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INTERNATIONAL GCSE

Mathematics (Specification A) (9-1)

SPECIFICATION

Pearson Edexcel International GCSE in Mathematics (Specification A) (4MA1)

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Pearson

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Acknowledgements

Pearson has produced this specification on the basis of consultation with teachers, examiners, consultants and other interested parties. Pearson would like to thank all those who contributed their time and expertise to the specification's development.

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Summary of Pearson Edexcel International GCSE in Mathematics A Specification Issue 2 changes

Summary of changes made between previous issue and this current issue	Page number/s
Paper codes 4MA1/3H changed to 4MA1/1H	5, 6, 10, 41, 42, 43, 51
Paper codes 4MA1/4H changed to 4MA1/2H	6, 28, 41, 42, 43, 51

Earlier issues show previous changes.

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

Contents

1 About this specification

The Pearson Edexcel International GCSE in **Mathematics (Specification A)** is part of a suite of International GCSE qualifications offered by Pearson.

This qualification is not accredited or regulated by any UK regulatory body.

This specification includes the following key features.

Structure: the Pearson Edexcel International GCSE in Mathematics (Specification A) is a linear qualification. It consists of two examinations available at Foundation and Higher Tier. Both examinations must be taken in the same series at the end of the course of study.

Content: relevant, engaging, up to date and of equivalent standard to Pearson's regulated GCSE in Mathematics.

Assessment: consists of tiers of entry (Foundation and Higher) that allow students to be entered for the appropriate level, with questions designed to be accessible to students of all abilities in that tier and papers that are balanced for topics and difficulty.

Approach: a solid basis for students wishing to progress to Edexcel AS and Advanced GCE Level, or equivalent qualifications.

Specification updates

This specification is Issue 1 and is valid for the Pearson Edexcel International GCSE in Mathematics (Specification A) examination from 2018. If there are any significant changes to the specification Pearson will inform centres to let them know. Changes will also be posted on our website.

For more information please visit qualifications.pearson.com

Using this specification

This specification has been designed to give guidance to teachers and encourage effective delivery of the qualification. The following information will help you get the most out of the content and guidance.

Content: arranged according to Foundation and Higher Tier, with the same topic headings, as summarised in *Section 2: Mathematics (Specification A) content*. The topic headings are placed in this section according to assessment objective.

Examples: we have included examples to exemplify content statements to support teaching and learning. It is important to note that these examples are for illustrative purposes only and centres can use other examples. We have included examples that are easily understood and recognised by international centres.

Qualification aims and objectives

The Pearson Edexcel International GCSE in Mathematics (Specification A) qualification enables students to:

- develop their knowledge and understanding of mathematical concepts and techniques
- acquire a foundation of mathematical skills for further study in the subject or related areas
- enjoy using and applying mathematical techniques and concepts, and become confident in using mathematics to solve problems
- appreciate the importance of mathematics in society, employment and study.

Why choose Edexcel qualifications?

Pearson – the world's largest education company

Edexcel academic qualifications are from Pearson, the UK's largest awarding organisation. With over 3.4 million students studying our academic and vocational qualifications worldwide, we offer internationally recognised qualifications to schools, colleges and employers globally.

Pearson is recognised as the world's largest education company, allowing us to drive innovation and provide comprehensive support for Edexcel students to acquire the knowledge and skills they need for progression in study, work and life.

A heritage you can trust

The background to Pearson becoming the UK's largest awarding organisation began in 1836, when a royal charter gave the University of London its first powers to conduct exams and confer degrees on its students. With over 150 years of international education experience, Edexcel qualifications have firm academic foundations, built on the traditions and rigour associated with Britain's educational system.

Results you can trust

Pearson's leading online marking technology has been shown to produce exceptionally reliable results, demonstrating that at every stage, Edexcel qualifications maintain the highest standards.

Developed to Pearson's world-class qualifications standards

Pearson's world-class standards mean that all Edexcel qualifications are developed to be rigorous, demanding, inclusive and empowering. We work collaboratively with a panel of educational thought-leaders and assessment experts, to ensure that Edexcel qualifications are globally relevant, represent world-class best practice and maintain a consistent standard.

For more information on the World Class Qualifications process and principles please go to *Appendix 2* or visit our website: uk.pearson.com/world-class-qualifications

Why choose Pearson Edexcel International GCSE in Mathematics (Specification A)?

We've listened to feedback from all parts of the International school and UK Independent school subject community, including a large number of teachers. We've made changes that will engage students and give them skills that will support progression to further study of Mathematics and a wide range of other subjects. Our content and assessment approach has been designed to meet students' needs and sits within our wider subject offer for Mathematics.

At Edexcel we offer both Specification A and Specification B International GCSE qualifications for Mathematics - these have been designed to meet different learner needs. The content and assessment approach for this Specification A qualification has been designed to meet learner needs in the following ways, and sits within our wider subject offer for Mathematics.

Tiered papers – Provided at two tiers of entry (Higher and Foundation) that allow students to be entered for a level appropriate to them with questions in each tier that are accessible to students of all abilities within that tier.

Clear and straightforward question papers – Our question papers are clear and accessible for all students of all ability ranges and learning style. Our mark schemes are straightforward, so that the assessment requirements are clear.

Broaden and deepen students' skills – We have designed the International GCSE to extend students' knowledge by broadening and deepening skills, for example:

- Students develop their problem-solving skills by translating problems in mathematical or non-mathematical contexts at both Higher and Foundation tiers
- Students will develop reasoning skills through exercises such as presenting arguments and proofs, and making deductions and drawing conclusions from mathematical information.

Comparable to GCSE – We have designed our International GCSE qualification to be of equivalent standard to Pearson's regulated GCSE qualification. This ensures that International GCSEs are recognised globally and provide learners with the same progression routes.

Supports progression to A Level – Our qualifications enable successful progression to A Level and beyond. Through our world-class qualification development process, we have consulted with International A Level and GCE A Level teachers, as well as university professors to validate the appropriacy of this qualification including the content, skills and assessment structure.

Centres wishing to teach mathematics using a different approach to meet their students' needs can use our Pearson Edexcel International GCSE in Mathematics (Specification B) or extend students' study with Pearson Edexcel International GCSE in Further Pure Mathematics. More information about all of our qualifications can be found on our Edexcel International GCSE pages at: qualifications.pearson.com

Supporting you in planning and implementing this qualification

Planning

- Our *Getting Started Guide* gives you an overview of the Pearson Edexcel International GCSE in Mathematics (Specification A) to help you understand the changes to content and assessment, and to help you understand what these changes mean for you and your students.
- We will provide you with a course planner and editable schemes of work.
- Our mapping documents highlight key differences between the new and 2009 legacy qualifications.

Teaching and learning

- Our skills maps will highlight skills areas that are naturally developed through the study of mathematics, showing connections between areas and opportunities for further development.
- Print and digital learning and teaching resources – promotes any time, any place learning to improve student motivation and encourage new ways of working.

Preparing for exams

We will also provide a range of resources to help you prepare your students for the assessments, including:

- specimen papers to support formative assessments and mock exams
- examiner commentaries following each examination series.

ResultsPlus

ResultsPlus provides the most detailed analysis available of your students' exam performance. It can help you identify the topics and skills where further learning would benefit your students.

examWizard

A free online resource designed to support students and teachers with exam preparation and assessment.

Training events

In addition to online training, we host a series of training events each year for teachers to deepen their understanding of our qualifications.

Get help and support

Our subject advisor service will ensure you receive help and guidance from us. You can sign up to receive the Edexcel newsletter to keep up to date with qualification updates and product and service news.

