



# Understanding Assessment and Improving Delivery in International GCSE Mathematics

Your Trainer Today is: TRAINERS NAME

# Welcome to this Professional Development Training

Designed for teachers teaching or who are looking to teach the Pearson Edexcel International GCSE Mathematics Specification.

- Be introduced to the idea of assessment objectives: what are they and why they are used when writing examination papers,
  - analyse recent question papers and learn which types of question match the different assessment objectives,
  - investigate different assessment objectives, considering how questions in these areas have been answered by looking at feedback from previous exam series,
  - discuss strategies for teaching to try and make sure students can access questions targeting different assessment objectives,
  - look at Problem Solving
  - look at Reasoning
  - look at extended response questions,
  - look at how Edexcel mark candidates work,
  - review the support Pearson offers for the qualification,
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# Welcome to Pearson

# Welcome to Pearson Edexcel

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We are the world's leading learning company and as the **UK's largest awarding organisation**, best placed to provide qualifications aligned to the British

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Our international **heritage stretches back over 150 years**.

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Today, we partner with schools, universities and employers worldwide, offering world-class, globally-recognized qualifications to over **3.5 million students a year**.

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**6,500**

Trusted and recognized qualifications partner to 6,500 schools, colleges and employers globally.

**10 million**

We mark over 10 million exam scripts on behalf of the UK Department for Education each year.

**70**

We operate in 70 countries worldwide.

# Introduction to Assessment

# Structure of an Assessment

The **key task** of an assessment in mathematics is to measure a student's ability in mathematics.

This means producing a mechanism which enables the student **to demonstrate** their ability to express these mathematical constructs.

Possible mechanisms by which this can be done include:

- Discussion with the student / guided problem solving
- Coursework or extended problem solving
- Marking exercise books
- Written examinations/ tests

# Structure of an Assessment

A written test seeks to measure student's ability (in mathematics) by requiring them to **demonstrate** their knowledge of mathematical facts and their ability to work with mathematical concepts.

In Edexcel examinations this means that the specification includes details of:

the mathematical facts and skills that have to be learned



Content

the way(s) in which the student will have to demonstrate what they have learned.



Assessment  
Objectives

# Structure of an Assessment

## Content

Facts

Techniques

Relationships

## Assessment Objectives

Demonstrate knowledge of facts, techniques and relationships  
**(DO IT)**

Demonstrate application of facts, techniques and relationships to solve problems  
**(SOLVE IT)**

Demonstrate mathematical reasoning by using application of facts, techniques and relationships to solve problems  
**(SHOW IT)**

In outline this is the Edexcel International GCSE scheme.



# Structure of an Assessment

## **Content coverage**

- sufficient for each separate assessment
- (samples from (nearly) all sections of the content list)
- complete coverage over a cycle of assessments

## **Assessment Objectives**

- fixed from assessment to assessment
- same weightings from assessment to assessment (some leeway allowed)

# Structure of an Assessment

An example page from the GCSE 4MA1 spec – Content pages 11 – 39

## 1 Numbers and the number system

	Students should be taught to:	Notes
<b>1.1 Integers</b>	<b>A</b> understand and use integers (positive, negative and zero)	
	<b>B</b> understand place value	
	<b>C</b> use directed numbers in practical situations	e.g. temperatures
	<b>D</b> order integers	
	<b>E</b> use the four rules of addition, subtraction, multiplication and division	
	<b>F</b> use brackets and the hierarchy of operations	
	<b>G</b> use the terms 'odd', 'even', 'prime numbers', 'factors' and 'multiples'	
	<b>H</b> identify prime factors, common factors and common multiples	
<b>1.2 Fractions</b>	<b>A</b> understand and use equivalent fractions, simplifying a fraction by cancelling common factors	$\frac{8}{60} = \frac{2}{15}$ in its simplest form (lowest terms)

# Structure of the Edexcel Assessment

Assessment Objective	Demonstrate knowledge, understanding and skills in	Percentage
AO1	number and algebra: <ul style="list-style-type: none"><li>• numbers and the numbering system</li><li>• calculations</li><li>• solving numerical problems</li><li>• equations, formulae and identities</li><li>• sequences, functions and graphs.</li></ul>	$60 \pm 3$
AO2	shape, space and measures: <ul style="list-style-type: none"><li>• geometry and trigonometry</li><li>• vectors and transformation geometry.</li></ul>	$25 \pm 3$
AO3	handling data: <ul style="list-style-type: none"><li>• statistics</li><li>• probability.</li></ul>	$15 \pm 3$

In outline this is the Edexcel Int GCSE scheme.

# Structure of the Edexcel Assessment

Sitting with these weightings are the higher order skills of:

- Mathematical problem solving
- Mathematical reasoning and argument

These are not 'add-ons' but are embedded in the 3AOs.

**Structure of the  
Edexcel Int  
GCSE  
assessment – all  
papers**

All figures in the following table are expressed as marks out of 100.

	AO1	AO2	AO3	Problem Solving	Mathematical Reasoning
1F	60	25	15	25	15
2F	60	25	15	25	15
1H	60	25	15	30	20
2H	60	25	15	30	20

# Introducing International GCSE Modular

# The two different routes of Assessment

If you're happy with the linear approach, there is no pressure to move to the modular route; our linear International GCSEs will continue to be offered and taken widely by students around the world.



## Modular route

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Unit assessments can be taken over multiple exam series.

Grades are calculated on raw marks which are then converted to a UMS (Uniform Mark Scale).

Students can re-sit individual units in any exam series.

Once a student has all their unit results, they can 'cash in' these results for their grade.

A modular route is only offered by Pearson Edexcel at International GCSE

## Linear route

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Assessments for all units are taken together in one exam series.

Grades are calculated on raw marks only.

Students can re-sit assessments for all units together in one exam series.

The grade students receive are calculated at the end of the exam series in which they sat their assessments.



# Modular exam structure

The modular and linear approach contain the same content, but the modular approach breaks the journey into two units with an exam at the end of each unit.

Unit 1	Unit 2
<b>Foundation Tier</b> <ul style="list-style-type: none"><li>• Duration: 2 hours</li><li>• Total number of marks: 100</li><li>• Weighting: 50%</li><li>• Grad range: 5-1</li></ul>	<b>Foundation Tier</b> <ul style="list-style-type: none"><li>• Duration: 2 hours</li><li>• Total number of marks: 100</li><li>• Weighting: 50%</li><li>• Grad range: 5-1</li></ul>
<b>Higher Tier</b> <ul style="list-style-type: none"><li>• Duration: 2 hours</li><li>• Total number of marks: 100</li><li>• Weighting: 50%</li><li>• Grad range: 9-4 with an allowable grade 3</li></ul>	<b>Higher Tier</b> <ul style="list-style-type: none"><li>• Duration: 2 hours</li><li>• Total number of marks: 100</li><li>• Weighting: 50%</li><li>• Grad range: 9-4 with an allowable grade 3</li></ul>
<b>For each unit exam, a formulae sheet will be included, and the use of a calculator is permitted.</b>	
<b>Approximately 40% of questions are the same across Foundation and Higher Tier papers.</b>	



# Modular content summary

The modular and linear approach contain the same content, but the modular approach breaks the journey into two units with an exam at the end of each unit.

Unit 1	Unit 2
<p>Number (AO1)</p> <ul style="list-style-type: none"><li>• Basic number skills</li><li>• Standard form</li><li>• Limits of accuracy</li><li>• <b>Surds and indices</b></li></ul>	<p>Number (AO1)</p> <ul style="list-style-type: none"><li>• Ratio and proportion</li><li>• Percentage skills</li><li>• Standard form</li><li>• <b>Repeated percentage change</b></li></ul>
<p>Algebra (AO1)</p> <ul style="list-style-type: none"><li>• Basic algebra skills</li><li>• Set notation</li><li>• Plotting graphs</li><li>• Solving basic quadratics <math>x^2 + bx + c = 0</math></li><li>• <b>Solving quadratics <math>ax^2 + bx + c = 0</math></b></li><li>• <b>Completing the square</b></li><li>• <b>The quadratic formula</b></li></ul>	<p>Algebra (AO1)</p> <ul style="list-style-type: none"><li>• Inequalities</li><li>• Simultaneous equations</li><li>• Sequences</li><li>• Change of subject</li><li>• <b>Algebraic proof</b></li><li>• <b>Direct and inverse proportion</b></li><li>• <b>Summation of arithmetic series</b></li><li>• <b>Function notation and transformations</b></li><li>• <b>Differentiation</b></li></ul>
<p><b>Topics in black: studied by both Foundation and Higher Tiers students</b> <b>Topics in red: studied by Higher Tier students only.</b></p>	

# Modular content summary, cntd.

The modular and linear approach contain the same content, but the modular approach breaks the journey into two units with an exam at the end of each unit.

Unit 1	Unit 2
<p>Shape, Space and Measure (AO2)</p> <ul style="list-style-type: none"><li>• Properties and areas of shapes</li><li>• Trigonometry</li><li>• Pythagoras' theorem</li><li>• Compound measures (speed, density)</li><li>• Sine and Cosine rule</li><li>• Sine area of a triangle</li><li>• 3D Pythagoras' theorem</li></ul>	<p>Shape, Space and Measure (AO2)</p> <ul style="list-style-type: none"><li>• Angles in polygons and circles</li><li>• Symmetry</li><li>• Constructions</li><li>• Volume</li><li>• Similarity</li><li>• Transformations</li><li>• Circle theorems</li><li>• Similar area and volume</li><li>• Vectors</li></ul>
<p>Handling Data (AO3)</p> <ul style="list-style-type: none"><li>• Basic probability</li><li>• Tree diagrams</li><li>• Conditional probability</li><li>• Histograms</li></ul>	<p>Handling Data (AO3)</p> <ul style="list-style-type: none"><li>• Statistical measure</li><li>• Cumulative frequency diagrams</li></ul>
<p><b>Topics in black: studied by both Foundation and Higher Tiers students</b> <b>Topics in red: studied by Higher Tier students only.</b></p>	

# Teaching in a Modular Way

You may want to change the way you teach the International GCSE Mathematics A Specification Content if you take the Modular route for assessment.

