GCSE
Applications of Mathematics (Pilot)

For use in pilot centres only

Specification

Edexcel GCSE in Applications of Mathematics (2AM01)

First certification 2014

Issue 2

Pearson Education Ltd is one of the UK's largest awarding organisations, offering academic and vocational qualifications and testing to schools, colleges, employers and other places of learning, both in the UK and internationally. Qualifications offered include GCSE, AS and A Level, NVQ and our BTEC suite of vocational qualifications, ranging from Entry Level to BTEC Higher National Diplomas. Pearson Education Ltd administers GCSE examinations.

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Introduction

The Edexcel GCSE in Applications of Mathematics is designed for use in school and colleges. It is part of a suite of GCSE qualifications offered by Edexcel.

This qualification is available as part of a GCSE pilot, to approved Pilot centres. This qualification should be offered alongside GCSE in Methods in Mathematics, as they share some common content and together meet the Key Stage 4 programme of study in Mathematics entitlement.

GCSE in Applications of Mathematics is designed to provide a course in mathematics which lends itself to applications of mathematics in real-life, everyday contexts, and to provide an introduction into financial and business applications.

This specification is aimed at teachers who plan the work around the unit content, but not necessarily in any pre-defined order, to support the learning style of some students.

This specification has particular benefits for teachers and learners:

- The topics can be chosen to reflect the needs of the students at the time.

- If the students are motivated by a particular topic (which could be linked to work in other subjects, see below), time and flexibility is available to continue that material.

- This specification may enable cross-curricular demands to be met, by mathematics servicing the needs of the curriculum. For example, whenever there is a mathematical need within Science, Geography, Business Studies, etc, this can be addressed within the mathematics course, at the most appropriate time for those subject areas. This specification introduces new content which can be used to support work in other subject areas.

- Although coursework is no longer part of the assessment for GCSE Mathematics, many schools and colleges still believe the task based project work has a function in mathematics teaching and are continuing to use it, internally, as a way of delivering mathematics content and developing skills of application. In order to facilitate this, flexibility is possible to plan the two-year programme of study around such project work. The use of project work alongside this specification can enhance the students' ability to apply mathematics to solve real-life problems.

- Some students do not learn well when spending too long on one topic. Some teachers therefore find that varying the topics as they move through the unit content enables their students to make better progress, and to reach a higher level.

- This specification favours those teachers who wish to build up a relationship over the two-year programme of study, being responsible for the design of the course for those students.

- This two unit specification allows teachers to plan delivery and assess their students when it best serves the needs of the students. It also allows flexible delivery alongside GCSE Methods in Mathematics, and can provide co-teaching opportunities across the two pilot specifications and the 2010 GCSE Mathematics courses.

About this specification

- The assessment of both units is at the end of the one- or two-year programme of study.

- Accessible assessment for all students.

- Written to meet the needs of the 2010 Key Stage 4 Programme of Study for mathematics alongside GCSE in Methods in Mathematics.

- Pilot qualification from September 2010.

Also available to support delivery:

- itemised assessment feedback through ResultsPlus

- advice from subject specialists available

- professional development support

- teacher support material

- online resources

- practice exam papers.

This specification is for use by approved pilot centres only. For more information regarding this pilot, please see our website www.edexcel.com.

Contents

Specification at a glance

The Edexcel GCSE in Applications of Mathematics comprises two units:

- Units 1 and 2.

Unit 1	Applications 1	*Unit code 1F: 5AM1F *Unit code 1H: 5AM1H
- Externally assessed - Availability: June and November - First assessment: June 2014		**50% of the total GCSE**
Overview of content **1.** Number **2.** Financial and business applications **3.** Algebra **4.** Geometry **5.** Measures **6.** Statistics		

Overview of assessment
- One written paper
- Tiered papers
   – Foundation Tier grades C-G available
   – Higher Tier grades A*-D available (E allowed)
   – 30-40% of the Foundation Tier papers assess the functional elements of mathematics
   – 20-30% of the Higher Tier papers assess the functional elements of mathematics
- 1 hour 45 minutes (Foundation paper)
- 1 hour 45 minutes (Higher paper)
- 100 marks
- Calculator allowed		

*See *Appendix 3* for description of this code and all other codes relevant to this qualification.

Unit 1	Applications 2	*Unit code 2F: 5AM2F
		*Unit code 2H: 5AM2H

• Externally assessed	
• Availability: June and November	**50% of the total GCSE**
• First assessment: June 2014	

Overview of content

1. Number

2. Algebra

3. Geometry

4. Measures

5. Probability

Overview of assessment

- One written paper

- Tiered papers

  – Foundation Tier grades C-G available

  – Higher Tier grades A*-D available (E allowed)

  – 30-40% of the Foundation Tier papers assess the functional elements of mathematics

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- 100 marks

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A   Qualification content

National Qualifications Framework (NQF) criteria

This specification complies with the requirements of the common criteria, the GCSE qualification criteria, Draft Framework for Piloting for Applications of Mathematics and, together with GCSE Methods in Mathematics, the Key Stage 4 Programme of Study for Mathematics, which are prescribed by the regulatory authorities.

Key subject aims

This qualification in Applications of Mathematics encourages students to develop confidence in, and a positive attitude towards, mathematics and they recognise the importance of mathematics and relevance of mathematics, including statistics, in helping to solve problems in the real world. This qualification prepares students to make informed decisions about the use of technology, the management of money, further learning opportunities and career choices and to help them function as informed citizens.

Knowledge and understanding

This Edexcel GCSE in Applications of Mathematics qualification requires students to:

- develop knowledge, skills and understanding of mathematical and statistical methods, techniques and concepts, including:

  - Number

  - Financial and business applications

  - Algebra

  - Geometry

  - Measures

  - Statistics

  - Probability

- use their knowledge and understanding to make connections between mathematical concepts

- apply the functional elements of mathematics in real-life situations.

Skills

This Edexcel GCSE in Applications of Mathematics qualification gives students the opportunity to develop the following skills:

- select and apply appropriate mathematics and statistics in every day situations and contexts from the real world,

- use mathematics to represent, analyse and interpret financial information

- understand and use the statistical problem solving cycle

- acquire and use strategies for problem solving and modelling in context, understanding that models may need refining and that there may be more than one way to solve a problem

- interpret mathematical results and draw and justify conclusions that are relevant to the context

- communicate mathematical information in a variety of forms.

List of subject contents

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Applications of Mathematics

Subject content

The content of the specification has been grouped into areas:

- Number
- Financial and business applications
- Algebra
- Geometry
- Measures
- Statistics
- Probability.

The specification content consists of a reference (ref), a content descriptor and examples of concepts and skills.

Content that is Higher Tier only is indicated in **bold type**.

The content of Higher Tier subsumes the content of Foundation Tier.

An overview of the content follow, showing in which units it is assessed.

The same content descriptors may appear in each unit but concepts and skills are developed through the units, so the concepts and skills may be different.

Ref	Content descriptor	Unit	
Number		Foundation	Higher
AN a	Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	Unit 1, Unit 2	Unit 1, Unit 2
AN b	Numbers and their representations including powers, roots, indices (integers, **fractional and negative)**, and **standard index form**	Unit 1, Unit 2	Unit 1, Unit 2
AN c	Use the concepts and vocabulary of factor (divisor), multiple, common factor, common multiple and prime number	Unit 1	Unit 1
AN d	Approximate to specified or appropriate degrees of accuracy including a given power of ten, number of decimal places and significant figures	Unit 1	Unit 1
AN e	**Understand and use upper and lower bounds**		Unit 2
AN f	Understand that 'percentage' means' number of parts per 100' and use this to compare proportions	Unit 1	Unit 1
AN g	Use multipliers for percentage change, **work with repeated percentage change and solve reverse percentage problems**	Unit 1	Unit 1
AN h	Interpret fractions, decimals and percentages as operators	Unit 1	Unit 1
AN i	Find proportional change **and repeated proportional change**	Unit 1	Unit 1
AN j	**Exponential growth/decay, its relationship with repeated proportional change including financial and scientific applications**		Unit 2
AN k	Understand and use direct **and inverse** proportion	Unit 2	Unit 2
AN l	Divide a quantity in a given ratio	Unit 2	Unit 2
AN m	Use calculators effectively and efficiently, including **trigonometrical** and statistical functions	Unit 1, Unit 2	Unit 1, Unit 2

Ref	Content descriptor	Unit	
Financial and Business applications		**Foundation**	**Higher**
AF a	Carry out calculations relating to enterprise, saving and borrowing, appreciation and depreciation and **understand AER**	Unit 1	Unit 1
AF b	Use mathematics in the context of personal and domestic finance including loan repayments, budgeting, RPI and CPI, exchange rates and commissions	Unit 1	Unit 1
AF c	Use spreadsheets to model financial, statistical and other numerical situations	Unit 1	Unit 1
AF d	Construct and use flow charts	Unit 1	Unit 1

Ref	Content descriptor	Unit	
Algebra		**Foundation**	**Higher**
AA a	Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors	Unit 1	Unit 1
AA b	Set up, and solve simple equations and inequalities	Unit 1, Unit 2	Unit 1, Unit 2
AA c	Derive a formula, substitute numbers into a formula	Unit 2	Unit 2
AA d	Use the conventions for coordinates in the plane and plot points in all four quadrants	Unit 1, Unit 2	Unit 1, Unit 2
AA e	Recognise and plot equations that correspond to straight-line graphs in the coordinate plane	Unit 1	Unit 1
AA f	Solve linear inequalities in one **or two** variables, and represent the solution set on a number line **or a suitable diagram**	Unit 2	Unit 2
AA g	**Set up and solve problems in linear programming, finding optimal solutions**		Unit 1
AA h	**Set up and solve linear simultaneous equations in two unknowns**		Unit 1
AA i	Find approximate solutions of equations using graphical methods and systematic trial and improvement	Unit 2	Unit 2
AA j	Find and interpret gradients and intercepts of straight line graphs in practical contexts	Unit 1	Unit 1
AA k	Construct linear, **quadratic and other** functions from real-life problems and plot their corresponding graphs	Unit 2	Unit 2
AA l	**Interpret the gradient at a point on a curve as the rate of change**		Unit 2
AA m	Recognise and use graphs that illustrate direct **and inverse** proportion	Unit 2	Unit 2
AA n	Discuss, plot and interpret graphs (which may be non-linear **and/or periodic**) modelling real situations, including journeys/travel graphs	Unit 2	Unit 2
AA o	Estimate areas of irregular shapes and **areas under curves**	Unit 2	Unit 2