Qualification at a glance

Foundation Tier	*Component/paper code 4MA1/1F and 4MA1/2F
• Externally assessed • Availability: January and June • First assessment: June 2018 • Two papers: 1F and 2F	Each paper is 50% of the total International GCSE
Content summary • Number • Algebra • Geometry • Statistics	
Assessment • Each paper is assessed through a 2-hour examination set and marked by Pearson. • The total number of marks for each paper is 100. • Each paper will assess the full range of targeted grades at Foundation Tier (5–1). • Each paper will have approximately equal marks available for each of the targeted grades. • There will be approximately 40% of questions targeted at grades 5 and 4, across papers 1F and 1H to aid standardisation and comparability of award between tiers. • A Foundation Tier formulae sheet (*Appendix 4*) will be included in the written examinations. • A calculator may be used in the examinations (please see *page 42* for further information).	

Higher Tier	*Component/paper code 4MA1/1H and 4MA1/2H
• Externally assessed • Availability: January and June • First assessment: June 2018 • Two papers: 1H and 2H	Each paper is 50% of the total International GCSE
Content summary • Number • Algebra • Geometry • Statistics	
Assessment • Each paper is assessed through a 2-hour examination set and marked by Pearson. • The total number of marks for each paper is 100. • Questions will assume knowledge from the Foundation Tier subject content. • Each paper will assess the full range of targeted grades at Higher Tier (9–4). • Each paper will have approximately 40% of the marks distributed evenly over grades 4 and 5 and approximately 60% of the marks distributed evenly over grades 6, 7, 8 and 9. • There will be approximately 40% of questions targeted at grades 5 and 4, across papers 2F and 2H, to aid standardisation and comparability of award between tiers. • A Higher Tier formulae sheet (*Appendix 5*) will be included in the written examinations. • A calculator may be used in the examinations (please see *page 42* for further information).	

* See *Appendix 1* for a description of these code and all the other codes relevant to this qualification.

2 Mathematics (Specification A) content

Foundation Tier

Higher Tier

Foundation Tier

Externally assessed

Description

The Pearson Edexcel International GCSE in Mathematics (Specification A) requires students to demonstrate application and understanding of the following.

Number

- Use numerical skills in a purely mathematical way and in real-life situations.

Algebra

- Use letters as equivalent to numbers and as variables.
- Understand the distinction between expressions, equations and formulae.
- Use algebra to set up and solve problems.
- Demonstrate manipulative skills.
- Construct and use graphs.

Geometry

- Use properties of angles.
- Understand a range of transformations.
- Work within the metric system.
- Understand ideas of space and shape.
- Use ruler, compasses and protractor appropriately.

Statistics

- Understand basic ideas of statistical averages.
- Use a range of statistical techniques.
- Use basic ideas of probability.

Students should be able to demonstrate **problem-solving skills** by translating problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes.

Students should be able to demonstrate **mathematical reasoning skills** by:

- making deductions and drawing conclusions from mathematical information
- constructing chains of reasoning
- presenting arguments and proofs
- interpreting and communicating information accurately.

Assessment information

Each paper is assessed through a 2-hour examination set and marked by Pearson.

The total number of marks for each paper is 100.

Each paper will assess the full range of targeted grades at Foundation Tier (5–1).

Each paper will have approximately equal marks available for each of the targeted grades.

There will be approximately 40% of questions targeted at grades 5 and 4, across papers 1F and 1H to aid standardisation and comparability of award between tiers.

Diagrams will not necessarily be drawn to scale and measurements should not be taken from diagrams unless instructions to this effect are given.

Each student may be required to use mathematical instruments, e.g. pair of compasses, ruler, protractor.

A Foundation Tier formulae sheet (*Appendix 4*) will be included in the written examinations.

Tracing paper may be used in the examinations.

A calculator may be used in the examinations (please see *page 42* for further information).

Questions will be set in SI units (international system of units).

AO1 Numbers and algebra

1 Numbers and the number system

	Students should be taught to:	Notes
1.1 Integers	**A** understand and use integers (positive, negative and zero)	
	B understand place value	
	C use directed numbers in practical situations	e.g. temperatures
	D order integers	
	E use the four rules of addition, subtraction, multiplication and division	
	F use brackets and the hierarchy of operations	
	G use the terms 'odd', 'even', 'prime numbers', 'factors' and 'multiples'	
	H identify prime factors, common factors and common multiples	
1.2 Fractions	**A** understand and use equivalent fractions, simplifying a fraction by cancelling common factors	$\frac{8}{60}=\frac{2}{15}$ in its simplest form (lowest terms)
	B understand and use mixed numbers and vulgar fractions	
	C identify common denominators	
	D order fractions and calculate a given fraction of a given quantity	
	E express a given number as a fraction of another number	
	F use common denominators to add and subtract fractions and mixed numbers	$\frac{2}{3}+\frac{5}{7}, \quad 3\frac{1}{5}-2\frac{2}{3}$
	G convert a fraction to a decimal or a percentage	$\frac{3}{5}=0.6=60\%$ $\frac{4}{9}=0.4444...=44.4...\%$
	H understand and use unit fractions as multiplicative inverses	$3\div 5=3\times\frac{1}{5}$
	I multiply and divide fractions and mixed numbers	$\frac{2}{3}\times\frac{5}{7}, \quad 3\frac{1}{5}\div 2\frac{2}{3}$

	Students should be taught to:	Notes
1.3 Decimals	**A** use decimal notation	
	B understand place value	
	C order decimals	
	D convert a decimal to a fraction or a percentage	Terminating decimals only
	E recognise that a terminating decimal is a fraction	$0.65 = \frac{65}{100} = \frac{13}{20}$
1.4 Powers and roots	**A** identify square numbers and cube numbers	
	B calculate squares, square roots, cubes and cube roots	
	C use index notation and index laws for multiplication and division of positive and negative integer powers including zero	
	D express integers as a product of powers of prime factors	$720 = 2^4 \times 3^2 \times 5$
	E find highest common factors (HCF) and lowest common multiples (LCM)	
1.5 Set language and notation	**A** understand the definition of a set	
	B use the set notation $\cup$, $\cap$ and $\in$ and $\notin$	$\mathscr{E}$ = universal set $\varnothing$ = empty set
	C understand the concept of the universal set and the empty set and the symbols for these sets	
	D understand and use the complement of a set	Use the notation A'
	E use Venn diagrams to represent sets	

	Students should be taught to:	Notes
1.6 Percentages	**A** understand that 'percentage' means 'number of parts per 100'	
	B express a given number as a percentage of another number	
	C express a percentage as a fraction and as a decimal	
	D understand the multiplicative nature of percentages as operators	$15\% \text{ of } 120 = \frac{15}{100} \times 120$
	E solve simple percentage problems, including percentage increase and decrease	
	F use reverse percentages	In a sale, prices were reduced by 30%. The sale price of an item was £17.50 Calculate the original price of the item
	G use compound interest and depreciation	
1.7 Ratio and proportion	**A** use ratio notation, including reduction to its simplest form and its various links to fraction notation	Express in the form $1 : n$
	B divide a quantity in a given ratio or ratios	Share £416 in the ratio 5 : 3 or 4 : 3 : 1
	C use the process of proportionality to evaluate unknown quantities	
	D calculate an unknown quantity from quantities that vary in direct proportion	s varies directly as t Find the missing value in a table
	E solve word problems about ratio and proportion	Including maps and scale diagrams
1.8 Degree of accuracy	**A** round integers to a given power of 10	
	B round to a given number of significant figures or decimal places	
	C identify upper and lower bounds where values are given to a degree of accuracy	
	D use estimation to evaluate approximations to numerical calculations	By rounding values to 1 significant figure
1.9 Standard form	**A** calculate with and interpret numbers in the form $a \times 10^n$ where n is an integer and $1 \leqslant a < 10$	$150\,000\,000 = 1.5 \times 10^8$

	Students should be taught to:	Notes
1.10 Applying number	**A** use and apply number in everyday personal, domestic or community life	
	B carry out calculations using standard units of mass, length, area, volume and capacity	Metric units only
	C understand and carry out calculations using time, and carry out calculations using money, including converting between currencies	
1.11 Electronic calculators	**A** use a scientific electronic calculator to determine numerical results	