- To support your planning and teaching of the course, we are producing **course planners, editable schemes of work** and **Getting Started Guide**.
- First teaching for International GCSE Mathematics A (Modular) is September 2024
- First assessment of International GCSE Mathematics A (Modular) is May/June 2025

# Re-sits for Modular International GCSE

- Learners can re-sit any unit irrespective of whether the qualification is to be cashed in.
- If a learner resits a unit more than once, only the better of the two most recent attempts of that unit will be available for aggregation to a qualification grade.
- Results of units will be held in Pearson Edexcel's unit bank for as many years as this specification remains available.
- Once International GCSE in Mathematics A (Modular) has been certificated, all unit results are deemed to be used up at that level. These results cannot be used again towards a further award of the same qualification at the same level.

# Understanding the Assessment Objectives

AOs are described  
in terms of content  
and mathematical  
processes

## **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.



More number than  
algebra at F tier



More algebra than  
number at H tier

AOs are described  
in terms of content  
and mathematical  
processes

## **AO2** Demonstrate knowledge, understanding and skills in shape, space and measures:

- geometry and trigonometry
- transformation geometry
- vectors



Only at H tier

AOs are described  
in terms of content  
and mathematical  
processes

## **AO3** Demonstrate knowledge, understanding and skills in

- statistics
- probability



## Some examples of 'knowledge'

Knowledge – know facts and definitions.

Know (standard) processes

# Some examples of 'knowledge'


Knowledge - know facts

$y^2$  means  $y \times y$   This is a definition

In the evaluation of  $3 \times (6 + 4)$  the expression inside the brackets has to be worked out first.

The sum of the angles around a point is  $360^\circ$  This is a fact

The range of a set of measurements is the difference between the largest and the smallest

  
This is a definition

## Some examples of 'knowledge'

Knowledge - processes

$$15\% \text{ of } \$60 \rightarrow 60 \div 100 = 0.60 \text{ and } 0.60 \times 15 = 9$$

$$15\% \text{ of } \$60 \rightarrow 15 \div 100 \times 60 = 9$$

$$\text{Solve } 4y - 3 = 8 - y$$

$$4y + y = 8 + 3$$

$$5y = 11$$

$$y = 11/5$$

## Some examples of 'knowledge'

Knowledge - processes

Expand and simplify  $(2y + 1)(y - 3)(y + 2)$

$$\text{Step 1} \quad (y - 3)(y + 2) = y^2 - y - 6$$

$$\text{Step 2} \quad (2y + 1)(y^2 - y - 6) = 2y^3 - 2y^2 - 12y + y^2 - y - 6$$

$$\text{Step 3} \quad 2y^3 - y^2 - 13y - 6$$

## Some examples of 'knowledge'

### Knowledge – processes

Work out the size of the internal angle of a regular decagon

One approach is  $360 \div 10 = 36$   
followed by  $180 - 44 = 144$

Of course the direct approach is also possible.

## Some examples of 'knowledge'

Knowledge - processes

The mean height of the 12 girls in a class is 160 cm  
The mean height of the 18 boys in the class is 170 cm

Quote and use  $\frac{ma + nb}{m + n}$

## Some examples of 'knowledge'

### Knowledge - processes

The mean height of the 12 girls in a class is 160 cm  
The mean height of the 18 boys in the class is 170 cm

Total height of all the girls is  $12 \times 160 = 1920$  cm  
Total height of all the boys is  $18 \times 170 = 3060$  cm  
Total height of all the students =  $3060 + 1920 = 4980$  cm

Total number of students =  $12 + 18 = 30$

Mean height of all the students =  $4980 \div 30 = 166$  cm

## Demonstrating 'knowledge' in exams when a modern calculator is allowed

- Functionality of many inexpensive calculators
- Can carry out operations with fractions
- Can write a number as a product of its prime factors
- Can solve simultaneous equations when written in 'usual' form.
- Can solve quadratic equations when written in 'usual' form
- Can carry out operations with surds including rationalising the denominator
- Can draw algebraic graphs



Demonstrating  
'knowledge' in  
exams when a  
calculator is **NOT**  
allowed on a  
question

At International GCSE these are usually signalled by

- 'Show'
- 'Use algebra to'
- 'You must show your working'
- 'Show full algebraic working'

Demonstrating  
'knowledge' in  
exams when a  
modern calculator is  
allowed

Example. Paper 1 Foundation

**19** Show that  $2\frac{1}{3} \div 5\frac{1}{4} = \frac{4}{9}$

Example. Paper 1 Higher

**3** Find the highest common factor (HCF) of 72 and 108  
Show your working clearly.

Demonstrating  
'knowledge' in  
exams when a  
modern calculator is  
allowed

Example. Paper 1 Higher Question 6 (b)

(b) Solve  $3n - 4 = \frac{5n + 6}{3}$

Show clear algebraic working.

Example. Paper 1 Higher

**12** Solve the simultaneous equations

$$4x + 3y = 9.6$$

$$6x + 5y = 16.8$$

Show clear algebraic working.

Demonstrating  
'knowledge' in  
exams when a  
modern calculator is  
allowed

### Example. Paper 1 Higher

20 In the diagram,  $ABCDE$  is a regular pentagon.

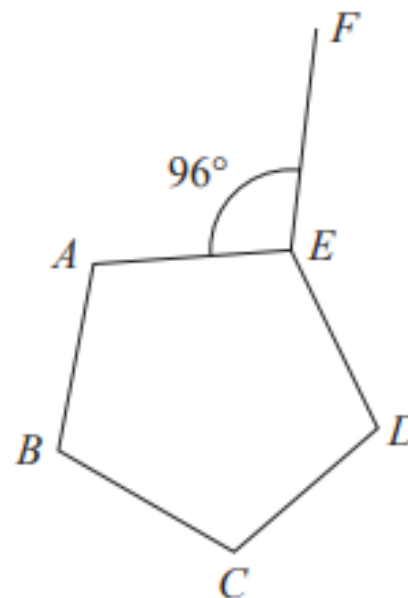


Diagram **NOT**  
accurately drawn

Angle  $AEF = 96^\circ$

Work out the size of the obtuse angle  $FED$

Show your working clearly.

## Demonstrating 'knowledge' in exams when a modern calculator is allowed

### Activity 1

Demonstrating 'knowledge' when solving a quadratic equation by using the formula or by completing the square.

- The philosophy is to reward application of the process(es)
- Accurate substitution
- Correct order of working out in a correct expression
- Correct roots BUT ONLY IF there is evidence of correct processes

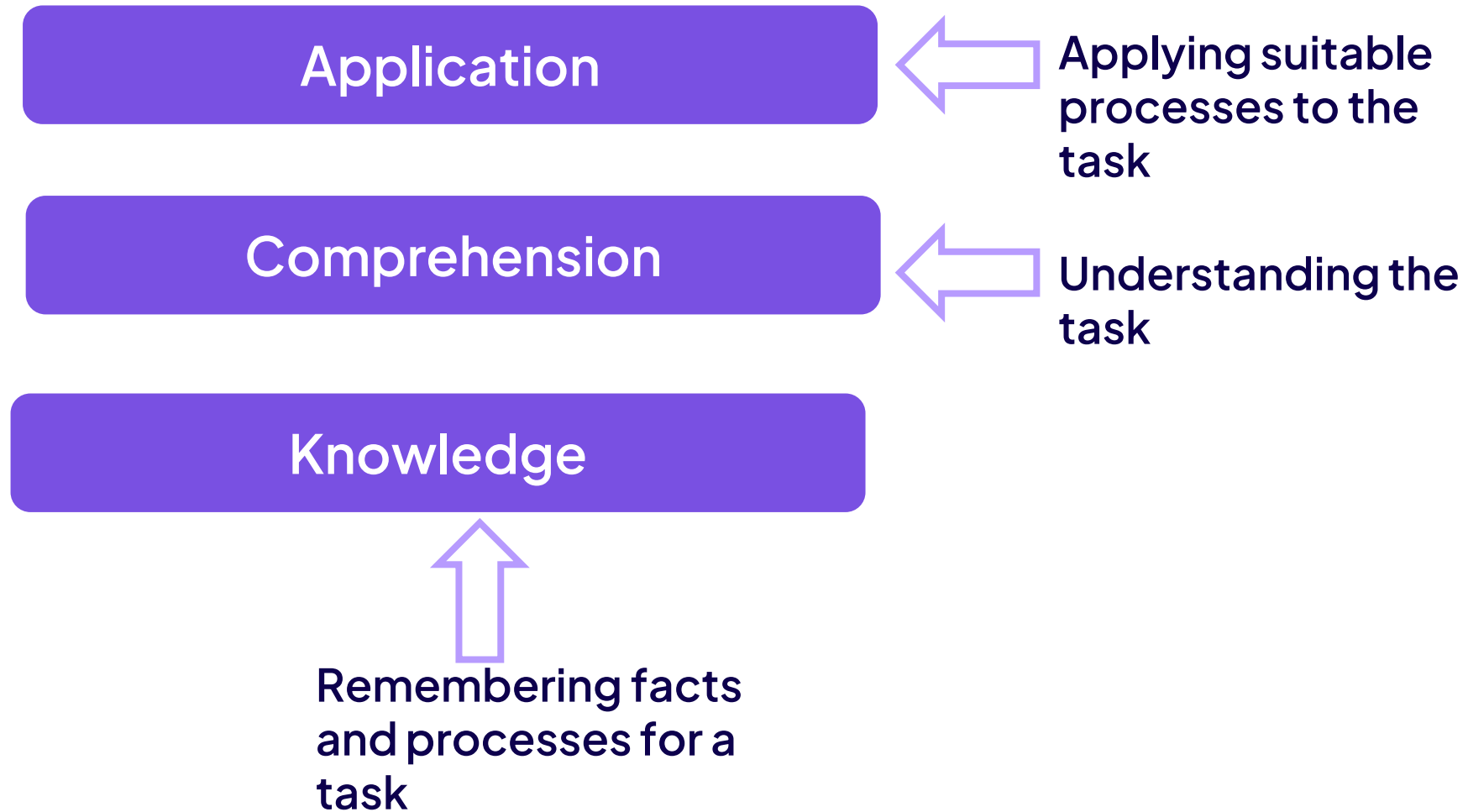
## Demonstrating 'knowledge' in exams when a modern calculator is allowed

### Activity 1

Demonstrating 'knowledge' when solving a quadratic equation by using the formula or by completing the square.

