Getting ready to teach the Pearson Edexcel International GCSE (9-1) Mathematics (A&B) specifications

16IAM07

Pearson

Your trainer today is:

IST

XXXX XXXXXX

Aims and Objectives

During the training you will:

- Consider the updated structure, content and assessment of these qualifications, and the support available to guide you through these changes
- Explore possible teaching and delivery strategies for the new qualifications
- Explore exemplar student work to support your understanding of the mark schemes
- Have the opportunity to network, discuss best practice, take away resources to help with your planning and delivery, and share ideas with other teachers
- Learn about the introduction of the new 9-1 grading scale
- Have dedicated time to ask questions to our trainer.

Session Agenda

10:00 Start - introductions
10:10 Changes to International GCSE (Spec A) Mathematics
10.30 Changes to Foundation level with student exemplars
11:15 Coffee
11:35 Complete Foundation level and begin Higher level
12.30 Lunch
13:30 Complete Higher level and begin International GCSE (Spec B) Mathematics
14.45 Tea
15:05 Continue with Spec B and resources, free and paid for.
16:00 Finish

Information gained from our consultations:

- International GCSE Maths is valued by teachers and learners as an attractive equivalent to GCSE Maths and an alternative preparation for A level
- Centres would welcome some updates, rather than large-scale changes to the specification
- Centres generally would like grades to be on the same scale as for the new GCSE 9-1

Following consultations we are making the following changes to International GCSE Maths:

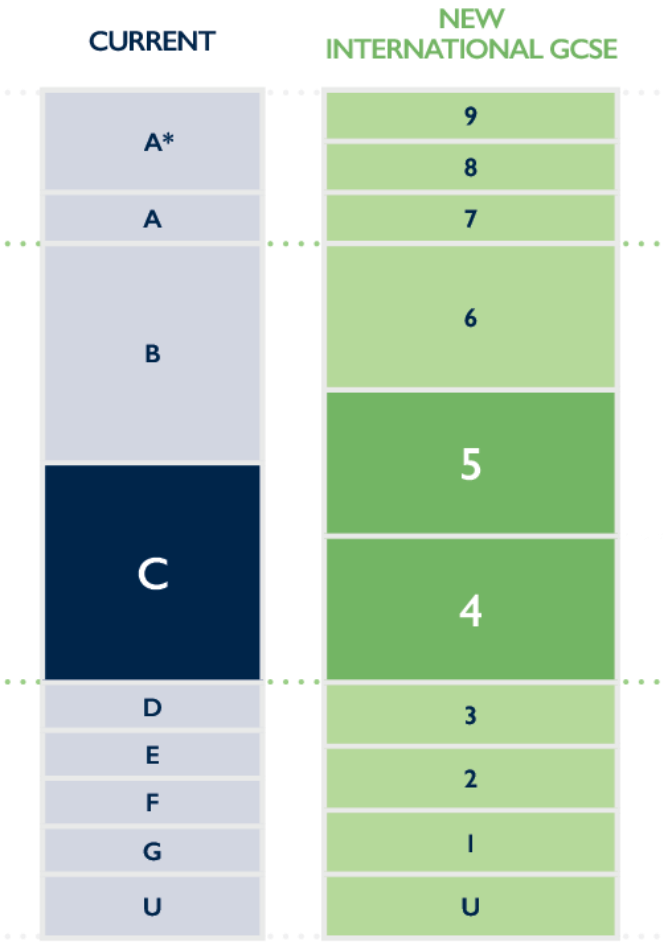
- A move from the current A* - G to the new 9–1 grading structure to maintain comparability to GCSE 9-1 Maths
- Some minor additions to the content assessed at each tier to reflect this new 9-1 grading structure
- A few more questions on problem-solving and mathematical reasoning

…but…

- The changes are natural extensions of the current content
- The changes should not involve a large amount of extra teaching time
- Questions requiring the use of Problem solving and mathematical reasoning are nothing new to the International GCSE specification – there is just a slight increase in these
- Question types and language used will be very similar to those on the current specification

New GCSE 9-1 grading scale

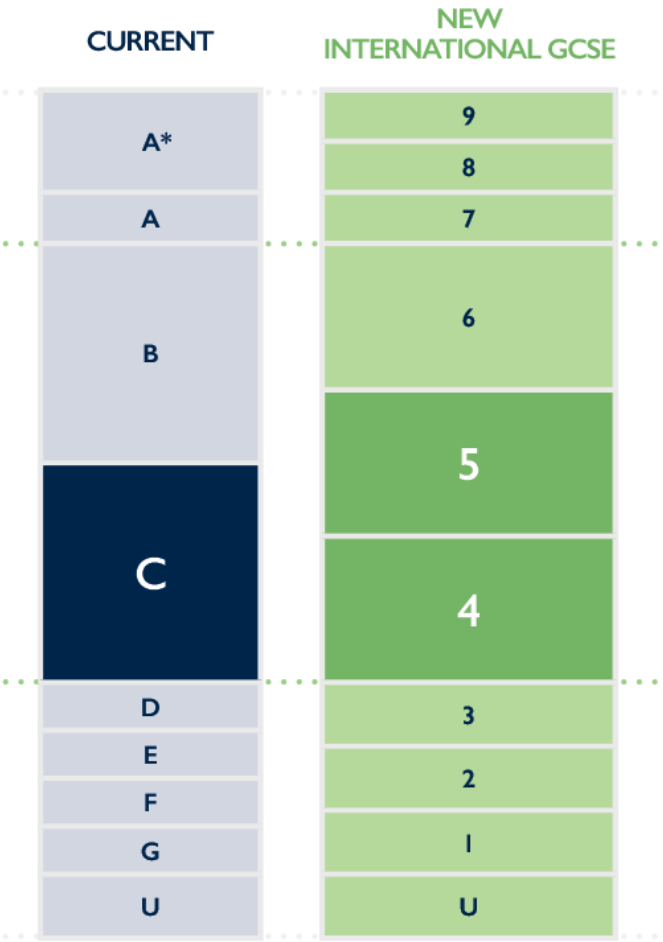
- New grading scale – therefore no direct comparability with old A*-G
- Levels 4 and 5 align to old grade C
- Level 7 aligns to grade A
- Level 8 & 9 align to grade A*
- Level 9 represents a higher level of attainment than A* grade boundary
- Introduced in GCSE in 3 phases 2015-2017
- Introduced into new International GCSE in one phase for first teaching September 2017
- Option to start early for English and Maths from September 2016



New GCSE 9-1 grading scale

Why the new scale gives learners better opportunities?

- Gives greater scope to differentiate across the levels of attainment, rewarding outstanding achievement
- Rewards outstanding achievement
- Gives teachers more information about students' attainment to help progress to A Level
- Internationally relevant: Grade 5 linked with best available evidence of average PISA performance in high performing countries
- Aligning with English national practice ensures international recognition and understanding from universities and ministries around the world
- Allows clear comparison with English standards, unlike old A* to G grading



FAQs

http://qualifications.pearson.com/content/dam/pdf/News/general-news/Edexcel-International-GCSE-FAQs-for-international-schools-only.pdf

4MA1

Assessment Structure

Foundation

Paper number	Level	Assessment information	Number of raw marks allocated in the paper
Paper 1F (calculator allowed)	Foundation	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 5 – 1.	100
Paper 2F (calculator allowed)	Foundation	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 5 – 1.	100

Assessment Structure

Higher tier

Paper number	Level	Assessment information	Number of raw marks allocated in the paper
Paper 3H (calculator allowed)	Higher	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 9 – 4 with 3 allowed.	100
Paper 4H (calculator allowed)	Higher	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 9 – 4 with 3 allowed.	100

Which tier of entry: Foundation or Higher?