2 Equations, formulae and identities

	Students should be taught to:	Notes
2.1 Use of symbols	**A** understand that symbols may be used to represent numbers in equations or variables in expressions and formulae	
	B understand that algebraic expressions follow the generalised rules of arithmetic	
	C use index notation for positive and negative integer powers (including zero)	$a \times a \times a = a^3$ $a^{-5} = \frac{1}{a^5}$; $a^0 = 1$
	D use index laws in simple cases	$x^m \times x^n = x^{m+n}$ $x^m \div x^n = x^{m-n}$ $(x^m)^n = x^{mn}$
2.2 Algebraic manipulation	**A** evaluate expressions by substituting numerical values for letters	
	B collect like terms	
	C multiply a single term over a bracket	$3x(2x+5)$
	D take out common factors	Factorise fully $8xy + 12y^2$
	E expand the product of two simple linear expressions	Expand and simplify $(x+8)(x-5)$
	F understand the concept of a quadratic expression and be able to factorise such expressions (limited to $x^2 + bx + c$)	Factorise $x^2 + 10x + 24$
2.3 Expressions and formulae	**A** understand that a letter may represent an unknown number or a variable	
	B use correct notational conventions for algebraic expressions and formulae	
	C substitute positive and negative integers, decimals and fractions for words and letters in expressions and formulae	Evaluate $2x - 3y$ when $x = 4$ and $y = -5$
	D use formulae from mathematics and other real-life contexts expressed initially in words or diagrammatic form and convert to letters and symbols	
	E derive a formula or expression	
	F change the subject of a formula where the subject appears once	Make r the subject of $A = \pi r^2$ Make t the subject of $v = u + at$

	Students should be taught to:	Notes
2.4 Linear equations	**A** solve linear equations, with integer or fractional coefficients, in one unknown in which the unknown appears on either side or both sides of the equation	$5x+8=12$ $7(x+3)=5x-8$ $\frac{4x+5}{2}=3$
	B set up simple linear equations from given data	The three angles of a triangle are $a°$, $(a+10)°$, $(a+20)°$. Find the value of a
2.5 Proportion	**Higher Tier only**	
2.6 Simultaneous linear equations	**A** calculate the exact solution of two simultaneous equations in two unknowns	$x+y=14, x-y=2$ $2a+5b=12,$ $3a+b=5$
2.7 Quadratic equations	**A** solve quadratic equations by factorisation (limited to $x^2+bx+c=0$)	Solve $x^2+x-30=0$
2.8 Inequalities	**A** understand and use the symbols $>,<,\geqslant$ and $\leqslant$	To include double-ended inequalities e.g. $1<x\leqslant 5$
	B understand and use the convention for open and closed intervals on a number line	
	C solve simple linear inequalities in one variable and represent the solution set on a number line	$3x-2<10$, so $x<4$ $7-x\leqslant 5$, so $x\geqslant 2$ $3<x+2\leqslant 5$ so $1<x\leqslant 3$
	D represent simple linear inequalities on rectangular Cartesian graphs	Shade the region defined by the inequalities $x\geqslant 0$, $y\geqslant 1, x+y\leqslant 5$
	E identify regions on rectangular Cartesian graphs defined by simple linear inequalities	Conventions for the inclusion of boundaries are not required

3 Sequences, functions and graphs

	Students should be taught to:	Notes
3.1 Sequences	**A** generate terms of a sequence using term-to-term and position-to-term definitions of the sequence	Including odd, even, squares, multiples and powers
	B find subsequent terms of an integer sequence and the rule for generating it	$5, 9, 13, 17, \ldots$ (add 4) $1, 2, 4, 8, \ldots$ (multiply by 2)
	C use linear expressions to describe the nth term of arithmetic sequences	$1, 3, 5, 7, 9, \ldots$ nth term is $2n - 1$ nth term is $4n + 3$, write down the first 3 terms of the sequence
3.2 Function notation	**Higher Tier only**	
3.3 Graphs	**A** interpret information presented in a range of linear and non-linear graphs	To include speed/time and distance/time graphs
	B understand and use conventions for rectangular Cartesian coordinates	
	C plot points (x, y) in any of the four quadrants or locate points with given coordinates	
	D determine the coordinates of points identified by geometrical information	
	E determine the coordinates of the midpoint of a line segment, given the coordinates of the two end points	
	F draw and interpret straight line conversion graphs	To include currency conversion graphs
	G find the gradient of a straight line	gradient = (increase in y) ÷ (increase in x)

	Students should be taught to:	Notes
	H recognise that equations of the form $y = mx + c$ are straight line graphs with gradient m and intercept on the y-axis at the point $(0, c)$	Write down the gradient and coordinates of the y intercept of $y = 3x + 5$; Write down the equation of the straight line with gradient 6 that passes through the point $(0, 2)$
	I recognise, generate points and plot graphs of linear and quadratic functions	To include $x = k$, $y = c$, $y = x$, $y - x = 0$ Including completion of values in tables and equations of the form $ax + by = c$
3.4 Calculus	**Higher Tier only**	

AO2 Shape, space and measure

4 Geometry

	Students should be taught to:	Notes
4.1 Angles, lines and triangles	**A** distinguish between acute, obtuse, reflex and right angles	
	B use angle properties of intersecting lines, parallel lines and angles on a straight line	Angles at a point, vertically opposite angles, alternate angles, corresponding angles, allied angles
	C understand the exterior angle of a triangle property and the angle sum of a triangle property	
	D understand the terms 'isosceles', 'equilateral' and 'right-angled triangles' and the angle properties of these triangles	
4.2 Polygons	**A** recognise and give the names of polygons	To include parallelogram, rectangle, square, rhombus, trapezium, kite, pentagon, hexagon and octagon
	B understand and use the term 'quadrilateral' and the angle sum property of quadrilaterals	The four angles of a quadrilateral are $90°$, $(x + 15)°$, $(x + 25)°$ and $(x + 35)°$ Find the value of x
	C understand and use the properties of the parallelogram, rectangle, square, rhombus, trapezium and kite	
	D understand the term 'regular polygon' and calculate interior and exterior angles of regular polygons	
	E understand and use the angle sum of polygons	For a polygon with n sides, the sum of the interior angles is $(2n - 4)$ right angles
	F understand congruence as meaning the same shape and size	
	G understand that two or more polygons with the same shape and size are said to be congruent to each other	

	Students should be taught to:	Notes
4.3 Symmetry	**A** identify any lines of symmetry and the order of rotational symmetry of a given two-dimensional figure	Name a quadrilateral with no lines of symmetry and order of rotational symmetry of 2
4.4 Measures	**A** interpret scales on a range of measuring instruments	
	B calculate time intervals in terms of the 24-hour and the 12-hour clock	Use am and pm
	C make sensible estimates of a range of measures	
	D understand angle measure including three-figure bearings	
	E measure an angle to the nearest degree	
	F understand and use the relationship between average speed, distance and time	
	G use compound measure such as speed, density and pressure	Formula for pressure will be given
4.5 Construction	**A** measure and draw lines to the nearest millimetre	
	B construct triangles and other two-dimensional shapes using a combination of a ruler, a protractor and compasses	
	C solve problems using scale drawings	
	D use straight edge and compasses to: (i) construct the perpendicular bisector of a line segment (ii) construct the bisector of an angle	
4.6 Circle properties	**A** recognise the terms 'centre', 'radius', 'chord', 'diameter', 'circumference', 'tangent', 'arc', 'sector' and 'segment' of a circle	
	B understand chord and tangent properties of circles	Two tangents from a point to a circle are equal in length Tangents are perpendicular to the radius at the point of contact The line from the centre of a circle which is perpendicular to a chord bisects the chord (and the converse)

