

Foundation course overview 2009-2011

The table below shows an overview of modules in the Foundation tier scheme of work.
Text Book and Homework references are for the Edexcel GCSE Maths Foundation Tier Books.

To see details of each module click on the topic title while holding Ctrl

Module	Chapt	Title	Hrs approx	Grade	Suggested h/w from workbook
Autumn Term Year 10			37		Please add
1	1	Number 1: Whole numbers	6	E	
2	4	Number 2: Fractions and Decimals	4	D	
3	3	Angles 1	3	E	
4	7	Decimals	3	D	
5	5	Drawing and constructing 2-D shapes	3	C/D	
6	6	Directed Number	2	E	
7	8	Algebra 1: Introduction to algebra	4	C	
END OF TERM TEST					
8	16	Measure: Reading scales, converting units, compound measure	4	D	
9	12	Graphs 1: Coordinates	4	E	
Spring Term Year 10			33		
10	2	Collecting data	4	C/D	
11	14	Displaying data 1: Charts and graphs	4	C	
12	20	Number 3: Powers, roots and indices	6	D	
13	10	Number 4: Patterns and sequences	4	C	
14	11	Angles 2: Angle properties of triangles and quadrilaterals	6	D	73-74
END OF TERM TEST					
15	13	Fractions: Addition Subtraction, Multiplication and Division	4	D	22-27
Summer Term Year 10			30		
16	23	Probability (recap)	5	C	88-89
17	18	Averages and Ranges	5	C	91-93
18	19	Linear equations and inequalities	4	C	137-140
19	25	3-D shapes	4	C	46-50
20	17	Percentages	4	C/D/E	
21	15	Graphs 2: Linear and Quadratics graphs	5	C	
END OF YEAR EXAM					
Autumn Term Year 11			37		
22	24	Ratio and proportion	5	D	18, 19
23	9	Mensuration 1: Perimeter and area	5	E	
24	31	Pythagoras' Theorem	3	C	
25	27	Algebra 2: Powers and brackets and trial and improvement	5	C	
26	21	Formulae	5	C	
27	26	Transformations	5	D	85-87
28	28	Estimating and Accuracy	2	C	
29	30	Scatter graphs and correlation	3	D	
END OF TERM TEST					
30	29	Constructions and Loci	3	C	
31	22	Mensuration 2: Harder problems	5	C	
Spring Term Year 11			20		
MOCKS					
Complete syllabus then revision until exam in June 2011					

GCSE

Edexcel GCSE in Mathematics (2540/2544)

First examination in 2009

The Archbishop Lanfranc Scheme of Work

Foundation tier Scheme of work

Last Updated: 7th April 2009

Introduction

This scheme of work is based upon a five-term model over two years for both Foundation and Higher students.

It can be used directly as a scheme of work for the GCSE Mathematics (A) (Linear) specification, and a mapping guide to a variety of models for the GCSE Mathematics (B) (Modular) specification can be found on pages **Error! Bookmark not defined.–Error! Bookmark not defined.Error! Reference source not found.Error! Reference source not found.Error! Reference source not found.Error! Reference source not found..**

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 National Curriculum Programme of Study
- Objectives for students at the end of the module
- Ideas for differentiation and extension activities
- Endorsed Publishers' resources, referenced to textbook chapters and sections
- Issues regarding assessment of the module

- Ideas for homework tasks
- Notes for general mathematical teaching points and common misconceptions.

Schemes of work giving more specific detail of each endorsed textbook will be available via a link from the Edexcel mathematics website (www.edexcel.org.uk).

Module 1	Chapter 1	Time: 5-7 hours
GCSE tier:	Foundation	
Contents:	Number 1	<u>Whole numbers</u>
NA2a	Understanding place value and round to a given power of 10	
NA2a	Understanding and using positive numbers and negative integers both as positions and translations on a number line	
NA2a	Order integers	
NA3a	Add, subtract, multiply and divide integers and then by any number	
NA3k	Using standard column procedures for addition and subtraction of integers	
NA3k	Using standard column procedures for multiplication of integers	
NA3a	Multiplying or dividing any number by powers of 10, and any positive number by a number between 0 and 1	
NA4c	Use a variety of checking procedures, including the problem backwards, and considering whether a result is of the right magnitude	
NA3b	Using brackets and the hierarchy of operations	
NA2a	Using the concepts and vocabulary of factors (divisor), multiple, common factor, HCF, LCM, prime numbers and prime factor decomposition	

Objectives

By the end of the module the student should be able to:

- understand and order integers
- add, subtract, multiply and divide integers
- understand simple instances of BIDMAS, eg work out $12 \times 5 - 24 \div 8$
- round whole numbers to the nearest, 10, 100, 1000, ...
- multiply and divide whole numbers by a given multiple of 10
- check their calculations by rounding, eg $29 \times 31 \approx 30 \times 30$
- check answers by reverse calculation, eg if $9 \times 23 = 207$ then $207 \div 9 = 23$
- find the HCF and the LCM of numbers
- write a number as a product of its prime factors, eg $108 = 2 \times 2 \times 3 \times 3 \times 3$

Prior knowledge

- The ability to order numbers, appreciation of place value, experience of the 4 operations using whole numbers.
- Knowledge of integer complements to 10
- Knowledge of multiplication facts to 10×10
- Knowledge of strategies for multiplying and dividing whole numbers by 10

Differentiation and extension

- More work on long multiplication and division without using a calculator.
- Estimating answers to calculations involving the four rules.
- Consideration of mental maths problems with negative powers of 10: 2.5×0.01 , 0.001
- Directed number work with two or more operations, or with decimals.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	1: Introducing number
Harper Collins	Foundation	1: Number
Heinemann (Harcourt)	Foundation	1: Understanding whole numbers 2: Number facts
Hodder Murray	Foundation	1: Number review
Oxford University Press	Foundation	N1: Properties of number N2: Whole number calculations
	Foundation Plus	N1: Integers and decimals N2: Decimal calculations N6: Estimating and calculating

Notes

- Present all working clearly with numbers in line; emphasising that all working is to be shown.
- For non-calculator methods make sure that remainders and carrying are shown.

Module 4 Chapter 4

Time: 4–6 hours

GCSE tier: Foundation

Contents: Number 2 [Fractions and Decimals](#)

NA2d Using decimal notation and recognising that each terminating decimal is a fraction

Objectives

By the end of the module the student should be able to:

- put digits in the correct place in a decimal number
- write decimals in ascending order of size
- Recognise equivalent fractions
- Simplify a fraction by cancelling
- Compare fractions by writing them with the same denominator
- Convert decimals to fractions by using their place value
- Convert fractions to decimals by using equivalent fractions or division

Prior knowledge

- Number 1.
- The concepts of a fraction and a decimal.

Differentiation and extension

- Use decimals in real-life problems.
- Use standard form for vary large/small numbers.
- Money calculations that require rounding answers to the nearest penny.
- Multiply and divide decimals by decimals (more than 2 dp).

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	4: Fractions and decimals
Heinemann (Harcourt)	Foundation	5: Decimals
Oxford University Press	Foundation	N3: Fractions, decimals and percentages N6: Decimal calculations
	Foundation Plus	N2: Decimal calculations N3: Fractions, decimals and percentages N6: Estimating and calculating

Notes

- Equivalent fractions is the key concept for this topic

GCSE tier: Foundation

Contents: [Angles 1](#)

SSM2b	Naming and estimating angles in degrees
SSM4d	Measuring and drawing angles to the nearest degree
SSM2a	Recalling and using properties of angles at a point, angles on a straight line (including right angles), perpendicular lines, and opposite angles at a vertex
SSM4b	Understanding angle measure using the associated language

Objectives

By the end of the module the student should be able to:

- distinguish between acute, obtuse, reflex and right angles
- estimate the size of an angle in degrees
- measure and draw angle to the nearest degree
- use angle properties on a line and at a point to calculate unknown angles

Prior knowledge

- An understanding of angle as a measure of turning.
- The ability to use a protractor to measure angles.
- Understanding of the concept of parallel lines.