- Complete the record sheet for the 6 student attempts.
- Does the attempt display knowledge of the process?

# The theoretical underpinning of the assessment objectives for Int GCSE



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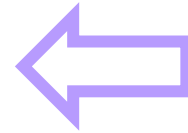


list, define, tell, describe, identify, show, label,  
collect, examine, tabulate, quote, name, who,  
when, where, etc.

These are general  
instruction words.  
More specifically for  
maths we have.....

Name, write down, simplify, solve

# The theoretical underpinning of the assessment objectives for Int GCSE



Understanding the task

understanding information  
grasp meaning  
translate knowledge into new context  
interpret facts, compare, contrast  
order, group, infer causes  
predict consequences

# The theoretical underpinning of the assessment objectives for Int GCSE



summarise, describe, interpret, contrast, predict,  
associate, distinguish, estimate, differentiate,  
discuss, extend

These are general  
instruction words.  
More specifically for  
maths we have.....

Find!

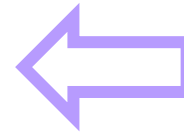
# The theoretical underpinning of the assessment objectives for Int GCSE



use information  
use methods, concepts, theories in new  
situations  
solve problems using required skills or knowledge

# The theoretical underpinning of the assessment objectives for Int GCSE

Application



Applying suitable processes to the task

apply, demonstrate, calculate, complete,  
illustrate, show, solve, examine, modify,  
relate, change, classify, experiment, discover

These are general  
instruction words.  
More specifically for  
maths we have... ..

Find!

## The theoretical underpinning of the assessment objectives for Int GCSE

### Activity 2

Make a record of the demand words used in the two examination papers 4MA1/2F and 4MA1/2H (both June 2024)

Write down any comments/ observations on your results.

## The theoretical underpinning of the assessment objectives for Int GCSE

### Activity 2

Make a record of the demand words used in the two examination papers 4MA1/2F and 4MA1/2H (both June 2024)

Write down any comments/ observations on your results.

There appear to be a greater variety of command words at F

Both F and H have 'Find' and 'Work out' as the most frequent demand words

There are more 'Work out' than 'Find' at F tier

This reverses at H tier

# Understanding Mark Schemes



## Understanding mark schemes – marking activities

### Mark codes

**M.** marks are awarded for a correct application of a method, or a correct attempt.

**A.** marks are awarded for a correct answer subject to a correct method being used.

The marking combination MOA1 is not possible

**B.** marks are independent marks, usually for a ‘write down’

## Understanding mark schemes – marking activities

### Other abbreviations

**Ft** means follow through. Applied on some A or B marks

**bod** benefit of doubt

**isw** ignore subsequent working

**cao** correct answer only

**cso** correct solution only

**d** or **dep** is a dependent M mark

# Marking activities

## Marking activities

### Activity 3

There are 2 Foundation candidate responses for you to mark. Use only the scheme and write the marks you award at the point you award them. This question [Q6] comes from a 2F paper

6 There are 150 animals on a farm.

Of these animals

19 are sheep

32 are goats

3 are dogs

The rest of the animals are chickens.

Write the number of chickens as a fraction of the total number of animals.

Give your fraction in its simplest form.

# Marking activities

## Activity 3

54 seen  
gains the  
first M  
mark

6 There are 150 animals on a farm.  
Of these animals  
19 are sheep  
32 are goats  
3 are dogs  
The rest of the animals are chickens.  
Write the number of chickens as a fraction of the total number of animals.  
Give your fraction in its simplest form.

$$\begin{array}{r} 19 \\ 32 \\ 3 \\ \hline 54 \end{array}$$
$$150 - 54 = 96$$
$$\frac{54}{96} = \frac{9}{16}$$
$$\frac{9}{16}$$

(Total for Question 6 is 3 marks)

Although we see 96, it must be seen with the correct denominator, so M0

A0 automatically follows M0

Now could you mark the two responses in your delegate booklet the same way please.

# Marking activities

## Attempt 1

M1, M1, A0

54 seen gains the first method mark. 96/150 is not shown for the second method mark but 9/25 (ie 54/150 in its simplest form) is an alternative for the award of the second method mark. The final answer is incorrect.

## Attempt 2

M1, M0, A0

54 seen gains the first method mark. If only the 96 had been seen, this also could have been awarded the first method mark. There is no further working shown so no further marks.

## Marking activities

### Activity 4

There are now 2 Higher candidate responses for you to mark. Use only the scheme and write the marks you award at the point you award them. This question [Q13] comes from a 1HR paper.

As before, complete the question FIRST, and then mark the responses ONLY using the MS

13

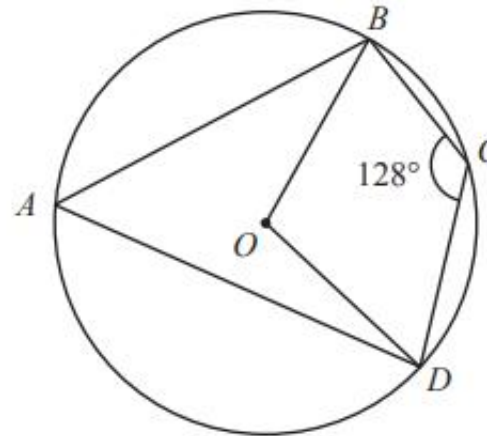


Diagram **NOT**  
accurately drawn

*A, B, C and D are points on a circle, centre O*

*Angle  $BCD = 128^\circ$*

*Work out the size of angle  $OBD$*

*Give a reason for each stage of your working.*

## Understanding mark schemes – marking activities

### Response 1

M1 for  $\text{BAD} = 180 - 128 (= 52)$

M0 although  $52 \times 2 = 104$  is seen this has been wrongly assigned to

angle OBD. If this calculation had not been assigned to angle OBD we could award this mark as the

student would not have contradicted their calculation but because they have assigned this to the

wrong angle we withhold the mark, this is also the case when an incorrect statement is made or the

angle is written in the wrong place on the diagram.

A0 answer is incorrect

B0 although they

have given the angle at the centre reason, this hasn't been used in their method. The wording for cyclic quadrilateral is not complete, they also need 'opposite angles' as per the underlined words in the mark scheme

M1M0A0B0 - 1 mark



## Understanding mark schemes – marking activities

### Response 2

M1 for  $\angle BAD = 180 - 128 (= 52)$

M1 for  $\angle BOD = 52 \times 2 (= 104)$

A0 answer is incorrect

B1 for

a correct circle theorem for their method - either cyclic quadrilateral or angle at the centre (they have used double as an alternative to  $2 \times$  which is acceptable). It is possible to gain B2 without the A mark but it is dependent on a fully correct method to find  $\angle OBD$  with the correct reasons - the student doesn't have this as their last stage is incorrect - they haven't used the triangle  $OBD$

M1M1A0B1 - 3 marks

# Reasoning and Problem Solving

# Mathematical reasoning and problem solving in Int GCSE mathematics

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

	<b>Problem solving</b>	<b>Mathematical reasoning</b>
Foundation (1F and 2F)	25%	15%
Higher (1H and 2H)	30%	20%

# Mathematical reasoning and problem solving in Int GCSE mathematics

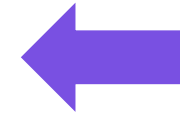
## Mathematical reasoning

make deductions  
draw conclusions  
present arguments and proofs  
interpret information accurately  
communicate results clearly

# Mathematical reasoning and problem solving in Int GCSE mathematics

## Problem solving

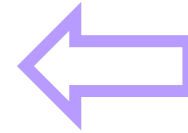
translate a situation into suitable mathematical form – then –  
carry out a suitable (possibly sequence of) mathematical process(es) – then –  
state the answer



There is some overlap between this and reasoning

# Mathematical Reasoning

Evaluation



Not really present  
in examinations

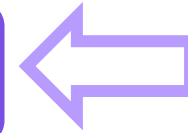
Synthesis

Present arguments  
and proofs, make  
deductions and draw  
conclusions from  
mathematical  
information.

Analysis

# Problem Solving

Evaluation



Not really present  
in examinations

Synthesis

Translating a problem in a  
mathematical or non-  
mathematical context into a  
process or a series of  
mathematical processes  
and solve the problem.

Analysis

# Reasoning in International GCSE mathematics

Reasoning involves these characteristic processes:

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



**Some  
circularity  
here!**



# Reasoning in Int GCSE mathematics

## Reasoning involves these characteristic processes

- making deductions and drawing conclusions from mathematical information
- Carrying out a calculation to answer a yes/no question

In a car sale all normal prices have been reduced by 12%.

- The normal price of a car Omar likes is \$24000
- Omar has \$20000
- Does he have enough money to buy the car in the sale?

# Reasoning in International GCSE mathematics

constructing chains of reasoning

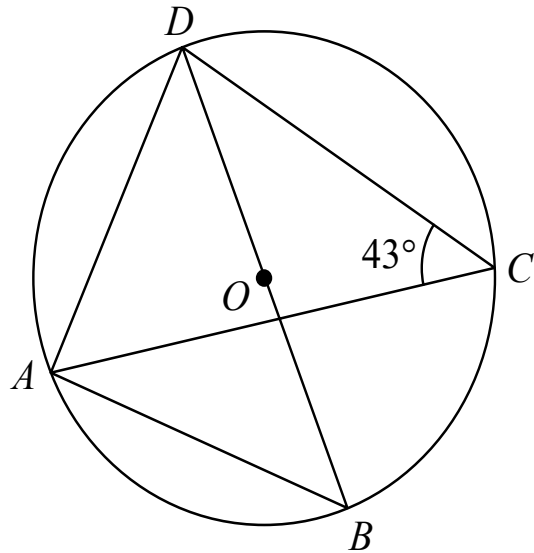


Diagram **NOT**  
accurately drawn

This will  
always be  
counted as  
reasoning

Work out the size of angle  $ADB$ .  
Give a reason for each stage in your working.