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Ref	Content descriptor	Unit	
Geometry		**Foundation**	**Higher**
AG 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	Unit 1	Unit 1
AG b	Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals	Unit 1, Unit 2	Unit 1, Unit 2
AG c	Recall the properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus	Unit 1	Unit 1
AG d	Recognise reflection and rotation symmetry of 2D shapes	Unit 1	Unit 1
AG e	Understand congruence and similarity, including the relationship between lengths, **areas and volumes** in similar figures	Unit 1, Unit 2	Unit 1, Unit 2
AG f	Use Pythagoras' theorem in 2D **and 3D**	Unit 2	Unit 2
AG g	**Use the trigonometrical ratios to solve 2D and 3D problems**		Unit 2
AG h	Distinguish between centre, radius, chord, diameter, circumference, tangent, arc, sector and segment	Unit 1	Unit 1
AG i	Use 2D representations of 3D shapes	Unit 2	Unit 2
AG j	Use and interpret maps and scale drawings	Unit 2	Unit 2
AG k	Draw triangles and other 2D shapes using a ruler, pair of compasses and protractor	Unit 2	Unit 2
AG l	Use straight edge and a pair of compasses to do constructions	Unit 2	Unit 2
AG m	Construct loci	Unit 2	Unit 2
AG n	Find circumferences of circles and areas enclosed by circles	Unit 2	Unit 2
AG o	Calculate perimeters and areas of shapes made from triangles and rectangles **and other shapes**	Unit 1, Unit 2	Unit 1, Unit 2
AG p	Calculate volumes of right prisms and of shapes made from cubes and cuboids	Unit 2	Unit 2
AG r	**Solve mensuration problems involving more complex shapes and solids**		Unit 2

Ref	Content descriptor	Unit	
Measures		**Foundation**	**Higher**
AM a	Interpret scales on a range of measuring instruments and recognise the inaccuracy of measurements	Unit 1	Unit 1
AM b	Convert measurements from one unit to another	Unit 1, Unit 2	Unit 1, Unit 2
AM c	Make sensible estimates of a range of measures	Unit 1	Unit 1
AM d	Understand and use compound measures in familiar and **unfamiliar** contexts	Unit 2	Unit 2
AM e	Understand and use bearings	Unit 2	Unit 2
AM f	Measure and draw lines and angles	Unit 1	Unit 1

Ref	Content descriptor	Unit	
Statistics		**Foundation**	**Higher**
AS d	Understand and use the statistical problem solving process/handling data cycle	Unit 1	Unit 1
AS e	Design an experiment or survey, identifying possible sources of bias	Unit 1	Unit 1
AS f	Design data-collection sheets distinguishing between different types of data	Unit 1	Unit 1
AS g	Extract data from publications, charts, tables and lists	Unit 1	Unit 1
AS h	Design, use and interpret two-way tables for discrete and grouped data	Unit 1	Unit 1
AS i	Look at data to find patterns and exceptions	Unit 1	Unit 1
AS j	Compare distributions and make inferences	Unit 1	Unit 1
AS k	Produce and interpret charts and diagrams for categorical data including bar charts, pie charts and pictograms	Unit 1	Unit 1
AS l	Produce and interpret diagrams for ungrouped discrete numerical data, including vertical line charts and stem-and-leaf diagrams	Unit 1	Unit 1
AS m	Produce and interpret diagrams for grouped discrete data and continuous data, **including histograms with unequal class intervals**		Unit 1
AS n	**Produce and use cumulative frequency graphs and box-and-whisker plots**		Unit 1
AS o	Work with time series and **moving averages**, including their graphical representation	Unit 1	Unit 1
AS p	Calculate, and **for grouped data estimate**, median, mean, range, **quartiles and interquartile range**, mode and modal class	Unit 1	Unit 1
AS q	Recognise correlation and draw and/or use lines of best fit by eye, understanding and interpreting what these represent, and appreciating that correlation does not imply causality	Unit 1	Unit 1

Ref	Content descriptor	Unit	
Probability		**Foundation**	**Higher**
AS a	Understand and use the vocabulary of probability and the probability scale	Unit 2	Unit 2
AS b	Understand and use theoretical models for probabilities including the model of equally likely outcomes	Unit 2	Unit 2
AS c	Understand and use estimates of probability from relative frequency	Unit 2	Unit 2
AS r	Understand that when a statistical experiment or survey is repeated there will usually be different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics	Unit 2	Unit 2
AS s	Discuss and start to estimate risk	Unit 2	Unit 2

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Applications of Mathematics

Unit 1: Applications 1

Foundation

Overview

Content overview

This unit contains:

1 **Number**

- Four operations
- Factors and multiples
- Indices, squares and roots
- Fractions, decimals and percentages
- Accuracy
- Using calculators

2 **Financial and business applications**

- Financial mathematics
- Spreadsheets
- Flow charts

3 **Algebra**

- Manipulating expressions
- Equations
- Coordinates
- Straight line graphs

4 **Geometry**

- Angles
- Quadrilaterals
- Symmetry
- Congruence and similarity
- Circles
- Perimeter and area

5 **Measures**

- Scales
- Converting between units
- Estimating measures
- Measuring and drawing

6 Statistics

- The data handling cycle

- Collecting data

- Representing data

- Analysing and interpreting data

Assessment overview

- 50% of the qualification

- One written paper

- 1 hour 45 minutes in total

- 100 marks in total

- Calculator allowed

- Grades C-G available

- Available in June and November

- 30-40% of the paper assesses the functional elements of mathematics

References

Each topic in this unit contains a specification reference (for example, **AN a, Applications Number Statement a**), the content descriptor and examples of concepts and skills associated with that content descriptor.

1   Number

What students need to learn:

Ref	Content descriptor	Concepts and skills
AN a	Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	• Add, subtract, multiply and divide whole numbers, integers, fractions and decimals • Add, subtract, multiply and divide negative numbers • Multiply or divide by any number between 0 and 1 • Recall all multiplication facts to 10 x 10, and use them to quickly derive the corresponding division facts • Multiply or divide any number by powers of 10 • Multiply and divide numbers with no more than two decimal digits, using the commutative, associative, and distributive laws and factorisation where possible, or place value adjustments • Use inverse operations • Use brackets and the hierarchy of operations • Use one calculation to find the answer to another

Ref	Content descriptor	Concepts and skills
AN b	Numbers and their representations including powers, roots, indices (integers)	• Order integers, decimals and fractions
		• Understand and use positive numbers and negative integers, both as positions and translations on a number line
		• Order fractions
		• Find equivalent fractions
		• Write a fraction in its simplest form
		• Compare fractions
		• Convert between mixed numbers and improper fractions
		• Recall integer squares from 2×2 to 15×15 and the corresponding square roots
		• Recall the cubes of 2, 3, 4, 5 and 10
		• Select a square number, cube number from a list
		• Use index notation for integer powers of 10
		• Use index notation for squares and cubes
		• Use index laws to find the value of expressions including powers of a power

Ref	Content descriptor	Concepts and skills
AN c	Use the concepts and vocabulary of factor (divisor), multiple, common factor, common multiple and prime number	• Recognise even and odd numbers • Identify factors, multiples and prime numbers from a list of numbers • Find the common factors and common multiples of two or three numbers • Find common factors and common multiples
AN d	Approximate to specified or appropriate degrees of accuracy including a given power of ten, number of decimal places and significant figures	• Use their previous understanding of integers and place value to deal with arbitrarily large positive numbers and round them to a given power of 10 • Round to the nearest integer and to any number of significant figures • Round to a given number of decimal places • Estimate answers to calculations
AN f	Understand that 'percentage' means 'number of parts per 100' and use this to compare proportions	• Convert between fractions, decimals and percentages • Use percentage, fractions and decimals to compare proportions
AN g	Use multipliers for percentage change	• Use percentages in real-life situations – VAT – Simple interest – Find prices after a percentage increase or decrease – Percentage profit and loss • Use multiplier to increase or decrease by a percentage in any scenario where percentages are used

Ref	Content descriptor	Concepts and skills
AN h	Interpret fractions, decimals and percentages as operators	• Interpret percentage as an operator • Find percentages of quantities • Calculate a given fraction of a given quantity • Express a given number as a fraction of another • Express a given number as a percentage of another • Understand the multiplicative nature of percentages as operators
AN i	Find proportional change	• Solve word problems about ratio and proportion
AN m	Use calculators effectively and efficiently, including statistical functions	• Use a calculator effectively and efficiently • Know how to enter complex calculations, including those involving time and money • Understand, and interpret, the calculator display, particularly when the display has been rounded by the calculator • Understand that premature rounding can cause problems when undertaking calculations with more than one step • Use an extended range of calculator functions, including $+$, $-$, $\times$, $\div$, x^2, $\sqrt{x}$, memory, x^y, $x^{\frac{1}{y}}$, brackets • Use a calculator to solve problems in statistics • Calculate the mean of a small dataset, using the appropriate key on a scientific calculator

2   Financial and business applications

What students need to learn:

Ref	Content descriptor	Concepts and skills
AF a	Carry out calculations relating to enterprise, saving and borrowing, appreciation and depreciation	• Work out the amount an investment is worth given the number of years and interest rate • Use multipliers to work out appreciation and depreciation
AF b	Use mathematics in the context of personal and domestic finance including loan repayments, budgeting, RPI and CPI, exchange rates and commissions	• Work out interest due on a loan • Convert between different currencies given the exchange rate and any rates of commission • Use simple index numbers • Use mathematics in the context of personal finance
AF c	Use spreadsheets to model financial, statistical and other numerical situations	• Use spreadsheets to model a situation mathematically
AF d	Construct and use flow charts	• Construct a flow chart from a simple algorithm • Use a flow chart given the input value(s)

3 Algebra

What students need to learn:

Ref	Content descriptor	Concepts and skills
AA a	Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors	• Multiply a single term over a bracket • Manipulate algebraic expressions by collecting like terms • Use instances of index laws, for integer powers • Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$ • Factorise algebraic expressions by taking out common factors
AA b	Set up, and solve simple equations and inequalities	• Set up simple equations • Rearrange simple equations • Solve simple equations • Solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation • Solve linear equations which include brackets, those that have negative signs occurring anywhere in the equation, and those with a negative solution • Solve linear equations in one unknown, with integer or fractional coefficients, in which the unknown appears on either side or on both sides of the equation • Set up and solve simple inequalities in one variable

Ref	Content descriptor	Concepts and skills
AA d	Use the conventions for coordinates in the plane and plot points in all four quadrants	• Use axes and coordinates to specify points in all four quadrants • Identify points with given coordinates • Identify coordinates of given points (NB: Points may be in the first quadrant or all four quadrants) • Find the coordinates of the midpoint of the line segment AB, given the coordinates of A and B
AA e	Recognise and plot equations that correspond to straight-line graphs in the coordinate plane	• Plot and draw graphs of functions • Draw, label and scale axes • Recognise that equations of the form $y = mx + c$ correspond to straight line graphs in the coordinate plane • Recognise that, in a mathematical context, an equation in the form $y = mx + c$ is a straight line • Plot and draw graphs of straight lines with equations of the form $y = mx + c$
AA j	Find and interpret gradients and intercepts of straight line graphs in practical contexts	• Find the gradient of lines given by equations of the form $y = mx + c$ • Find the gradient of a straight line from a graph • Use the method of finding a gradient to see how one variable increases in relation to another

4   Geometry

What students need to learn:

