

PEARSON EDEXCEL INTERNATIONAL GCSE (9-1)

Understanding assessment and
improving delivery in International
GCSE Maths A
(Module 2)



First teaching in 2017, first assessment in 2018.

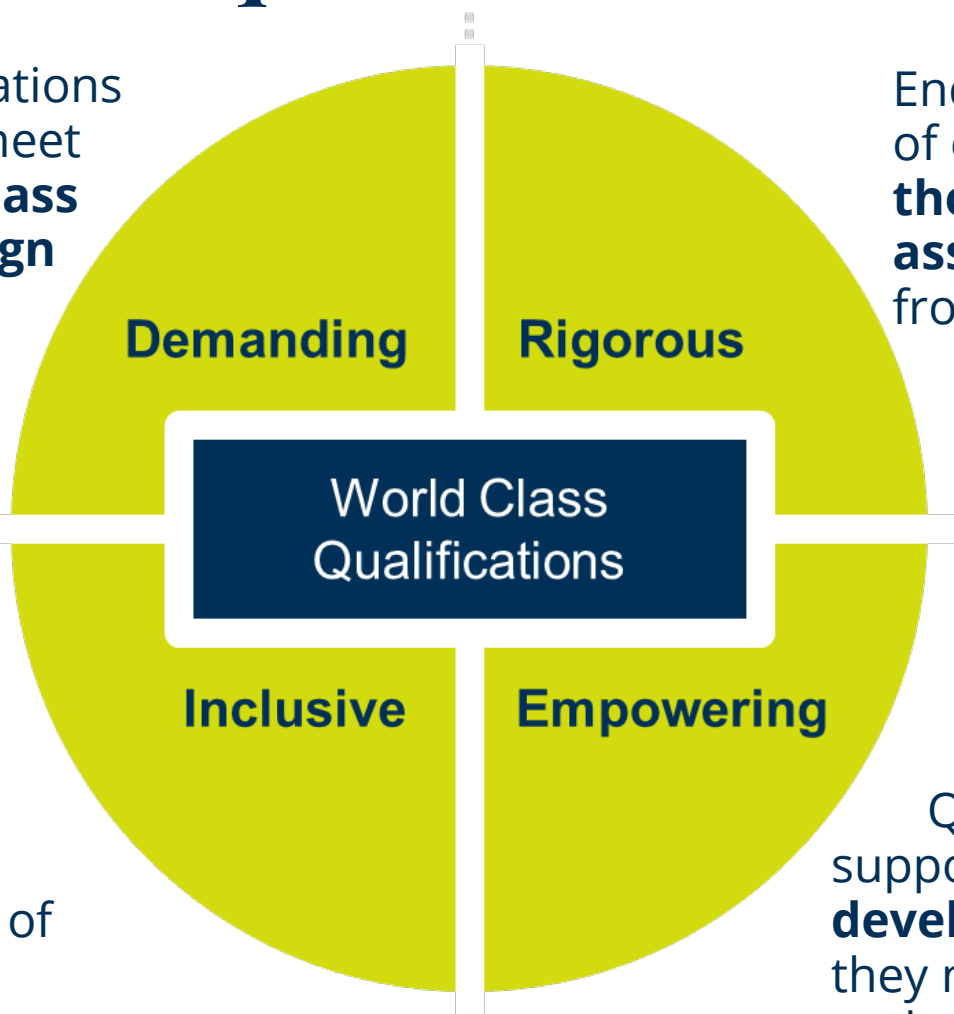
World-class qualifications

All Edexcel qualifications are developed to meet Pearson's **World Class Qualification design principles**

Endorsement of educational **thought-leaders and assessment experts** from across the globe

Developed using an understanding and benchmarking of **all educational systems**

Qualifications that support young people to **develop the capabilities** they need to **progress** and prosper in their lives



Session Agenda

| | |
|-------|---|
| 10:00 | Welcome and Introductions |
| 10:05 | Recap of module 1 Activity 1 |
| 10:15 | Reasoning. Activity 2 |
| 10:45 | Demand. Activities 3 and 4 |
| 11:30 | Improving problem solving and reasoning |
| 11:50 | Support from Pearson |
| 12:00 | Finish: |



Aims and objectives

Delegates will:

1. review problem solving on our International GCSE papers and consider how questions in these areas have been answered in previous exam series,
2. learn about the role of mathematical reasoning so that students can access questions targeting the ability to produce a correct mathematical argument
3. understand how the ideas already met in the course are applied to produce Edexcel International GCSE papers
4. see the support Pearson offers for the qualification,
5. network, discuss best practice and share ideas with other teachers.