# Reasoning in International GCSE mathematics

Presenting arguments and proofs

Line **L**<sub>1</sub> has equation  $y = 3x + 5$   
Line **L**<sub>2</sub> has equation  $6y + 2x = 1$

Show that **L**<sub>1</sub> is perpendicular to **L**<sub>2</sub>


Students do not  
have to **PROVE** the  
rule  
 $m_1 \times m_2 = -1$

They just have to  
show that in this case  
the gradients do  
satisfy that rule.

# Reasoning in International GCSE mathematics

Presenting arguments and proofs

Helena thinks that any number of the form  $2^n + 3$  is always a prime number when  $n$  is a whole number. Give an example to show that Helena is wrong.

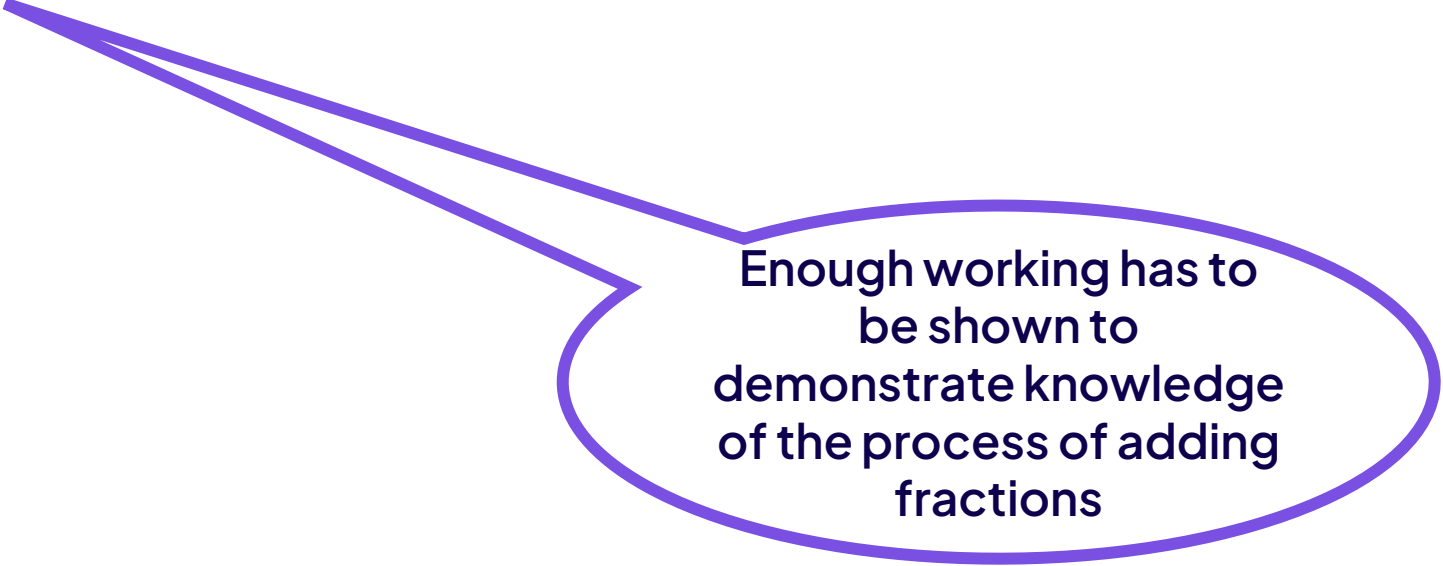


The term  
'counterexample'  
does not appear in  
the specification

# Reasoning in International GCSE mathematics

Presenting arguments and proofs

Show that  $1\frac{2}{3} + 2\frac{3}{4} = 4\frac{5}{12}$



Enough working has to be shown to demonstrate knowledge of the process of adding fractions

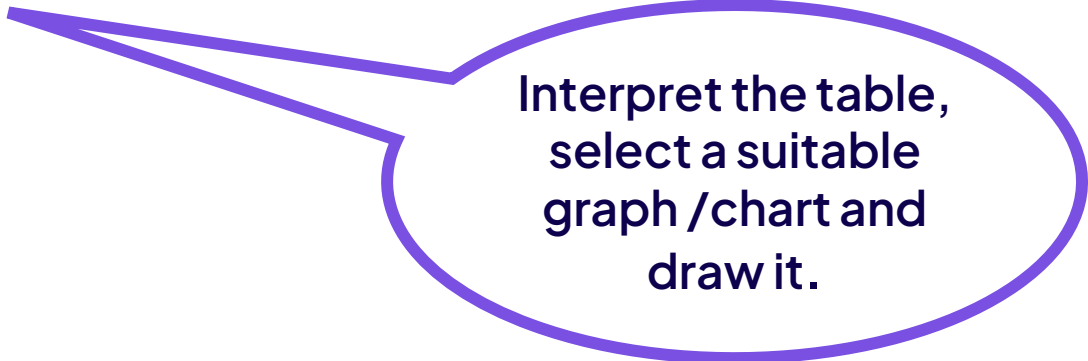
# Reasoning in International GCSE mathematics

Interpreting and communicating information accurately.

The table shows the average monthly temperatures, in  $^{\circ}\text{C}$ , for four months in London and in Cairo.

	January	April	July	October
London ( $^{\circ}\text{C}$ )	5	11	19	13
Cairo ( $^{\circ}\text{C}$ )	14	21	28	23

Show this information by drawing a suitable diagram on the grid below.



Interpret the table,  
select a suitable  
graph /chart and  
draw it.

# Reasoning in Int GCSE mathematics

## Activity 5

- There are 5 questions from two January papers.
- Work through the questions:
- Make a decision of whether each question is a reasoning question or not
- If it is a reasoning question, decide on what aspects of the question makes it so.

# Reasoning in International GCSE mathematics

Reasoning involves these characteristic processes:

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



Some  
circularity  
here!



# Reasoning in Int GCSE Mathematics

- A. Students have to decide on a method to communicate the data – this is reasoning.
- B. This is a complex simplification and all 5 marks were set against reasoning here.
- C. One mark [the final mark] was set against reasoning. ‘Explain’ a statement etc is always reasoning.
- D. Two marks were allocated to reasoning in this question. ‘Give a reason’ is always going to be a reasoning mark.
- E. There is no reasoning here, this is demonstration of knowledge.

## Problem solving in International GCSE mathematics

Some further comments on what are the properties of a mathematical problem. A mathematical problem:

- requires use of techniques from more than one content area
- requires a succession of processes – but not just a standard set such as with simultaneous equations
- is unfamiliar so there is no **obvious** standard method of solution
- is in an unfamiliar context
- requires translation to a form which allows suitable mathematical processes to be used to solve the problem.

## Problem solving in International GCSE mathematics

Some further comments on what are the properties of a mathematical problem.

So a question such as

Solve

$$2x + y = 6$$

$$2x^2 + y^2 = 66$$

....would NOT normally be considered a mathematical problem, even though many students will find it difficult.

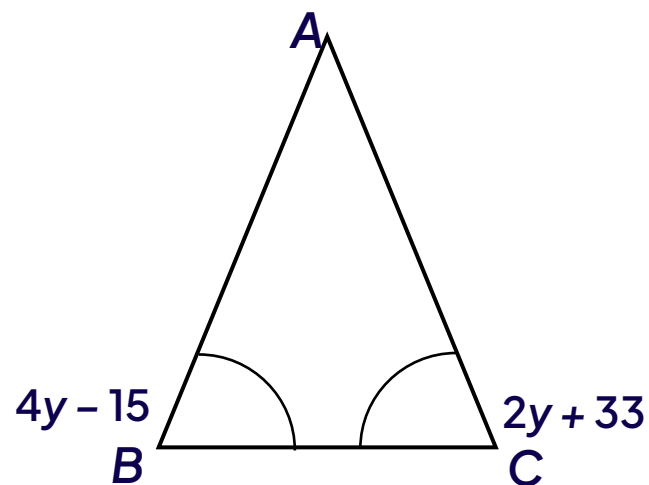
## Problem solving in International GCSE mathematics

### Activity 6

Make up some further examples which (although possibly difficult) should **not** be considered as problem solving.

## Problem solving in International GCSE mathematics

Translate a situation into suitable mathematical form



$$4y - 15 = 2y + 33$$

Triangle ABC is isosceles with  $AB = AC$   
Find the size of angle BAC

Base angles of an isosceles triangle  
are equal

Set up an equation.

Solve the equation

Work out angles B and C

Work out angle A

## **Problem solving in International GCSE mathematics**

Chen buys 120 watches for \$50 each.  
He sells 60% of the watches for \$80 each.  
He sells half the remaining watches for \$60 each.  
Any watches he still has left he sells for \$50 each

Work out the percentage profit.

**Work out the initial total cost  
Work out the income from the first 60%  
Work out the income from the remainder  
Work out the percentage profit**

## **Problem solving in International GCSE mathematics**

Find the sum of all the multiples of 3 which are less than 1000

**First task – recognise this is a Q about  
arithmetic series**

**Second task – work out how many  
terms**

**Third task – work out the sum of the  
arithmetic series**

## Problem solving in International GCSE mathematics

### Activity 7

There are 5 questions from two Jan papers.  
Work through the questions:

Make a decision of whether each question is a problem or not.

If it is a problem, decide on what aspects of the question makes it a problem.



## Problem solving in International GCSE mathematics

Some further comments on what are the properties of a mathematical problem. A mathematical problem:

- requires use of techniques from more than one content area
- requires a succession of processes – but not just a standard set such as with simultaneous equations
- is unfamiliar so there is no **obvious** standard method of solution
- is in an unfamiliar context
- requires translation to a form which allows suitable mathematical processes to be used to solve the problem.

# Problem solving in International GCSE mathematics

## Activity 7

There are 5 questions from two papers.  
Work through the questions:

Make a decision of whether each question is a problem or not  
If it is a problem, decide on what aspects of the question makes it a problem.

A. Q12

This had no marks for problem solving. It is a standard set of processes.