- The new Foundation tier goes up to a grade 5, which is of a higher level of demand than the current grade C, and the Higher tier starts at grade 4, which is of a higher level of demand than the current grade D. We expect this to have an effect on the number of Foundation and Higher students.
- Consider how confident your students are with topics that were previously regarded as C grade.
- Common questions on the SAMs appear at the end of the Foundation tier papers and form the first part of the Higher tier paper – how well your students perform on these questions will give you an indication if they are working below, at or above grades 4 & 5 (the target grades for these questions)

Subject Areas on Specification

A01 (57 – 63%)

- Numbers and the number system
- Equations, formulae and identities
- Sequences, functions and graphs

A02 (22 – 28%)

- Geometry
- Vectors and transformation geometry

A03 (12 - 18%)

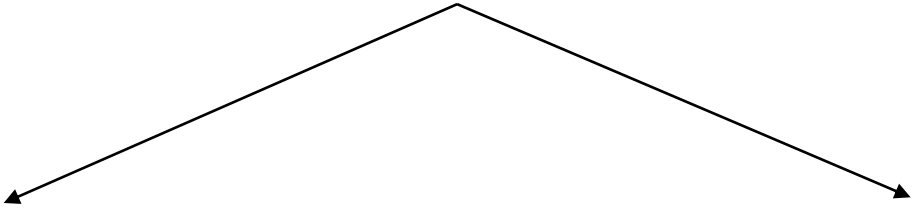
- Statistics and probability

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 3H and 4H	28.5–31.5%	11–14%	6–9%
Total for International GCSE	57–63%	22–28%	12–18%

A01 Split for Foundation and Higher

A01 (57 - 63% of marks)



Foundation
Number : Algebra
3 : 2

Higher
Number : Algebra
1 : 2

Relationship of problem solving and mathematical reasoning skills to tier

	Problem solving	Reasoning, interpretation and Communication
Foundation (1F and 2F)	25%	15%
Higher (3H and 4H)	30%	20%

Marks allocated to Grades

Higher tier

- 40% marks distributed evenly over grades 4 & 5
- 60% of marks distributed over grades 6, 7, 8 & 9

Foundation tier

- All marks distributed evenly over grades 1, 2, 3, 4 & 5

Content changes

- Very similar to KMA0 and 4MA0
- Some topics have moved so that they can be assessed on the Foundation tier papers as well as on the Higher tier papers in order to accommodate the award of grade 5 at Foundation level.
- Introduction of density and pressure.
- Slight increase in the number of questions targeting problem solving as well as questions targeting reasoning, interpretation and communication.
- Reference to Pythagoras' theorem and the trigonometric ratios has been deleted from the formula sheet; candidates are expected to know them.

Types of marks

M - Method mark ; is awarded for a correct method. Note: The method must be **complete** for the award of this mark.

A – Accuracy mark; is awarded for a correct answer
Note: If the method mark has not been awarded, for example an incorrect method has been used, the A mark is automatically not available, even if the final answer is correct.

B - Independent mark; is awarded for a correct answer seen.

Foundation tier

There is new content in the foundation tier - some of this is to accommodate the grade 5 which is now available at this tier.

Fractions

1.2 Fractions	**F**	use common denominators to add and subtract fractions and mixed numbers
	I	multiply and divide fractions and mixed numbers

SAMs Paper 2F q25 / Paper 4H q10 (part (b) only)

(a) Show that $\frac{5}{9} + \frac{1}{6} = \frac{13}{18}$ (2)

(b) Show that $4\frac{2}{3} \div 3\frac{5}{9} = 1\frac{5}{16}$ (3)

Powers and roots

1.4 Powers and roots	**C**	use index notation and index laws for multiplication and division of positive and negative integer powers including zero
	E	find highest common factors (HCF) and lowest common multiples (LCM)

Candidates may, for example be asked to simplify $5^{-6} \times 5^{2}$ and give their answer as a power of 5

SAMs Paper 2F q16 / Paper 4H q1

Find the lowest common multiple (LCM) of 20, 30 and 45

(3)

Set language and notation

1.5 Set language and notation	**D**	understand and use the complement of a set
	E	use Venn diagrams to represent sets

Percentages

1.6 Percentages	**F**	use reverse percentages
	G	use compound interest and depreciation

SAMs Paper 1F q23 / Paper 3H q8

In a sale, all normal prices are reduced by 15%
The normal price of a mixer is reduced by 22.50 dollars.

Work out the normal price of the mixer.

(3)

Task 1

SAMs Paper 2F q23 / Paper 4H q8

Kwo invests HK$40 000 for 3 years at 2% per year compound interest.
Work out the value of the investment at the end of 3 years.

(3)

Marking Task 1

SAMs Paper 2F Q23 / Paper 4H Q8

Marking Scheme	
M1	0.02 × 40 000 (=800) or 1.02 × 40 000(=40800) or 2400
M1	for method to find interest for year 2 **and** year 3 "40800" × 0.02 (=816) and "41616" × 0.02 (=832.32) **OR** 2448.32 (**M2** for 40 000 × 1.02^3)
A1 42448.32	

Standard form

1.9 Standard form	**A**	calculate with and interpret numbers in the form $a \times 10^n$ where n is an integer and $1 \square a < 10$

SAMs Paper 1F q24 / Paper 3H q9

The table shows the diameters, in kilometres, of five planets.

Planet	Diameter (km)
Venus	1.2×10^4
Jupiter	1.4×10^5
Neptune	5.0×10^4
Mars	6.8×10^3
Saturn	1.2×10^5

(a) Write 1.4×10^5 as an ordinary number.

(1)

(b) Which of these planets has the smallest diameter?

(1)

(c) Calculate the difference, in kilometres, between the diameter of Saturn and the diameter of Neptune.
Give your answer in standard form.

(2)

Equations, formulae and identities

2.1 Use of symbols	**C**	use index notation for positive and negative integer powers (including zero)

SAMs Paper 2F q19 / Paper 4H q4

(a) Simplify $p^5 \times p^4$

(1)

(b) Simplify $(m^4)^{-3}$

(1)

(c) Write down the value of c^0

(1)

Algebraic manipulation

2.2 Algebraic manipulation	**D**	take out common factors
	F	understand the concept of a quadratic expression and be able to factorise such expressions (limited to $x^2 + bx + c$)

Task 2

SAMs Paper 1F q21a / Paper 3H q6a

Factorise **fully** $18e^3f + 45e^2f^4$ (2)

e.g. Factorise $x^2 + 2x - 15$, factorise $x^2 - 25$

Marking Task 2

SAMs Paper 1F Q21a / Paper 3H Q6a

(a) Factorise fully $18e^3f + 45e^2f^4$

Marking Scheme
M1 Any correct partially factorised expression **A1** fully correct $9e^2f(2e + 5f^3)$

Expressions and formulae

2.3 Expressions and formulae	**F**	change the subject of a formula where the subject appears once

For example: make q the subject of $x = 7q + 3$

or make y the subject of $w = 6y^2$

Simultaneous equations

2.6 Simultaneous linear equations	**A**	calculate the exact solution of two simultaneous equations in two unknowns

SAMs Paper 2F q24 / Paper 4H q9

Solve the simultaneous equations $3x + y = 13$

$x - 2y = 9$

Show clear algebraic working. (3)

The requirement to show clear algebraic will still be given (as here); the correct answer without supporting algebraic working will not score any marks.

How would you solve these equations?

Teaching Simultaneous equations

- Solve $\begin{aligned} 2x + 3y &= 14 \\ 4x + y &= 3 \end{aligned}$ How do you do it?

- Elimination: $\begin{aligned} 4x + 6y &= 28 \\ 4x + y &= 3 \end{aligned}$ and subtract?

- Substitution: $y = 3 - 4x \quad \Rightarrow \quad 2x + 3(3 - 4x) = 14$

- Substitution can be generalised!

- Make sure candidates going on to Higher tier meet substitution.

Quadratic equations

Marking Task 3

SAMs Paper 1F q21b / Paper 3H q6b

Solve $x^2 - 4x - 12 = 0$

Show **clear** algebraic working.

(3)

2.7 Quadratic expressions	**A**	solve quadratic equations by factorisation (limited to $x^2 + bx + c = 0$)

Mark Scheme
M1 $(x \pm 6)(x \pm 2)$ or correct substitution into a correct quadratic formula (allow one sign error)
M1 their $(x \pm 6)(x \pm 2) = 0 \Rightarrow x = \pm 6, \pm 2$ **or** $\frac{4 \pm \sqrt{64}}{2}$
A1 6, –2 dependant on at least M1

Sequences, functions and graphs (A01)

3.1 Sequences	**C**	use linear expressions to describe the *n*th term of arithmetic sequences

SAMs Paper 2F q17 / Paper 4H q2

The first four terms of an arithmetic sequence are

2 9 16 23

Write down an expression, in terms of *n*, for the *n*th term.