Ref	Content descriptor	Concepts and skills
AG 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	• Recall and use properties of angles: – at a point – angles at a point on a straight line – vertically opposite angles – perpendicular lines
AG b	Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals	• Distinguish between scalene, isosceles, equilateral, and right-angled triangles • Understand and use the angle properties of triangles • Use the fact that the angle sum of a triangle is 180° • Understand and use the angle properties of intersecting lines • Recognise reasons for angle calculations
AG c	Recall the properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus	• Recall the properties and definitions of special types of quadrilateral • List the properties of each, or identify (name) a given shape from its properties • Use symmetry properties of quadrilaterals • Classify quadrilaterals by their geometric properties
AG d	Recognise reflection and rotation symmetry of 2D shapes	• Recognise reflection symmetry • Draw lines of reflection • State the line of reflective symmetry as a simple algebraic equation • Recognise rotational symmetry • Be able to identify the order of rotational symmetry

Ref	Content descriptor	Concepts and skills
AG e	Understand congruence and similarity, including the relationship between lengths in similar figures	• Identify shapes which are similar, including circles or all regular polygons • Identify shapes which are congruent • Understand what makes two shapes either congruent or similar • Understand the relationships between lengths, in similar figures • Recognise that all corresponding angles in similar shapes are equal in size when the lengths of sides are not • Use scale factors to find the length of a missing side in each of two similar triangles, given the lengths of a pair of corresponding sides
AG h	Distinguish between centre, radius, chord, diameter, circumference, tangent, arc, sector and segment	• Recall the definition of a circle and identify (name) and draw the parts of a circle • Understand related terms of a circle, such as semicircle or quarter circle • Draw a circle given the radius or diameter
AG o	Calculate perimeters and areas of shapes made from triangles and rectangles	• Measure shapes to find perimeter and areas • Find the perimeter of rectangles and triangles • Calculate perimeters of shapes made from triangles and rectangles • Find the perimeter of compound shapes • Calculate areas of shapes made from triangles and rectangles • Recall and use the formulae for the area of a triangle, rectangle and a parallelogram • Find the area of a trapezium • Find surface area using rectangles and triangles • Find the area of a parallelogram, given formulae or derived from triangles and rectangles

5   Measures

What students need to learn:

Ref	Content descriptor	Concepts and skills
AM a	Interpret scales on a range of measuring instruments and recognise the inaccuracy of measurements	• Interpret scales on a range of measuring instruments, *Example*: mm, cm, m, km, m*l*, *l*, c*l*, kg, g, tonnes, °C • Indicate given values on scale • Recognise the inaccuracy of measurements • Know that measurements using real numbers depend upon the choice of unit • Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction
AM b	Convert measurements from one unit to another	• Use and convert between units of time • Convert between units of measure in the same system (NB: Conversion between imperial units will be given. Metric equivalents should be known) • Know rough metric equivalents of pounds, feet, miles, pints and gallons **Metric** **Imperial** 1 kg 2.2 pounds 1 *l* $1\frac{3}{4}$ pints 4.5 *l* 1 gallon 8 km 5 miles 30 cm 1 foot • Convert between imperial and metric measures
AM c	Make sensible estimates of a range of measures	• Make sensible estimates of a range of measures in everyday settings • Choose appropriate units for estimating or carrying out measurements
AM f	Measure and draw lines and angles	• Measure and draw lines to the nearest mm • Measure and draw angles to the nearest degree

6 Statistics

What students need to learn:

Ref	Content descriptor	Concepts and skills
AS d	Understand and use the statistical problem solving process/handling data cycle	• Specify the problem and plan • Decide what data to collect and what statistical analysis is needed • Collect data from a variety of suitable primary and secondary sources • Use suitable data collection techniques • Process and represent the data • Interpret and discuss the data
AS e	Design an experiment or survey, identifying possible sources of bias	• Discuss how data relates to a problem, identify possible sources of bias and plan to minimise it • Understand how different sample sizes may affect the reliability of conclusions drawn • Design an experiment or survey • Consider fairness • Design a question for a questionnaire by identifying key questions that can be addressed by statistical methods • Criticise questions for a questionnaire • Identify which primary data they need to collect including grouped data, considering appropriate equal class intervals (and using appropriate notation)
AS f	Design data-collection sheets distinguishing between different types of data	• Design and use data-collection sheets for grouped, discrete and continuous data • Understand and use tallying methods • Collect data using various methods • Sort, classify and tabulate data and discrete or continuous quantitative data • Group discrete and continuous data into class intervals of equal width

Ref	Content descriptor	Concepts and skills
AS g	Extract data from publications, charts, tables and lists	• Extract data from lists and tables
AS h	Design, use and interpret two-way tables for discrete and grouped data	• Design and use two-way tables for discrete and grouped data • Use information provided to complete a two-way table
AS i	Look at data to find patterns and exceptions	• Look at data to find patterns and exceptions • Present findings from databases, tables and charts
AS j	Compare distributions and make inferences	• Compare distributions and make inferences, using the shapes of distributions and measures of average • Compare the mean and range of two distributions • 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 • Use comparative bar charts to compare distributions • Recognising the advantages and disadvantages between measures of average
AS k	Produce and interpret charts and diagrams for categorical data including bar charts, pie charts and pictograms	• Produce or complete: – pie charts – bar charts – multiple and dual bar charts – pictograms – composite bar charts • Interpret a wide range of graphs and diagrams and draw conclusions – pie charts – bar charts – multiple and dual bar charts – pictograms – composite bar charts • From pie charts: – find the total frequency – find the frequency represented by each section

Ref	Content descriptor	Concepts and skills

AS l	Produce and interpret diagrams for ungrouped discrete numerical data, including vertical line charts and stem-and-leaf diagrams	• Produce line graphs
		• Produce ordered stem and leaf diagrams
		• Interpret a wide range of graphs and diagrams and draw conclusions
		• Interpret stem and leaf diagrams
		• Recognise simple patterns, characteristics and relationships in line graphs
		• From line graphs:
		  – read off frequency values
		  – calculate total population
		  – finding greatest and least values
		• Find range and median from stem and leaf diagrams, as well as the greatest and least value
		• Produce and interpret histograms with equal class intervals

AS m	Produce and interpret diagrams for grouped discrete data and continuous data	• Produce
		  – frequency polygons
		  – histograms with equal class intervals
		  – frequency diagrams for grouped discrete data
		  – grouped frequency table for continuous data
		• Interpret a wide range of graphs and diagrams and draw conclusions
		• Interpret and complete
		  – frequency polygons
		  – histograms with equal class intervals
		• Recognise simple patterns, characteristics relationships in line graphs and frequency polygons

AS o	Work with time series, including their graphical representation	• Draw and produce time series graphs (line graphs) from given and experimental data • Identify seasonality and trends in time series

Ref	Content descriptor	Concepts and skills
AS p	Calculate median, mean, range, mode and modal class	• Calculate averages and range of small data sets with discrete data • Find the median and calculate the mean • Find the modal class of grouped data • Find the interval containing the median
AS q	Recognise correlation and draw and/or use lines of best fit by eye, understanding and interpreting what these represent, and appreciating that correlation does not imply causality	• Draw a scatter diagram • Complete a scatter diagram • Appreciate that correlation is a measure of the strength of the association between two variables and that zero correlation does not necessarily imply 'no relationship' but merely 'no linear relationship' • Draw lines of best fit by eye • Distinguish between positive, negative and zero correlation using lines of best fit • Use a line of best fit to predict values of one variable given values of the other variable • Interpret scatter graphs in terms of the relationship between two variables • Interpret correlation in terms of the problem • Understand that correlation does not imply causality

Unit 2: Applications 2

Foundation

Overview

Content overview

This unit contains:

1 **Number**
- Four operations
- Reciprocals
- Proportion
- Ratio
- Using calculators

2 **Algebra**
- Formulae
- Inequalities
- Solving equations graphically
- Coordinates
- Trial and improvement
- Direct proportion
- Travel graphs
- Area under shapes

3 **Geometry**
- Angles and lines
- Congruency and similarity
- Pythagoras
- Area and circumference
- Perimeter, area and volume
- 2D representations of 3D shapes
- Constructions and loci
- Circle mensuration

4 **Measures**
- Conversions
- Speed
- Bearings

5 **Probability**

Assessment overview

- 50% of the qualification
- One written paper
- 1 hour 45 minutes in total
- 100 marks in total
- Calculator allowed
- Grades C-G available
- Available in June and November
- 30-40% of the paper assesses the functional elements of mathematics

References

Each topic in this unit contains a specification reference (for example, **AA a** is for Applications, Algebra, Statement a), the content descriptor and examples of concepts and skills associated with that content descriptor.

The content of Unit 2 subsumes the content of Unit 1. However, the content of Unit 1 will not be the direct focus of the assessment.

1   Number

What students need to learn:

Ref	Content descriptor	Concepts and skills
AN a	Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	• Add, subtract, multiply and divide whole numbers, directed numbers, integers, fractions and decimals • Solve a problem involving division by a decimal • Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal gives 1 (and that zero has no reciprocal, because division by zero is not defined) • Use inverse operations • Find reciprocals • Understand and use unit fractions as multiplicative inverses • Use brackets and hierarchy of operations • Solve word problems • Understand place value
AN b	Numbers and their representations	• Recall the fraction-to-decimal conversion of familiar simple fractions • Convert between fractions and decimals
AN k	Understand and use direct proportion	• Calculate an unknown quantity from quantities that vary in direct proportion • Solve word problems about ratio and proportion
AN l	Divide a quantity in a given ratio	• Divide a quantity in a given ratio • Solve a ratio problem in a context
AN m	Use calculators effectively and efficiently	• Use a calculator effectively and efficiently • Know how to enter complex calculations, including those involving time and money • Understand, and interpret, the calculator display, particularly when the display has been rounded by the calculator • Use an extended range of calculator functions, including $+$, $-$, $\times$, $\div$, x^2, $\sqrt{x}$, memory, x^y, $x\frac{1}{y}$, brackets, reciprocal functions

2 Algebra

What students need to learn:

Ref	Content descriptor	Concepts and skills
AA b	Set up, and solve simple equations and inequalities	• Set up and solve simple linear inequalities in one variable
AA c	Derive a formula, substitute numbers into a formula	• Derive a formula, including those with squares, cubes and roots
		• Use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols
		• Substitute numbers into a formula
		• Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$
AA d	Use the conventions for coordinates in the plane and plot points in all four quadrants	• Calculate the length of a line segment
AA f	Solve linear inequalities in one variable, and represent the solution set on a number line	• Solve simple linear inequalities in one variable, and represent the solution set on a number line
		• Use the correct notation to show inclusive and exclusive inequalities
AA i	Find approximate solutions of equations using graphical methods and systematic trial and improvement	• Use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them
		• Generate points and plot graphs of simple quadratic functions, then more general quadratic functions
		• Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function
		• Use suitable mathematical techniques to draw quadratic graphs
AA k	Construct linear functions from real-life problems and plot their corresponding graphs	• Draw straight line graphs for real-life situations
		– ready reckoner graphs
		– conversion graphs
		– fuel bills
		– fixed charge (standing charge) and cost per unit

Ref	Content descriptor	Concepts and skills
AA m	Recognise and use graphs that illustrate direct proportion	• Set up and use equations to solve word and other problems involving direct proportion • Relate algebraic solutions to graphical representation of the equations
AA n	Discuss, plot and interpret graphs (which may be non-linear) modelling real situations, including journeys/travel graphs	• Interpret straight line graphs for real-life situations • Use travel graphs • Interpret information presented in a range of linear and non-linear graphs
AA o	Estimate areas of irregular shapes	• Estimate area by counting squares • Estimate areas of irregular shapes by approximating area to area of known shapes