	Students should be taught to:	Notes
4.7 Geometrical reasoning	**A** give informal reasons, where required, when arriving at numerical solutions to geometrical problems	Reasons will only be required for geometrical calculations based on lines (including chords and tangents), triangles or polygons
4.8 Trigonometry and Pythagoras' theorem	**A** know, understand and use Pythagoras' theorem in two dimensions	
	B know, understand and use sine, cosine and tangent of acute angles to determine lengths and angles of a right-angled triangle	
	C apply trigonometrical methods to solve problems in two dimensions	To include bearings
4.9 Mensuration of 2D shapes	**A** convert measurements within the metric system to include linear and area units	e.g. cm^2 to m^2 and vice versa
	B find the perimeter of shapes made from triangles and rectangles	
	C find the area of simple shapes using the formulae for the areas of triangles and rectangles	
	D find the area of parallelograms and trapezia	
	E find circumferences and areas of circles using relevant formulae; find perimeters and areas of semicircles	
4.10 3D shapes and volume	**A** recognise and give the names of solids	To include cube, cuboid, prism, pyramid, cylinder, sphere and cone
	B understand the terms 'face', 'edge' and 'vertex' in the context of 3D solids	
	C find the surface area of simple shapes using the area formulae for triangles and rectangles	
	D find the surface area of a cylinder	
	E find the volume of prisms, including cuboids and cylinders, using an appropriate formula	
	F convert between units of volume within the metric system	e.g. cm^3 to m^3 and vice versa and 1 litre = 1000 cm^3

	Students should be taught to:	Notes
4.11 Similarity	**A** understand and use the geometrical properties that similar figures have corresponding lengths in the same ratio but corresponding angles remain unchanged	
	B use and interpret maps and scale drawings	

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5 Vectors and transformation geometry

	Students should be taught to:	Notes
5.1 Vectors	**Higher Tier only**	
5.2 Transformation geometry	**A** understand that rotations are specified by a centre and an angle	
	B rotate a shape about a point through a given angle	
	C recognise that an anti-clockwise rotation is a *positive* angle of rotation and a clockwise rotation is a *negative* angle of rotation	
	D understand that reflections are specified by a mirror line	Such as $x = 1$, $y = 2$, $y = x$, $y - x = 0$
	E construct a mirror line given an object and reflect a shape given a mirror line	e.g. reflect a triangle in the line $y = x$
	F understand that translations are specified by a distance and direction	
	G translate a shape	
	H understand and use column vectors in translations	
	I understand that rotations, reflections and translations preserve length and angle so that a transformed shape under any of these transformations remains congruent to the original shape	
	J understand that enlargements are specified by a centre and a scale factor	Positive scale factor only (including fractions)
	K understand that enlargements preserve angles and not lengths	
	L enlarge a shape given the scale factor	With or without a centre given
	M identify and give complete descriptions of transformations	

AO3 Handling Data

6 Statistics and probability

	Students should be taught to:	Notes
6.1 Graphical representation of data	**A** use different methods of presenting data	Pictograms, bar charts and pie charts, and only two-way tables
	B use appropriate methods of tabulation to enable the construction of statistical diagrams	
	C interpret statistical diagrams	
6.2 Statistical measures	**A** understand the concept of average	Data could be in a list or tabulated form
	B calculate the mean, median, mode and range for a discrete data set	Includes simple problems using these measures
	C calculate an estimate for the mean for grouped data	
	D identify the modal class for grouped data	
6.3 Probability	**A** understand the language of probability	Outcomes, equal likelihood, events, random
	B understand and use the probability scale	$\mathrm{P}(\text{certainty}) = 1$ $\mathrm{P}(\text{impossibility}) = 0$
	C understand and use estimates or measures of probability from theoretical models	
	D find probabilities from a Venn diagram	
	E understand the concepts of a sample space and an event, and how the probability of an event happening can be determined from the sample space	For the tossing of two coins, the sample space can be listed as: Heads (H), Tails (T): (H, H), (H, T), (T, H), (T, T)
	F list all the outcomes for single events and for two successive events in a systematic way	
	G estimate probabilities from previously collected data	
	H calculate the probability of the complement of an event happening	$\mathrm{P}(A') = 1 - \mathrm{P}(A)$

	Students should be taught to:	Notes
	I use the addition rule of probability for mutually exclusive events	P(Either A or B occurring) = P(A) + P(B) when A and B are mutually exclusive
	J understand and use the term 'expected frequency'	Determine an estimate of the number of times an event with a probability of 0.4 will happen over 300 tries

Higher Tier

Externally assessed

Description

Knowledge of the Foundation Tier content is assumed for students being prepared for the Higher Tier. The Pearson Edexcel International GCSE in Mathematics (Specification A) requires students to demonstrate application and understanding of the following:

Number

- Use numerical skills in a purely mathematical way and in real-life situations.

Algebra

- Use letters as equivalent to numbers and as variables.
- Understand the distinction between expressions, equations and formulae.
- Use algebra to set up and solve problems.
- Demonstrate manipulative skills.
- Construct and use graphs.

Geometry

- Use the properties of angles.
- Understand a range of transformations.
- Work within the metric system.
- Understand ideas of space and shape.
- Use ruler, compasses and protractor appropriately.

Statistics

- Understand basic ideas of statistical averages.
- Use a range of statistical techniques.
- Use basic ideas of probability.

Students should also be able to demonstrate **problem-solving skills** by translating problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes.

Students should be able to demonstrate **mathematical reasoning skills** by:

- making deductions and drawing conclusions from mathematical information
- constructing chains of reasoning
- presenting arguments and proofs
- interpreting and communicating information accurately.

Assessment information

Each paper is assessed through a 2-hour examination set and marked by Pearson.

The total number of marks for each paper is 100.

Questions will assume knowledge from the Foundation Tier subject content.

Each paper will assess the full range of targeted grades at Higher Tier (9–4).

Each paper will have approximately 40% of the marks distributed evenly over grades 4 and 5 and approximately 60% of the marks distributed evenly over grades 6, 7, 8 and 9.

There will be approximately 40% of questions targeted at grades 5 and 4, across papers 2F and 2H, to aid standardisation and comparability of award between tiers.

Diagrams will not necessarily be drawn to scale and measurements should not be taken from diagrams unless instructions to this effect are given.

Each student may be required to use mathematical instruments, e.g. pair of compasses, ruler, protractor.

A Higher Tier formulae sheet (*Appendix 5*) will be included in the written examinations.

Tracing paper may be used in the examinations.

A calculator may be used in the examinations (please see *page 42* for further information).

Questions will be set in SI units (international system of units).

AO1 Number and algebra

1 Numbers and the number system

	Students should be taught to:	Notes
1.1 Integers	**See Foundation Tier**	
1.2 Fractions	**See Foundation Tier**	
1.3 Decimals	**A** convert recurring decimals into fractions	$0.3\dot{2} = 0.322... = \frac{29}{90}$
1.4 Powers and roots	**A** understand the meaning of surds	Simplify: $\sqrt{8} + 3\sqrt{32}$
	B manipulate surds, including rationalising a denominator	Express in the form $a + b\sqrt{2} : (3 + 5\sqrt{2})^2$ Rationalise: $\frac{2}{\sqrt{8}}; \frac{1}{2 - \sqrt{3}}$
	C use index laws to simplify and evaluate numerical expressions involving integer, fractional and negative powers	Evaluate: $\sqrt[3]{8^2}$, $625^{-\frac{1}{2}}$, $\left(\frac{1}{25}\right)^{\frac{3}{2}}$
1.5 Set language and notation	**A** understand sets defined in algebraic terms, and understand and use subsets	If A is a subset of B, then $A \subset B$
	B use Venn diagrams to represent sets and the number of elements in sets	
	C use the notation $\mathrm{n}(A)$ for the number of elements in the set A	
	D use sets in practical situations	
1.6 Percentages	**A** use repeated percentage change	Calculate the total percentage increase when an increase of 30% is followed by a decrease of 20%
	B solve compound interest problems	
1.7 Ratio and proportion	**See Foundation Tier**	