Polls to get to know
the delegates.

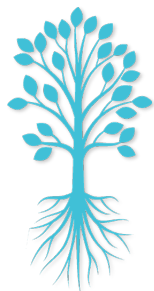


The assessment objectives for International GCSE are described in terms of content and mathematical processes

AO1 Demonstrate knowledge, understanding and skills in number and algebra:

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

AO3 Demonstrate knowledge, understanding and skills in statistics and probability



Problem solving in International GCSE mathematics

Recapping:

- 25% of the marks at F tier on 4MA1
- 30% of the marks at H tier on 4MA1
- 30% of the marks at H tier on 4MB1
- translate a situation into suitable mathematical form
 - then –
 - carry out a suitable (possibly sequence of) mathematical process(es)
 - then –
 - state the answer

4MB1 is H tier only



Problem solving in International GCSE mathematics

Recapping:

So “This week a factory produced 24 000 tins of paint.

This was 20% more than it produced last week.

Work out how many tins of paint it produced last week.”

Is **NOT** a problem

“A factory produces just blue paint and red paint.

The ratio of the number of tins of blue to red paint is 3 : 5

The volume of the blue tins is twice the volume of the red tins.

Work out the percentage of total paint production that is blue.”

Is a problem



Problem solving in International GCSE mathematics

Activity 1 Marking solutions to a short problem – Q14 4MA1 1H

There are 5 attempts to mark using the mark scheme which is in your activity file.

Complete the poll when you have finished marking.



Problem solving in International GCSE mathematics

Activity 1 Marking solutions to a short problem – Q14 4MA1 1H

If you have any general comments please put in Chat.

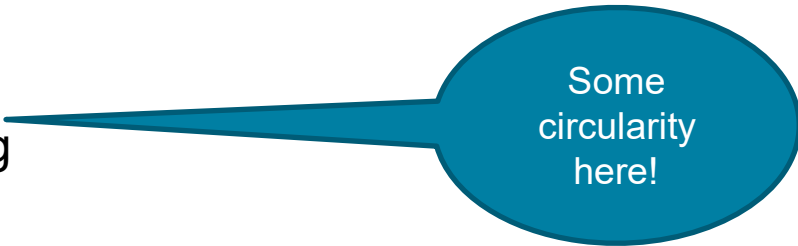
One comment is that there are a lot of ways in which students can go wrong.



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 process

- 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

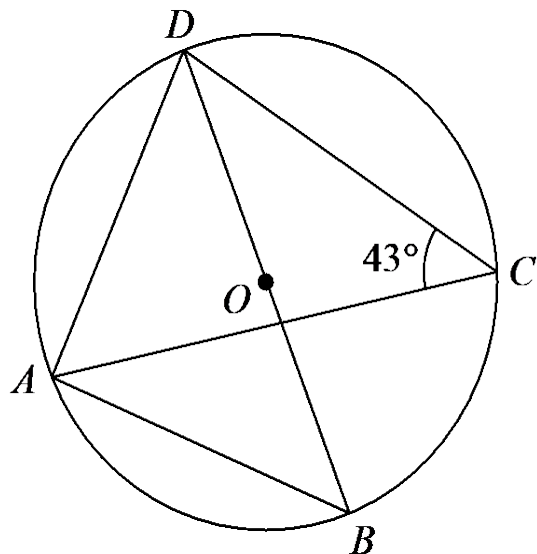


Diagram **NOT**
accurately drawn

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

This will
always be
counted as
reasoning



Reasoning in International GCSE mathematics

- presenting arguments and proofs

Line L_1 has equation $y = 3x + 5$

Line L_2 has equation $6y + 2x = 1$

Show that L_1 is perpendicular to L_2

Students do not have to PROVE the rule

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 International GCSE mathematics

Activity 2

- 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.