3 Geometry

What students need to learn:

Ref	Content descriptor	Concepts and skills
AG b	Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals	• Understand and use the angle properties of parallel lines • Mark parallel lines on a diagram • Use the properties of corresponding and alternate angles • Use the properties of intersecting lines and triangles • Understand and use the angle properties of quadrilaterals • Give reasons for angle calculations • Explain why the angle sum of a quadrilateral is 360° • Understand the proof that the angle sum of a triangle is 180° • Understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices
AG e	Understand congruence and similarity, including the relationship between lengths in similar figures	• Understand the effect of enlargement for perimeter • Know the relationships between linear scale factors of mathematically similar shapes
AG f	Use Pythagoras' theorem in 2D	• Understand, recall and use Pythagoras' theorem in 2D • Calculate the height of an isosceles triangle given the lengths of all three sides
AG i	Use 2D representations of 3D shapes	• Use 2D representations of 3D shapes • Draw nets and show how they fold to make a 3D solid • Understand and draw front and side elevations and plans of shapes made from simple solids
AG j	Use and interpret maps and scale drawings	• Use and interpret maps and scale drawings • Read and construct scale drawings • Draw lines and shapes to scale • Estimate lengths using a scale diagram

Ref	Content descriptor	Concepts and skills
AG k	Draw triangles and other 2D shapes using a ruler, pair of compasses and protractor	• Make accurate drawing of triangles and other 2D shapes using a ruler and a protractor • Make an accurate scale drawing from a diagram
AG l	Use straight edge and a pair of compasses to do constructions	• Use straight edge and a pair of compasses to do standard constructions • Construct a triangle • Construct an equilateral triangle • Understand, from the experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not • Construct the perpendicular bisector of a given line • Construct the perpendicular from a point to a line • Construct the perpendicular from a point on a line • Construct the bisector of a given angle • Construct angles of 60°, 90°, 30°, 45° • Draw parallel lines • Draw circles and arcs to a given radius • Construct a regular hexagon inside a circle • Construct diagrams of everyday 2-D situations involving rectangles, triangles, perpendicular and parallel lines • Draw and construct diagrams from given information

AG m	Construct loci	(NB: All loci restricted to two dimensions only)
		
		• Construct:
		  – a region bounded by a circle and an intersecting line
		  – given distance from a point and a given distance from a line
		  – equal distances from two points or two line segments
		  – regions which may be defined by 'nearer to' or 'greater than'
		
		• Find and describe regions satisfying a combination of loci

Ref	Content descriptor	Concepts and skills
AG n	Find circumferences of circles and areas enclosed by circles	• Find circumferences of circles • Find areas enclosed by circles • Recall and use the formulae for the circumference of a circle and the area enclosed by a circle • Use $\pi \approx 3.142$ or use the π button on a calculator • Find the perimeters and areas of semi circles and quarter circles • Find the surface area of a cylinder
AG o	Calculate perimeters and areas of shapes made from triangles and rectangles	• Find the surface area of simple shapes (prisms) using the formulae for triangles and rectangles
AG p	Calculate volumes of right prisms and of shapes made from cubes and cuboids	• Calculate volumes of right prisms, including the triangular prism, and shapes made from cubes and cuboids • Find the volume of a compound solid constructed from cubes and cuboids • Recall and use the formula for the volume of a cuboid • Find the volume of a cylinder • Find the volume of a compound solid • Find the volume of a prism, cube and cuboid

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4   Measures

What students need to learn:

Ref	Content descriptor	Concepts and skills
AM b	Convert measurements from one unit to another	• Convert between and within metric and imperial units • Convert between units of time • Convert between metric area measures • Convert between metric volume measures • Convert between metric measures of volume and capacity, eg 1ml = 1cm³
AM d	Understand and use compound measures in familiar contexts	• Understand and use compound measures, including speed
AM e	Understand and use bearings	• Use bearings to specify direction • Given the bearing of a point A from point B, work out the bearing of point B from point A • Use three-figure bearings to specify direction • Use bearings to solve problems • Draw and measure bearings

5   Probability

What students need to learn:

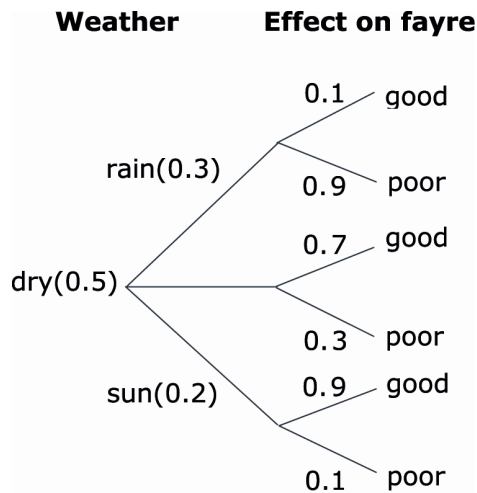| Ref	Content descriptor	Concepts and skills
AS a	Understand and use the vocabulary of probability and the probability scale	• Mark probabilities on a probability scale • Write probabilities using fractions, percentages or decimals • Distinguish between events which are impossible, unlikely, even chance, likely and certain to occur
AS b	Understand and use theoretical models for probabilities including the model of equally likely outcomes	• Understand and use measures of probability • Use theoretical models to include outcomes using dice, spinners, coins, etc • Find the probability of successive events, such as several throws of a single dice • Use theoretical models to estimate the number of times an event will occur for a given number of trials
AS c	Understand and use estimates of probability from relative frequency	• Work out relative frequency • Understand and use estimates of probability • Use relative frequency to estimate the number of times an event will occur for a given number of trials
AS r	Understand that when a statistical experiment or survey is repeated there will usually be different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics	• Compare relative frequencies from samples of different sizes

Ref	Content descriptor	Concepts and skills
AS s	Discuss and start to estimate risk	• Identify threats that may have an effect on the outcome of an event
		Examples: Weather, illness, technical faults relating to the cost/profit of an event
		• Understand and use decision tree diagrams to estimate the effect of risk
		Example:
		• Estimate probabilities on the tree diagram to estimate the risk of a good/poor fayre
		• Begin to use estimates of costs and probabilities

Specification – Issue 2

Edexcel GCSE in
Applications of Mathematics

Unit 1: Applications 1

Higher

Overview

Content overview

This unit contains:

1 **Number**
- Four operations
- Multiples and factors
- Indices, roots and squares
- Index laws
- **Standard form**
- Fractions, decimals and percentages
- **Repeated proportional change**
- Accuracy

2 **Financial and business applications**
- Financial mathematics, **AER**
- Spreadsheets
- Flow charts

3 **Algebra**
- Manipulating expressions
- Equations
- **Quadratic equations**
- Coordinates
- **Linear programming**
- **Simultaneous equations**
- Linear graphs
- **Gradient**

4 **Geometry**
- Angles
- Quadrilaterals
- Symmetry
- Congruence
- Circles
- Transformations
- Area and perimeter

5 Measure

- Scales and measurements
- Converting units
- Estimating measures

6 Statistics

- The handling data cycle
- Collecting data **and sampling**
- Representing data
- **Histograms and boxplots**
- Intepreting and analysing data
- **Cumulative frequency**
- **Quartiles and interquartile range**

Assessment overview

- 50% of the qualification
- One written paper
- 1 hour 45 minutes
- 100 marks
- Calculator allowed
- Grades A*-D available (E allowed)
- Available June and November
- 20-30% of the paper assesses the functional elements of mathematics

References

Each topic in this unit contains a specification reference (for example, **AG a** for Application, Geometry, Statement a), the content descriptor and examples of concepts and skills associated with that content descriptor.

Content that is Higher Tier only is indicated in **bold type**.

The content of Foundation Tier is subsumed in the content for Higher Tier.

1   Number

What students need to learn:

Ref	Content descriptor	Concepts and skills
AN a	Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	• Add, subtract, multiply and divide whole numbers, integers, negative numbers, fractions and decimals • Multiply or divide by any number between 0 and 1 • Solve a problem involving division by a decimal (up to two decimal points) • Multiply and divide numbers with no more than two decimal digits, using the commutative, associative, and distributive laws and factorisation where possible, or place value adjustments • Use inverse operations • Use brackets and the hierarchy of operations • Use one calculation to find the answer to another
AN b	Numbers and their representations including powers, roots, indices (integers, fractional and negative), and standard index form	• Order integers, decimals and fractions • Understand and use positive numbers and negative integers, both as positions and translations on a number line • Order fractions • Find equivalent fractions • Write a fraction in its simplest form • Convert between mixed numbers and improper fractions • Recall integer squares from 2×2 to 15×15 and the corresponding square roots • Recall the cubes of 2, 3, 4, 5 and 10 • Use index notation for integer powers of 10, squares and cubes and roots • **Recall that n^0 = 1 and $n^{-1} = \dfrac{1}{n}$ for positive integers n as well as $n^{\frac{1}{2}} = \sqrt{n}$ and $n^{\frac{1}{3}} = \sqrt[3]{n}$ for any positive number n**

Ref	Content descriptor	Concepts and skills
AN b	(*Continued*)	• Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer, **fractional and negative** powers, and the power of a power
		• **Use standard form, expressed in conventional notation**
		• **Be able to write very large and very small numbers presented in a context in standard form**
		• **Convert between ordinary and standard form representations, converting to standard form to make sensible estimates for calculations involving multiplication and/or division**
		• **Interpret a calculator display using standard form**
		• **Calculate with standard form**
AN c	Use the concepts and vocabulary of factor (divisor), multiple, common factor, common multiple and prime number	• Identify factors, multiples and prime numbers from a list of numbers
		• Find common factors and common multiples
AN d	Approximate to specified or appropriate degrees of accuracy including a given power of ten, number of decimal places and significant figures	• Use round numbers to a given power of 10
		• Round to the nearest integer and to any number of significant figures
		• Rounding to a given number of decimal places
		• Estimate answers to calculations
AN f	Understand that 'percentage' means 'number of parts per 100' and use this to compare proportions	• Convert between fractions, decimals and percentages
		• Use percentage, fractions and decimals to compare proportions

Ref	Content descriptor	Concepts and skills

AN g	Use multipliers for percentage change; **work with repeated percentage change; solve reverse percentage problems**	• Use percentages in real-life situations
		   – VAT
		   – Simple interest
		   – **Compound interest**
		   – **Depreciation**
		   – Find prices after a percentage increase or decrease
		   – Percentage profit and loss
		 • **Calculate an original amount when given the transformed amount after a percentage change**
		 • **Reverse percentage calculations**

AN h	Interpret fractions, decimals and percentages as operators	• Interpret percentage as an operator • Find percentages of quantities • Calculate a given fraction of a given quantity • Express a given number as a fraction of another • Express a given number as a percentage of another • Understand the multiplicative nature of percentages as operators • **Understand compound interest and depreciation** • Use a multiplier to increase or decrease by a percentage in any scenario where percentages are used
AN i	Find proportional change and **repeated proportional change**	• **Use repeated proportional change** • Solve word problems about ratio and proportion, including using informal strategies and the unitary method of solution • **Represent repeated proportional change using a multiplier raised to a power**