Differentiation and extension

- Measuring angles in polygons.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	3: Angles 1
Harper Collins	Foundation	15: Angles
Heinemann (Harcourt)	Foundation	6: Angles and turning
Hodder Murray	Foundation	13: Angles
Oxford University Press	Foundation	S2: Angles and coordinates
	Foundation Plus	S2: Angles and circles

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Regular quick test type homework on angle properties of various shapes.

Notes

- Make sure that all pencils are sharp and drawings are neat and accurate.
- Angles should be accurate to within 2 degrees.

GCSE tier: Foundation

Contents: Numbers 2 [Decimals](#)

- NA2d Writing decimal numbers in order of size
- NA3h Rounding to a given number of significant figures (and decimal places)
- NA3i Adding and subtracting mentally numbers with up to two decimal places
- NA3k Dividing by a decimal (up to 2 dp) by transforming it to a problem involving division using by an integer
- NA3k Using standard column procedures for addition and subtraction of decimals
- NA3k Using standard column procedures for multiplication of decimals, understanding where to position the decimal point by considering what happens if they multiply equivalent fractions
- NA4c Estimating answers to problems

Objectives

By the end of the module the student should be able to:

- put digits in the correct place in a decimal number
- write decimals in ascending order of size
- approximate decimals to a given number of decimal places or significant figures
- add and subtract decimal numbers
- multiply and divide decimal numbers by whole numbers and decimal numbers (up to 2 decimal places), eg $266.22 \div 0.34$
- know that eg $13.5 \div 0.5 = 135 \div 5$

Prior knowledge

- The concepts a decimal and place value

Differentiation and extension

- Use decimals in real-life problems.
- Use standard form for vary large/small numbers.
- Money calculations that require rounding answers to the nearest penny.
- Multiply and divide decimals by decimals (more than 2 dp).

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	7: Decimals
Heinemann (Harcourt)	Foundation	5: Decimals
Oxford University Press	Foundation	N3: Fractions, decimals and percentages N6: Decimal calculations
	Foundation Plus	N2: Decimal calculations N3: Fractions, decimals and percentages N6: Estimating and calculating

Notes

- Present all working clearly with decimal points in line; emphasising that all working is to be shown.
- For non-calculator methods make sure that remainders and carrying are shown.
- Amounts of money should always be rounded to the nearest penny where necessary.

GCSE Tier: Foundation

Contents: [Drawing and constructing 2-D shapes](#)

SSM4d	Drawing triangles and other 2-D shapes using a ruler and a protractor, given information about their lengths and angles
SSM4e	Using straight edge and compass to do standard constructions
SSM 4j	Finding loci
SSM2d	Using angle properties of triangles and quadrilaterals, and understanding congruence
SSM4d	Understand, by their experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not
SSM2f	Recalling the essential properties and definitions of special types of quadrilateral
SSM2i	Recalling the definition of a circle and the meaning of related terms, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
SSM2i	Understanding that inscribed regular polygons can be constructed by equal division of a circle

Objectives

By the end of the module the student should be able to:

- use a ruler and compass to draw accurate triangles, and other 2-D shapes, given information about their side lengths and angles.
- use straight edge and compass to construct: an equilateral triangle; the midpoint and perpendicular bisector of a line segment; the bisector of an angle
- find the locus of points eg the locus of points equidistant to two given points
- understand, by their experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not
- recall and use angle properties of equilateral, isosceles and right-angled triangles
- recall and use the properties of squares, rectangles, parallelograms, trapeziums and rhombuses
- recall and use properties of circles
- appreciate why some shapes tessellate and why some shapes do not tessellate.

Prior knowledge

- An ability to use a pair of compasses.
- Understanding of the terms perpendicular and parallel.

Differentiation and extension

- Solve loci problems that require a combination of loci.
- Construct combinations of 2-D shapes to make nets.
- Investigate tessellation.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	5: Two-dimensional shapes
Heinemann (Harcourt)	Foundation	7: 2-D shapes
Oxford University Press	Foundation	S4: 2-D and 3-D shapes S5: Measuring and constructing
	Foundation Plus	S4: 2-D and 3-D shapes S5: Constructions and loci

Notes

- All working should be presented clearly and accurately.
- A sturdy pair of compasses are essential.
- Have some spare equipment available.

Contents: [Directed Number](#)**Objectives****By the end of the module the student should be able to:**

- Order directed numbers
- Add and subtract directed numbers
- Multiply and divide directed numbers
- Use calculator and non-calculator methods for the above.

Prior knowledge

- The concept of positive and negative numbers

Differentiation and extension

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	6: Directed Numbers
Heinemann (Harcourt)	Foundation	
Oxford University Press	Foundation	
	Foundation Plus	

Notes

- Present all working clearly with decimal points in line; emphasising that all working is to be shown.
- For non-calculator methods make sure that remainders and carrying are shown.
- Amounts of money should always be rounded to the nearest penny where necessary.

GCSE tier: Foundation

Contents: Algebra 1 [Introduction to algebra](#)

NA5a	Distinguishing the different roles played by letter symbols in algebra
NA5a	Performing simple algebraic multiplication and division using the correct notation
NA5b	Distinguishing the meaning between the words 'equation', 'formula', 'identity' and expression
NA5b	Understanding that the transformation of algebraic expressions obeys and generalises the rules of generalised arithmetic
NA5b	Manipulating algebraic expressions by collecting like terms

Objectives**By the end of the module the student should be able to:**

- simplify algebraic expressions in one, or more like terms, by adding and subtracting.
- multiply and divide with letters and numbers.
- Multiply single brackets e.g. $3(2a - b) = 6a - 3b$
- Factorise into a single bracket by finding a common factor e.g. $6a - 12b + 3 = 3(2a - 4b + 1)$

Prior knowledge

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

Differentiation and extension

- Further work on collecting like terms, involving negative terms.
- Collecting terms where each term may consist of more than one letter, eg $3ab + 4ab$.
- Examples where all the skills above are required.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	8: Algebra 1
Heinemann (Harcourt)	Foundation	3: Essential algebra
Oxford University Press	Foundation	A1: Expressions
	Foundation Plus	A1: Expressions A5: Formulae

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.

Notes

- Explanations about mathematical terminology should be tailored to suit the ability of the group.
- Emphasise correct use of symbolic notation (eg $3x$ rather than $3 \times x$).
- Present all work neatly, writing out the questions with the answers to aid revision at a later stage.

Module 16 Chapter 16

Time: 3–5 hours

GCSE tier: Foundation

Contents: Measures [Reading scales, converting units, compound measure](#)

SSM4a	Interpreting scales on a range of measuring instruments, including those for time and mass
SSM4a	Knowing that measurements using real numbers depend on the choice of unit
SSM4a	Recognising that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction
SSM4a	Converting measurements from one unit to another
SSM4a	Knowing rough metric equivalents of pounds, feet, miles, pints and gallons
SSM4a	Making sensible estimates of a range of measures in everyday settings
SSM4c	Understanding and using compound measures, speed and density

Objectives

By the end of the module the student should be able to:

- make estimates of: length; volume and capacity; weights
- make approximate conversions between metric and imperial units
- decide on the appropriate units to use in real life problems
- read measurements from instruments: scales; analogue and digital clocks; thermometers, etc
- do calculations involving time, including the use of time tables and calendars.
- use the relationship between distance, speed and time to solve problems
- convert between metric units of speed eg km/h to m/s
- know that density is found by mass \div volume
- use the relationship between density, mass and volume to solve problems
- convert between metric units of density eg kg/m³ to g/cm³.