	Students should be taught to:	Notes
1.8 Degree of accuracy	**A** solve problems using upper and lower bounds where values are given to a degree of accuracy	The dimensions of a rectangle are 12 cm and 8 cm to the nearest cm Calculate, to 3 significant figures, the smallest possible area as a percentage of the largest possible area
1.9 Standard form	**A** solve problems involving standard form	
1.10 Applying number	**See Foundation Tier**	
1.11 Electronic calculators	**See Foundation Tier**	

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2 Equations, formulae and identities

	Students should be taught to:	Notes
2.1 Use of symbols	**A** use index notation involving fractional, negative and zero powers	
2.2 Algebraic manipulation	**A** expand the product of two or more linear expressions	Expand and simplify $(x+2)(x+3)(x-1)$
	B understand the concept of a quadratic expression and be able to factorise such expressions	Factorise $6x^2-5x-6$
	C manipulate algebraic fractions where the numerator and/or the denominator can be numeric, linear or quadratic	Express as a single fraction $\frac{3x+1}{x+2}-\frac{x-2}{x-1}$ Simplify $\frac{2x^2+3x}{4x^2-9}$
	D complete the square for a given quadratic expression	Write $2x^2+6x-1$ in the form $a(x+b)^2+c$
	E use algebra to support and construct proofs	
2.3 Expressions and formulae	**A** understand the process of manipulating formulae or equations to change the subject, to include cases where the subject may appear twice or a power of the subject occurs	Make r the subject of $V=\frac{4}{3}\pi r^3$ Make a the subject of $3a+5=\frac{4-a}{r}$ Make l the subject of $T=2\pi\sqrt{\frac{l}{g}}$
2.4 Linear equations	**See Foundation Tier**	For example $\frac{2x-3}{6}+\frac{x+2}{3}=\frac{5}{2}$

	Students should be taught to:	Notes
2.5 Proportion	**A** set up problems involving direct or inverse proportion and relate algebraic solutions to graphical representation of the equations	To include only the following: $y \propto x, y \propto \frac{1}{x}$ $y \propto x^2, y \propto \frac{1}{x^2}$ $y \propto x^3, y \propto \frac{1}{x^3}$ $y \propto \sqrt{x}, y \propto \frac{1}{\sqrt{x}}$
2.6 Simultaneous linear equations	**A** calculate the exact solution of two simultaneous equations in two unknowns	$2x + 3y = 17$ $3x - 5y = 35$
	B interpret the equations as lines and the common solution as the point of intersection	
2.7 Quadratic equations	**A** solve quadratic equations by factorisation	$2x^2 - 3x + 1 = 0,$ $x(3x - 2) = 5$
	B solve quadratic equations by using the quadratic formula or completing the square	
	C form and solve quadratic equations from data given in a context	
	D solve simultaneous equations in two unknowns, one equation being linear and the other being quadratic	$y = 2x - 11$ and $x^2 + y^2 = 25$ $y = 11x - 2$ and $y = 5x^2$
2.8 Inequalities	**A** solve quadratic inequalities in one unknown and represent the solution set on a number line	$x^2 \leqslant 25, 4x^2 > 25$ $x^2 + 3x + 2 > 0$
	B identify harder examples of regions defined by linear inequalities	Shade the region defined by the inequalities $x \leqslant 4,$ $y \leqslant 2x + 1,$ $5x + 2y \leqslant 20$

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3 Sequences, functions and graphs

	Students should be taught to:	Notes
3.1 Sequences	**A** understand and use common difference (d) and first term (a) in an arithmetic sequence	e.g. given 2nd term is 7 and 5th term is 19, find a and d
	B know and use nth term $= a + (n-1)d$	
	C find the sum of the first n terms of an arithmetic series (Sn)	e.g. given $4 + 7 + 10 + 13 + \ldots$ find sum of first 50 terms
3.2 Function notation	**A** understand the concept that a function is a mapping between elements of two sets	
	B use function notations of the form $\mathrm{f}(x) = \ldots$ and $\mathrm{f} : x \mapsto \ldots$	
	C understand the terms 'domain' and 'range' and which values may need to be excluded from a domain	$\mathrm{f}(x) = \frac{1}{x-2}$ exclude $x = 2$
	D understand and find the composite function fg and the inverse function f^{-1}	'fg' will mean 'do g first, then f'
3.3 Graphs	**A** recognise, plot and draw graphs with equation: $y = Ax^3 + Bx^2 + Cx + D$ in which: (i) the constants are integers and some could be zero (ii) the letters x and y can be replaced with any other two letters or: $y = Ax^3 + Bx^2 + Cx + D + \frac{E}{x} + \frac{F}{x^2}$ in which: (i) the constants are numerical and at least three of them are zero (ii) the letters x and y can be replaced with any other two letters or: $y = \sin x, y = \cos x, y = \tan x$ for angles of any size (in degrees)	$y = x^3$ $y = 3x^3 - 2x^2 + 5x - 4$ $y = 2x^3 - 6x + 2$ $V = 60w(60 - w)$ $y = \frac{1}{x}, x \neq 0,$ $y = 2x^2 + 3x + \frac{1}{x},$ $x \neq 0,$ $y = \frac{1}{x}(3x^2 - 5),$ $x \neq 0,$ $w = \frac{5}{d^2}, d \neq 0$

	Students should be taught to:	Notes
	B apply to the graph of $y = \mathrm{f}(x)$ the transformations $y = \mathrm{f}(x) + a$, $y = \mathrm{f}(ax)$, $y = \mathrm{f}(x + a)$, $y = a\mathrm{f}(x)$ for linear, quadratic, sine and cosine functions	
	C interpret and analyse transformations of functions and write the functions algebraically	
	D find the gradients of non-linear graphs	By drawing a tangent
	E find the intersection points of two graphs, one linear (y_1) and one non-linear (y_2), and and recognise that the solutions correspond to the solutions of $(y_2 - y_1) = 0$	The x values of the intersection of the two graphs: $y = 2x + 1$ $y = x^2 + 3x - 2$ are the solutions of: $x^2 + x - 3 = 0$ Similarly, the x values of the intersection of the two graphs: $y = 5$ $y = x^3 - 3x^2 + 7$ are the solutions of: $x^3 - 3x^2 + 2 = 0$
	F calculate the gradient of a straight line given the coordinates of two points	Find the equation of the straight line through $(1, 7)$ and $(2, 9)$
	G find the equation of a straight line parallel to a given line; find the equation of a straight line perpendicular to a given line	Find the equation of the line perpendicular to $y = 2x + 5$ through the point $(3, 7)$
3.4 Calculus	**A** understand the concept of a variable rate of change	
	B differentiate integer powers of x	
	C determine gradients, rates of change, stationary points, turning points (maxima and minima) by differentiation and relate these to graphs	Find the coordinates of the maximum and minimum points
	D distinguish between maxima and minima by considering the general shape of the graph only	

	Students should be taught to:	Notes
	E apply calculus to linear kinematics and to other simple practical problems	The displacement, s metres, of a particle from a fixed point O after t seconds is given by: $s = 24t^2 - t^3,$ $0 \leqslant t \leqslant 20$ Find expressions for the velocity and the acceleration.