Ref	Content descriptor	Concepts and skills
AN m	Use calculators effectively and efficiently, including **trigonometrical** and statistical functions	• Use a calculator effectively and efficiently • Know how to enter complex calculations, including those involving time and money • Understand, and interpret, the calculator display, particularly when the display has been rounded by the calculator • Use an extended range of calculator functions, including $+$, $-$, $\times$, $\div$, x^2, $\sqrt{x}$, memory, x^y, $x^{\frac{1}{y}}$, brackets • **Use standard form display and know how to enter numbers in standard form** • **Use calculators for reverse percentage calculations by doing an appropriate division** • Use a calculator to solve problems in statistics • Calculate the mean of a small dataset, using the appropriate key on a scientific calculator

2   Financial and business applications

What students need to learn:

Ref	Content descriptor	Concepts and skills
AF a	Carry out calculations relating to enterprise, saving and borrowing, appreciation and depreciation and **understand AER**	• Work out the amount an investment is worth given the number of years and interest rate • Use multipliers to work out appreciation and depreciation • **Understand and use AER**
AF b	Use mathematics in the context of personal and domestic finance including loan repayments,, budgeting, RPI and CPI, exchange rates and commissions	• Work out interest due on a loan • Convert between different currencies given the exchange rate and any rates of commission • Use simple index numbers • Use mathematics in the context of personal finance
AF c	Use spreadsheets to model financial, statistical and other numerical situations	• Use spreadsheets to model mathematical situations
AF d	Construct and use flow charts	• Construct a flow chart from a simple algorithm • Use a flow chart given the input value(s)

3   Algebra

What students need to learn:

Ref	Content descriptor	Concepts and skills
AA a	Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors	• Multiply a single term over a bracket • Manipulate algebraic expressions by collecting like terms • Use instances of index laws, **including use of fractional, zero and negative powers**, and the power of a power • Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$ • Factorise algebraic expressions by taking out common factors
AA b	Set up, and solve simple equations and inequalities	• Set up simple equations • Solve simple equations by using inverse operations or by transforming both sides in the same way • Solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation • Solve linear equations which include brackets, those that have negative signs occurring anywhere in the equation, and those with a negative solution • Solve linear equations in one unknown, with integer or fractional coefficients, in which the unknown appears on either side or on both sides of the equation • Set up and solve simple linear inequalities

Ref	Content descriptor	Concepts and skills
AA d	Use the conventions for coordinates in the plane and plot points in all four quadrants	• Use axes and coordinates to specify points in all four quadrants in 2D **then 3D** • Identify points with given coordinates (NB: Points may be in the first quadrant or all four quadrants) • Find the coordinates of the midpoint of the line segment AB, given the coordinates of A and B in 2D
AA e	Recognise and plot equations that correspond to straight-line graphs in the coordinate plane	• Draw, label and scale axes • Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane • Plot and draw graphs of functions • Plot and draw graphs of straight lines with equations of the form $y = mx + c$
AA g	**Set up and solve problems in linear programming, finding optimal solutions**	• **Express real life constraints in terms of linear inequalities** • **Use constraints and conditions** • **Draw graphs of linear inequalities** • **Write down the objective function for a real life problem** • **Find the feasible region** • **Be able to use graphs of linear inequalities to solve maximisation or minimisation problems** • **Use either the profit line or point testing to find an optimal solution** • **Interpret graphs of linear inequalities as a real life problem**

Ref	Content descriptor	Concepts and skills
AA h	**Set up and solve linear simultaneous equations in two unknowns**	• **Find the exact solutions of two simultaneous equations in two unknowns** • **Use elimination or substitution to solve simultaneous equations** • **Interpret a pair of simultaneous equations as a pair of straight lines and their common solution as the point of intersection** • **Set up and solve a pair of simultaneous equations in two variables**
AA j	Find and interpret gradients and intercepts of straight line graphs in practical contexts	• Find the gradient of lines given by equations of the form $y = mx + c$ • Find the gradient of a straight line from a graph • Use the method of finding a gradient to see how one variable increases in relation to another • **Analyse problems and use gradients to interpret how one variable changes in relation to another**

4   Geometry

What students need to learn:

Ref	Content descriptor	Concepts and skills

AG 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	• Recall and use properties of angles
		  – angles at a point
		  – angles at a point on a straight line
		  – perpendicular lines
		  – vertically opposite angles

AG b	Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals	• Draw and identify parallel lines • Distinguish between scalene, isosceles, equilateral, and right-angled triangles • Understand and use the angle properties of triangles • Understand and use the angle properties of intersecting lines. • Give reasons for angle calculations • **Recall and use these basic properties of angles in more complex problems**
AG c	Recall the properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus	• Recall the properties and definitions of special types of quadrilateral, including symmetry properties • List the properties of each, or identify (name) a given shape from its properties • Use symmetry properties of quadrilaterals • Classify quadrilaterals by their geometric properties
AG d	Recognise reflection and rotation symmetry of 2D shapes	• Recognise reflection symmetry • Draw lines of reflection • Recognise rotational symmetry • Be able to identify the order of rotational symmetry • State the line of reflective symmetry as a simple algebraic equation

Ref	Content descriptor	Concepts and skills
AG e	Understand congruence and similarity, including the relationship between lengths, **areas and volumes** in similar figures	• Identify similar shapes • Identify congruent shapes • Understand what makes two shapes congruent or similar • Understand the relationships between lengths, **areas and volumes** in similar figures • **Identify similar solids** • Recognise that all corresponding angles in similar shapes are equal in size when the lengths of sides are not
AG h	Distinguish between centre, radius, chord, diameter, circumference, tangent, arc, sector and segment	• Recall the definition of a circle and identify (name) and draw the parts of a circle • Understand related terms of a circle, such as semicircle or quarter circle • Draw a circle given the radius or diameter
AG o	Calculate perimeters and areas of shapes made from triangles and rectangles **and other shapes**	• Calculate perimeters of shapes made from triangles and rectangles • Find the perimeter of compound shapes • Calculate areas of shapes made from triangles and rectangles **and other shapes** • Recall and use the formulae for the area of a triangle and a rectangle and a parallelogram • Find the area of a trapezium. • Find the area of a parallelogram • Measure sides of a rectangle to work out perimeter or area

5   Measures

What students need to learn:

Ref	Content descriptor	Concepts and skills
AM a	Interpret scales on a range of measuring instruments and recognise the inaccuracy of measurements	• Interpret scales on a range of measuring instruments *Examples*: m, km, mm, cm, m*l*, c*l*, *l*, kg, g, tonnes, °C • Indicate measures on a scale • Recognise the inaccuracy of measurements • Know that measurements using real numbers depend upon the choice of unit • Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction
AM b	Convert measurements from one unit to another	• Convert between units of time • Convert between units of measure in the same system (NB: Imperial conversions: conversion between imperial units will be given.) • Metric equivalents should be known • Know rough metric equivalents of pounds, feet, miles, pints and gallons <table><tr><td>**Metric**</td><td>**Imperial**</td></tr><tr><td>1 kg</td><td>2.2 pounds</td></tr><tr><td>1 *l*</td><td>$1\frac{3}{4}$ pints</td></tr><tr><td>4.5 *l*</td><td>1 gallon</td></tr><tr><td>8 km</td><td>5 miles</td></tr><tr><td>30 cm</td><td>1 foot</td></tr></table> • Convert between imperial and metric measures
AM c	Make sensible estimates of a range of measures	• Make sensible estimates of a range of measures in everyday settings • Choose appropriate units for estimating or carrying out measurements
AM f	Measure and draw lines and angles	• Measure and draw lines to the nearest mm • Measure and draw angles to the nearest degree

6   Statistics

What students need to learn:

Ref	Content descriptor	Concepts and skills
AS d	Understand and use the statistical problem solving process/handling data cycle	• Specify the problem and • Decide what data to collect and what statistical analysis is needed • Collect data from a variety of suitable sources, including experiments and surveys, and primary and secondary sources • Use suitable data collection techniques • Process and represent the data • Interpret and discuss the data
AS e	Design an experiment or survey, identifying possible sources of bias	• Discuss how data relates to a problem, identify possible sources of bias and plan to minimise it • Understand how different sample sizes may affect the reliability of conclusions drawn • Design an experiment or survey • Consider fairness • Design a question, with response boxes, for a questionnaire by identifying key questions that can be addressed by statistical methods • Criticise questions for a questionnaire • Identify which primary data they need to collect and in what format, including grouped data, considering appropriate equal class intervals (and using appropriate notation) • **Select and justify a sampling scheme and a method to investigate a population, including random and stratified sampling** • **Use stratified sampling**

Ref	Content descriptor	Concepts and skills
AS f	Design data-collection sheets distinguishing between different types of data	• Design and use data-collection sheets for grouped, discrete and continuous data • Understand and use tallying methods • Collect data using various methods, including observation, controlled experiment, data logging, questionnaires and surveys • Sort, classify and tabulate (categorical or qualitative) data and discrete or continuous quantitative data • Group discrete and continuous data into class intervals of equal width
AS g	Extract data from publications, charts, tables and lists	• Extract data from lists and tables
AS h	Design, use and interpret two-way tables for discrete and grouped data	• Design and use two-way tables for discrete and grouped data • Use information provided to complete a two-way table
AS i	Look at data to find patterns and exceptions	• Look at data to find patterns and exceptions • **Explain an isolated point on a scatter graph**
AS j	Compare distributions and make inferences	• Compare distributions and make inferences, using the shapes of distributions and measures of average and **spread, including median and quartiles** • Compare the mean and range of two distributions, **or median and interquartile range**, as appropriate. • 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. • Recognise the advantages and disadvantages between measures of average • **Compare the measures of spread between a pair of box plots/cumulative frequency graphs**

Ref	Content descriptor	Concepts and skills
AS k	Produce and interpret charts and diagrams for categorical data including bar charts, pie charts and pictograms	• Produce, interpret and complete: – pie charts – bar charts – pictograms – composite bar charts – multiple or dual bar charts • From pie charts: – find the total frequency – find the frequency represented by each section
AS l	Produce and interpret diagrams for ungrouped discrete numerical data, including vertical line charts and stem-and-leaf diagrams	• Produce – line graphs – stem and leaf diagrams • Interpret a wide range of graphs and diagrams and draw conclusions • Recognise simple patterns, characteristics relationships in line graphs • From line graphs: – read off frequency values – calculating total population – finding greatest and least values • Find range and median from stem and leaf diagrams, as well as the greatest and least value

Ref	Content descriptor	Concepts and skills
AS m	Produce and interpret diagrams for grouped discrete data and continuous data**, including histograms with unequal class intervals**	• Produce – frequency polygons – histograms with equal class intervals – frequency diagrams for grouped discrete data – frequency polygons for grouped data – grouped frequency table for continuous data – **histograms from class intervals with unequal width** • **Use and understand frequency density** • Interpret a wide range of graphs and diagrams and draw conclusions • Interpret and complete – frequency polygons – **histograms, including those with unequal class intervals** • Recognise simple patterns, characteristics relationships in line graphs and frequency polygons • **Find the median from a histogram or any other information from a histogram, such as the number of people in a given interval** • **From histograms** – **complete a grouped frequency table** – **understand and define frequency density**