Prior knowledge

- An awareness of the imperial system of measures.
- Strategies for multiplying and dividing by 10
- Knowledge of the conversion facts for metric lengths, mass and capacity.
- Knowledge of the conversion facts between seconds, minutes and hours.
- Knowledge of metric units, eg 1m = 100 cm, etc.
- Know that 1 hour = 60mins, 1min = 60 seconds.
- Experience of multiply by powers of 10, eg. $100 \times 100 = 10\,000$

Differentiation and extension

- This could be made a practical activity by collecting assorted everyday items and weighing, measuring to check the estimates of their lengths, weights and volumes.
- Use ICT and reference books to find the weights, volumes and heights of large structures such as buildings, aeroplanes and ships.
- Work with more difficult examples.
- Work with 'real' timetables and 'real' holiday brochures for working out holiday dates.
- Perform calculations on a calculator by using standard form.
- Convert imperial units to metric units, eg mph into km/h.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	16: Measures
Heinemann (Harcourt)	Foundation	9: Estimating and using measures 26: Advanced area, perimeter and volume
Oxford University Press	Foundation	N1: Integers and decimals S1: Length, area and volume
	Foundation Plus	N1: Integers and decimals N2: Decimal calculations S1: Length, area and volume

Assessment issues

- Written testing to assess knowledge of content.
- Mental testing to check for knowledge of everyday measures, and estimation.
- Mental test questions on changing units, changing between metric and imperial units.
- Mental questions to test knowledge of common conversion factors.
- Aural questions on dates, times and timetables.

Homework

- Plan a foreign holiday with dates, timetables to arrive at the airport etc.

Notes

- Measurement is essentially a practical activity.
- Use a range of everyday objects to make the lesson more real.
- All working should be shown with multiplication or division by powers of 10
- Use a distance, speed and time triangle to help students see the relationship between the variables.

GCSE tier: Foundation

Contents: Graphs 1 [Co-ordinates](#)

SSM3e	Understanding that one coordinate identifies a point on a line, two coordinates identify a point in a plane and three coordinates identify a point in space, using the terms '1-D', '2-D' and '3-D'
NA6b	Use the conventions for coordinates in the plane
SSM3e	Using axes and coordinates to specify points in all four quadrants
NA6b	Plot points in all four quadrants
SSM3e	Locating points with given coordinates
SSM3e	Finding the coordinates of points identified by geometrical information
SSM3e	Finding the coordinates of the midpoint of the a line segment

Objectives**By the end of the module the student should be able to:**

- plot and reading coordinates on a coordinate grid (in all four quadrants)
- understand that one coordinate identifies a point on a line, two coordinates identify a point in a plane and three coordinates identify a point in space, and use the terms '1-D', '2-D' and '3-D'
- find the coordinates of the fourth vertex of a parallelogram
- identify the coordinates of the vertex of a cuboid on a 3-D grid
- writing down the coordinates of the midpoint of the line connecting two points
- calculate the length of the line segment joining to point in the plane (all four quadrants).

Prior knowledge

- Directed numbers.
- Parallel and perpendicular lines.

Differentiation and extension

- Find the coordinates of the point of intersection of the medians of a triangle, and explore further.
- Identify the coordinates of the mid-point of a line segment in 3-D.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	12: Graphs 1
Heinemann (Harcourt)	Foundation	16: Coordinates and graphs
Hodder Murray	Foundation	10: Coordinates and graphs
Oxford University Press	Foundation	S2: Angles and coordinates A4: Functions and graphs

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.

Notes

- Students should use a ruler to draw coordinate axes.
- Coordinate axes should be labelled.
- Students often have difficulty visualising 3-D coordinates.

Module 2 Chapter 2

Time: 4–6 hours

GCSE tier: Foundation

Contents: [Collecting data](#)

HD3a Designing and using data-collection sheets for grouped discrete and continuous data
HD3a Collecting data using various method
HD3b Gathering data from secondary sources
HD3c Designing and using two-way tables

Objectives

By the end of the module the student should be able to:

- design a suitable question for a questionnaire
- understand the difference between: primary and secondary data; discrete and continuous data
- design suitable data capture sheets for surveys and experiments
- understand about bias in sampling.

Prior knowledge

- An understanding of why data needs to be collected.
- Some idea about different types of graphs.

Differentiation and extension

- Carry out a statistical investigation of their own including — designing an appropriate means of gathering the data.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	2: Collecting and recording data
Harper Collins	Foundation	6: Statistical representation
Heinemann (Harcourt)	Foundation	10: Collecting and recording data
Hodder Murray	Foundation	19: Collecting data
Oxford University Press	Foundation	D1: Surveys
	Foundation Plus	D1: Collecting data

Assessment issues

Homework

Notes

- Present all working clearly with numbers in line; emphasising that all working is to be shown.
- For non-calculator methods make sure that remainders and carrying are shown.

Module 14 Chapter 14

Time: 4-6 hours

GCSE tier: Foundation

Contents: Displaying data 1 [Charts and graphs](#)

HD4a Drawing and producing a wide range of graphs and diagrams

HD5b Interpreting a wide range of graphs and diagrams and drawing conclusions

Objectives

By the end of the module the student should be able to:

- Represent, interpret and identify trends in data as:
 - bar charts (including dual bar charts)
 - pictograms
 - line graphs
 - histograms (intervals with equal width)
 - frequency polygons.
 - Pie charts
 - Time series
- Choose an appropriate way to display discrete, continuous and categorical data.

Prior knowledge

- An understanding of why data needs to be collected and some idea about different types of graphs.
- Experience of collecting, interpreting, displaying and calculating with data.
- Measuring and drawing angles.
- Fractions of simple quantities.

- Differentiation and 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.
- Draw comparative pie charts (equal radii).
- Compare pie charts for, eg boys and girls, to identify similarities and differences.
- Make predictions by considering trends of line graphs for time series.
- Additional work on making predictions based on current trends, using time series and/or moving averages.
- Collect data from the internet (eg RPI) and analyse it for trend.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	14: Processing, representing and interpreting data
Harper Collins	Foundation	6: Statistical representation
Heinemann (Harcourt)	Foundation	12: Sorting and representing data
Hodder Murray	Foundation	21: Presenting data
Oxford University Press	Foundation	D2: Displaying data D5: Interpreting diagrams and charts
	Foundation Plus	D2: Displaying data D5: Interpreting diagrams and charts

Assessment issues

- Written testing to assess knowledge of content.
- Their own statistical investigation.
- GCSE coursework — data handling project.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Completion of a simple statistical project.

Notes

- Clearly label all axes on graphs and use a ruler to draw straight lines.
- Many students enjoy drawing statistical graphs for classroom displays.
- Accurate drawing skills need to be reinforced.
- Angles should be accurate to within 2 degrees.
- All working should be presented clearly, with descriptions of trends expressed as clearly as possible.

- NA2a Using negative numbers in context
- NA2b Using the terms square, positive and negative square roots, cube and cube roots
- NA2b Using index notation for squares, cubes

Objectives

By the end of the module the student should be able to:

- Know the index laws and how to use them
- find: squares; cubes; square roots; cube roots of numbers, with and without a calculator (including the use of trial and improvement)
- interpret standard index form from a calculator display.

Prior knowledge

- Number complements to 10 and multiplication/division facts.
- Use a number line to show how numbers relate to each other.
- Recognise basic number patterns.
- Experience of classifying integers.