Complete the poll for the first two questions



Reasoning in International GCSE mathematics

Activity 2

- The remaining 3 questions



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

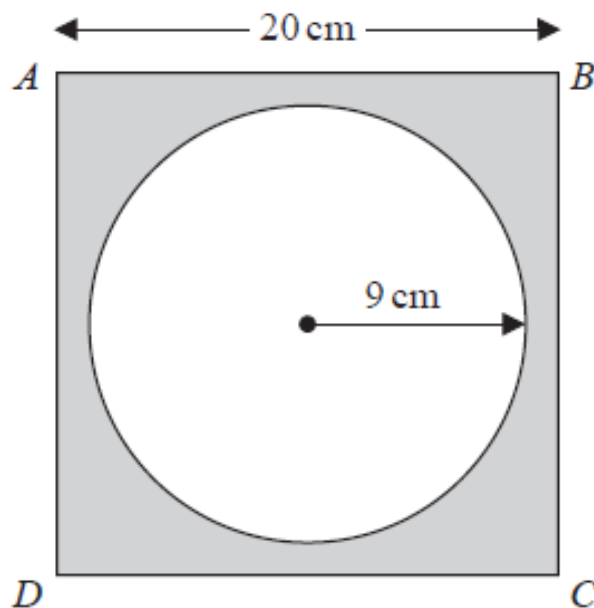
Simultaneous equations, one linear, one quadratic.



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Or – we could look at the data that Edexcel collects on responses to each question via the online marking system.

6 The diagram shows a circle inside a square $ABCD$.



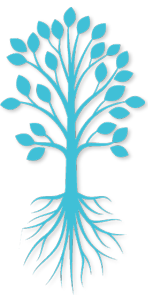
June 18 4H Q6

$AB = 20$ cm.

The radius of the circle is 9 cm.

Work out the area of the shaded region.

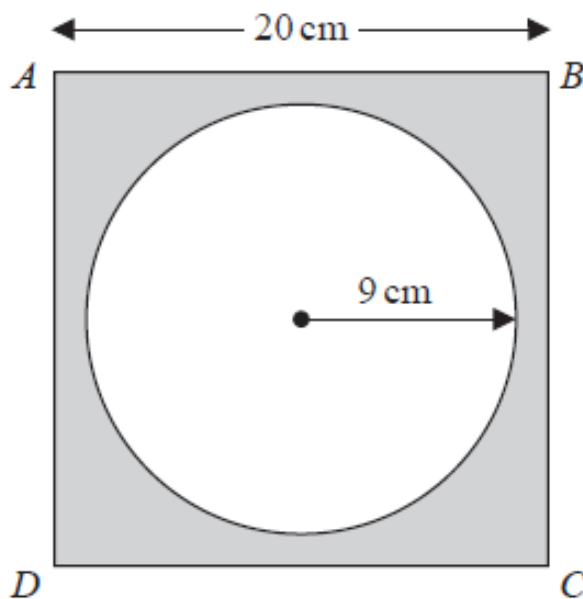
Give your answer correct to 1 decimal place.



Constructing International GCSE mathematics papers

Or – we could look at the data that Edexcel collects on responses to each question via the online marking system.

6 The diagram shows a circle inside a square $ABCD$.



Mean mark was 2.6
81% got all 3 marks

Mean mark was 2.9
for level 7 students

Mean mark was 2.1
for level 4 students

$AB = 20$ cm.

The radius of the circle is 9 cm.

Work out the area of the shaded region.

Give your answer correct to 1 decimal place.



Constructing International GCSE mathematics papers

Demand

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

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

- this forms the basis of **Activity 3**



Constructing International GCSE mathematics papers

Activity 3

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.