Ref	Content descriptor	Concepts and skills

AS n	**Produce and use cumulative frequency graphs and box-and-whisker plots**	• **Produce and complete:**
		  – **cumulative frequency tables**
		  – **cumulative frequency graphs**
		  – **box plots from raw data and when given quartiles, median, etc**
		• **Interpret a wide range of graphs and diagrams and draw conclusions**
		  – **box plots**
		  – **cumulative frequency diagrams**
		• **From cumulative frequency graphs**
		  – **estimate frequency greater/less than a given value**
		  – **find the median and quartile values and interquartile range**

AS o	Work with time series and **moving averages**, including their graphical representation	• Draw and produce time series graphs (line graphs) from given and experimental data • **Calculate an appropriate moving average** • Identify seasonality and trends in time series • **Use moving average to identify trend**
AS p	Calculate, and for **grouped data estimate**, median, mean, range, **quartiles and interquartile range**, mode and modal class	• Calculate averages and range of small data sets with discrete then continuous data • Find the median, **quartiles and interquartile range** for large data sets and estimate the mean for large data sets with grouped data • Understand that the expression 'estimate' will be used where appropriate, when finding the mean of grouped data using mid-interval values • **Use cumulative frequency graphs to find median, quartiles and interquartile range** • **Interpret box plots to find median, quartiles, range and interquartile range** • Find the modal class of grouped data • Find the interval containing the median

Ref	Content descriptor	Concepts and skills
AS q	Recognise correlation and draw and/or use lines of best fit by eye, understanding and interpreting what these represent, and appreciating that correlation does not imply causality	• Draw and interpret a scatter diagram
		• Appreciate that correlation is a measure of the strength of the association between two variables and that zero correlation does not necessarily imply 'no relationship' but merely 'no linear relationship'
		• Understand that correlation does not imply causality
		• Draw lines of best fit by eye, understanding what these represent
		• Distinguish between positive, negative and zero correlation using lines of best fit
		• Use a line of best fit, or otherwise, to predict values of one variable given values of the other variable

Unit 2: Applications 2

Higher

Overview

Content overview

This unit contains:

1 Number

- Four operations
- Reciprocals
- **Direct and inverse proportion**
- Ratio
- **Lower and upper bounds**
- **Exponential growth and decay**
- Using calculators

2 Algebra

- Formulae
- Inequalities
- Trial and improvement
- Coordinates
- **Graphs of direct and indirect proportion**
- **Gradients and rates of change**
- **Areas under curves**

3 Geometry

- Angles and lines
- Congruence
- Pythagoras
- **Trigonometry**
- Representations of 3D shapes
- Constructions
- Loci
- Mensuration and volume
- Circles

    4 Measure

- Scale drawings

- Converting units

- Bearings

- Compound measures

    5 Probability

Assessment overview

- 50% of the qualification

- One written paper

- 1 hour 45 minutes

- 100 marks

- Calculator allowed

- Grades A*-D available (E allowed)

- Available June and November

- 20-30% of the paper assesses the functional elements of mathematics

References

Each topic in this unit contains a specification reference (for example, **AM a** for Applications, Measures, Statement a), the content descriptor and examples of concepts and skills associated with that content descriptor.

Content that is Higher Tier only is indicated in **bold type**.

The content of Unit 1 is subsumed in the content of Unit 2. However, Unit 1 content will not be the direct focus of assessment.

The content of Foundation Tier is subsumed in the content for Higher Tier.

1 Number

What students need to learn:

Ref	Content descriptor	Concepts and skills
AN a	Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	• Add, subtract, multiply and divide whole numbers, directed numbers, integers, fractions and decimals • Solve a problem involving division by a decimal • 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 not defined) • Use inverse operations • **Understand that the inverse operation of raising a positive number to a power n is raising the result of this operation to the power $\dfrac{1}{n}$** • Understand and use unit fractions as multiplicative inverses • Find reciprocals
AN b	Numbers and their representations	• Recall the fraction-to-decimal conversion of familiar simple fractions • Convert between fractions and decimals
AN e	**Understand and use upper and lower bounds**	• **Calculate the upper and lower bounds of calculations, particularly when working with measurements** • **Find the upper and lower bounds of calculations involving perimeter, areas and volumes of 2D and 3D shapes** • **Find the upper and lower bounds in real life situations using measurements given to appropriate degrees of accuracy** • **Give the final answer to an appropriate degree of accuracy following an analysis of the upper and lower bounds of a calculation**

Ref	Content descriptor	Concepts and skills
AN j	**Exponential growth/decay, its relationship with repeated proportional change including financial and scientific applications**	• **Understand the meaning of exponential growth** • **Use multipliers to explore exponential growth/decay** • **Use exponential growth in real life problems**
AN k	Understand and use direct and **inverse** proportion	• Calculate an unknown quantity from quantities that vary in direct or **inverse** proportion • Solve word problems about ratio and proportion
AN l	Divide a quantity in a given ratio	• Divide a quantity in a given ratio • Solve a ratio problem in a context
AN m	Use calculators effectively and efficiently, including **trigonometrical** and statistical functions	• Use a calculator effectively and efficiently • Know how to enter complex calculations, including those involving time and money • Understand, and interpret, the calculator display, particularly when the display has been rounded by the calculator • Use an extended range of calculator functions, including $+, -, \times, \div, x^2, \sqrt{x}$, memory, x^y, $x\frac{1}{y}$, brackets, **trigonometric** and reciprocal functions • **Calculate the upper and lower bounds of calculations, particularly when working with measurements** • **Use calculators to explore exponential growth and decay, using a multiplier and the power key**

2   Algebra

What students need to learn:

Ref	Content descriptor	Concepts and skills
AA b	Set up, and solve simple inequalities	• Set up and solve simple linear inequalities in one variable, and represent the solution set on a number line
AA c	Derive a formula, substitute numbers into a formula	• Derive a formula • Use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols • Substitute numbers into a formula or expression
AA d	Use the conventions for coordinates in the plane and plot points in all four quadrants	• Given the coordinates of points A and B, in 2D **or 3D** calculate the length of AB
AA f	Solve linear inequalities in one **or two** variables, and represent the solution set on a number line **or suitable diagram**	• Solve simple linear inequalities in one variable, **or two variables**, and represent the solution set on a number line • Use the correct notation to show inclusive and exclusive inequalities • **Show the solution set of several inequalities in two variables on a graph**
AA i	Find approximate solutions of equations using graphical methods and systematic trial and improvement	• Use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them • Find the solution of two equations by finding intersection of graphs of simple quadratic functions, then more general quadratic functions • Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function

Ref	Content descriptor	Concepts and skills
AA k	Construct linear**, quadratic and other** functions from real-life problems and plot their corresponding graphs	• Draw straight line graphs for real-life situations • Generate points and plot graphs of simple quadratic functions, then more general quadratic functions • Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function • Find the intersection points of the graphs of a linear and quadratic function, knowing that these are the approximate solutions of the corresponding simultaneous equations representing the linear and quadratic functions
AA l	**Interpret the gradient at a point on a curve as the rate of change**	• **Know that the gradient of a curve at a point is given by the gradient of the tangent at that point** • **Draw in a tangent to a curve at a given point** • **Work out the gradient at a point on a curve by finding the gradient of the tangent** • **Be able to interpret the gradient as the rate of change in context of the given real life problem**
AA m	Recognise and use graphs that illustrate direct and **inverse** proportion	• Set up and use equations to solve word and other problems involving direct proportion **or inverse proportion** • Relate algebraic solutions to graphical representation of the equations

AA n	Discuss, plot and interpret graphs (which may be non-linear **and/or periodic)** modelling real situations, including journeys/travel graphs	• Interpret straight line graphs for real-life situations:
		  – ready reckoner graphs
		  – conversion graphs
		  – fuel bills eg gas and electric
		  – fixed charge (standing charge) and cost per unit
		
		• Understand distance-time, speed-time and travel graphs
		
		• Interpret information presented in a range of linear and non-linear graphs
		
		• Interpret periodic graphs for real-life situations

Ref	Content descriptor	Concepts and skills
AA o	Estimate areas of irregular shapes and **areas under curves**	• Estimate areas of irregular shapes by approximating area to area of known shapes
		• **Estimate area under curves by dividing area into strips of equal width**
		• **Understand that if the area is divided into a greater number of strips then the effect is to increase the accuracy of the approximation**

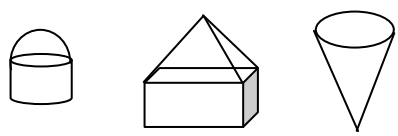## 3   Geometry

What students need to learn:

Ref	Content descriptor	Concepts and skills
AG b	Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals	• Understand and use the angle properties of parallel lines • Mark parallel lines on a diagram • Use the properties of corresponding and alternate angles • Understand and use the angle properties of quadrilaterals • Give reasons for angle calculations • Explain why the angle sum of a quadrilateral is 360° • Understand the proof that the angle sum of a triangle is 180° • Understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices
AG e	Understand congruence and similarity, including the relationship between lengths, **areas and volumes** in similar figures	• Understand the effect of enlargement for perimeter, **area and volume** of shapes and **solids** • **Understand that enlargement does not have the same effect on area and volume** • **Use simple examples of the relationship between enlargement and areas and volumes of simple shapes and solids** • **Use the effect of enlargement on areas and volumes of shapes and solids** • Know the relationships between linear**, area and volume** scale factors of mathematically similar shapes **and solids**
AG f	Use Pythagoras' theorem in 2D **and 3D**	• Understand, recall and use Pythagoras' theorem in 2D, **then in 3D problems** • Calculate the height (altitude) of an isosceles triangle given the lengths of all three sides • **Understand the language of planes, and recognise the diagonals of a cuboid** • **Calculate the length of a diagonal of a cuboid**

Ref	Content descriptor	Concepts and skills
AG g	**Use the trigonometrical ratios to solve 2D and 3D problems**	• **Use the trigonometric ratios to solve 2D and 3D problems** • **Understand, recall and use trigonometric relationships in right-angled triangles, and use these to solve problems in 2D and in 3D configurations** • **Find angles of elevation and angles of depression**
AG i	Use 2D representations of 3D shapes	• Use 2D representations of 3D shapes • Draw nets and show how they fold to make a 3D solid • Understand and draw front and side elevations and plans of shapes made from simple solids
AG j	Use and interpret maps and scale drawings	• Use and interpret maps and scale drawings • Read and construct scale drawings • Draw lines and shapes to scale • Estimate lengths using a scale diagram
AG k	Draw triangles and other 2D shapes using a ruler, pair of compasses and protractor	• Make accurate drawing of triangles and other 2D shapes using a ruler and a protractor • Make an accurate scale drawing from a diagram