(2)

Graphs

3.3 Graphs	**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 $(0, c)$
	I	recognise, generate points and plot graphs of linear and quadratic functions

The requirement in 3.3H has been extended so that candidates could, for example, be asked to write down the gradient and the coordinates of the *y* axis intercept of the graph of y = 3x + 4. The inclusion of the word '**recognise**' in 3.3I means that candidates could, for example, be given the graphs of several linear functions and then be asked to identify which of these is the graph of $y = 2x + 1$

Geometry and Trigonometry (A02)

4.4 Measure	**G**	use compound measure such as speed, density and pressure

The formula for pressure will be given if required.

The questions from the SAMs shown below is a more demanding question testing knowledge of density in a problem.

SAMs Paper 2F q18 / Paper 4H q3

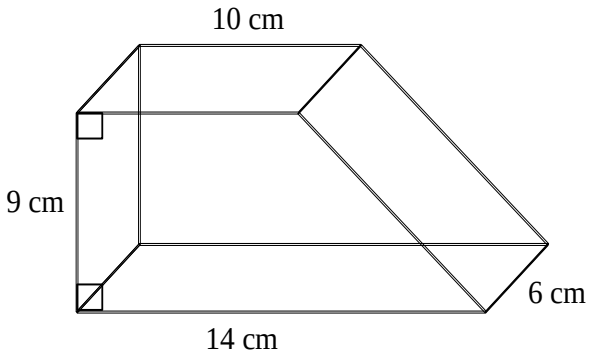


Diagram **NOT** accurately drawn

The diagram shows a solid prism. The cross section of the prism is a trapezium.

The prism is made from wood with density 0.7 g/cm^3

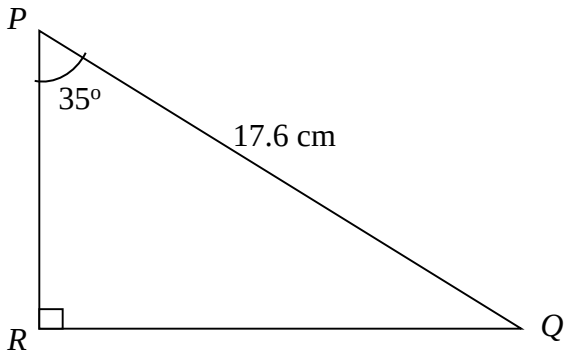
Work out the mass of the prism.

(4)

Geometry and Trigonometry (A02)

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

SAMs Paper 1F q22 / Paper 3H q7



Calculate the length of *PR*.
Give your answer correct to 3 significant figures.

(3)

Geometry and Trigonometry (A02)

4.9 Mensuration of 2-D shapes	**E**	find circumferences and areas of circles using relevant formulae; find perimeters and areas of semicircles

SAMs Paper 1F q25 / Paper 3H q10

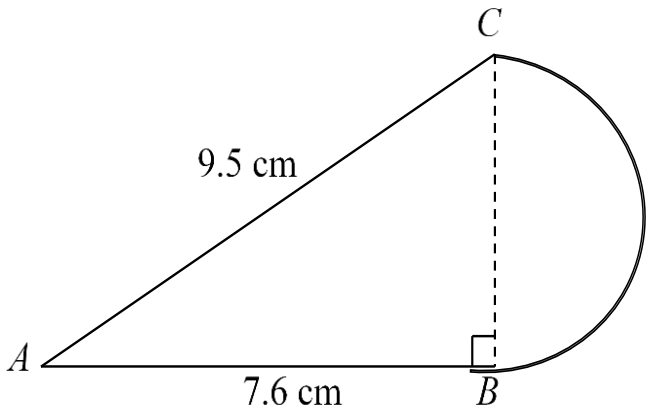


Diagram **NOT** accurately drawn

The diagram shows a shape made from triangle *ABC* and a semicircle with diameter *BC*.
Triangle *ABC* is right-angled at *B*.
AB = 7.6 cm and *AC* = 9.5 cm.

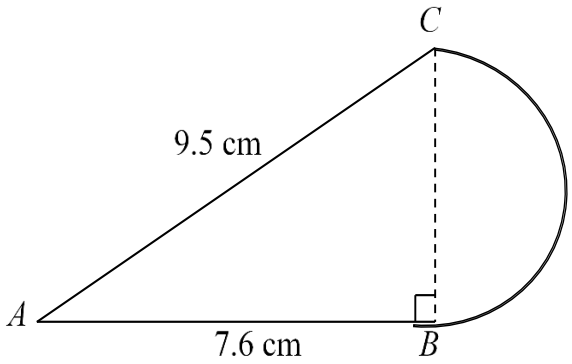
Calculate the area of the shape.
Give your answer correct to 3 significant figures.

(5)

This question is a good example of one requiring 'problem solving skills' in that the student needs to translate the problem into a series of mathematical processes – the student needs to interpret the question and decide how to solve it.

Marking Task 4

SAMs Paper 1F q25 / Paper 3H q10



The diagram shows a shape made from triangle *ABC* and a semicircle with diameter *BC*.
Triangle *ABC* is right-angled at *B*.
AB = 7.6 cm and *AC* = 9.5 cm.

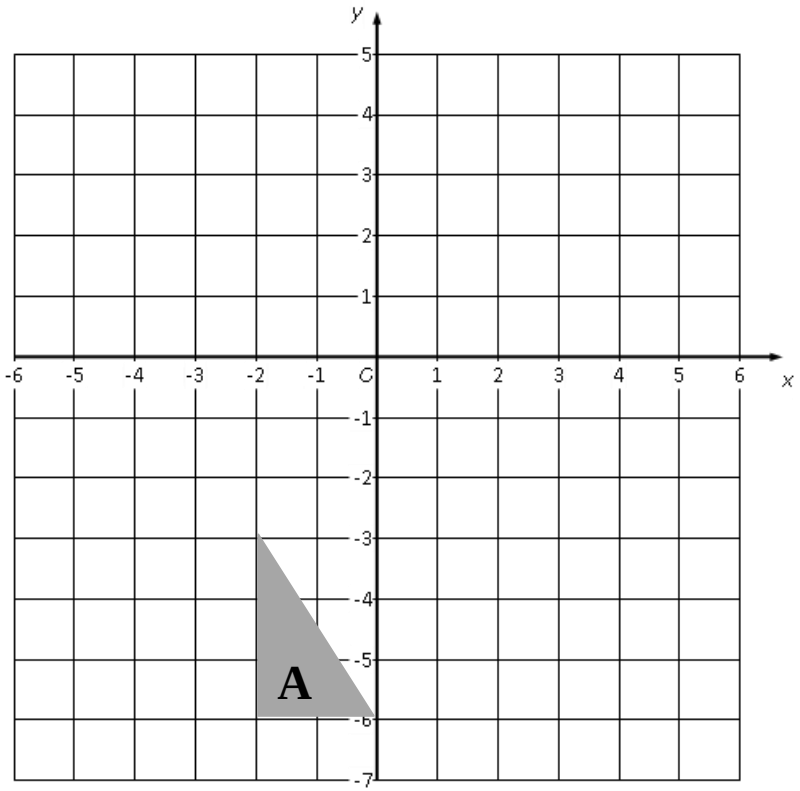
Calculate the area of the shape.
Give your answer correct to 3 significant figures.

Marking Scheme	
M1	$\sqrt{9.5^2 - 7.6^2}$ oe
A1	(BC =) 5.7
M1d	dep on first M1 for 0.5 × 7.6 × '5.7' **or** 21.6(6) **or** 21.7 oe
M1	$0.5\times\pi\times('5.7'\div 2)$ **or** 12.7(587...) **or** 12.8
A1	34.4

Vectors and transformation geometry (A02)

5.2 Transformation geometry	**H**	understand and use column vectors in translations

SAMs Paper 2F q21 / Paper 4H q6



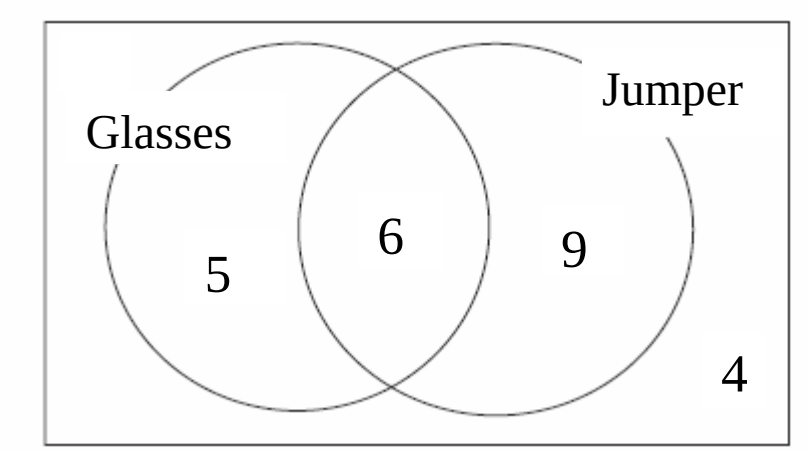
(a) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$

(1)

Statistics and probability (A03)

6.3 Probability	**D** Find probabilities from a Venn diagram.

This will link in with the new work in section 1.5



The Venn diagram shows the number of children in a class wearing a jumper or glasses.
A child is selected at random.