AO2 Shape, space and measures

4 Geometry and trigonometry

	Students should be taught to:	Notes
4.1 Angles, lines and triangles	**See Foundation Tier**	
4.2 Polygons	**See Foundation Tier**	
4.3 Symmetry	**See Foundation Tier**	
4.4 Measures	**See Foundation Tier**	
4.5 Construction	**See Foundation Tier**	
4.6 Circle properties	**A** understand and use the internal and external intersecting chord properties	
	B recognise the term 'cyclic quadrilateral'	
	C understand and use angle properties of the circle including: (i) angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the remaining part of the circumference (ii) angle subtended at the circumference by a diameter is a right angle (iii) angles in the same segment are equal (iv) the sum of the opposite angles of a cyclic quadrilateral is $180°$ (v) the alternate segment theorem	Formal proof of these theorems is not required
4.7 Geometrical reasoning	**A** provide reasons, using standard geometrical statements, to support numerical values for angles obtained in any geometrical context involving lines, polygons and circles	
4.8 Trigonometry and Pythagoras' theorem	**A** understand and use sine, cosine and tangent of obtuse angles	
	B understand and use angles of elevation and depression	

	Students should be taught to:	Notes
	C understand and use the sine and cosine rules for any triangle	
	D use Pythagoras' theorem in three dimensions	
	E understand and use the formula $\frac{1}{2}ab\sin C$ for the area of a triangle	
	F apply trigonometrical methods to solve problems in three dimensions, including finding the angle between a line and a plane	The angle between two planes will not be required
4.9 Mensuration	**A** find perimeters and areas of sectors of circles	Radian measure is excluded
4.10 3D shapes and volume	**A** find the surface area and volume of a sphere and a right circular cone using relevant formulae	
4.11 Similarity	**A** understand that areas of similar figures are in the ratio of the square of corresponding sides	
	B understand that volumes of similar figures are in the ratio of the cube of corresponding sides	
	C use areas and volumes of similar figures in solving problems	

5 Vectors and transformation geometry

	Students should be taught to:	Notes
5.1 Vectors	**A** understand that a vector has both magnitude and direction	
	B understand and use vector notation including column vectors	The notations $\overrightarrow{OA}$ and $\mathbf{a}$ will be used
	C multiply vectors by scalar quantities	
	D add and subtract vectors	
	E calculate the modulus (magnitude) of a vector	Find the magnitude: of $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$
	F find the resultant of two or more vectors	$\overrightarrow{OA} = 3\mathbf{a}$, $\overrightarrow{AB} = 2\mathbf{b}$, $\overrightarrow{BC} = \mathbf{c}$ so: $\overrightarrow{OC} = 3\mathbf{a} + 2\mathbf{b} + \mathbf{c}$ $\overrightarrow{CA} = -\mathbf{c} - 2\mathbf{b}$
	G apply vector methods for simple geometrical proofs	
5.2 Transformation geometry	**See Foundation Tier**	

AO3 Handling data

6 Statistics and probability

	Students should be taught to:	Notes
6.1 Graphical representation of data	**A** construct and interpret histograms	For continuous variables with unequal class intervals
	B construct cumulative frequency diagrams from tabulated data	
	C use cumulative frequency diagrams	
6.2 Statistical measures	**A** estimate the median from a cumulative frequency diagram	
	B understand the concept of a measure of spread	
	C find the interquartile range from a discrete data set	The terms 'upper quartile' and 'lower quartile' may be used
	D estimate the interquartile range from a cumulative frequency diagram	
6.3 Probability	**A** draw and use tree diagrams	
	B determine the probability that two or more independent events will occur	
	C use simple conditional probability when combining events	Picking two balls out of a bag, one after the other, without replacement
	D apply probability to simple problems	

3 Assessment information

Assessment requirements

Paper number	Level	Assessment information	Number of marks allocated in the paper
Paper 1F	Foundation	Assessed through a 2-hour examination set and marked by Pearson. The paper is weighted at 50% of the qualification, targeted at grades 5–1.	100
Paper 2F	Foundation	Assessed through a 2-hour examination set and marked by Pearson. The paper is weighted at 50% of the qualification, targeted at grades 5–1.	100
Paper 1H	Higher	Assessed through a 2-hour examination set and marked by Pearson. The paper is weighted at 50% of the qualification, targeted at grades 9–4 with 3 allowed.	100
Paper 2H	Higher	Assessed through a 2-hour examination set and marked by Pearson. The paper is weighted at 50% of the qualification, targeted at grades 9–4 with 3 allowed.	100

Sample assessment materials

Sample papers and mark schemes can be found in the *Pearson Edexcel International GCSE in Mathematics Sample Assessment Materials (SAMs)* document.

Calculators

Students will be expected to have access to a suitable electronic calculator for all examination papers.

Foundation Tier

The electronic calculator to be used by students attempting Foundation Tier examination papers (1F and 2F) should have these functions as a minimum:

- $+, -, \times, \div, x^2, \sqrt{x}$, memory, brackets, $x^y, x^{\frac{1}{y}}, \overline{x}, \sum x, \sum fx$, sine, cosine, tangent and their inverses

Higher Tier

The electronic calculator to be used by students attempting Higher Tier examination papers (1H and 2H) should have these functions as a minimum:

- $+, -, \times, \div, x^2, \sqrt{x}$, memory, brackets, $x^y, x^{\frac{1}{y}}, \overline{x}, \sum x, \sum fx$, standard form, sine, cosine, tangent and their inverses

Prohibitions

Calculators with any of the following facilities are prohibited in all examinations:

- databanks
- retrieval of text or formulae
- QWERTY keyboards
- built-in symbolic algebra manipulations
- symbolic differentiation or integration.

Assessment objectives and weightings

		% in International GCSE
AO1	Demonstrate knowledge, understanding and skills in number and algebra: • numbers and the numbering system • calculations • solving numerical problems • equations, formulae and identities • sequences, functions and graphs.	57–63%
AO2	Demonstrate knowledge, understanding and skills in shape, space and measures: • geometry and trigonometry • vectors and transformation geometry.	22–28%
AO3	Demonstrate knowledge, understanding and skills in handling data: • statistics • probability.	12–18%
	TOTAL	**100%**

Relationship of assessment objectives to units

Unit number	**Assessment objective**		
	AO1	**AO2**	**AO3**
Papers 1F and 2F	28.5–31.5%	11–14%	6–9%
Papers 1H and 2H	28.5–31.5%	11–14%	6–9%
Total for International GCSE	57–63%	22–28%	12–18%

All components will be available for assessment from June 2018.

Relationship of problem-solving and mathematical reasoning skills to tier.

	Problem solving	**Mathematical reasoning**
Foundation (1F and 2F)	25%	15%
Higher (1H and 2H)	30%	20%

4 Administration and general information

Entries

Details of how to enter students for the examinations for this qualification can be found in our *International Information Manual*. A copy is made available to all examinations officers and is also available on our website.

Students should be advised that, if they take two qualifications in the same subject, colleges, universities and employers are very likely to take the view that they have achieved only one of the two GCSEs/International GCSEs. Students or their advisers who have any doubts about subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

Access arrangements, reasonable adjustments, special consideration and malpractice

Equality and fairness are central to our work. Our equality policy requires all students to have equal opportunity to access our qualifications and assessments, and our qualifications to be awarded in a way that is fair to every student.

We are committed to making sure that:

- students with a protected characteristic (as defined by the UK Equality Act 2010) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to students who do not share that characteristic
- all students achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Language of assessment

Assessment of this qualification will only be available in English. All student work must be in English.

We recommend that students are able to read and write in English at Level B2 of the Common European Framework of Reference for Languages.

Access arrangements

Access arrangements are agreed before an assessment. They allow students with special educational needs, disabilities or temporary injuries to:

- access the assessment
- show what they know and can do without changing the demands of the assessment.

The intention behind an access arrangement is to meet the particular needs of an individual student with a disability without affecting the integrity of the assessment. Access arrangements are the principal way in which awarding bodies comply with the duty under the UK Equality Act 2010 to make 'reasonable adjustments'.

Access arrangements should always be processed at the start of the course. Students will then know what is available and have the access arrangement(s) in place for assessment.

Reasonable adjustments

The UK Equality Act 2010 requires an awarding organisation to make reasonable adjustments where a student with a disability would be at a substantial disadvantage in undertaking an assessment. The awarding organisation is required to take reasonable steps to overcome that disadvantage.