Ref	Content descriptor	Concepts and skills
AG l	Use straight edge and a pair of compasses to do constructions	• Use straight edge and a pair of compasses to do standard constructions • Construct a triangle • Construct an equilateral triangle Understand, from the experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not • Construct the perpendicular bisector of a given line • Construct the perpendicular from a point to a line • Construct the perpendicular from a point on a line • Construct the bisector of a given angle • Construct angles of 60°, 90°, 30°, 45° • Draw parallel lines • Draw circles and arcs to a given radius • Construct a regular hexagon inside a circle • Construct diagrams of everyday 2D situations involving rectangles, triangles, perpendicular and parallel lines • Draw and construct diagrams from given information
AG m	Construct loci	(NB: All loci restricted to two dimensions only) • Construct: – a region bounded by a circle and an intersecting line – given distance from a point and a given distance from a line – equal distances from two points or two line segments – regions which may be defined by 'nearer to' or 'greater than' • Find and describe regions satisfying a combination of loci

Ref	Content descriptor	Concepts and skills
AG n	Find circumferences of circles and areas enclosed by circles	• Find circumferences of circles • Find an area enclosed by a circle • Recall and use the formulae for the circumference of a circle and the area enclosed by a circle • Use $\pi \approx 3.142$ or use the π button on a calculator • Find the perimeters and areas of semicircles and quarter circles • **Calculate the lengths of arcs and the areas of sectors of circles** • Find the surface area of a cylinder
AG o	Calculate perimeters and areas of shapes made from triangles and rectangles **and other shapes**	• Find the surface area of simple shapes (prisms) using the formulae, triangles, parallelograms, rectangles • Find the surface area of a cylinder
AG p	Calculate volumes of right prisms and of shapes made from cubes and cuboids	• Calculate volumes of right prisms, including the triangular prism, and shapes made from cubes and cuboids • Find the volume of a compound solid • Find the volume of a cuboid • Find the volume of a cylinder
AG r	**Solve mensuration problems involving more complex shapes and solids**	• **Solve problems involving more complex shapes and solids, including segments of circles and frustums of cones** • **Find the surface area and volumes of compound solids constructed from; cubes, cuboids, cones, pyramids, spheres, hemispheres, cylinder eg** • **Including examples of solids in everyday use** • **Find the area of a segment of a circle given the radius and length of the chord**

4   Measures

What students need to learn:

Ref	Content descriptor	Concepts and skills
AM b	Convert measurements from one unit to another	• Convert between and within imperial and metric measurements • Convert between units of time • Convert between metric area measures • Convert between metric volume measures • Convert between metric measures of volume and capacity, eg 1 m*l* = 1 cm^3
AM d	Understand and use compound measures in familiar and **unfamiliar** contexts	• Understand and use compound measures, including speed and density
AM e	Understand and use bearings	• Use three-figure bearings to specify direction • Draw and measure bearings • Use bearings to solve loci problems

5 Probability

What students need to learn:

Ref	Content descriptor	Concepts and skills
AS a	Understand and use the vocabulary of probability and the probability scale	• Write probabilities using fractions, percentages or decimals
AS b	Understand and use theoretical models for probabilities including the model of equally likely outcomes	• Use theoretical models to include outcomes using dice, spinners, coins, etc • Understand and use measures of probability • Find the probability of successive events, such as several throws of a single dice • Use theoretical models to find an estimate for the number of times an event occurs, given the number of trials
AS c	Understand and use estimates of probability from relative frequency	• Calculate relative frequency • Understand and use estimates of probability • Find the probability of successive events, such as several throws of a single dice • Use relative frequency to find an estimate for the number of times an event occurs, given the number of trials
AS r	Understand that when a statistical experiment or survey is repeated there will usually be different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics	• Compare relative frequencies from samples of different sizes

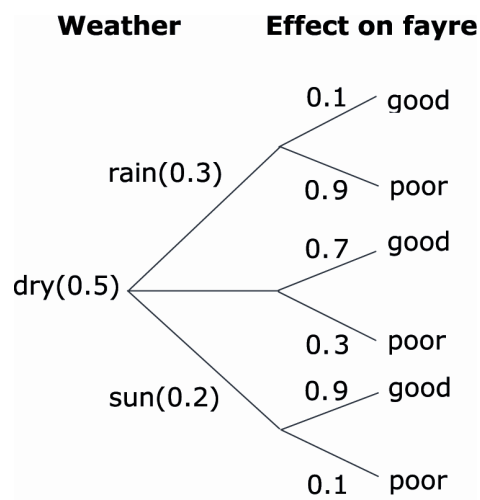| Ref	Content descriptor	Concepts and skills
AS s	Discuss and start to estimate risk	• Identify threats that may have an effect on the outcome of an event

Examples: Weather, illness, technical faults relating to the cost/profit of an event

• Understand and use decision tree diagrams to estimate the effect of risk

Example:

Weather **Effect on fayre**

$$
\begin{array}{ll}
\text{rain}(0.3) & \begin{cases} 0.1 \to \text{good} \\ 0.9 \to \text{poor} \end{cases} \\
\text{dry}(0.5) & \begin{cases} 0.7 \to \text{good} \\ 0.3 \to \text{poor} \end{cases} \\
\text{sun}(0.2) & \begin{cases} 0.9 \to \text{good} \\ 0.1 \to \text{poor} \end{cases}
\end{array}
$$

• Estimate probabilities on the tree diagram to estimate the risk of a good/poor fayre

• **Quantify risk using Risk = probability of event × cost (desired outcome)**

Examples: **For above situation**
P(good) = 0.3 × 0.1 + 0.5 × 0.7 + 0.2 × 0.9
= 0.54 risk of a good fayre

B   Assessment

Assessment summary

Unit 1 and Unit 2 are both externally assessed.

Summary of table of assessment

| Unit 1: | Applications 1 | Unit code 1F: 5AM1F |
| | | Unit code 1H: 5AM1H |

- Externally assessed
- One written paper
- 1 hour 45 minutes (Foundation)
- 1 hour 45 minutes (Higher)
- 100 marks
- Calculator allowed
- Tiered papers:
  - Foundation Tier grades C-G available
  - Higher Tier grades A*-D available (E allowed)
  - 30–40% of the Foundation Tier papers assess the functional elements of mathematics
  - 20–30% of the Higher Tier papers assess the functional elements of mathematics

| Unit 2: | Applications 2 | Unit code 2F: 5AM2F |
| | | Unit code 2H: 5AM2H |

- Externally assessed
- One written paper
- 1 hour 45 minutes (Foundation)
- 1 hour 45 minutes (Higher)
- 100 marks
- Calculator allowed
- Tiered papers:
  - Foundation Tier grades C-G available
  - Higher Tier grades A*-D available (E allowed)
  - 30–40% of the Foundation Tier papers assess the functional elements of mathematics
  - 20–30% of the Higher Tier papers assess the functional elements of mathematics

Assessment Objectives and weightings

	% in GCSE
AO1: Recall and use their knowledge of the prescribed content	40-50%
AO2: Select and apply mathematical methods in a range of contexts	30-40%
AO3: Interpret and analyse problems and generate strategies to solve them	15-25%
TOTAL	100%

Relationship of Assessment Objectives to units

Unit	Assessment Objective			
	AO1	**AO2**	**AO3**	**Total for AO1, AO2 and AO3**
Unit 1: Applications 1	20-25%	15-20%	7.5-12.5%	50%
Unit 2: Applications 2	20-25%	15-20%	7.5-12.5%	50%
Total for GCSE	40-50%	30-40%	15-25%	100%

Entering your students for assessment

Student entry

From Summer 2014 students will be required to sit all their examinations at the end of the course.

Students may enter a unit at any tier of entry.

Details of how to enter students for this qualification can be found in Edexcel's Information Manual, a copy is sent to all examinations officers. The information can also be found on Edexcel's website: www.edexcel.com.

Further information will be made available from the Edexcel Pilots team.

During the pilot, students must take both GCSE Applications of Mathematics and GCSE Methods in Mathematics, although the two GCSE qualifications do not have to be sat in the same series.

Forbidden combinations and classification code

Centres should be aware that students who enter for more than one GCSE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the school and college performance tables.

Students should be advised that, if they take two qualifications with the same classification code, schools and colleges are very likely to take the view that they have achieved only one of the two GCSEs. The same view may be taken if students take two GCSE qualifications that have different classification codes but have significant overlap of content. Students who have any doubts about their subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

During the pilot, GCSE Applications of Mathematics and GCSE Methods in Mathematics will not be a forbidden combination.

Access arrangements and special requirements

Edexcel's policy on access arrangements and special considerations for GCE, GCSE, and Entry Level is designed to ensure equal access to qualifications for all students (in compliance with the Equality Act 2010) without compromising the assessment of skills, knowledge, understanding or competence.

Please see the Edexcel website (www.edexcel.com) for:

- the JCQ policy Access Arrangements Reasonable Adjustments and Special Consideration
- the forms to submit for requests for access arrangements and special considerations
- dates for submission of the forms.

Requests for access arrangements and special considerations must be addressed to:

Special Requirements
Edexcel
One90 High Holborn
London WC1V 7BH

Equality Act 2010

Please see the Edexcel website (www.edexcel.com) for information with regard to the Equality Act 2010.

Assessing your students

The first assessment opportunity for Units 1 and 2 of this qualification will take place in the June 2014 series and in each following November and June series for the lifetime of the specification.

Assessment opportunities

Unit	June 2014	November 2014	June 2015
Unit 1	✓	✓	✓
Unit 2	✓	✓	✓

Please note, first certification of this qualification is in **June 2014** and thereafter.

Awarding and reporting

The grading, awarding and certification of this qualification will comply with the requirements of the GCSE/GCE Code of Practice, which is published by the Office of the Qualifications and Examinations Regulator (Ofqual). The GCSE qualification will be graded and certificated on an eight-grade scale from A* to G. Higher Tier units are awarded A*-D, with E allowed. Foundation Tier papers are awarded C-G. Individual unit results will be reported.

The first certification opportunity for the Edexcel GCSE in Applications of Mathematics will be June 2014.

Students whose level of achievement is below the minimum judged by Edexcel to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

Unit results

The minimum uniform marks required for each grade for each unit:

Units 1 and 2 (Foundation and Higher Tier)

Unit grade	*A	A	B	C	D	E	F	G
Maximum uniform mark = 200	180	160	140	120	100	80	60	40

The maximum uniform mark available for students entered for the Foundation Tier unit is 139.

Students who do not achieve the standard required for a grade G will receive a uniform mark in the range 0-39.

Qualification results

The minimum uniform marks required for each grade:

GCSE in Applications in Mathematics cash-in code: 2AM01

Qualification grade	*A	A	B	C	D	E	F	G
Maximum uniform mark = 400	360	320	280	240	200	160	120	80

Students who do not achieve the standard required for a grade G will receive a uniform mark in the range 0-79.

Students may enter a unit at any tier of entry. However, the overall grade calculation will be based upon their total uniform mark score.

Re-taking of qualifications

Students wishing to re-take a GCSE are required to retake all the units in the qualification.

Language of assessment

Assessment of this specification will be available in English only. Assessment materials will be published in English only and all work submitted for examination must be produced in English.

Quality of written communication

Students will be assessed on their ability to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear

- select and use a form and style of writing appropriate to purpose and to complex subject matter

- organise relevant information clearly and coherently, using specialist vocabulary when appropriate.