Find the probability that the child is wearing glasses but is not wearing a jumper.

Higher Tier

Assumes knowledge of Foundation tier – all content included in Foundation tier could be assessed in the Higher tier papers, provided that the question is targeting at least grade 4

Numbers and the number system (A01)

1.4 Powers and roots	**B**	manipulate surds, including rationalising a denominator

SAMs Paper 4H q24

Show that $\dfrac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

(4)

$\sqrt{12} = 2\sqrt{3}$

Marking Task 5

SAMs Paper 4H q24

Show that $\dfrac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

Mark Scheme

M1 Method to rationalise $\dfrac{\left(\sqrt{12}-1\right)\left(2+\sqrt{3}\right)}{\left(2-\sqrt{3}\right)\left(2+\sqrt{3}\right)}$

M1 correct expansion of brackets $\dfrac{2\sqrt{12}-2+\sqrt{12}\sqrt{3}-\sqrt{3}}{4-3}$

B1 $\sqrt{12} = 2\sqrt{3}$ (may be seen before expansion)

A1 answer from fully correct working with all steps seen

Teaching surd division

- Make connections with the difference of two squares

- Prepare candidates for "show that" questions:
  - Make sure they write down and show the multiplication by for example $\frac{2+\sqrt{3}}{2+\sqrt{3}}$
  - Put in every step e.g. write $\sqrt{12} \times \sqrt{3}$ not just 6 and don't just assume that $\sqrt{12} = 2\sqrt{3}$ but write $\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$

- Prepare candidates for questions using algebra e.g.
  - Given that $\frac{6}{a-\sqrt{b}} = 8 + 2\sqrt{b}$, where ais an integer and *b* is a prime number, find the value of *a* and the value of *b*.

Equations, formulae and identities (A01)

2.2 Algebraic manipulation	**A**	expand the product of two or more linear expressions
	D	complete the square for a given quadratic expression
	E	use algebra to support and construct proofs

SAMs Paper 3H q11

Expand and simplify $(x + 5)(x - 3)(x + 3)$ (3)

KMAO June 2015 Paper 4H q20b

Show, using algebra, that the sum of any 4 consecutive odd numbers is always a multiple of 8 (3)

1MA0 June 2014 Paper 2H q21b

Prove algebraically that

$(2n + 1)^2 - (2n + 1)$ is an even number for all positive integer values of n.

Multiplying out brackets

- Now 2 or more, **not just two**.
- Start with simple "tools" e.g. FOIL, smiley face etc
- E.g. $(x + 5)(x - 3) = x^2 - 3x + 5x - 15$ etc
- **BUT … don't leave them there!**
- Students now need a method that generalises
- E.g. $(x + 5)(x - 3) = x(x - 3) + 5(x - 3)$ etc

Proportions

No change in wording but we have added a couple of cases (in red)in the notes. This brings into line with spec B

2.5	**A** set up problems involving direct or inverse proportion…	To include only the following: $y \propto x$, $y \propto \frac{1}{x}$ and $y \propto x^2$, $y \propto \frac{1}{x^2}$ $y \propto x^3$, $y \propto \frac{1}{x^3}$ and $y \propto \sqrt{x}$, $y \propto \frac{1}{\sqrt{x}}$

Quadratic equations

2.7 Quadratic equations	**B**	solve quadratic equations by using the quadratic formula or completing the square

SAMs Paper 4H q22

(a) Write $2x^2 - 8x + 9$ in the form $a(x + b)^2 + c$

(3)

(b) Hence, or otherwise, explain why the graph of the curve with equation $y = 2x^2 - 8x + 9 = 0$ does not intersect the x-axis.

(1)

Marking
(a) M1 $2(x^2 - 4x) + 9$ or $2(x^2 - 4x + 9/2)$
M1 $2((x - 2)^2 - 2^2) + 9$
A1 $2(x - 2)^2 + 1$
(b) **B1** Explanation e.g. because minimum is at (2, 1)

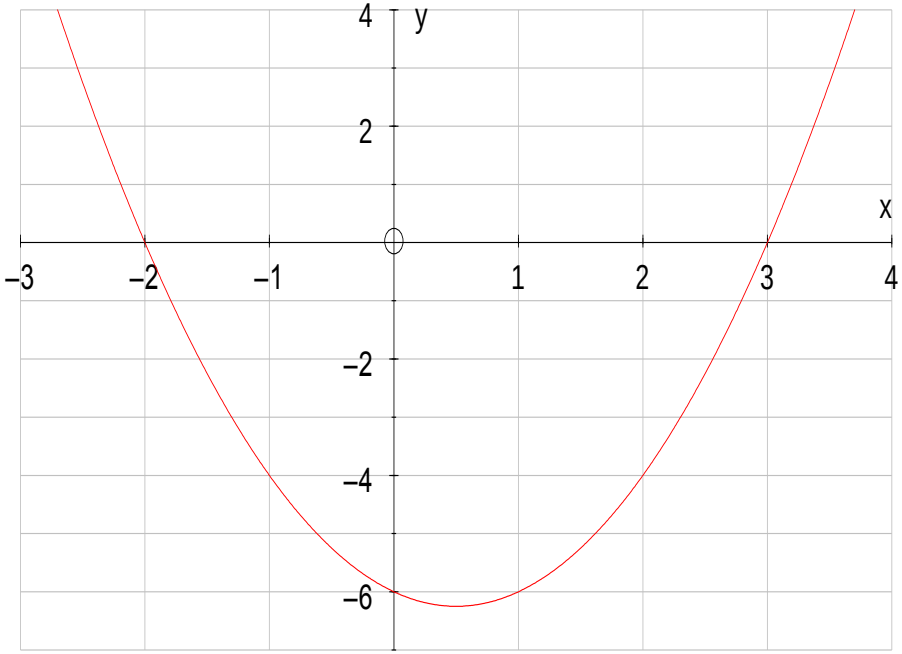
Teaching quadratic inequalities

e.g. $x^2 - x - 6 < 0$

- Find critical values: solve $x^2 - x - 6 = 0$
- $(x - 3)(x + 2) = 0$ so $x = 3$ or -2

- Sketch or table?
- So $-2 < x < 3$

- For $x^2 - x - 6 > 0$
- $x < -2$ or $x > 3$
- **Don't** write $3 < x < -2$



Discuss

Sequences(A01)

3.1 Sequences	**A**	Understand and use common difference (d) and first term (a) in an arithmetic sequence
	B	Know and use nth term = $a + (n - 1)d$
	C	Find the sum of the first n terms of an arithmetic series (Sn)

SAMs Paper 3H q23

The 4th term of an arithmetic series is 17
The 10th term of the same arithmetic series is 35

Find the sum of the first 50 terms of this arithmetic series.

(5)

Arithmetic series

- **Formulae**
  - $t_n = a + (n - 1)d$ is **not** given
  - $S_n = \frac{n}{2}[2a + (n-1)d]$ **is** given - proof is not required but it is a "beautiful" piece of mathematics and worth doing even if only in a special case.
- **Question types**
  - Given 3rd term and say 8th term of an arithmetic series …find *a* and *d* (simultaneous equations)
  - Find the sum of 4 + 7 + 10 + … + 109 (use the t_n formula to find *n* then the sum formula)
  - Questions in context e.g. I save $10 in week 1 and increase the amount I save each week by $5.
    (a) How much do I save in week 40?
    (b) What is the total amount I have saved after 40 weeks?

Marking Task 6

SAMs Paper 3H q23

The 4th term of an arithmetic series is 17
The 10th term of the same arithmetic series is 35

Find the sum of the first 50 terms of this arithmetic series.