Differentiation and 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).

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	14: Processing, representing and interpreting data
Heinemann (Harcourt)	Foundation	2: More about numbers
Hodder Murray	Foundation	6: Powers and roots
Oxford University Press	Foundation	N1: Properties of number N5: Powers, roots and primes
	Foundation Plus	N1: Integers and decimals N5: integers, powers and roots

Assessment issues

- Written testing to assess knowledge of content.
- Regular oral work — eg a five-minute assessment at the beginning or end of a lesson.
- Mental test to check knowledge of squares and cubes.
- Mental test on the recognition of odd and even numbers.
- Test on performance using a calculator to find squares, cubes and square roots.
- Test without a calculator on knowledge of squares, cubes and square numbers (keeping the numbers small).

Homework

- Investigational tasks leading to number patterns involving powers of numbers.
- GCSE past paper questions.

Notes

- Oral discussion should be used to ensure recognition of odd and even numbers.
- Calculators are only used when appropriate.

NA6a Generating common integer sequences (including: sequences of odd or even integers; squared integers; powers of 2; powers of 10; triangle numbers)

NA6a Using linear expressions to describe the n th term of an arithmetic sequence, justifying its form by referring to the activity or context from which it was generated

NA6a Generating terms of a sequence using term-by-term and position-to-term definitions of the sequence

Objectives

By the end of the module the student should be able to:

- find the missing numbers in a number pattern or sequence
- find the n th term of a number sequence
- find whether a number is part of a given sequence
- use a calculator to produce a sequence of numbers.

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.

Differentiation and extension

- Matchstick problems.
- Sequences of triangle numbers, Fibonacci numbers, etc.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	10: Sequences
Harper Collins	Foundation	23: Pattern
Heinemann (Harcourt)	Foundation	4: Patterns and sequences
Hodder Murray	Foundation	9: Number sequences
Oxford University Press	Foundation	A3: Sequences
	Foundation Plus	A3: Sequences

Assessment issues

- Written testing to assess knowledge of content.
- Simple investigation of a sequence, using diagrams and number patterns.
- Use of mental maths in the substitution of simple numbers into expressions.
- GCSE A01 coursework tasks.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Fibonacci sequence, Pascal's triangle.
- Uses of algebra to describe real situation eg n quadrilaterals have $4n$ sides.

Notes

- Emphasis on 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 n th term.
- The cube (and cube root) function on a calculator may not be the same for other makes.

SSM2b	Using angle properties of equilateral, isosceles and right-angled triangles
SSM2c	Understanding the consequent properties of a parallelogram and a proof that the angle sum of a triangle is 180 degrees
SSM2c	Understanding a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices
SSM2d	Explain why the angle sum of a quadrilateral is 360 degrees
SSM2g	Calculating and using the sums of the interior angles of quadrilaterals, pentagons and hexagons
SSM2g	Calculating and using the angles of regular polygons
SSM2g	Understanding that inscribed regular polygons can be constructed by equal divisions of a circle

Objectives

By the end of the module the student should be able to:

- mark parallel lines in a diagram
- use angle properties of triangles and quadrilaterals to find missing angles
- prove that the angle sum of a triangle is 180 degrees
- explain why the angle sum of a quadrilateral is 360 degrees
- find missing angles using properties of corresponding angles and alternate angles, giving reasons
- find the three missing angles in a parallelogram when one of them is given
- identify and list the properties of quadrilaterals (including kites)
- name all quadrilaterals that have a pair of opposite sides that are equal.
- calculate and use the sums of the interior angles of convex polygons of sides 3, 4, 5, 6, 8, 10
- know, or work out, the relationship between the number of sides of a polygon and the sum of its interior angles
- know that the sum of the exterior angles of any polygon is 360 degrees
- find the size of each exterior/interior angle of a regular polygon.

Prior knowledge

- Recall the names of special types of triangle, including equilateral, right-angled and isosceles.
- Know that angles on a straight line sum to 180 degrees.
- Know that a right angle = 90 degrees.

Differentiation and extension

- Practical activities help understanding of the properties and proofs.
- Harder problems involving multi-step calculations.

Resources

Publisher	Textbook	Chapter	Section
Edexcel	Foundation	11: Angles 2	11.1–11.6
Harper Collins	Foundation	15: Angles	
Heinemann (Harcourt)	Foundation	6: Angles and turning 7: 2-D shapes	6.8–6.9 7.1
Hodder Murray	Foundation	13: Angles 14: 2-D and 3-D shapes	13.3, 13.4 14.1
Oxford University Press	Foundation	S2: Angles and coordinates S8: Properties of shapes	S2.1–S2.4 S8.1–8.3
	Foundation Plus	S2: Angles and circles S4: 2-D and 3-D shapes	S2.1–2.4 S4.1–4.2

Assessment issues

- Written testing to assess knowledge of content.

Homework**Notes**

- Generally the diagrams in examinations are not accurately drawn.

NA3c	Expressing a given number as a fraction of another
NA3c	Adding and subtracting fractions by writing them with a common denominator
NA2c	Understanding equivalent fractions; simplifying a fraction by cancelling all common factors
NA2c	Ordering fractions by rewriting them with a common denominator
NA3c	Calculating a given fraction of a quantity, expressing the answer as a fraction
NA3c	Performing short division to convert a fraction to a decimal
NA3a	Understanding 'reciprocal' as multiplicative inverse
NA3a	Using inverse operations
NA3d	Multiplying and dividing a fraction by an integer, by a unit fraction and by a general fraction
NA3l	Using efficient methods to calculate with fractions, including cancelling common factors before carrying out a calculation
NA2d	Recognising that recurring decimals are exact fractions, and that some exact fractions are recurring decimals

Objectives

By the end of the module the student should be able to:

- visualise a fraction diagrammatically
- understand a fraction as part of a whole
- recognise and write fractions in everyday situations
- write a fraction in its simplest form and recognise equivalent fractions
- compare the sizes of fractions using a common denominator
- add and subtract fractions by using a common denominator
- write an improper fraction as a mixed fraction.
- multiply and divide a number with a fraction, and a fraction with a fraction (expressing the answer in its simplest form)
- simplify multiplication of fractions by first cancelling common factors
- convert a fraction to a decimal, or a decimal to a fraction
- convert a fraction to a recurring decimal
- find the reciprocal of whole numbers, fractions, and decimals, eg find the reciprocal of 0.4
- know that 0 does not have reciprocal, and that a number multiplied by its reciprocal is 1
- use fractions in contextualised problems.

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.

Differentiation and extension

Careful differentiation is essential for this topic dependent upon the student's ability

- Relating simple fractions to remembered percentages and vice-versa.
- Using a calculator to change fractions into decimals and looking for patterns.
- Working with improper fractions and mixed numbers.
- Solve word problems involving fractions (and in real-life problems eg find perimeter using fractional values).
- Using a calculator to find fractions of given quantities.
- Working with improper fractions and mixed numbers.
- Using the four operations using fractions (and in real-life problems eg find area using fractional values).
- For very able students cancelling down of algebraic expressions could be considered.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	13: Further fractions 4: Fractions and decimals
Heinemann (Harcourt)	Foundation	8: Fractions
Oxford University Press	Foundation	N3: Fractions, decimals and percentages
	Foundation Plus	N3: Fractions, decimals and percentages

Assessment issues

- Testing the ability to perform calculations, using simple fractions, without a calculator.
- Mental arithmetic test involving simple fractions such as $\frac{1}{2}$, $\frac{1}{4}$, ...
- Mental testing on a regular basis, of the basic conversions of simple fraction into decimals.