Please complete the polls



Constructing International GCSE mathematics papers

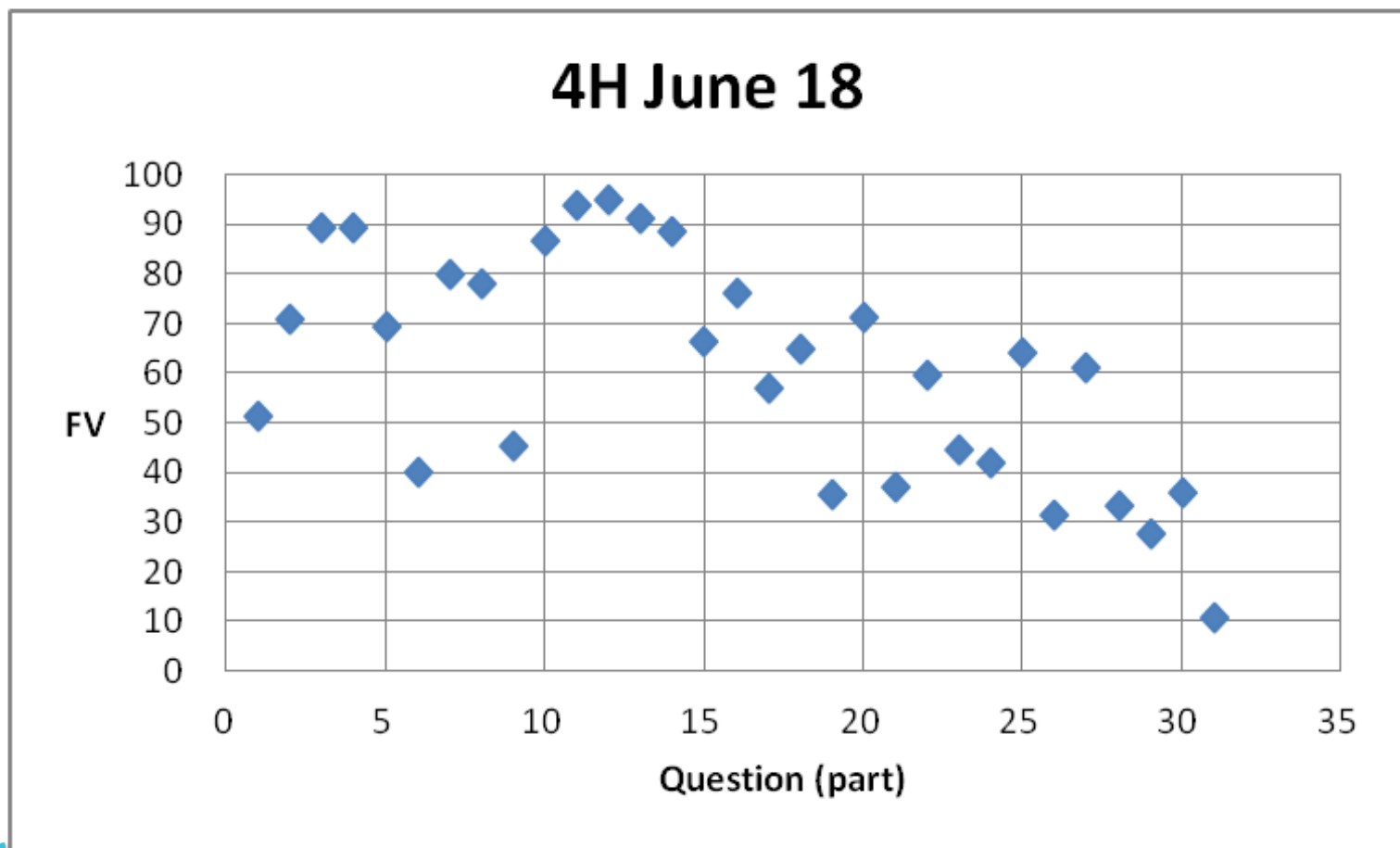
Activity 3 discussion and poll

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

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.



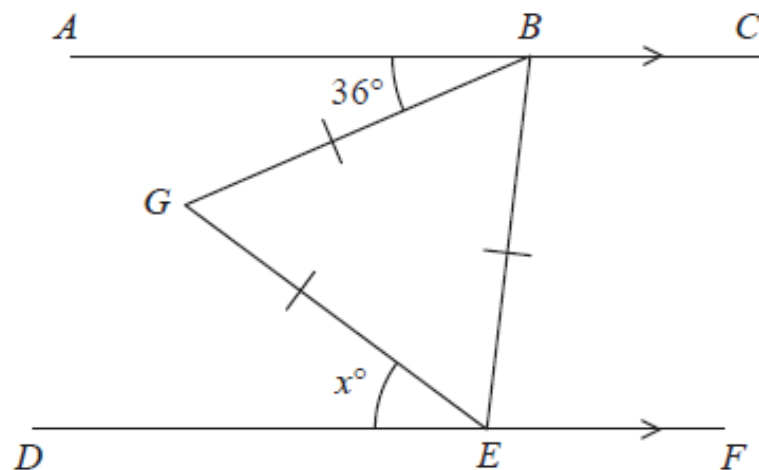
Constructing International GCSE mathematics papers



Constructing International GCSE mathematics papers

This was found
to be too hard
for its position

4



ABC and *DEF* are parallel lines.