B. Q7

This is a classic problem-solving question and had all 4 marks set against it for problem solving

# Problem solving in International GCSE mathematics

## Activity 7

There are 5 questions from two papers.  
Work through the questions:

Make a decision of whether each question is a problem or not  
If it is a problem, decide on what aspects of the question makes it a problem.

C. Q23

This had all 4 marks set against AO1 only. No problem solving marks.

D. Q18

This is a straightforward application ratio. There are no problem solving marks here.

E. Q 8

All 4 marks were set against problem solving.

# Extended response questions

# Extended response questions

An extended response question is a question that generally;

- Involves problem solving or perhaps reasoning
- Uses more than one mathematical concept
- Draws on mathematical experiences
- Requires the student to communicate their findings in detail and **always** requires a conclusion

# Examples of extended response questions [Foundation]

26 The diagram shows a roof support.

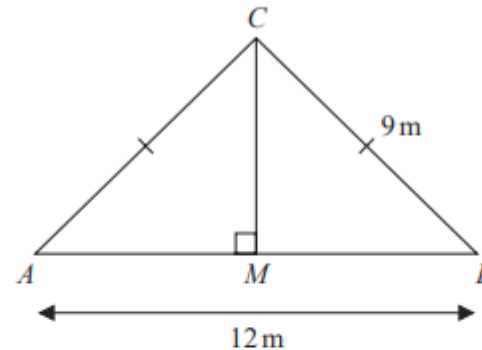


Diagram **NOT** accurately drawn

This is also a problem solving question

The roof support is made from four lengths of wood,  $AB$ ,  $AC$ ,  $BC$  and  $MC$

$$AC = BC = 9\text{ m} \quad AB = 12\text{ m}$$

$$\text{angle } AMC = 90^\circ$$

Lewis is going to buy lengths of wood to make the roof support.

The wood costs 21.50 euros per metre.

Each length of wood he buys has to be a whole number of metres.

Work out the total cost of the wood Lewis needs to buy.

Show your working clearly.

..... euros

(Total for Question 26 is 4 marks)

# Examples of extended response questions [Higher]

24 The diagram shows a solid, **S**, made from a cone and a hemisphere.

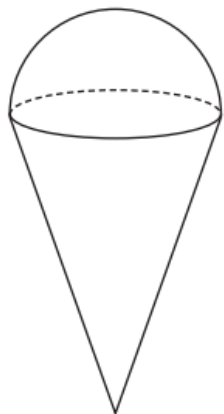


Diagram **NOT**  
accurately drawn

The centre of the circular face of the cone coincides with the centre of the flat surface of the hemisphere.

The radius of the circular face of the cone,  $x$  cm, is equal to the radius of the hemisphere.

The total height of **S** is  $4 \times$  the radius of the hemisphere.

A separate sphere has radius  $kx$  cm.

The volume of this sphere is  $12.5 \times$  the volume of **S**

(a) Work out the value of  $k$

A solid, **T**, is similar to solid **S**

The volume of **T** is  $512 \times$  the volume of **S**

The total surface area of **T** is  $d \times$  the total surface area of **S**

(b) Find the value of  $d$

$d = \dots\dots\dots$   
(1)

(Total for Question 24 is 5 marks)

Another problem  
solving question, but  
this time in two parts.

Part (a) – 4 marks, part (b) 1 mark

# Improving students' ability in extended response questions



**Improving student's  
ability in answering  
reasoning, problem  
solving and  
extended response  
questions**

Here are some suggestions:

- start them young!
- use suitable processes in class where possible (e.g. questioning for reasoning)
- set single tasks which may require students to work at length
- find and use suitable resources
- set single tasks which may require students to work at length
- old Edexcel coursework GCSE tasks are an excellent source.

**Improving student's ability in answering reasoning, problem solving and extended response questions**

Here are some more suggestions:

- Build into the faculty plan the importance of reasoning and problem solving permeating maths lessons
- Make sure that any assessments (e.g. end of term tests) have questions on reasoning and problem solving
- Insist that students provide reasons in all geometry problems (even if the question does not ask for it)
- Encourage different approaches (where possible) in solving a problem

**Improving student's  
ability in answering  
reasoning, problem  
solving and  
extended response  
questions**

Here are some more suggestions:

- improve student's knowledge of the mathematics they meet – short tests, short questions – increases fluency
- Old Edexcel coursework GCSE tasks are an excellent source.
  - e.g. 6 papers covering various aspects of problem solving and reasoning (for IGCSE) on the Edexcel site.
  - e.g. adapt 'standard' questions to make them problem solving

**Improving student's  
ability in answering  
reasoning, problem  
solving and  
extended response  
questions**

Adapt problem solving questions by scaffolding them and remove scaffolding in stages.

**8** Barsha buys some nails and some bolts.

Each box of nails costs £2.60

Each pack of bolts costs £3.94

Barsha buys 5 boxes of nails and 4 packs of bolts.

He pays with a £50 note.

Work out how much change he should get.

Improving student's  
ability in answering  
reasoning, problem  
solving and  
extended response  
questions

This can become:

Barsha buys some nails and some bolts.

Each box of nails costs £2.60

Each pack of bolts costs £3.94

Barsha buys 5 boxes of nails and 4 packs of bolts.

(a) Work out the cost of 5 boxes of nails and 4 packs of bolts. **(2)**

Barsha pays with a £50 note

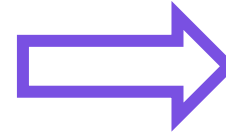
(b) Work out how much change will should get. **(1)**

**(Total for Question 8 is 3 marks)**

Improving student's ability in answering reasoning, problem solving and extended response questions

Adapting 'standard' questions to make them problem solving.

x	f
0	7
1	8
2	9
3	10
4	6
5	2



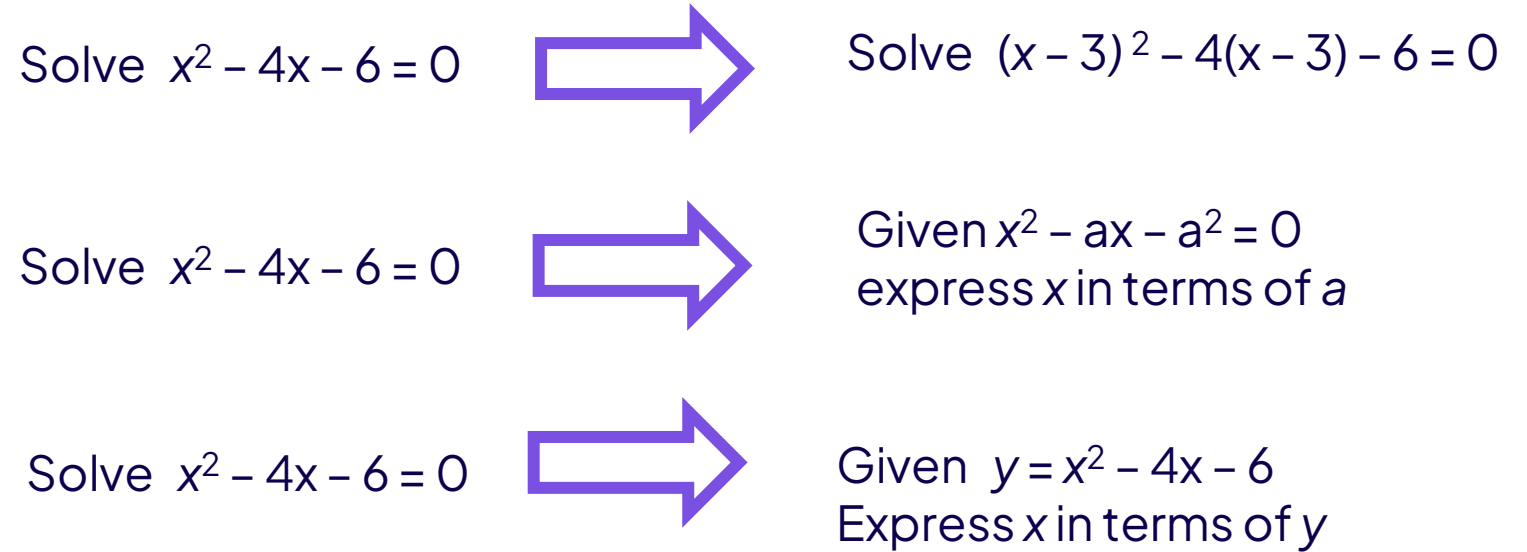
x	f
0	a
1	8
2	9
3	10
4	6
5	2

Calculate the mean value of x

Given that the mean value of x is 2.25, find the value of a

**Improving student's  
ability in answering  
reasoning, problem  
solving and  
extended response  
questions**

Adapting 'standard' questions to make them problem solving.



# Demand and how papers are constructed



# Constructing International GCSE mathematics papers

The ‘other’ factor not mentioned so far is – demand

‘Demand’ is not the focus of this course but since it plays a significant role in papers we will look at it briefly

# Constructing International GCSE mathematics papers

We can say that the demand of a question is similar to its difficulty

But that does not really help.

We can try to make subjective/ qualitative judgements

e.g. a hierarchy of equations to solve

Single linear, unknown on one side

Single linear, unknown on both sides

Simultaneous linear equations

Simultaneous equations, one linear, one quadratic.

# Constructing International GCSE mathematics papers

Or – we could look at the vast amount of data that Edexcel collects on responses to each question as a product of the online marking system.

Or – we could write questions, pre-test them and construct a question bank

However, there is a health warning with both of these approaches:

Which forms the basis of Activity 8

# Constructing International GCSE mathematics papers

## Activity 8

There are several question which all are based on the Theorem of Pythagoras.

Put the questions in increasing order of difficulty and add a comment about the demand of each one which you used to make your decision.