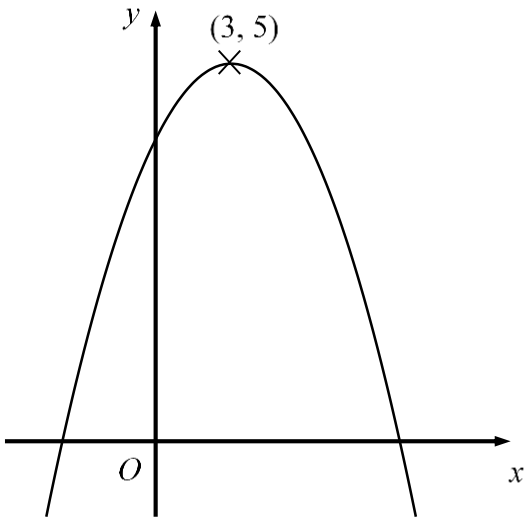
(5)

Marking
M1 for a + 3d = 17 **and** a + 9d = 35 **or** 35 − 17 = 6d
A1 d = 3
A1 a = 8 (ft from d = 3)
M1 for 50/2(2 x '8'+(50 − 1) × '3') oe
A1 4075

Graphs

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: $y = \sin x$, $y = \cos$, $y = \tan x$ for angles of any size (in degrees)
	B	apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(ax)$, $y = f(x + a)$, $y = af(x)$ for linear, quadratic, sine and cosine functions
	C	interpret and analyse transformations of functions and write the functions algebraically
	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

SAMs Paper 3H q20



The diagram shows part of the curve with equation $y = f(x)$
The coordinates of the maximum point of the curve are (3, 5)

(a) Write down the coordinates of the maximum point of the curve with equation

(i) $y = f(x + 3)$ (1)

(ii) $y = 2f(x)$ (1)

(iii) $y = f(3x)$ (1)

The curve with equation $y = f(x)$ is transformed to give the curve with equation $y = f(x) – 4$

(b) Describe the transformation. (1)

SAMs Paper 3H q13b

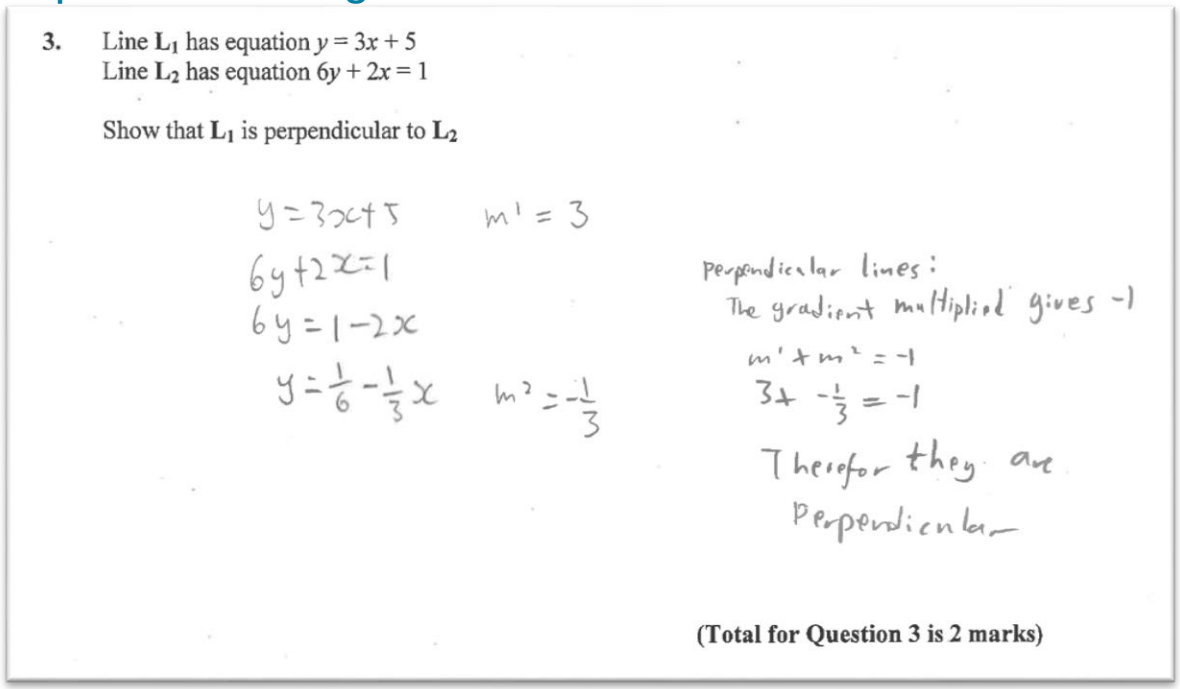
Line $\mathbf{L_1}$ has equation $y = 3x + 5$

Line $\mathbf{L_2}$ has equation $6y + 2x = 1$

(b) Show that $\mathbf{L_1}$ is perpendicular to $\mathbf{L_2}$

(2)

A good way for students to explain this is to give the two gradients and then show that they multiply to make −1 and explain that this means the lines are perpendicular, e.g.



3. Line $\mathbf{L_1}$ has equation $y = 3x + 5$
Line $\mathbf{L_2}$ has equation $6y + 2x = 1$

Show that $\mathbf{L_1}$ is perpendicular to $\mathbf{L_2}$

$y = 3x + 5$ $\quad m^1 = 3$

$6y + 2x = 1$

$6y = 1 - 2x$

$y = \frac{1}{6} - \frac{1}{3}x$ $\quad m^2 = -\frac{1}{3}$

perpendicular lines:
The gradient multiplied gives -1

$m^1 \times m^2 = -1$

$3 \times -\frac{1}{3} = -1$

Therefor they are Perpendicular

(Total for Question 3 is 2 marks)

Calculus

3.4 Calculus	**D** Now includes a reference to stationary points

Geometry and Trigonometry (A02)

No new content

But the change in this area is that any reference to Pythagoras' theorem and the trigonometric ratios has been deleted from the formula sheet.

Vectors and transformation geometry (A02)

5.1 Vectors	**C**	understand and use vector notation including column vectors

SAMs Paper 4H q23

ABCD is a parallelogram.

$$\overrightarrow{AB} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad \overrightarrow{AC} = \begin{pmatrix} 9 \\ 4 \end{pmatrix}$$

Find the magnitude of $\overrightarrow{BC}$

(3)

Statistics and probability (A03)

No new content

Problem solving skills

Students need to 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.

Questions requiring problem solving skills

KMA0 May 2014 Paper 1F q11

The cost of an adult ticket to a zoo is $13.50

A teacher buys 4 adult tickets and 24 pupil tickets.

The total cost of the tickets is $270

Work out the cost, in dollars ($), of a ticket for one pupil.

KMA0 May 2014 Paper 4H q21

A sphere has a surface area of 81π cm^2

Work out the volume of the sphere.
Give your answer correct to 3 significant figures.

Reasoning skills

Students need to be able to demonstrate reasoning skills by:

- Making deductions and drawing conclusions from mathematical information
- Constructing chains of reasoning (e.g. angles questions requiring reasons)
- Presenting arguments and proofs
- Interpreting and communicating information accurately.

Questions requiring reasoning skills

KMA0 May 2014 Paper 1F q4

Here are the first five terms of a number sequence.

10 14 18 22 26

(a) Write down the next two terms of the sequence.

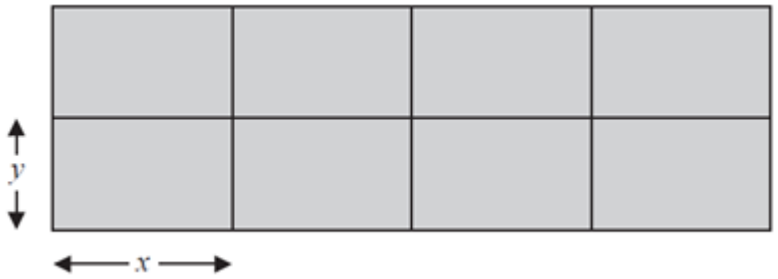
(b) Explain how you worked out your answer.

(c) Find the 12^{th} term of the sequence.

(d) Explain why 100 cannot be a term of the sequence.

KMA0 May 2014 Paper 3H q14

A farmer has 180 metres of fencing.
With the 180 metres of fencing,
he makes an enclosure divided
into eight equal, rectangular pens.



The fencing is used for the perimeter of each pen.

The length of each pen is x metres and the width of each pen is y metres.