Homework

- An equivalent fractions worksheet as a preliminary, following on from the initial lesson.
- Use the worksheet for comparing fractions, ordering fractions, and adding and subtracting fractions.
- Other work given could have fractional answers as a part of the process.
- Extra examples on a regular basis for revision purposes.
-

Notes

- Understanding of equivalent fractions is the key issue in order to be able to tackle the other content.
- Calculators should only be used when appropriate.
- Constant revision of this aspect is needed.
- All work needs to be presented clearly with the relevant stages of working shown.
- Non-calculator work with fractions is generally poorly attempted at GCSE. Students may have difficulty with the concept of dividing by a fraction.

HD4c	Understanding and using the probability scale
HD5g	Using the vocabulary of probability to interpret results involving uncertainty and prediction
HD4f	Identifying different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1
HD4e	Listing all outcomes for single events, and for two successive events, in a systematic way
HD4d	Understanding and using estimates or measures of probability from theoretical models (including equally likely outcomes), or from relative frequency
HD5h	Comparing experimental data and theoretical probabilities
HD5i	Understanding 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

Objectives

By the end of the module the student should be able to:

- use the language of probability to describe the likelihood of an event
- represent and compare probabilities on a number scale
- list outcomes for single mutually exclusive events and write down their probability.
- write down the theoretical probability for an equally likely event
- estimate a probability by relative frequency
- know that a better estimate for a probability is achieved by increasing the number of trials.

Prior knowledge

- Some idea of chance and the likelihood of an event happening; and recognition that some events are more likely than others.
- Experience of using the language of likelihood.
- Ability to read from a two-way table.

Differentiation and extension

- Write down probabilities of events that may or may not happen.
- Play simple probability games, predicting outcomes eg horse race for sum of 2 dice.
- The work can be extended to include that of the Higher syllabus.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	23: Probability
Harper Collins	Foundation	18: Probability
Heinemann (Harcourt)	Foundation	23: Probability
Hodder Murray	Foundation	22: Probability
Oxford University Press	Foundation	D3: Probability
	Foundation Plus	D3: Probability

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.

Notes

- Where possible introduce practical work to support the theoretical work.
- Only fractions, decimals or percentages should be used for probability.
- Students can be unsure of the relationship $P(\text{not } n) = 1 - P(n)$.
- Only fractions, decimals or percentages should be used for probability.

Module 18

Chapter 18

Time: 5–7 hours

GCSE tier:

Foundation

Contents:

Averages and Range

Small and large data sets

HD4b	Finding the (mode) median, mean and range of small data sets with discrete data
HD4a	Drawing and producing a stem and leaf diagram
HD5a	Relating summarised data to the initial questions
HD5d	Comparing distributions and making inferences, using the shapes of distributions and measures of average and spread
HD4b	Identifying the modal class for grouped data
HD4g	Finding the median for large data sets
HD4g	Calculating an estimate of the mean for large data sets with grouped data
HD5j	Using relevant statistical functions on a calculator or spreadsheet

Objectives

By the end of the module the student should be able to:

- **find the mode, the median, the mean, and the range for (small) sets of data**
- **use a stem and leaf diagram to sort data**
- **know the advantages/disadvantages of using the different measure of average.**
- **identify the modal class interval in grouped and ungrouped frequency distributions**
- **find the class interval containing the median value**
- **find the mean of an ungrouped frequency distribution**
- **find an estimate for the mean of a grouped frequency distribution by using the mid-interval value**
- **use the statistical functions on a calculator or a spreadsheet to calculate the mean for discrete data.**

Prior knowledge

- Some experience of the measures of averages.
- Ability to order numbers.
- Finding the average of two number (ie the midpoint).

Differentiation and extension

- Collect data from class — children per family etc.
- Find measures of average for data collected in a frequency distribution.
- Use stem and leaf diagrams with unusual stems, eg 234.1, 234.6, 235.1, ...
- Discuss occasions when one average is more appropriate, and the limitations of each average.
- Compare distributions and making inferences, using the shapes of distributions and measures of average and spread, eg 'boys are taller on average but there is a much greater spread in heights'.
- 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.
- Find the median by cumulative frequency diagram.
- Consider other measures of spread, eg interquartile range; appreciate advantages/limitations of the range.
- Use the statistical functions on a calculator or a spreadsheet to calculate the mean for continuous data.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	18: Averages and ranges
Heinemann (Harcourt)	Foundation	20: Presenting and representing data 1
Oxford University Press	Foundation	D1: Surveys, D2: Displaying data D4: Averages and range
	Foundation Plus	D1: Collectioning data D2: Displaying data D4: Averages and range

Assessment issues

- Written testing to assess knowledge of content.
- Test a given hypothesis either using data provided or by collecting data from the class

Homework

- Written testing to assess knowledge of content.
- A group work assessment through selected questions and mini-projects.
- Data handling project coursework task.

Notes

- Students tend to select modal class but identify it by the frequency rather than the class description.
- Explain that the median of grouped data is not necessarily from the middle class interval.
- Students should be aware that the actual mean can not be calculated from a grouped frequency distribution; and that using the midpoint of the class intervals gives the best estimate for the mean
- The modal class is found for grouped frequency distributions in which the class intervals have an equal

NA5e	Setting up simple equations
NA5e	Solving simple equations by using inverse operations or by transforming both sides in the same way
NA5e	Solving linear equations with integer coefficients, in which the unknown appears on either side or on both sides of the equation
NA5d	Solving simple linear inequalities in one variable, and represent the solution set on a number line

Objectives

By the end of the module the student should be able to:

- solve linear equations with one, or more, operations
- solve linear equations involving a single pair of brackets
- solve linear inequalities in one variable and present the solution set on a number line.

Prior knowledge

- Experience of finding missing numbers in calculations.
- The idea that some operations are ‘opposite’ to each other.
- An understanding of balancing.
- Experience of using letters to represent quantities.
- Be able to draw a number line.

Differentiation and extension

- Use of inverse operations and rounding to 1 sig. fig. could be applied to more complex calculations.
- Derive equations from practical situations (such as angle calculations).
- Solve equations where manipulation of fractions (including the negative fractions) is required.
- Solve linear inequalities where manipulation of fractions is required.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	19: Equations and inequalities
Harper Collins	Foundation	13: Equations and inequalities
Heinemann (Harcourt)	Foundation	11: Linear equations
Hodder Murray	Foundation	8: Equations
Oxford University Press	Foundation	A2: Simple equations A6: Linear equations
	Foundation Plus	A2: Equations and inequalities

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.

Notes

- Students need to realise that not all linear equations can easily be solved by either observation or trial and improvement, and hence the use of a formal method is vital.
- Students can leave their answers in fractional form where appropriate.
- Interpreting the direction of an inequality is a problem for many.

Module 25 Chapter 25

Time: 5-7 hours

GCSE tier: Foundation

Contents: [3-D shapes](#)

SSH2j	Exploring the geometry of cuboids (including cubes), and shapes from cuboids
SSM2k	Using 2-D representations of 3-D shapes and analysing 3-D shapes through 2-D projections and cross-sections, including plan and elevation
SSM3b	Recognising and visualising reflection symmetry of 3-D shapes
SSM4d	Construct cubes, tetrahedra, square-based pyramids and other 3-D shapes from given information
SSM4g	Finding volumes of cuboids, recalling the formula and understanding the connection to counting cubes and how it extends this approach
SSM4g	Calculating volumes of (right prisms and of) shapes made from cubes and cuboids
SSM4i	Converting between volume measures, including cubic centimetres and cubic metres

Objectives

By the end of the module the student should be able to:

- count the vertices, faces and edges of 3-D shapes
- draw nets of solids and recognise solids from their nets
- draw and interpret plans and elevations
- draw planes of symmetry in 3-D shapes
- find volumes of shapes by counting cubes
- use formulae for the volume of cuboids
- solve a range of problems involving volume
- convert between units of volume.