A reasonable adjustment for a particular student may be unique to that individual and therefore might not be in the list of available access arrangements.

Whether an adjustment will be considered reasonable will depend on a number of factors, including:

- the needs of the student with the disability
- the effectiveness of the adjustment
- the cost of the adjustment; and
- the likely impact of the adjustment on the student with the disability and other students.

An adjustment will not be approved if it involves unreasonable costs to the awarding organisation, timeframes or affects the security or integrity of the assessment. This is because the adjustment is not 'reasonable'.

Special consideration

Special consideration is a post-examination adjustment to a student's mark or grade to reflect temporary injury, illness or other indisposition at the time of the examination/ assessment, which has had, or is reasonably likely to have had, a material effect on a candidate's ability to take an assessment or demonstrate their level of attainment in an assessment.

Further information

Please see our website for further information about how to apply for access arrangements and special consideration.

For further information about access arrangements, reasonable adjustments and special consideration please refer to the JCQ website: www.jcq.org.uk

Candidate malpractice

Candidate malpractice refers to any act by a candidate that compromises or seeks to compromise the process of assessment or that undermines the integrity of the qualifications or the validity of results/certificates.

Candidate malpractice in examinations **must** be reported to Pearson using a *JCQ Form M1* (available at www.jcq.org.uk/exams-office/malpractice). The form can be emailed to pqsmalpractice@pearson.com or posted to: Investigations Team, Pearson 190 High Holborn, London, WC1V 7BH. Please provide as much information and supporting documentation as possible. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice constitutes staff or centre malpractice.

Staff/centre malpractice

Staff and centre malpractice includes both deliberate malpractice and maladministration of our qualifications. As with candidate malpractice, staff and centre malpractice is any act that compromises or seeks to compromise the process of assessment or that undermines the integrity of the qualifications or the validity of results/certificates.

All cases of suspected staff malpractice and maladministration **must** be reported immediately, before any investigation is undertaken by the centre, to Pearson on a *JCQ Form M2(a)* (available at www.jcq.org.uk/exams-office/malpractice).

The form, supporting documentation and as much information as possible can be emailed to pqsmalpractice@pearson.com or posted to: Investigations Team, Pearson, 190 High Holborn, London, WC1V 7BH. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice itself constitutes malpractice.

More-detailed guidance on malpractice can be found in the latest version of the document *JCQ General and vocational qualifications: Suspected Malpractice in Examinations and Assessments,* available at www.jcq.org.uk/exams-office/malpractice

Awarding and reporting

The International GCSE qualification will be graded and certificated on a nine-grade scale from 9 to 1 using the total subject mark where 9 is the highest grade. For Foundation Tier grades 5–1 are available, and for Higher Tier grades 9–4 are available (grade 3 allowed). Individual components are not graded. The first certification opportunity for the Pearson Edexcel International GCSE in Mathematics (Specification A) will be in June 2018. Students whose level of achievement is below the minimum judged by Pearson to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

Student recruitment and progression

Pearson's 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 and other requirements

The qualification builds on the content, knowledge and skills developed in the Key Stage 3 Programme of Study (ages 11–14) or international equivalences for Mathematics.

Progression

Students can progress from this qualification to:

- the Pearson Edexcel International GCSE in Further Pure Mathematics
- the GCE Advanced Subsidiary (AS) and Advanced Level in Mathematics, Further Mathematics and Pure Mathematics
- the International Advanced Subsidiary (AS) and Advanced Level in Mathematics, Further Mathematics and Pure Mathematics
- other equivalent, Level 3 Mathematics qualifications
- further study in other areas where mathematics is required
- other further training or employment where numerate skills and knowledge are required.

Appendices

Appendix 1: Codes

Type of code	Use of code	Code
Subject codes	The subject code is used by centres to enter students for a qualification.	Pearson Edexcel International GCSE Mathematics (Specification A): 4MA1
Paper codes	These codes are provided for information. Students may need to be entered for individual papers.	Paper 1F: 4MA1/1F Paper 2F: 4MA1/2F Paper 1H: 4MA1/1H Paper 2H: 4MA1/2H

Appendix 2: Pearson World Class Qualification Design Principles

Pearson's world-class qualification design principles mean that all Edexcel qualifications are developed to be **rigorous, demanding, inclusive and empowering**.

We work collaboratively to gain approval from an external panel of educational thought-leaders and assessment experts from across the globe. This is to ensure that Edexcel qualifications are globally relevant, represent world-class best practice in qualification and assessment design, maintain a consistent standard and support learner progression in today's fast changing world.

Pearson's Expert Panel for World-class Qualifications is chaired by Sir Michael Barber, a leading authority on education systems and reform. He is joined by a wide range of key influencers with expertise in education and employability.

"I'm excited to be in a position to work with the global leaders in curriculum and assessment to take a fresh look at what young people need to know and be able to do in the 21st century, and to consider how we can give them the opportunity to access that sort of education." Sir Michael Barber.

Endorsement from Pearson's Expert Panel for World-class Qualifications for International GCSE development processes

December 2015

"We were chosen, either because of our expertise in the UK education system, or because of our experience in reforming qualifications in other systems around the world as diverse as Singapore, Hong Kong, Australia and a number of countries across Europe.

We have guided Pearson through what we judge to be a rigorous world-class qualification development process that has included:

- Extensive international comparability of subject content against the highest-performing jurisdictions in the world

- Benchmarking assessments against UK and overseas providers to ensure that they are at the right level of demand
- Establishing External Subject Advisory Groups, drawing on independent subject-specific expertise to challenge and validate our qualifications

Importantly, we have worked to ensure that the content and learning is future oriented, and that the design has been guided by Pearson's Efficacy Framework. This is a structured, evidence-based process which means that learner outcomes have been at the heart of this development throughout.

We understand that ultimately it is excellent teaching that is the key factor to a learner's success in education but as a result of our work as a panel we are confident that we have supported the development of Edexcel International GCSE qualifications that are outstanding for their coherence, thoroughness and attention to detail and can be regarded as representing world-class best practice."

Sir Michael Barber (Chair) Chief Education Advisor, Pearson plc	**Professor Sing Kong Lee** Professor, National Institute of Education in Singapore
Dr Peter Hill Former Chief Executive ACARA	**Bahram Bekhradnia** President, Higher Education Policy Institute
Professor Jonathan Osborne Stanford University	**Dame Sally Coates** Director of Academies (South), United Learning Trust
Professor Dr Ursula Renold Federal Institute of Technology, Switzerland	**Professor Bob Schwartz** Harvard Graduate School of Education
Professor Janice Kay Provost, University of Exeter	**Jane Beine** Head of Partner Development, John Lewis Partnership
Jason Holt CEO, Holts Group	

All titles correct as at December 2015

Appendix 3: Transferable skills

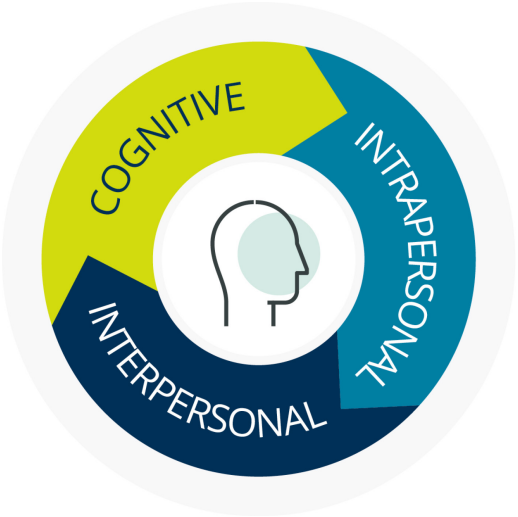
The need for transferable skills

In recent years, higher education institutions and employers have consistently flagged the need for students to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

The Organisation for Economic Co-operation and Development (OECD) defines skills, or competencies, as 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.'[1]

To support the design of our qualifications, the Pearson Research Team selected and evaluated seven global 21st-century skills frameworks. Following on from this process, we identified the National Research Council's (NRC) framework [2] as the most evidence-based and robust skills framework, and have used this as a basis for our adapted skills framework.