(a) (i) Show that $y = 18 - 1.2x$

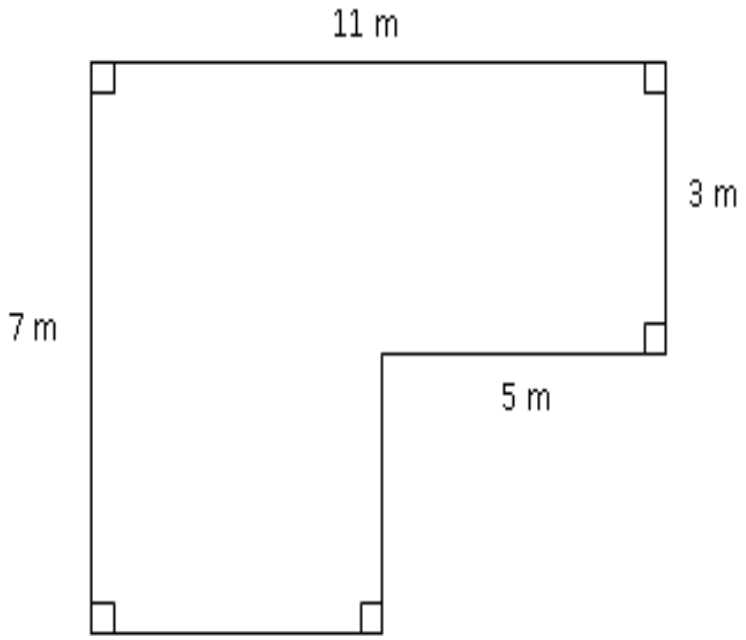
The total area of the enclosure if A m^2

(ii) Show that $A = 144x - 9.6x^2$

Preparing for grade 9

- Usually multi step (but with no structure)
- Mixing of ideas
- Perhaps some problem solving
- Perhaps some mathematical reasoning or proof

Problem solving



The diagram shows the floor plan of a room in Kate's house.

Kate is going to cover the floor with tiles. She is going to buy some packs of tiles.

The tiles in each pack of tiles cover 2 m² of floor. Each pack of tiles costs £24.80

Work out how much it will cost Kate to buy the packs of tiles she needs.

Task 7

Construct a basic mark scheme for this question – worth 5 marks.

A suggestion

Mark	Working	Comments
M1	5 × 3 (=15) **or** 7 × (11 – 5)(=42) **or** 11 × 7 (=77) **or** 5×(7-3)(=20) **or** 11×3(=33) **or** (11–5)×(7–3)(=24)	The first method mark is for a correct start to find the area of the floor.
M1	5 × 3 + 7 × (11 – 5)(=57) **or** 11 × 7 − 5×(7–3)(=57) **or** 11 × 3 + (11–5)×(7–3)(=57)	The second method mark is then awarded for a complete method to find area
M1	'57' ÷ 2 (28.5)	The award of this mark depends on the award of at least one previous method mark. As the focus of the problem is on area, students need to be able to show that they understand this and the method to find the area of a rectangle. A common error in problems of this type is for students to use perimeter rather than area.
M1	'29' × 24.8	The final method mark is for both the appreciation that the number of packs of tiles needs to be rounded up to the nearest integer and then multiplied by the cost.
A1	719.20	At the pre-standardisation meeting with examiners, final decisions will be made as to what is acceptable for the answer. The draft mark scheme for this paper shows that, at present, the only acceptable answer is 719.20

International centres

The FINAL assessment date for both Maths A and Maths B specifications will be January 2019. You may choose whether to start teaching in this September (first assessment June 2018) or September 2017 (first assessment June 2019)

For International GCSE Maths A and International GCSE Maths B, you have a choice of first assessment dates. You may choose to start on the new specification this September, using the first available assessment window for the new specification in June 2018.

If you wish to wait, centres can choose to have a first assessment window in June 2019. This will be the first assessment window for all other International GCSE subjects (excluding English where there is also a choice to move a year early too) and so students will receive only 9-1 grades for all subjects in June 2019.

Poll

Would your centre wish to use 4MA0 and/or 4MB0 in summer 2018?

4MB1

Structure of 4MB1

There are no changes from 4MB0 to the structure of the examination.

Paper 1 will consist of 26 – 30 questions with varying mark allocations, and will be 33⅓% of the total mark.

Paper 2 will consist of 11 – 12 questions with varying mark allocations, and will be 66⅔% of the total mark.

Content changes

Very similar to 4MB0

Slight increase in the number of questions targeting problem solving as well as questions targeting reasoning, interpretation and communication.

Formulae list for paper 2 has been adjusted slightly – the formulae for the circumference and area of a circle will no longer be given.

Candidates will be expected to know these in both papers.

Details of content changes

Section 1 Number

1 **E**	Rationalising the denominator

Surds – we now expect candidates to be able to rationalise the denominator for expressions such as $\frac{20}{\sqrt{14}+3}$ or $\frac{15}{\sqrt{7}-2}$

as well as those with a denominator that is a pure surd.

1 **G**	Weights, measures and money	Carry out calculations using standard units of mass, length, area, volume and capacity, time and average speed Metric and SI units only Carry out calculations using money, including converting between currencies (where conversion is required, the rate of conversion will always be given)

We have clarified this section to include the term “average speed”

1 **J**	Solve problems using upper and lower bounds where values are given to a degree of accuracy

This is a new section. It is something that was previously on spec A

e.g. if x = 15.3 (to 1 dp) and y = 28 (to the nearest integer)

calculate the lower bound of $\frac{x}{y}$

SAMS Paper 1 Qu 8

The lengths of the sides of a rectangle, measured to the nearest 10 mm, are 90 mm and 40 mm.
Find the smallest possible perimeter, in mm, of the rectangle.

(2 Marks)

Details of Content Changes

Section 2 Sets

There are no changes to this section

Details of content changes

Section 3 Algebra

3 **D**	Use of the factor theorem	Including application to cubics and factors of the form $(ax+b)$ or $(ax-b)$
3 **E**	Algebraic division of a cubic by a linear factor	

We have clarified the work on the use of the factor theorem and factorising algebraic expressions to explicitly include "algebraic division of a cubic by a linear factor"

SAMS Paper 1 Qu 26

(a) Use the factor theorem to show that (2*x* + 3) is a factor of

$2x^3 - 3x^2 - 17x - 12$ **(2)**

(b) Hence, factorise completely $2x^3 - 3x^2 - 17x - 12$

(4)

Marking Task 8

(a) Use the factor theorem to show that $(2x+3)$ is a factor of

$$2x^3-3x^2-17x-12$$

(2)

(b) Hence, factorise completely $2x^3-3x^2-17x-12$

(4)

Mark	Scheme
M1	$2\times(1.5)^3-3\times(1.5)^2-17\times(1.5)-12$
A1	= 0
M1	$(2x^3-3x^2-17x-12)\div(2x+3)=x^2-3x+k$
A1	x^2-3x-4
M1	Factorises trinomial quadratic $(x-4)(x+1)$
A!	$(x-4)(x+1)(2x+3)$

3 **G**	Solution of equations of 1st, 2nd and 3rd degree containing one unknown quantity	Solution of quadratics to include solution by factorisation, by graph, by completing the square or by formula Problems that result in the solution of such equations may also be set

This is linked to the previous section.
We have extended the solution of equations to include cubics as well.
So questions of the following form could be asked.

(a) Show that $(2x - 1)$ is a factor of $4x^3 + 16x^2 + 9x - 9$

(b) Solve $4x^3 + 16x^2 + 9x - 9 = 0$

3 **I**	Solve simultaneous equations in two unknowns, one equation being linear and the other being quadratic.

The work on simultaneous equations has been extended to include the case where one equation is linear and the other is quadratic. This brings the specification in line with spec A.

SAMS Paper 2 Qu 5

Solve the simultaneous equations

$$x^2 + y^2 = 5$$
$$x + 1 = y$$

Show clear algebraic working.

(6 marks)

3 **K**	Solve quadratic inequalities in one unknown and represent the solution set on a number line

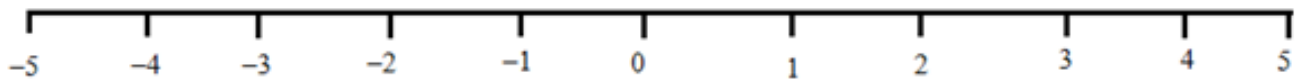
The work on inequalities has been extended to include quadratic inequalities in one unknown. This of course links in with the material on sketching quadratic curves which was on the old 4MB0 specification.