Prior knowledge

- The names of standard 3-D shapes.
- The unit on 2-D shapes.
- recognise and name examples of solids, including prisms, in the real world.
- Names of triangles, quadrilaterals and polygons.
- Nets of simple solids.
- Concept of volume.
- Ability to give answers to a degree of accuracy.
- Experience of constructing cubes or cuboids.

Differentiation and extension

- Make solids using equipment such as clixi or multi-link.
- Draw shapes made from multi-link on isometric paper.
- Build shapes from cubes that are represented in 2D.
- Work out how many small boxes can be packed into a larger box.
- Additional work using symbolic expressions.
- Find all possible nets of a cube.
- Convert between less familiar units eg cm^3 to mm^3 , cm^3 to litres.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	25: Three-dimensional shapes
Harper Collins	Foundation	24: Surface area and volume of 3-D shapes
Heinemann (Harcourt)	Foundation	13: 3-D shapes
Hodder Murray	Foundation	18: Constructions and loci
Oxford University Press	Foundation	S4: 2-D and 3-D shapes, S8: Properties of shapes
	Foundation Plus	S4: 2-D and 3-D shapes

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, an additional work of a similar nature, or extension work detailed above.
- Sketch a plan view of your bedroom or an elevation of your house.
- Investigate the different nets that can be used to make certain 3-D shapes.

Notes

- Accurate drawing skills need to be reinforced.
- Some students find visualising 3-D objects difficult — simple models will assist.
- Need to constantly revise the expressions for area/volume of shapes.

NA2c	Understanding equivalent fractions
NA2e	Understanding the ‘percentage’ means ‘number of parts per 100’ and use this to compare proportions
NA2e	Interpreting percentage as the operator ‘so many hundredths of’
NA2e	Converting simple fractions of a whole to percentages of the whole and visa versa
NA3c	Expressing a given number as a fraction of another
NA3c	Performing short division to convert a simple fraction to a decimal
NA2e	Using percentages in real-life situations
NA3m	Solving simple percentage problems, including increase and decrease
HD5k	Interpret social statistics including index numbers

Objectives

By the end of the module the student should be able to:

- understand that a percentage is a fraction in hundredths
- write a percentage as a decimal; or as a fraction in its simplest terms
- write one number as a percentage of another number
- calculate the percentage of a given amount.
- find a percentage increase/decrease, of an amount
- calculate simple and compound interest for two, or more, periods of time.

Prior knowledge

- 4 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.

Differentiation and extension

- Fractional percentages of amounts.
- Percentages which convert to recurring decimals (eg $33\frac{1}{3}\%$), and situations which lead to percentages of more than 100%.
- 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).
- Comparisons between simple and compound interest calculations.
- Formulae in simple interest/compound interest methods.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	4: Fractions and decimals 17: Percentages
Harper Collins	Foundation	12: Percentages
Heinemann (Harcourt)	Foundation	15: Percentages
Hodder Murray	Foundation	5: Percentages
Oxford University Press	Foundation	N7: Finding fractions and percentages N8: Number problems
	Foundation Plus	N7: Fraction and percentages calculations

Assessment issues

- Written testing to assess knowledge of content.
- Reinforce equivalence and the connection between percentage, fraction and decimal.
- Mental methods of calculating common percentages (eg 17.5% using 10%, 5%, 2.5%).

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Independent research into the many uses made of percentages, particularly in the media.
- The construction of a VAT ready-reckoner table.

Notes

- For non-calculator methods make sure that remainders and carrying are shown.
- In preparation for this unit students should be reminded of basic percentages and recognise their fraction and decimal equivalents.

Contents:

[Graphs 2: Linear and Quadratic graphs](#)

NA6c	Constructing linear functions from real-life problems and plotting their corresponding graphs
NA6c	Discussing and interpreting graphs modelling real-life situations
NA6e	Interpreting information presented in a range of linear graphs
NA6b	Using the conventions for coordinates in the plane
NA6b	Plotting points in all four quadrants
NA6b	Recognising (when values are given for m and c) that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane
NA6b	Plotting graphs of functions in which y is given explicitly in terms of x , or implicitly
SSM2c	Distinguishing between lines and line segment
NA6d	Finding the gradient of lines given by equations of the form $y = mx + c$, (when values are given for m and c) and investigating the gradients of parallel lines
NA6d	Investigating the gradients of parallel lines
NA6e	Generating points and plotting graphs of simple quadratic functions
NA6e	Finding approximate solutions of a quadratic equation from the graph of the corresponding quadratic function
NA5b	Expand the product of two linear expressions

Objectives

- draw linear graphs from tabulated data, including real-world examples
- interpret linear graphs, including conversion graphs and distance-time graphs
- understand the difference between a line and a line segment
- draw and interpret graphs in the form $y = mx + c$ (when values for m and c are given)
- understand that lines are parallel when they have the same value of m
- solve graphically simultaneous equations, eg find when/where the car overtakes the bus.
- substitute values of x into a quadratic function to find the corresponding values of y
- draw graphs of quadratic functions
- use quadratic graphs to solve quadratic equations

Prior knowledge

- Plotting points on a coordinate grid.
- Experience of dealing with algebraic expression with one pair of brackets.
- Know $ax \quad bx = (ab)x^2$, where a and b are integers.
- Experience at plotting points in all quadrants.
- Substituting numbers into algebraic expressions.

Differentiation and 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.
- More able students could extend to identifying regions relating to straight-line graphs.
- Students performing below grade C will struggle with much of this module and examples should be set accordingly.
- Draw quadratic graphs.
- Use a graphical calculator to draw straight-line graphs.
- Find the coordinates of the point of intersection of two lines.
- Shading regions in a linear inequality.
- Draw simple cubic graphs.
- Solve graphically simultaneous equations involving a quadratic graph and a line.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	15: Graphs 2
Heinemann (Harcourt)	Foundation	16: Coordinates and graphs
Oxford University Press	Foundation	A4: Functions and graphs
	Foundation Plus	A4: Straight line graphs A7: Graphical solutions

Assessment issues

- Test ability to join points up in consecutive order.

Homework

- Drawing shapes using co-ordinates.
- Use data collected by students to draw linear graphs.
- Consolidation work using conversion graphs.

Notes

- Clear presentation with axes labelled correctly is vital.
- Recognise linear graphs and hence when data may be incorrect.
- Link to graphs and relationships in other subject areas, ie science, geography etc.
- 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.
- Students will often forget the middle term of the expansion — they will need to be reminded later.

GCSE tier: Foundation

Contents: [Ratio and proportion](#)

NA2f	Using ratio notation, including reduction to its simplest form and its various links to fraction notation
NA3f	Dividing a quantity in a given ratio including $a:b:c$
NA3n	Solving word problems about ratio and proportion, including using informal strategies and the unitary method of solution

Objectives**By the end of the module the student should be able to:**

- understand what is meant by ratio
- write a ratio in its simplest form; and find an equivalent ratio
- share a quantity in a given ratio
- understand and use examples in direct proportion
- interpret map/model scales as a ratio.

Prior knowledge

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

Differentiation and extension

- Similar triangles.
- Share quantities in a ratio involving fractions, and decimals.
- Use a map to plan a journey, eg how long will the journey take travelling at average speed of 40 km/h (or mixed speeds for different roads).