The framework includes cognitive, intrapersonal skills and interpersonal skills.



The skills have been interpreted for this specification to ensure they are appropriate for the subject. All of the skills listed are evident or accessible in the teaching, learning and/or assessment of the qualification. Some skills are directly assessed. Pearson materials will support you in identifying these skills and developing these skills in students.

The table overleaf sets out the framework and gives an indication of the skills that can be found in the Pearson Edexcel International GCSE in Mathematics (Specification A) and indicates the interpretation of the skill in this area. A full subject interpretation of each skill, with mapping to show opportunities for students' development is provided on the subject pages of our website: qualifications.pearson.com

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1 OECD (2012), Better Skills, Better Jobs, Better Lives (2012): http://skills.oecd.org/documents/OECDSkillsStrategyFINALENG.pdf

2 Koenig, J. A. (2011) Assessing 21st Century Skills: Summary of a Workshop, National Research Council

Cognitive skills	Cognitive processes and strategies	• Critical thinking • Problem solving • Analysis • Reasoning/argumentation • Interpretation • Decision making • Adaptive learning • Executive function
	Creativity	• Creativity • Innovation
Intrapersonal skills	Intellectual openness	• Adaptability • Personal and social responsibility • Continuous learning • Intellectual interest and curiosity
	Work ethic/ conscientiousness	• Initiative • Self-direction • Responsibility • Perseverance • Productivity • Self-regulation (metacognition, forethought, reflection) • Ethics • Integrity
	Positive core self-evaluation	• Self-monitoring/self-evaluation/self-reinforcement
Interpersonal skills	Teamwork and collaboration	• Communication • Collaboration • Teamwork • Co-operation • Interpersonal skills
	Leadership	• Leadership • Responsibility • Assertive communication • Self-presentation

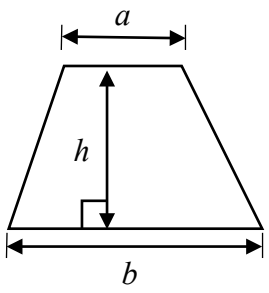
Problem solving for translating problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes and solving them.

Initiative for using mathematical knowledge, independently (without guided learning), to further own understanding.

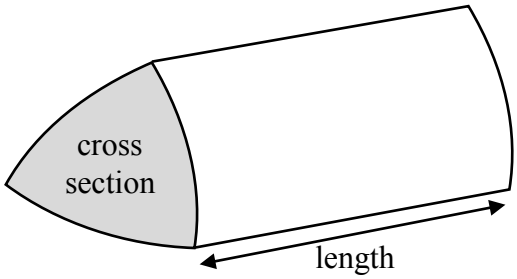
Communication to communicate a mathematical process or technique (verbally or written) to peers and teachers and answer questions from others.

Appendix 4: Foundation Tier formulae sheet

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

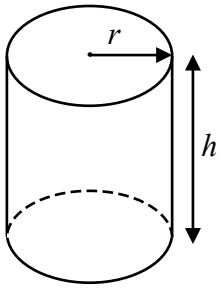


Volume of prism = area of cross section × length



Volume of cylinder = $\pi r^2 h$

Curved surface area of cylinder = $2\pi rh$



Appendix 5: Higher Tier formulae sheet

Arithmetic series

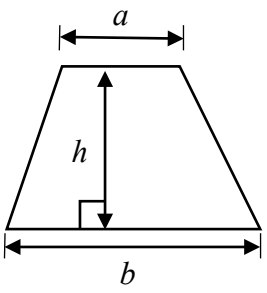
Sum to n terms, $S_n = \frac{n}{2}\left[2a + (n-1)d\right]$

The quadratic equation

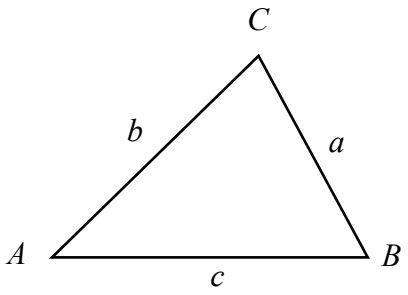
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle *ABC*

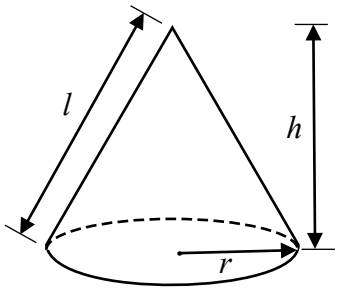
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

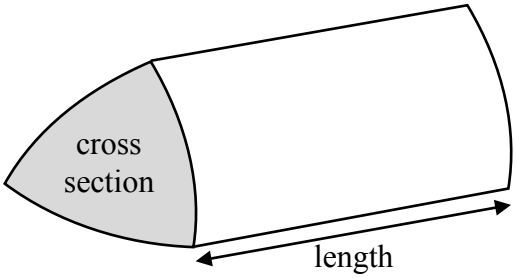
Area of triangle $= \frac{1}{2}ab\sin C$

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

Curved surface area of cone $= \pi rl$

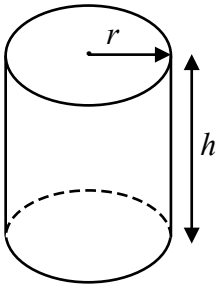


Volume of prism
= area of cross section × length



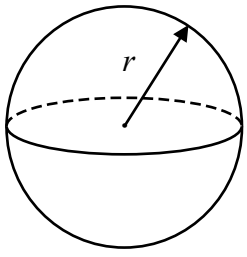
Volume of cylinder $= \pi r^2 h$

Curved surface area of cylinder $= 2\pi rh$



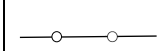
Volume of sphere $= \frac{4}{3}\pi r^3$

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



Appendix 6: Notation

Notation used in the examination include the following:

$\{\quad\}$	the set of
$\mathrm{n}(A)$	the number of elements in the set A
$\{x:\ \}$	the set of all x such that
$\in$	is an element of
$\notin$	is not an element of
$\varnothing$	the empty (null) set
$\mathscr{E}$	the universal set
$\cup$	union
$\cap$	intersection
$\subset$	is a subset of
A'	the complement of the set A
PQ	operation Q followed by P
$\mathrm{f}: A \to B$	is a function under which each element of set A has an image in set B
$\mathrm{f}: x \mapsto y$	f is a function under which x is mapped to y
$\mathrm{f}(x)$	the image of x under the function f
f^{-1}	the inverse relation of the function f
fg	the function g followed by function f, i.e. $\mathrm{f}(\mathrm{g}(x))$
	open interval on the number line
	closed interval on the number line
$\mathbf{a}$	the vector $\mathbf{a}$
$\overrightarrow{AB}$	the vector represented in magnitude and direction by $\overrightarrow{AB}$ the vector from point A to point B
$\lvert\mathbf{a}\rvert$	the magnitude of vector $\mathbf{a}$

Appendix 7: Glossary

Term	Definition
Assessment objectives	The requirements that students need to meet to succeed in the qualification. Each assessment objective has a unique focus which is then targeted in examinations or coursework. Assessment objectives may be assessed individually or in combination.
External assessment	An examination that is held at the same time and place in a global region.
JCQ	Joint Council for Qualifications. This is a group of UK exam boards that develop policy related to the administration of examinations.
Linear	Qualifications that are linear have all assessments at the end of a course of study. It is not possible to take one assessment earlier in the course of study.
Unit	A modular qualification will be divided into a number of units. Each unit will have its own assessment.

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