SAMS Paper 1 Qu 27

(a) Solve the inequality $x^2 - x - 6 < 0$

(4)

(b) On the number line below represent your answer to part (a).



(2)

Details of content changes

Section 4 Functions

4 **G**	Variation, direct and indirect proportion	To include only the following: $y \propto x,\ y \propto \frac{1}{x}$ and $y \propto x^2,\ y \propto \frac{1}{x^2}$ $y \propto x^3,\ y \propto \frac{1}{x^3}$ and $y \propto \sqrt{x},\ y \propto \frac{1}{\sqrt{x}}$

We have clarified the work on direct and indirect proportion by restricting the functions.

Direct Proportion Exemplar responses

Task 9

SAMS Paper 1 Qu 19

y varies directly as the square root of *x*.

y = 52 when *x* = 169

Find the value of *x* when *y* = 68

(4 marks)

Discuss the following 3 student responses. Note the methods used (not always successful).

Student A

19 y varies directly as the square root of x.
$y = 52$ when $x = 169$
Find the value of x when $y = 68$

$y = k\sqrt{x}$

$k(52) = \sqrt{169}$

$52k = 13$

$k = \frac{1}{4}$

$\frac{1}{4}y = \sqrt{x}$

$\frac{1}{4}(68) = \sqrt{x}$

$17 = \sqrt{x}$

$x = 17^2$

$= 289$

$x =$ 289

(Total for Question 19 is 4 marks)

Student B

19 y varies directly as the square root of x.
$y = 52$ when $x = 169$
Find the value of x when $y = 68$

$169 : 52$

$: 13 : 4$

$\cdot \frac{68}{4}$

$: 17$

$X : 17^2$

$x = 289$

Student C

19 y varies directly as the square root of x.
$y = 52$ when $x = 169$
Find the value of x when $y = 68$

$Y = KX$

$52^2 = K169$

$\frac{2704}{169} = K$

$K = 16$

4 **I**	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 $(0, c)$

We have added a section about recognising that equations of the form $y = mx + c$ are straight line graphs with gradient m and y intercept $(0, c)$. Many teachers would already expect their students to know this but we have now made it an explicit requirement.

SAMS Paper 1 Qu 13

The straight line **L** has equation $3y = x - 4$

(a) Find the gradient of **L**.

(2)

(b) Find the intercept of **L** on the y-axis.

(1)

4 **M**	Determination of gradients, rates of change, maxima and minima, stationary points and turning points	Students will either be required to differentiate or use graphical methods to arrive at solutions and relate their calculations to their graphs and vice versa

We have also added “turning points” to the section about determining maxima, minima and stationary points. Again this is a phrase many teachers will have used but it is now one which can appear in examination questions.

SAMS Paper 2 Qu 4

The curve C has the equation $y = 6 - x - 2x^2$

(a) Show that the co-ordinates of the stationary point of C are $\left(-\frac{1}{4}, \quad 6\frac{1}{8}\right)$

(4)

(b) (i) Find the gradient of the curve C at the points where $x = -1$ and $x = 0$

(ii) Hence, or otherwise, explain why the stationary point of C is a maximum.

(2)

Matrices - Details of content changes

5 **F**	Transformations of the plane associated with 2×2 matrices	Transformations include: Reflections in and Rotations about the origin Enlargements with centre at the origin

We have tidied up the notes here so that the transformations referred to are linear transformations that can be represented by matrices and the other, more general transformations have been moved to section 8

e.g. **SAMS Paper 2 Qu 10**
A 7 part 14 mark question similar to questions from 4MB0

SAMs Paper 2 Question 10

10 The vertices of triangle A are the points with coordinates (2, 6), (4, 2) and (6, 2).

(a) On the grid opposite, draw and label triangle A.

(1)

Triangle B is the image of triangle A under a reflection in the line with equation $y = -1$

(b) On the grid, draw and label the line with equation $y = -1$

(1)

(c) On the grid, draw and label triangle B.

(1)

Triangle B is transformed to triangle C by the enlargement with centre (0, –2) and scale factor $-\frac{1}{2}$

(d) On the grid, draw and label triangle C.

(3)

Triangle C is transformed to triangle D under the transformation with matrix $\mathbf{M}$ where

$$\mathbf{M} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

(e) On the grid, draw and label triangle D.

(3)

(f) Describe fully the transformation with matrix $\mathbf{M}$.

(2)

(g) Describe fully the **single** transformation that maps triangle D onto triangle A.

Mark Scheme

Question	Working	Answer	Mark
10(a)	**Penalise labelling ONCE only** Triangle A	triangle A drawn	B1
10(b)		$y=-1$ drawn	B1
10(c)		triangle B drawn	B1
10(d)	At least two construction lines through (0, –2)		M1
		triangle C drawn	A2 ft (–1 ee)
10(e)	$\begin{pmatrix}-1 & 0\\ 0 & 1\end{pmatrix}\begin{pmatrix}-1 & -2 & -3\\ 1 & -1 & -1\end{pmatrix}$		M1
		$\begin{pmatrix}1 & 2 & 3\\ 1 & -1 & -1\end{pmatrix}$	A1 ft
		triangle D drawn	A1
10(f)		reflection $x=0$ or y-axis	B1 B1
10(g)	More than one transformation scores B0, B0, B0	enlargement scale factor 2 centre (0, –4)	B1 B1 B1

5 **G**	Combination of transformations	The matrix **AB** represents the transformation represented by **B** followed by the transformation represented by **A**

There is a new note clarifying the interpretation of the matrix **AB** as a combination of transformations.

Details of content changes

Section 6 Geometry

6 **B**	Geometrical reasoning

There is a new line called “Geometrical reasoning” designed to clarify that we shall continue to sometimes ask candidates to “give reasons” when using geometrical facts e.g. “corresponding angles” or “the alternate segment theorem” etc.

6 **H**	Prove the similarity of two triangles
6 **I**	Congruent shapes
6 **J**	Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles

There is a new heading “Prove the similarity of two triangles” and another that requires candidates to “Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles.” We already had a heading about congruent shapes but this section will mean we can ask for more formal proofs about congruent triangles.

Example for 6 **I** and 6 **J** on congruent triangles

SAMS Paper 1 Qu 17

ABCD and *DEFG* are squares that are not identical.

Prove that *AE* = *CG*

(4 marks)

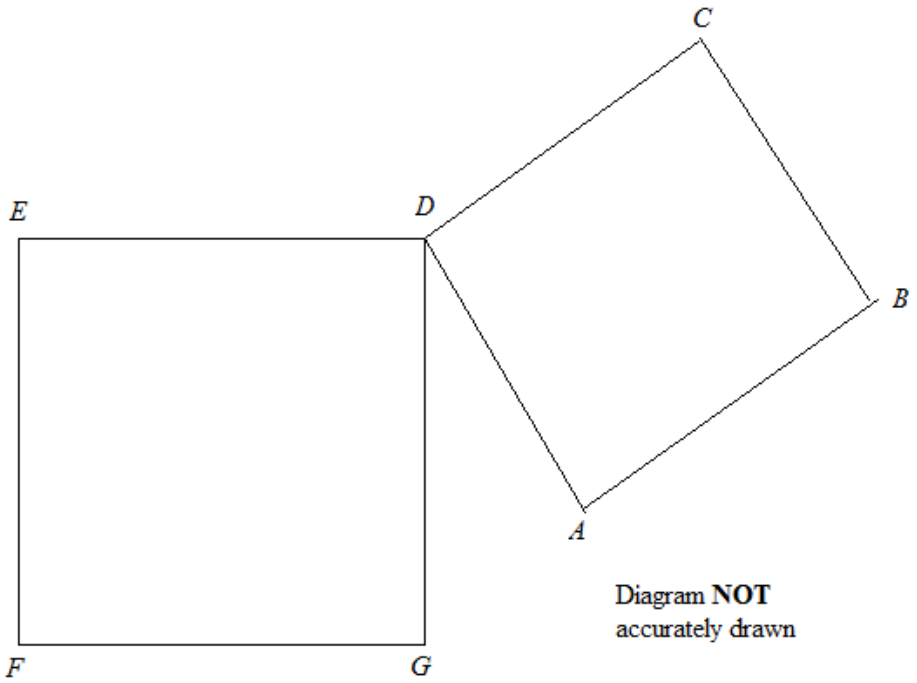


Diagram **NOT** accurately drawn

Task 10

Construct a basic mark scheme for this question – worth 4 marks.