Resources

Publisher	Textbook	Chapter	Section
Edexcel	Foundation	24: Ratio and proportion	24.1–24.4
Harper Collins	Foundation	9: Ratios, fractions, speed and proportion	
Heinemann (Harcourt)	Foundation	17: Ratio and proportion	17.1–17.8
Hodder Murray	Foundation	2: Ratio and proportion	2.1–2.4
Oxford University Press	Foundation	N4: Proportion N8: Number problems	N4.1–4.5 N8.1–8.5
	Foundation Plus	N4: Proportionality N8: Ratio and proportion	N4.1–4.5 N8.1–8.5

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Draw a map, eg of a room in your house.
- Use a map to work out a distance, eg the real distance between two exits on a motorway.
- Plan a journey on a map.

Notes

- Students often cope well with ratios of two quantities.
- They have greater difficulty with ratios of three quantities and particular attention needs to be given to this.

GCSE tier: Foundation

Contents: Mensuration 1 [Perimeter and area](#)

- SSM2h Understand, recall and use Pythagoras' theorem
- SSM4f Finding areas of rectangles, recalling the formula, understanding the connection to counting squares and how it extends this approach
- SSM4f Recalling and using the formulae for the area of a parallelogram and a triangle
- SSM4f Calculating perimeters, areas and surface areas of shapes made from triangles and rectangles
- SSM4i Converting between area measures, including square centimetres and square metres

Objectives

By the end of the module the student should be able to:

- find the perimeters and areas of shapes made up from triangles and rectangles
- find areas of shapes by counting squares
- use formulae to find the area of shapes made up of rectangles and triangles
- find the surface area of cuboids and prisms
- solve a range of problems involving areas
- convert between units of area.

Prior knowledge

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

Differentiation and extension

- Calculating areas and volumes using formulae.
- Using compound shape methods to investigate areas of other standard shapes such as a trapezium or a kite.
- Practical activities eg using estimation and accurate measuring to calculate perimeters and areas of classroom/corridor floors.

Resources

Publisher	Textbook	Chapter	Section
Edexcel	Foundation	Perimeters and area of two-dimensional shapes	9.1–9.5
Harper Collins	Foundation	5: Perimeter and area	
Heinemann (Harcourt)	Foundation	19: Simple perimeter, area and volume 25: Pythagoras' theorem 26: Advanced perimeter, area and volume	19.1, 19.2, 19.4, 19.8, 19.9, 19.11, 25.1, 25.2, 26.1
Oxford University Press	Foundation	S1: Length and area	S1.1–S1.5
	Foundation Plus	S1: Length, area and volume	S1.1–S1.5

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Find the perimeter and area of the floor of a room at home.
- A fencing problem — find the smallest/largest area with a fixed perimeter.

Notes

- Discuss the correct use of language and units.
- Ensure that students can distinguish between perimeter, area and volume.
- Many students have little real understanding of perimeter, area and volume. Practical experience is essential to clarify these concepts.

Module 31 Chapter 31

Time: 2-4 hours

GCSE tier: Foundation

Contents: [Pythagoras' Theorem](#)

Objectives

By the end of the module the student should be able to:

- use trigonometric ratios (sin, cos and tan) to calculate angles in right-angled triangles
- use the trigonometric ratios to calculate unknown lengths in right-angled triangles.

Prior knowledge

-

Differentiation and extension

-

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	31: Pythagoras' Theorem
Harper Collins	Foundation	
Heinemann (Harcourt)	Foundation	
Hodder Murray	Foundation	
Oxford University Press	Foundation	
	Foundation Plus	

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.

-

Notes

GCSE tier: Foundation

Contents: Algebra 2 [Powers and brackets](#)

NA5c	Using index notation for simple integer powers and simple instances of index laws
NA3a	Using the index laws to simplify and calculate the value of numerical expression involving multiplication and division of integer powers
NA5b	Simplifying algebraic expressions with brackets; factorising using single brackets.
NA5e	Solving linear equations that require prior simplification of brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative solution
NA5m	Using systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them

Prior knowledge

- Experience of using a letter to represent a number.
- Ability to use negative numbers with the four operations.
- Substituting numbers into algebraic expressions.
- Dealing with decimals on a calculator.
- Ordering decimals.

Objectives

By the end of the module the student should be able to:

- multiply and divide powers of the same number
- understand and use the index rules to simplify algebraic expressions, eg $5^5 \div 5^2 = 5^3$
- use brackets to expand and simplify simple algebraic expressions
- solve linear equations involving a single pair of brackets.
- Solve cubic functions by successive substitution of values of x .

Differentiation and extension

- Examples where all the skills above are required.
- Factorising where the factor may involve more than one variable.
- Use index rules with negative numbers (and fractions).
- Solve functions of the form $\frac{1}{x} = x^2 - 5$.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	27: Algebra 2
Harper Collins	Foundation	4: More about number
Heinemann (Harcourt)	Foundation	3: Essential algebra
Hodder Murray	Foundation	7: Working with algebra
Oxford University Press	Foundation	
	Foundation Plus	A1: Expressions A6: More equations

Assessment issues

- Written testing to assess knowledge of content.

Homework**Notes**

- Emphasise correct use of symbolic notation (eg $3x$ rather than $3 \times x$).
- Present all work neatly, writing out the questions with the answers to aid revision at a later stage.
- Students should be encouraged to use their calculators efficiently — by using the ‘replay’ function.
- The cube function on a calculator may not be the same for different makes.
- Students should write down all the digits on their calculator display.

NA5c	Substituting positive and negative numbers into expressions (and formulae)
NA5e	Setting up simple equations
NA5e	Solving simple equations by using inverse operations or by transforming both sides in the same way
NA5f	Using formulae from mathematics and other subjects that require prior simplification of brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative solution
NA5f	Derive a formula and change its subject

Objectives

By the end of the module the student should be able to:

- use letters or words to state the relationship between different quantities
- substitute positive and negative numbers into simple algebraic formulae
- substitute positive and negative numbers into algebraic formulae involving powers
- find the solution to a problem by writing an equation and solving it
- change the subject of a formula, eg change the formula for converting Centigrade into Fahrenheit into a formula that converts Fahrenheit into Centigrade.

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.

Differentiation and extension

- Use negative numbers in formulae involving indices.
- Develop algebraic skills in the Higher syllabus.
- Various investigations leading to generalisations.

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	21: Formulae
Harper Collins	Foundation	13: Equations and inequalities
Heinemann (Harcourt)	Foundation	21: Formulae and inequalities 28: Expressions, formulae, equations and graphs
Hodder Murray	Foundation	7: Working with algebra
Oxford University Press	Foundation	A5: Formulae
	Foundation Plus	A5: Formulae

Assessment issues

- Written testing to assess knowledge of content.
- Discussion of situations that lead to formulae.
- Spreadsheet tasks such as ‘guess my rule’.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Uses of algebra to describe real situation eg n quadrilaterals have $4n$ sides.

Notes

- Emphasis on good use of notation $3ab$ means $3 \times a \times b$.
- Students need to be clear on the meanings of the words expression, equation, word formulae and algebraic formulae as they can find this confusing.