# Constructing International GCSE mathematics papers

## Activity 8

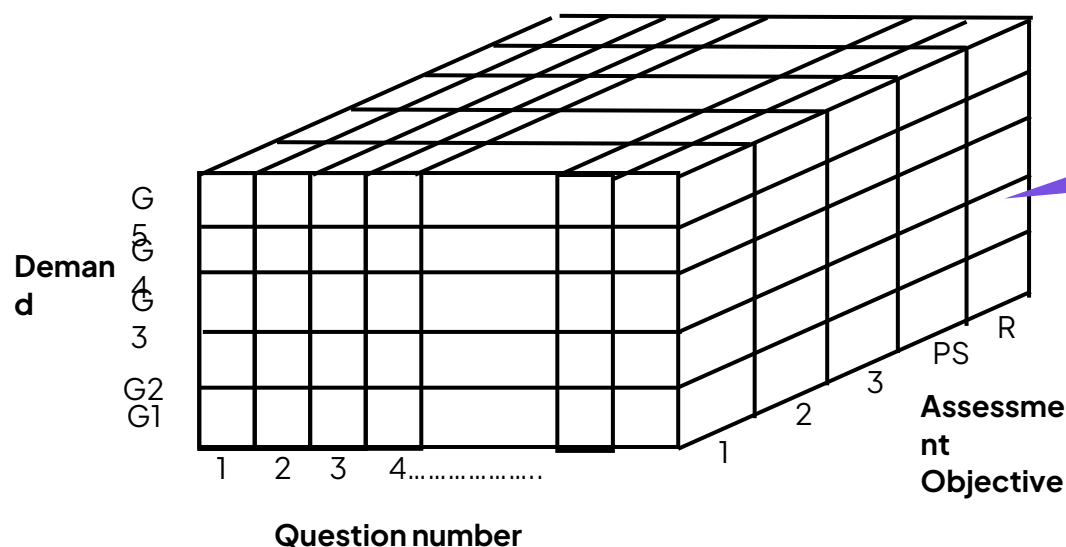
There are several question which all are based on the Theorem of Pythagoras.

1 = easiest, 8 = most difficult							
A	B	C	D	E	F	G	H
2	3	1	4	7	5	6	8

Great reliance (and responsibility) is placed on the paper setting team to get the level of demand consistent from session to session and to set questions which accurately reflect the demands of the different levels.

# Constructing International GCSE mathematics papers

A schematic diagram of the Foundation paper setting grid.



There are approximately  $5 \times 5 \times 20 = 500$  cells to fill with marks subject to various conditions.

# Constructing International GCSE mathematics papers

$$\Sigma AO1 = 60 \pm 3, \Sigma AO2 = 25 \pm 3, \Sigma AO3 = 15 \pm 3, \text{ and} \\ \Sigma AO1 + \Sigma AO2 + \Sigma AO3 = 100$$

And

$$\Sigma G1 + G2 + G3 + G4 + G5 = 100 \text{ and} \\ G1 = G2 = G3 = G4 = G5 = 20 \pm 1$$

And

$$\Sigma PS \approx 25, \Sigma R \approx 15 \text{ with } \Sigma PS + R = 40$$

This is for the Foundation level, paper F1, say.

The grid for Higher level, H1 will have a similar structure.

One additional constraint is that there have to be a considerable number of questions and hence marks common to F1 and H1, so changing a question on F tier can have a knock-on effect on H tier.

# Constructing International GCSE mathematics papers

## Activity 9

This has the overlap questions between the F tier paper and the H tier paper for June 2024 Paper 1HR

(50 marks)

Complete the grid to show how the marks have been distribution across the 3 AOs and identify marks for reasoning and for problem solving.



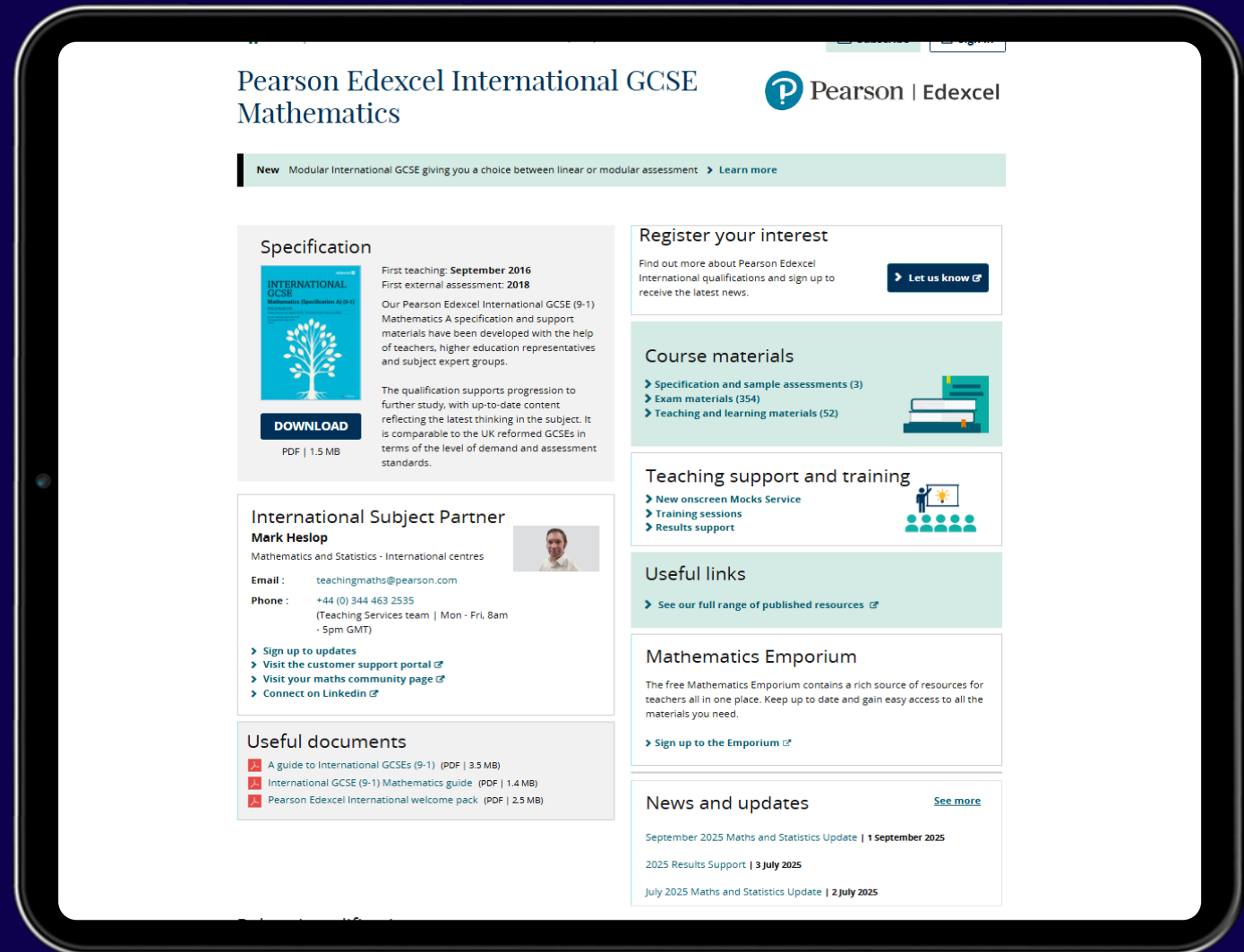
# Constructing Int GCSE mathematics papers

The actual AOG used on this paper 1H January 2023

Specification level and title			Unit and Paper Number	GCE* (I)GCSE untiered* (I)GCSE Foundation* (I)GCSE Higher* *delete as appropriate	Total mark	100					
2406			1HR				Mark allocation per AO according to the Specification				
Qu.No	Specification Content Reference / Topic Area / Sub Topic				Marks	AO1		AO2	AO3	Problem solving	Reason
	Spec Ref	Description	Marker		Number	Algebra	SSM	HD			
1	F6.2B	mean	1	3				3			
2	F1.1G, F6.3ABHIJ	probability problem	1	4	1			3	4		
3	F1.7BE F1.6BD	ratio and profit problem	1	5	5				5		
4	F1.2I	divide mixed numbers	1	3	3					3	
5	F1.6G	compound interest	1	3	3						
6	F4.10E, F4.4G, F4.9A	finding height in vol of cylinder, density	2, 2	4			4		2		
7	F2.1D, F2.2C, F2.2F, F2.7A, F2.7B	simplify, expand, factorise & solve, inequality	2,3,(c) one ty	9		9					
8	F4.8A, F4.9BCD	area and perimeter problem	1	6			6		6		
9	F3.3GH	find equation of graph	1	3		3				3	
10	H6.2C	interquartile range from list	2	2				2			
11	F1.4CDE H1.4C	HCF and use of indices with prime factors	1 (one clip)	4	4						
12	F2.6A	simultaneous equations (linear)	1	4		4				4	
13	H4.6BC H4.7A	circle theorems	1	5			5			5	

# Support

# Support for you at every Stage




The screenshot shows the Pearson Edexcel International GCSE Mathematics website. The header includes the Pearson | Edexcel logo. A green banner highlights a new modular international GCSE option. The main content is organized into several sections: Specification, International Subject Partner (Mark Heslop), Useful documents, Register your interest, Course materials, Teaching support and training, Useful links, Mathematics Emporium, and News and updates.

**Pearson Edexcel International GCSE Mathematics**

**New** Modular International GCSE giving you a choice between linear or modular assessment [Learn more](#)

### Specification

 First teaching: **September 2016**  
First external assessment: **2018**

Our Pearson Edexcel International GCSE (9-1) Mathematics A specification and support materials have been developed with the help of teachers, higher education representatives and subject expert groups.

The qualification supports progression to further study, with up-to-date content reflecting the latest thinking in the subject. It is comparable to the UK reformed GCSEs in terms of the level of demand and assessment standards.

**DOWNLOAD**  
PDF | 1.5 MB




### International Subject Partner

**Mark Heslop**  
Mathematics and Statistics - International centres

**Email :** [teachingmaths@pearson.com](mailto:teachingmaths@pearson.com)  
**Phone :** +44 (0) 344 463 2535  
(Teaching Services team | Mon - Fri, 8am - 5pm GMT)

- [Sign up to updates](#)
- [Visit the customer support portal](#)
- [Visit your maths community page](#)
- [Connect on LinkedIn](#)

### Useful documents

-  [A guide to International GCSEs \(9-1\)](#) (PDF | 3.5 MB)
-  [International GCSE \(9-1\) Mathematics guide](#) (PDF | 1.4 MB)
-  [Pearson Edexcel International welcome pack](#) (PDF | 2.5 MB)

### Register your interest

Find out more about Pearson Edexcel International qualifications and sign up to receive the latest news.