Mark Scheme for Qu 17

Mark	Working	Comments
B1	$\left(\begin{array}{l}\because \angle EDG = \angle ADC = 90^\circ \\ \text{and } \because \angle ADG \text{ is common}\end{array}\right)$ $\angle EDA = \angle CDG$	They first need to state that the angles *EDA* and *CDG* are equal. A suitable reason would need to be given to secure the final mark.
B1	$\therefore \Delta s \begin{matrix} EDA \\ GDC \end{matrix}$ are congruent (SAS)	They need to state that the two triangles are congruent and a suitable reason should be stated (SAS)
dB1	Hence $AE = CG$	This mark would be dependent on the previous two statements for deducing the required result. The formal statement that since the triangles are congruent therefore $EA = GC$ would not be required provided the supporting argument was given.
B1	Two reasons (those in brackets above)	This final mark would only be awarded when a complete argument was given with the supporting reasons.

6 **L**	Properties of a cyclic quadrilateral

We have also added a heading “Properties of a cyclic quadrilateral” to clarify that a knowledge of cyclic quadrilaterals and their properties is included.

Details of content changes

7 **C**	Mensuration of the three–dimensional shapes, right circular cylinder, right circular cone and sphere, cuboid, pyramid, prism	Straightforward calculations, where appropriate, of volumes of the shapes mentioned and also of three–dimensional shapes which can be divided into a collection of such shapes (e.g. cone, hemisphere)

There is no new content here but we have amended the notes to clarify that 3D shapes formed from say a cone and a cylinder are included.

Details of content changes

Section 8 Vectors and transformation geometry

Although the heading has been changed to include transformation geometry there is hardly any alteration in the content.

8 **B**	Understand and use vector notation	The notations $\overrightarrow{OA}$ and **a** will be used, as will column vectors

We have added “position vectors” as a term we may use.

Example for 8 B

SAMS Paper 1 Qu 7

The point *A* has co-ordinates $(3, -4)$ with respect to the origin *O*.

The point *C* is such that $\overrightarrow{AC} = \begin{pmatrix} -5 \\ 7 \end{pmatrix}$

Express, as a column vector, the position vector of *C*.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$

(2 marks)

8 **L**	Multiplication of a vector by a matrix	To include the finding of a matrix for a given transformation of the plane, using $\begin{pmatrix}1\\0\end{pmatrix}$ and $\begin{pmatrix}0\\1\end{pmatrix}$ These transformations will be those for which the origin is unchanged.

We have added a section to the notes about using the effects of a transformation on the vectors $\begin{pmatrix}1\\0\end{pmatrix}$ and $\begin{pmatrix}0\\1\end{pmatrix}$ to find the matrix representation of this transformation.

8 J	Transformations of the plane	Reflections in any line Rotations about any point Translations Enlargements

The only other change involves the listing of transformations of the plane that cannot be represented by a matrix but were expected in the 4MB0 specification e.g. reflections in any line, translations etc.

SAMS Paper 2 Qu 10

A 7 part question worth 14 marks

Details of content changes

Section 9 Trigonometry

There are no changes to this section

Details of content changes
Section 10 Statistics and Probability

There are a few minor alterations of the wording here to clarify some of the terms and the coverage we expect.

10 **A**	Graphical representation of numerical data	To include bar charts, pie charts and histograms Cumulative frequency graphs are excluded

We now refer to bar charts and pie charts rather than “bar diagrams” and “circular diagrams”.

10 **D**	Determination of a modal class and the class containing the median for grouped data

For grouped data we have clarified that we would expect candidates to determine the class containing the median.

They are not expected to estimate the median using interpolation.

10 **I**	Using simple conditional probability for combined events	
10 **J**	Finding very simple conditional probability	**The notation P(*A*|*B*) will not be used**

We have changed the section on conditional probability so that it is clear that candidates are expected to use simple conditional probabilities and also find them.

SAMS Paper 1 Qu 9

A fair 6-sided red dice and a fair 6-sided blue dice are rolled. The score on the red dice and the score on the blue dice are added together to get the total.

Given that the score on the red dice is 1, find the probability that the total is **less than 4**

(2 marks)

10 **K**	Understand and use the term 'expected frequency'

Finally we have added a heading "Understand and use the term expected frequency" to clarify that we might, for example, ask how many times we would expect to get a six if a fair die is rolled 150 times.

SAMS Paper 1 Qu 14

The probability that a train arrives on time at a station is 0.76

Mary has a list of all the trains that are due to arrive at the station on Monday. She picks, at random, a train from this list.

(a) Write down the probability that this train **will not** arrive on time at the station on Monday.

(1)

600 trains arrive at this station on Monday.

(b) Work out an estimate for the number of trains that **do** arrive on time at this station on Monday.

(2)

Considering Delivery Strategies and sharing best practice

1. Teaching Strategies.
2. Resources.
3. Technology.

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- Specification
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Support

Subject Advisor: Graham Cumming

- email: TeachingMaths@pearson.com
- telephone: 020 7010 2174
- Twitter: @EmporiumMaths

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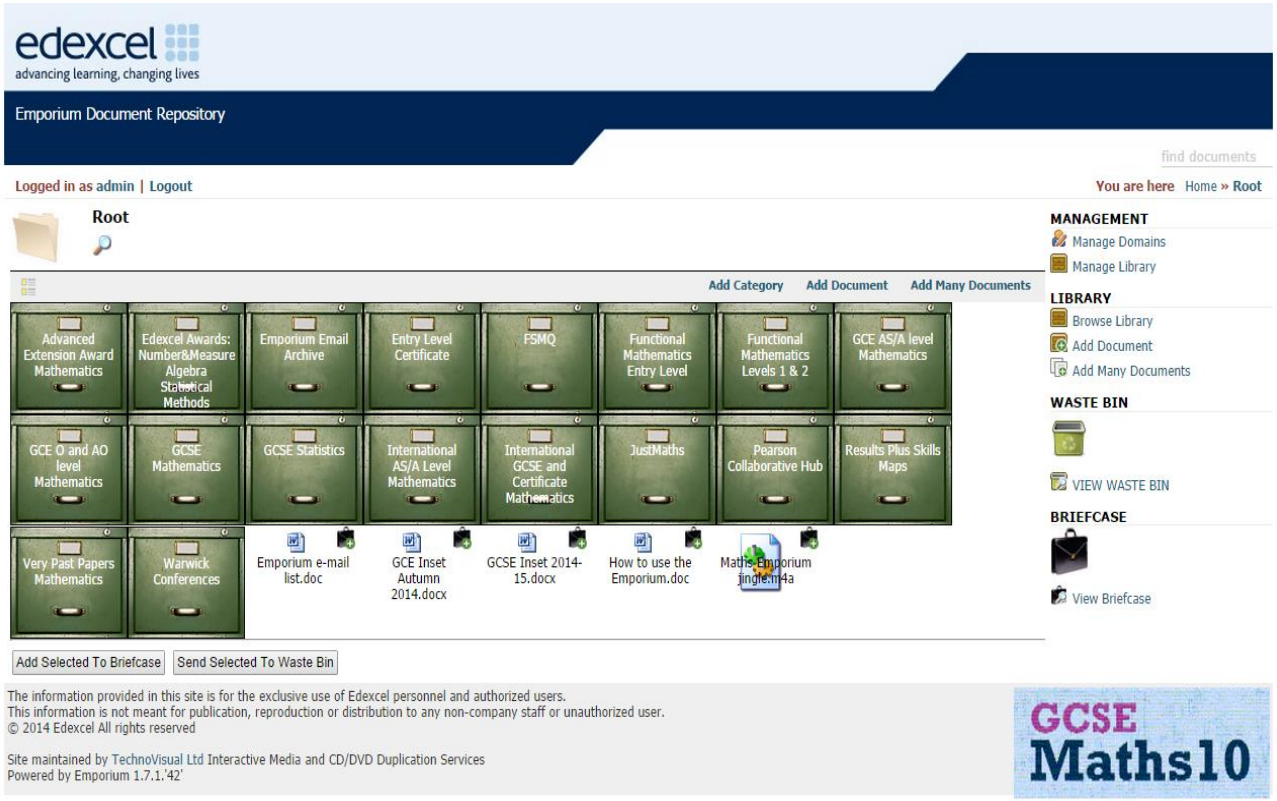

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   This page shows the minimum marks needed to achieve a certain grade for all UK and international examinations. Also refer to the examiners report which is available for download with other documents.

2. **Examination Results Statistics**

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