SSM3a	Understanding that translations are specified by a distance and direction (or a vector), and enlarging by a centre and positive scale factor
SSM3a	Rotating a shape about the origin, or any other point
SSM3e	Understanding and using vector notation for transformations
SSM3a	Measuring the angle of rotation using right angles, simple fractions of a turn or degrees
SSM3a	Understanding that rotations are specified by a centre and an (anticlockwise) angle
SSM3a	Understanding that reflections are specified by a mirror line, at first using a line parallel to any axis, then a mirror line such as $y = x$ or $y = -x$
SSM3b	Transforming triangles and other 2-D shapes by translation, rotation and reflection and combinations of transformations of these transformations, recognising that these transformations preserve length and angle, so that any figure is congruent to its image under any transformation of these transformations
SSM5c	Recognising, visualising and constructing enlargements of objects using positive scale factors greater than one, then positive scale factors less than one
SSM3b	Distinguishing properties that are preserved under transformations
SSM3c	Understanding that any two circles and any two squares are mathematically similar, while, in general, two rectangles are not
SSM3d	Recognising that enlargements preserve angle but not length
SSM3d	Identifying the scale factor of an enlargement as a ratio of the lengths of any two corresponding line segments
SSM3d	Understanding the implications of enlargement for perimeter
SSM3d	Using and interpreting maps and scale drawing

Objectives

By the end of the module the student should be able to:

- transform triangles and other shapes by translation, rotation and reflection (including combinations of transformations)
- understand translation as a combination of a horizontal and vertical shift (including vector notation)
- understand rotation as a (clockwise) turn about a given origin
- reflect shapes in a given mirror line. Initially line parallel to the coordinate axes and then $y = x$ or $y = -x$
- enlarge shapes by a given scale factor from a given point; using positive whole number scale factors, then positive fractional scale factors
- distinguish properties that are preserved under transformations, eg write down the angles of a triangle that has been enlarged.
- use integer and non-integer scale factors to find the length of a missing side in each of two similar shapes, given the lengths of a pair of corresponding sides
- know the relationship between linear, area and volume scale factors of similar shapes
- deduce the areas and volumes of similar shapes after they have been enlarged by simple scale factors
- read and construct scale drawing, eg work out the real distance if the map distance is 6cm scale 1:25000

Prior knowledge

- Recognition of basic shapes.
- An understanding of the concept of rotation, reflection and enlargement.
- Coordinates in four quadrants.
- Linear equations parallel to the coordinate axes.
- Use ruler and compasses to construct triangles with given dimensions.
- Some concept of enlargement (magnification).

Differentiation and extension

- The tasks set can be extended to include combinations of transformations.

- Deduce areas and volumes of similar shapes for harder scale factor enlargements (including fractions).
- Further problems involving scale drawing, eg find the real distance in metres between two points on 1:40000 map.

Resources

Publisher	Textbook	Chapter
Edexcel		26: Transformations
Heinemann (Harcourt)	Foundation	22: Transformations 27: Describing transformations
Oxford University Press	Foundation	S3: Transformations S4: 2-D and 3-D shapes
	Foundation Plus	S3: Transformations S7: Enlargement and similarity

Assessment issues

- Practical poster work.

Notes

- Emphasis needs to be placed on ensuring that students do describe the given transformation fully.
- Diagrams should be drawn carefully.
- The use of tracing paper is allowed in the examination.

Module 28 Chapter 28

Time: 2-4 hours

GCSE tier: Foundation

Contents: [Estimating and Accuracy](#)

Objectives

By the end of the module the student should be able to:

- round whole numbers to the nearest, 10, 100, 1000, ...
- write a number to a given number of decimal places or significant figures
- check their calculations by rounding.
- estimate the value of an expression by writing all the numbers correct to 1 significant figure
- write down the lower and upper bounds of a value written to a given degree of accuracy
- work out the lower and upper bounds of an expression

Prior knowledge

-

Differentiation and extension

-

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	
Harper Collins	Foundation	
Heinemann (Harcourt)	Foundation	
Hodder Murray	Foundation	
Oxford University Press	Foundation	
	Foundation Plus	

Assessment issues

Notes

HD4a	Drawing and producing a scatter graph
HD5b	Interpreting scatter graphs
HD5f	Appreciating that correlation is a measure of the strength of association between two variables
HD5f	Distinguishing between positive, negative and zero correlation using lines of best fit
DH5f	Appreciating that zero correlation does not necessarily imply 'no correlation' but merely 'no linear relationship'
HD4h	Drawing lines of best fit by eye, understanding what these represent
NA6c	Draw a line of best fit through a set of linearly related points and find its equation

Objectives

By the end of the module the student should be able to:

- draw and produce a scatter graph
- appreciate that correlation is a measure of the strength of association between two variables
- distinguish between positive, negative and zero correlation using a line of best fit
- appreciate that zero correlation does not necessarily imply 'no correlation' but merely 'no linear relationship'
- draw lines of best fit by eye and understand what it represents
- find the equation of the line of best and use it to interpolate/extrapolate.

Prior knowledge

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

Differentiation and 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.
- 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.

Resources

Publisher	Textbook	Chapter	Section
Edexcel	Foundation	30: Scatter graphs	30.1–30.3
Heinemann (Harcourt)	Foundation	24: Presenting and analysing data 2	24.1
Oxford University Press	Foundation	D4: Averages and Range	D4.4–4.5
	Foundation Plus	D5: Interpreting diagrams and charts	D5.5

Assessment issues

- Written testing to assess knowledge of content.
- Test a given hypothesis either using data provided or by collecting data from the class
- Their own statistical investigation.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
- Completion of simple statistical project.

Notes

- Students should realise that lines of best fit should have the same gradient as the correlation of the data.
- Clearly label all axes on graphs and use a ruler to draw straight lines.

Module 29 Chapter 29

Time: 2-4 hours

GCSE tier: Foundation

Contents: [Constructions and Loci](#)

Objectives

By the end of the module the student should be able to do a range of standard constructions including:

- an equilateral triangle with a given side
- the mid-point and perpendicular bisector of a line segment
- the perpendicular from a point on a line
- the bisector of an angle
- the angles 60, 30 and 45 degrees
- a regular hexagon inside a circle, etc
- a region bounded by a circle and an intersecting line
- a path equidistant from 2 points or 2 line segments, etc
- Understand what loci are and construct and shade simple loci

Prior knowledge

-

Differentiation and extension

-

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	
Harper Collins	Foundation	
Heinemann (Harcourt)	Foundation	
Hodder Murray	Foundation	
Oxford University Press	Foundation	
	Foundation Plus	

Assessment issues

- Written testing to assess knowledge of content.

Homework

- Homework at each stage could comprise consolidation of work in class by completion of exercises set, additional work of a similar nature, or extension work detailed above.
-

Notes

GCSE tier: Foundation

Contents: Mensuration 2 [Harder problems](#)

SSM4h Finding circumferences of circles and areas enclosed by circles, recalling relevant formulae

SSM2k Solving problems involving surface areas and volumes of prisms and cylinders

NA3n Using pi in exact calculations, without a calculator

Objectives**By the end of the module the student should be able to:**

- solve problems involving the circumference and area of a circle (and simple fractional parts of a circle)
- solve problems involving the volume of a cylinder
- find exact answers by leaving answers in terms of pi
- understand formulae by considering its dimensions, eg identify formulae that represent area from a list.

Prior knowledge

- Mensuration 1
- The ability to substitute numbers into formulae.

Differentiation and extension

- Use more complex 2-D shapes, eg (harder) sectors of circles.
- Use more complex 3-D shapes, eg half-cylinders.
- Surface area of cylinder/half-cylinder.
- Approximate pi as $\frac{22}{7}$
- Consider the dimensions of harder formulae, eg the surface area of a cone (including base).

Resources

Publisher	Textbook	Chapter
Edexcel	Foundation	22: Circumference and area of a circle 25.7: Three-dimensional shapes
Harper Collins	Foundation	24: Surface area and volume of 3-D shapes
Heinemann (Harcourt)	Foundation	26: Advanced perimeter, area and volume
Hodder Murray	Foundation	15: Circles and cylinders
Oxford University Press	Foundation	S4: 2-D and 3-D shapes S6: Perimeter, area and volume
	Foundation Plus	S1: Length, area and volume S6: Perimeter, area and volume

Assessment issues:

Written testing to assess knowledge of content.

Notes

- Need to constantly revise the expressions for area/volume of shapes.