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### Course materials

- [Specification and sample assessments \(3\)](#)
- [Exam materials \(354\)](#)
- [Teaching and learning materials \(52\)](#)

### Teaching support and training

- [New onscreen Mocks Service](#)
- [Training sessions](#)
- [Results support](#)

### Useful links

- [See our full range of published resources](#)

### Mathematics Emporium

The free Mathematics Emporium contains a rich source of resources for teachers all in one place. Keep up to date and gain easy access to all the materials you need.

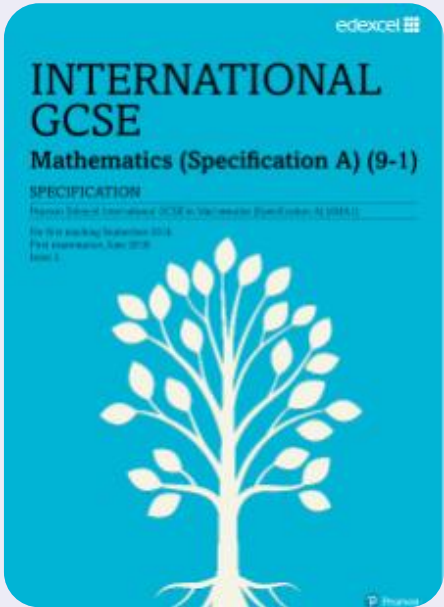
[Sign up to the Emporium](#)

### News and updates

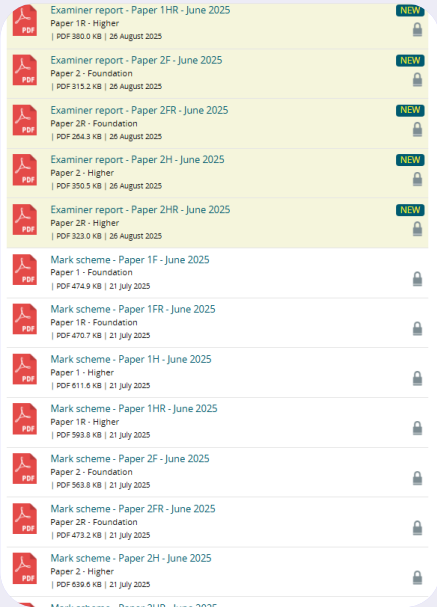
[See more](#)

- [September 2025 Maths and Statistics Update](#) | **1 September 2025**
- [2025 Results Support](#) | **3 July 2025**
- [July 2025 Maths and Statistics Update](#) | **2 July 2025**

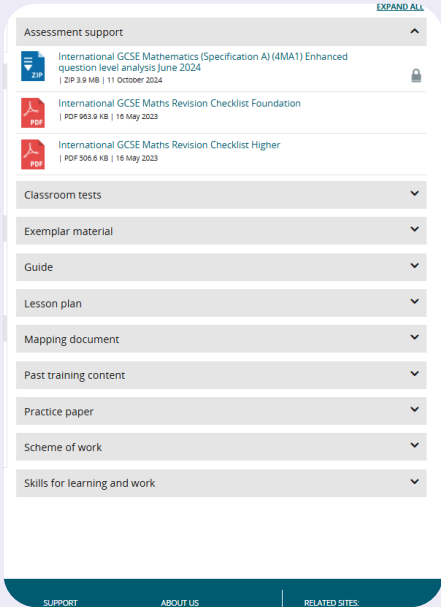
# Teaching and Learning Materials



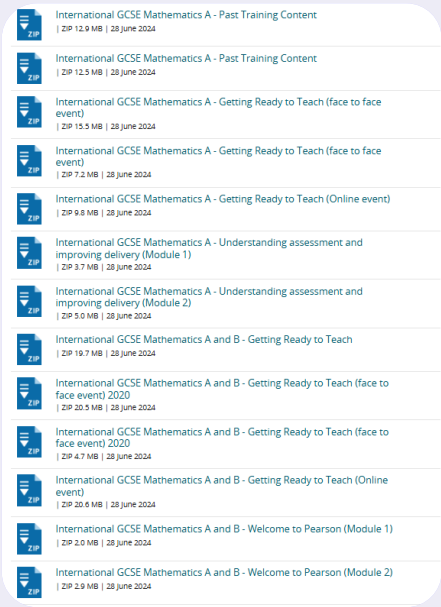
Specification



Past Papers



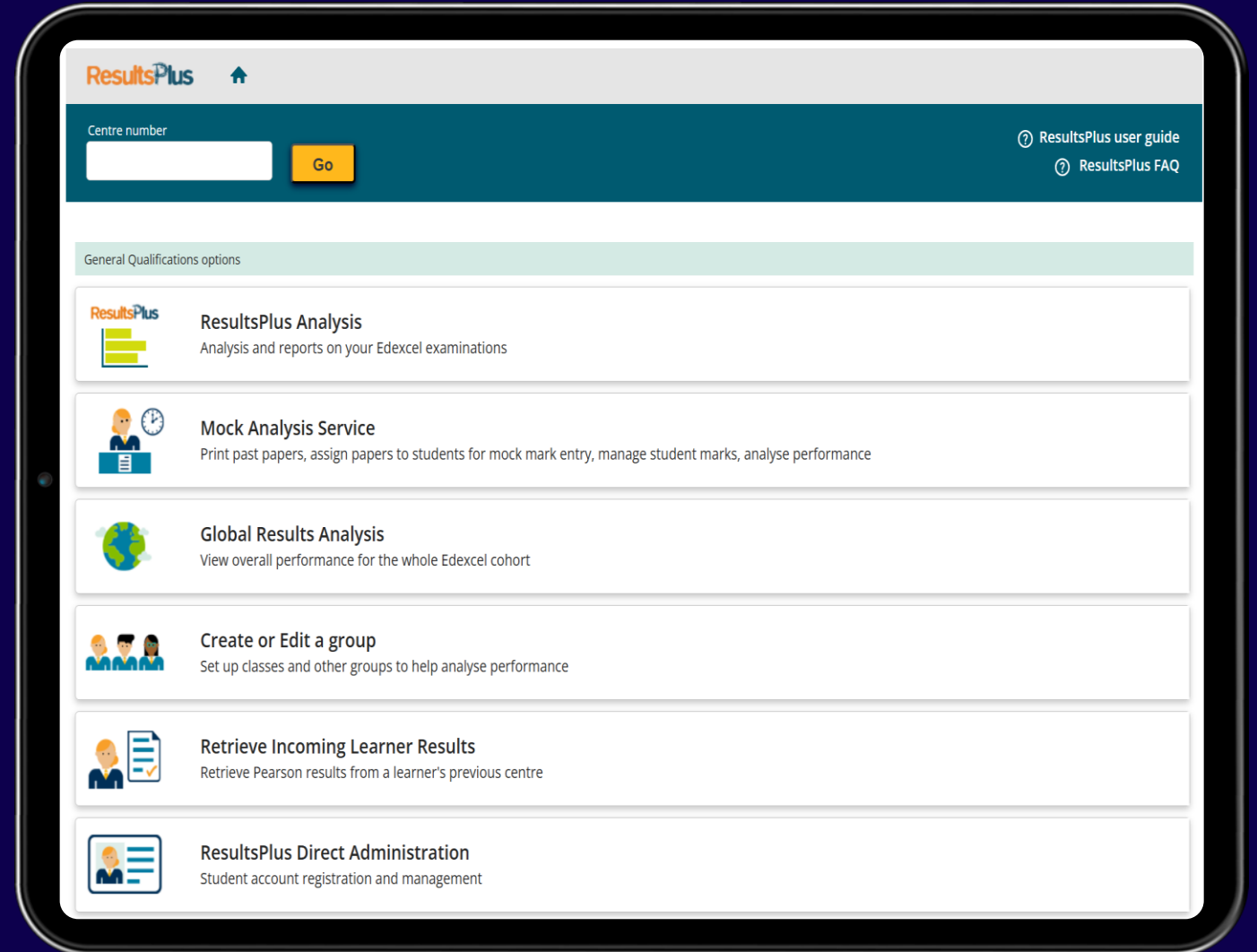
Teaching and Learning Materials



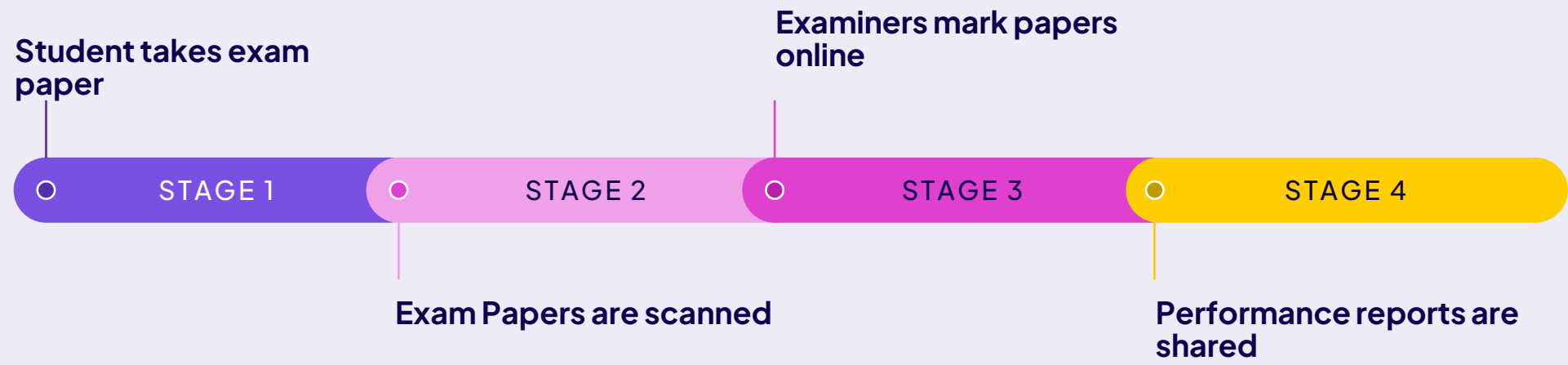
Past Training Content

# Results Plus

- Provides detailed analysis of your learners performance.
- Identify potential topics, skills and types of question where students may need to develop their learning further.
- See actual scores for each exam question for a student, class or group.
- Understand how your students' performance compares with class and Pearson Edexcel national averages.
- Acquire data that may support effective learning and teaching approaches.