Stretch and challenge

Students can be stretched and challenged in both units through the use of different assessment strategies, for example:

- using a variety of stems in questions – for example: explain, find, calculate, compare, prove

- ensuring connectivity between parts of questions

- use of a wider range of question types to address different skills – for example structured, unstructured, task-based questions, proof etc

- students are challenged by the content, skills and knowledge defined in each unit of the specification.

Functional elements

GCSE in Applications of Mathematics will assess the functional elements of Mathematics, as required by the Key Stage 4 Programme of Study for Mathematics.

This will be 20-30% on Higher Tier papers, and 30-40% on Foundation Tier papers.

Malpractice and plagiarism

For up-to-date advice on malpractice and plagiarism, please refer to the Joint Council for Qualifications Suspected Malpractice in Examinations: Policies and Procedures document on the JCQ website: www.jcq.org.uk.

Student recruitment

Edexcel's access policy concerning recruitment to our qualifications is that:

- they must be available to anyone who is capable of reaching the required standard

- they must be free from barriers that restrict access and progression

- equal opportunities exist for all students.

Prior learning

This qualification builds on the content, knowledge and skills developed in the Key Stage 3 Programme of Study for Mathematics as defined by the National Curriculum Orders for England.

Progression

This GCSE in Applications of Mathematics provides progression to Level 3 qualifications in numerate disciplines, such as:

- GCE Mathematics

- GCE Further Mathematics

- GCEs in the Science subjects

- GCE Geography

- other qualifications which require mathematical skills, knowledge and understanding.

This qualification also supports further training and employment where mathematical skills, knowledge and understanding is desirable.

Grade descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.

The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade A

Candidates use a wide range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise equivalent representations, for example numerical, graphical and algebraic representations. Their numerical skills are sound, they use a calculator effectively and they demonstrate algebraic fluency. They use trigonometry and geometrical properties to solve problems.

Candidates identify and use mathematics accurately in a range of contexts. They evaluate the appropriateness, effectiveness and efficiency of different approaches. Candidates choose methods of mathematical communication appropriate to the context. They are able to state the limitations of an approach or the accuracy of results. They use this information to inform conclusions within a mathematical or statistical problem.

Candidates make and test hypotheses and conjectures. They adopt appropriate strategies to tackle problems (including those that are novel or unfamiliar), adjusting their approach when necessary. They tackle problems that bring together different aspects of mathematics and may involve multiple variables. They can identify some variables and investigate them systematically; the outcomes of which are used in solving the problem.

Candidates communicate their chosen strategy. They can construct a rigorous argument, making inferences and drawing conclusions. They produce simple proofs and can identify errors in reasoning.

Grade C

Candidates use a range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise some equivalent representations for example, numerical, graphical and algebraic representations of linear functions; percentages, fractions and decimals. Their numerical skills are sound and they use a calculator accurately. They apply ideas of proportionality to numerical problems and use geometric properties of angles, lines and shapes.

Candidates identify relevant information, select appropriate representations and apply appropriate methods and knowledge. They are able to move from one representation to another, in order to make sense of a situation. Candidates use different methods of mathematical communication.

Candidates tackle problems that bring aspects of mathematics together. They identify evidence that supports or refutes conjectures and hypotheses. They understand the limitations of evidence and sampling, and the difference between a mathematical argument and conclusions based on experimental evidence.

They identify strategies to solve problems involving a limited number of variables. They communicate their chosen strategy, making changes as necessary. They construct a mathematical argument and identify inconsistencies in a given argument or exceptions to a generalisation.

Grade F

Candidates use some mathematical techniques, terminology, diagrams and symbols from the Foundation Tier consistently, appropriately and accurately. Candidates use some different representations effectively and can select information from them. They complete straightforward calculations competently with and without a calculator. They use simple fractions and percentages, simple formulae and some geometric properties, including symmetry.

Candidates work mathematically in everyday and meaningful contexts. They make use of diagrams and symbols to communicate mathematical ideas. Sometimes, they check the accuracy and reasonableness of their results.

Candidates test simple hypotheses and conjectures based on evidence. Candidates are able to use data to look for patterns and relationships. They state a generalisation arising from a set of results and identify counter-examples. They solve simple problems, some of which are non-routine.

C   Resources, support and training

Mathematics resources

Mathematics Emporium – an online filing cabinet with essential documents for teachers.

Register online to gain access to our **Mathematics Emporium** – you'll find everything you need to support your students throughout the year. Sample papers, mock papers and mark schemes will be made available as the pilot progresses.

To request free access, please visit www.edexcelmaths.com

Edexcel resources

Online resources to support the GCSE Linked Pair specification will be made available as the pilot progresses.

Training

A programme of professional development and training courses covering various aspects of the specification and examination will be arranged by Edexcel each year.

Full details will be available from:

Training from Edexcel
Edexcel
One90 High Holborn
London WC1V 7BH

Telephone: 0844 576 0027
Email: trainingbookings@edexcel.com
Website: www.edexcel.com

Edexcel support services

We have a wide range of support services to help you plan, teach and manage this qualification successfully.

ResultsPlus – our free online analysis service provides you with an in-depth analysis of how students performed in their exams on a question-by-question basis. Quick and easy to use, you can download exam performance data in Excel spreadsheets and reference papers, examiner reports and mark schemes. At a glance, you'll be able to see how well a specification is understood across the whole department.

ResultsPlus Skills Maps will be available for the GCSE Linked Pair pilot and go one step further with the analysis by mapping performance to specific areas of knowledge that are being tested. You can pinpoint areas for improvement to help you tailor revision for individual students.

For further information or find out how to access and use this service, please call 0844 576 0024 or visit **www.edexcel.com/resultsplus**

Ask Edexcel is our online question and answer service. You can access it at **www.edexcel.com/ask** or by visiting our homepage and selecting 'contact us'.

The service allows you to search through a database of thousands of questions and answers on everything we offer. If you don't find an answer to your question, you can submit it straight to us. One of our customer services team will log your query, find an answer and send it to you. They'll also add it to the database if your question could help other customers. This way the volume of helpful information that the service has available is growing all the time.

Regional teams – Do you know your dedicated Curriculum Development Manager? Every school and college in the country has an allocated member of the Edexcel team, regionally based, who is available to provide support, help, advice and training for your curriculum offer.

Regional office telephone numbers are listed below:

Birmingham	0121 616 2585
Bristol	0117 950 1908
Cardiff	0292 079 4865
Manchester	0161 855 7560
Leeds	0115 224 2253

D   Appendices

Specification – Issue 2

Edexcel GCSE in
Applications of Mathematics

Appendix 1   Key skills

Key skills (Level 2)	All units
Application of number	
N2.1	✓ (grade C standard or above)
N2.2	✓ (grade C standard or above)
N2.3	✓ (grade C standard or above)
Communication	
C2.1a	✓
C2.1b	✓
C2.2	✓
C2.3	✓
Information and communication technology (ICT)	
ICT2.1	✓
ICT2.2	✓
ICT2.3	✓
Improving own learning and performance	
LP2.1	✓
LP2.2	✓
LP2.3	✓
Problem solving	
PS2.1	✓
PS2.2	✓
PS2.3	✓
Working with others	
WO2.1	✓
WO2.2	✓
WO2.3	✓

Development suggestions

Please refer to the Edexcel website for key skills development
suggestions.

    Specification – Issue 2   Edexcel GCSE in
Applications of Mathematics

Appendix 2   Wider curriculum

Signposting

Issue	All units
Spiritual	✓
Moral	✓
Ethical	✓
Social	✓
Legislative	✓
Economic	✓
Cultural	✓
Sustainable	✓
Health and safety	✓
European initiatives	✓

Development suggestions

Issue	Unit	Opportunities for development or internal assessment
Spiritual	All units	This qualification will enable centres to provide courses in mathematics that will allow students to discriminate between truth and falsehood. As candidates explore mathematical models of the real world there will be many naturally arising moral and cultural issues, environmental and health and safety considerations and aspects of European developments for discussion, for example:
Moral	All units	
Ethical	All units	
Social	All units	
Legislative	All units	
Economic	All units	• use and abuse of statistics in the media
Cultural	All units	• financial and business mathematics
Sustainable	All units	• how mathematics is used to communicate climate change
Health and safety	All units	• cultural and historical roots of mathematics
European initiatives	All units	• use of mathematics in cultural symbols and patterns.

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Appendix 3   Codes

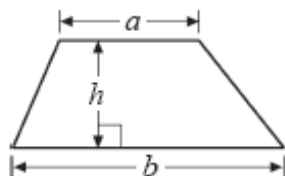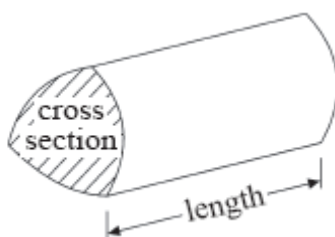| Type of code	Use of code	Code number
National classification codes	Every qualification is assigned to a national classification code indicating the subject area to which it belongs. Centres should be aware that students who enter for more than one GCSE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the school and college performance tables.	2212
National Qualifications Framework (NQF) codes	Each qualification title is allocated a National Qualifications Framework (NQF) code. The QCA National Qualifications Framework (NQF) code is known as a Qualification Number (QN). This is the code that features in the DfE Section 96, and on the LARA as being eligible for 16-18 and 19+ funding, and is to be used for all qualification funding purposes. The QN is the number that will appear on the student's final certification documentation.	The QN for the qualification in this publication is: GCSE – 500/7940/2
Unit codes	Each unit is assigned a unit code. This unit code is used as an entry code to indicate that a student wishes to take the assessment for that unit. Centres will need to use the entry codes only when entering students for their examination.	Unit 1F – 5AM1F Unit 1H – 5AM1H Unit 2F – 5AM2F Unit 2H – 5AM2H
Cash-in codes	The cash-in code is used as an entry code to aggregate the student's unit scores to obtain the overall grade for the qualification. Centres will need to use the entry codes only when entering students for their qualification.	GCSE – 2AM01
Entry codes	The entry codes are used to: • enter a student for the assessment of a unit • aggregate the student's unit scores to obtain the overall grade for the qualification.	Please refer to the Edexcel Information Manual, available on our website. (www.edexcel.com)

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Appendix 4   Formulae sheets

Area of trapezium = $\frac{1}{2}(a+b)h$

Volume of prism = area of cross section × length
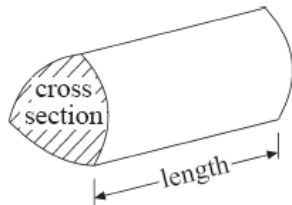
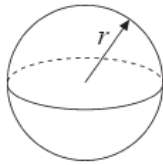## GCSE Mathematics

Formulae: Higher Tier

You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.
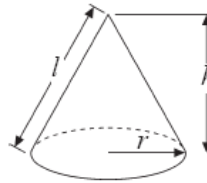
Volume of a prism = area of cross section × length

Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

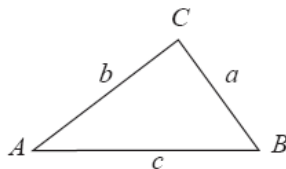**Volume of cone** $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$

Area of trapezium $= \frac{1}{2}(a+b)h$

In any triangle ABC

Sine Rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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