two successive events, in a systematic way and derive relative probabilities
SP p	Identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1
SP s	Compare experimental data and theoretical probabilities
SP t	Understand that if they repeat an experiment, they may − and usually will − get different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics
SP u	Use calculators efficiently and effectively, including statistical functions

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