# Results Plus



# Exam Wizard

- Saves time by creating your own mock paper exams, topic tests, homework or revision activities.
- Uses our Pearson back catalogue of exam questions to practice and develop these skills with your learners'.
- Gain access to past papers and test questions to create tailored learners plans, which target individuals weaknesses.
- Works in conjunction with ResultsPlus to help create exam practice resources for whole cohorts or individual learners.

The screenshot displays the Exam Wizard web application. The top navigation bar includes the 'examWiz' logo, 'Find Past Papers', 'Build a paper', 'My Papers', 'Help', and 'Log out'. The left sidebar contains search filters: 'Search papers', 'Select a qualification' (International GCSE (9-1)), 'Select a specification' (All selected (1)), 'Select a year' (Select one or more), 'Select a series' (Select one or more), and 'Select a unit' (Select one or more). At the bottom of the sidebar are 'Search' and 'Clear' buttons. The main content area shows 'Showing 1 - 20 of 21 results' with pagination controls. Below this is a table of search results.

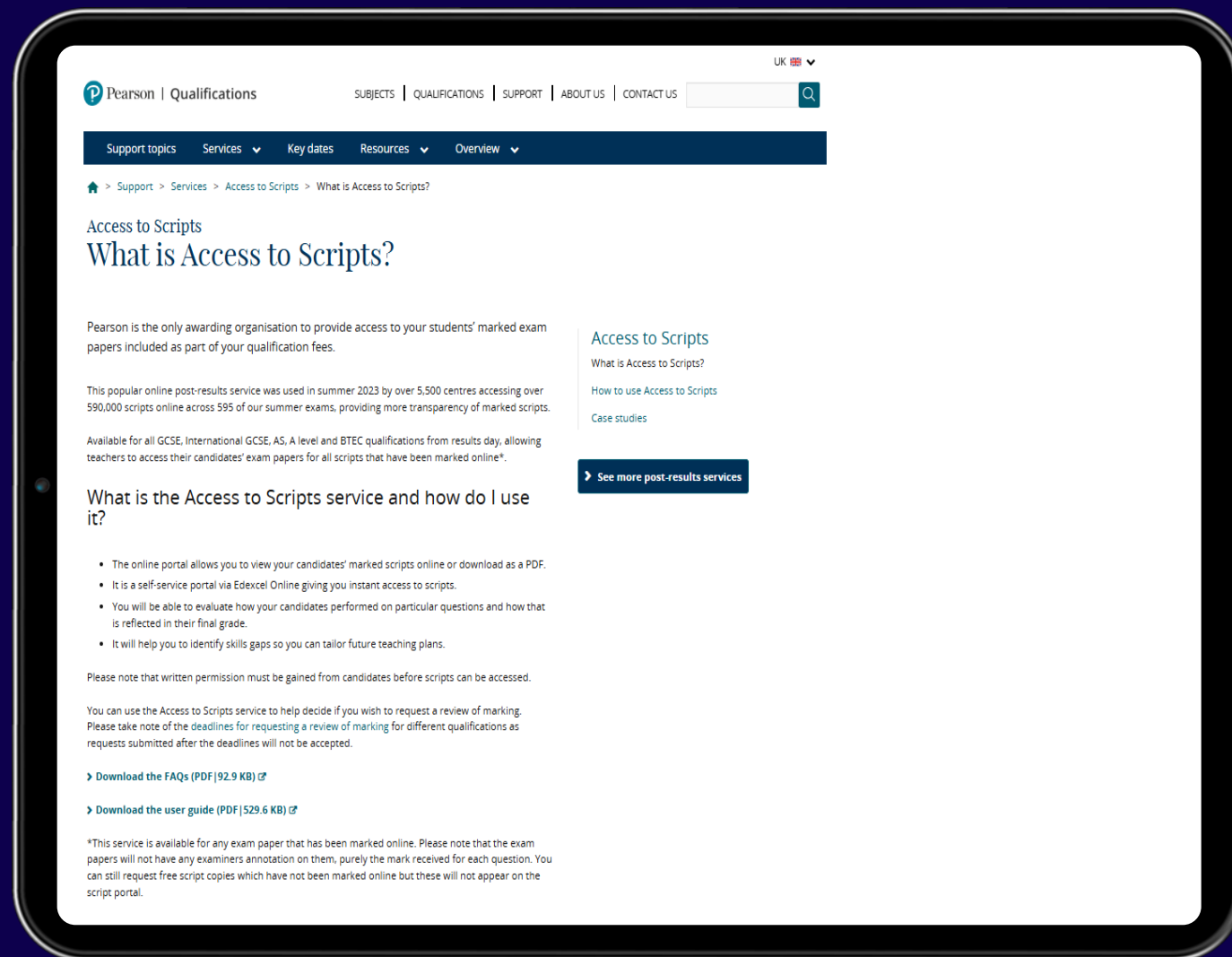
Paper name	Code	Tier	Series	Year	Export PDF
Paper 1: Physical geography	4GE1/01		Nov	2021	
Paper 1: Physical geography	4GE1/01		Nov	2020	
Paper 1: Physical geography	4GE1/01		June	2022	
Paper 1: Physical geography	4GE1/01R		June	2022	
Paper 1: Physical geography	4GE1/01		Nov	2023	
Paper 1: Physical geography	4GE1/01		June	2023	
Paper 1: Physical geography	4GE1/01		SAM	SAM	
Paper 1: Physical geography	4GE1/01		June	2024	
Paper 1: Physical geography	4GE1/01		Specimen papers	Specimen papers	
Paper 1: Physical geography	4GE1/01		Nov	2024	

# Access to Scripts

Access to Scripts is an online service, included as part of your qualification fees, that allows you to view your candidates' marked scripts online or download as a PDF.

The Access to Scripts service provides a rich source of information, enabling detailed analysis to inform teaching and learning and support students – giving insights and visibility that performance data alone cannot provide.

Pearson is the only awarding organisation to provide access to your students' marked exam papers included as part of your qualification fees.



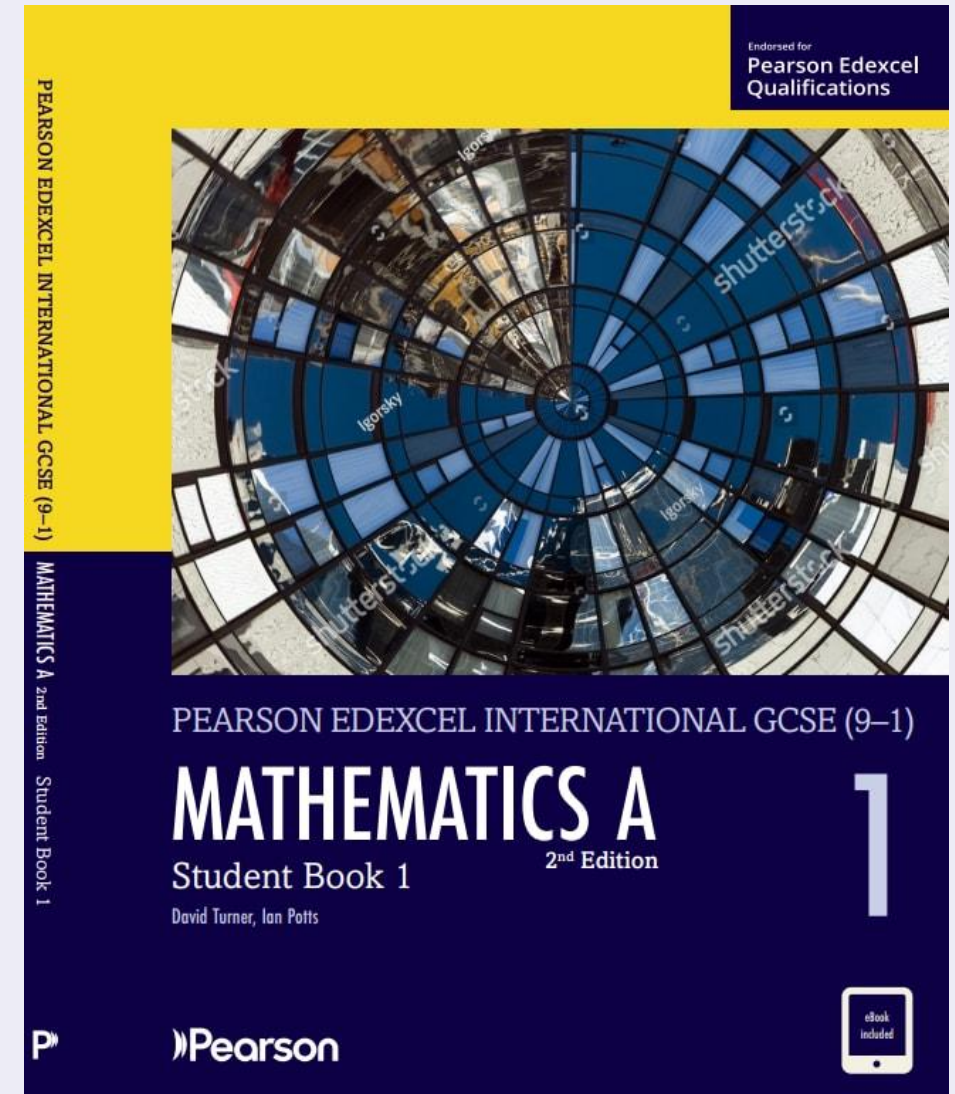


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# Subject Partner Support



Our subject partners are experts in their fields and are here to support you throughout the year.

**Mark Heslop**

**Email:** [Teachingmaths@pearson.com](mailto:Teachingmaths@pearson.com)

**Phone:** +44 (0) 344 463 2535 (Mon–Fri, 8.00–17.00)

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Insight

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# Questions



Thank you