BGE is an equilateral triangle.

Angle *ABG* = 36°

Angle *DEG* = x°

Work out the value of x .

Give reasons for your answer.

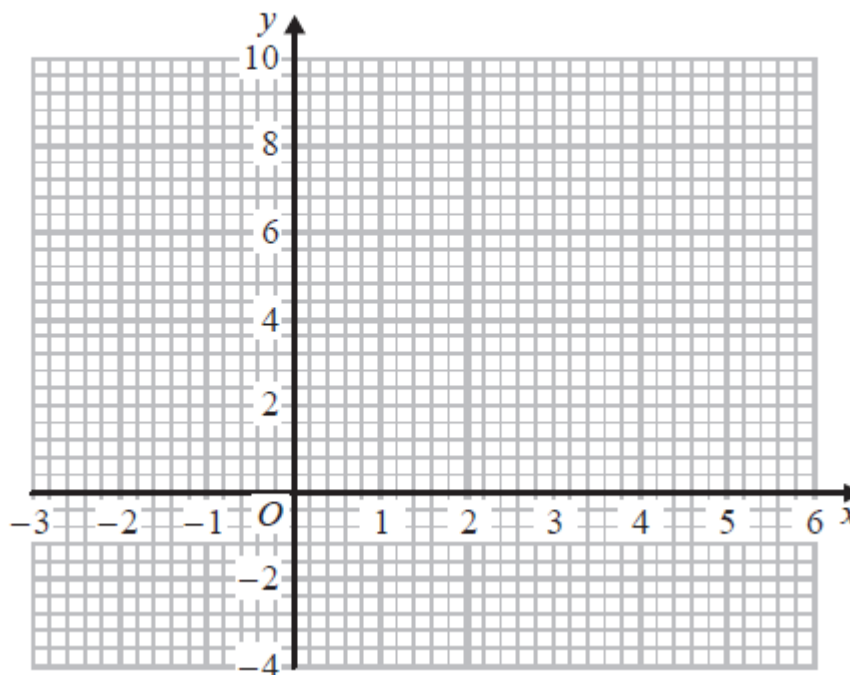


Constructing International GCSE mathematics papers

8 (a) Complete the table of values for $y = x^2 - 3x - 1$

| | | | | | | | | |
|-----|----|----|---|----|---|----|---|---|
| x | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| y | | 3 | | -3 | | -1 | | 9 |

(b) On the grid, draw the graph of $y = x^2 - 3x - 1$ for values of x from -2 to 5



Facility value
was about 75%

The point P on the graph of $y = x^2 - 3x - 1$ has coordinates (p, q)

(c) Use the graph to find an estimate for the least possible value of q .



Constructing International GCSE mathematics papers

20 Given that $\frac{12 \times (\sqrt{8})^{2y+2}}{6 \times 4^{2y+1}}$ can be written in the form 2^p ,
find an expression for p in terms of y .

Facility value
was about 10 %

Spend a minute thinking about this question.
What makes it so demanding?



Constructing International GCSE mathematics papers

20 Given that $\frac{12 \times (\sqrt{8})^{2y+2}}{6 \times 4^{2y+1}}$ can be written in the form 2^p ,

find an expression for p in terms of y .

| Working | Answer | Mark | Notes |
|--|---------|------|--|
| e.g. $\frac{2 \times (2^{\frac{3}{2}})^{2y+2}}{(2^2)^{2y+1}}$ or $\frac{12 \times (\sqrt{2^3})^{2y+2}}{6 \times (2^2)^{2y+1}}$ or $2 \times \left(2^{\frac{3}{2}}\right)^{2y+2} = (2^2)^{2y+1} \times 2^p$ $\frac{2^{3y+4}}{2^{4y+2}}$ or $\frac{2 \times 2^{3y+3}}{2^{4y+2}}$ or $\frac{12 \times 2^{3y+2}}{6 \times 2^{4y+2}}$ $2^{3y+4} = 2^{4y+2} \times 2^p$ or $2 \times 2^{3y+3} = 2^{4y+2} \times 2^p$ | $2 - y$ | 3 | M1 for writing 8 and 4 correctly in terms of 2 in a correct fraction or equation M1 (dep) for use of $(2^q)^r = 2^{qr}$ twice or $(2\sqrt{2})^{2n} = 2^{3n}$ in a correct expression or equation A1 |

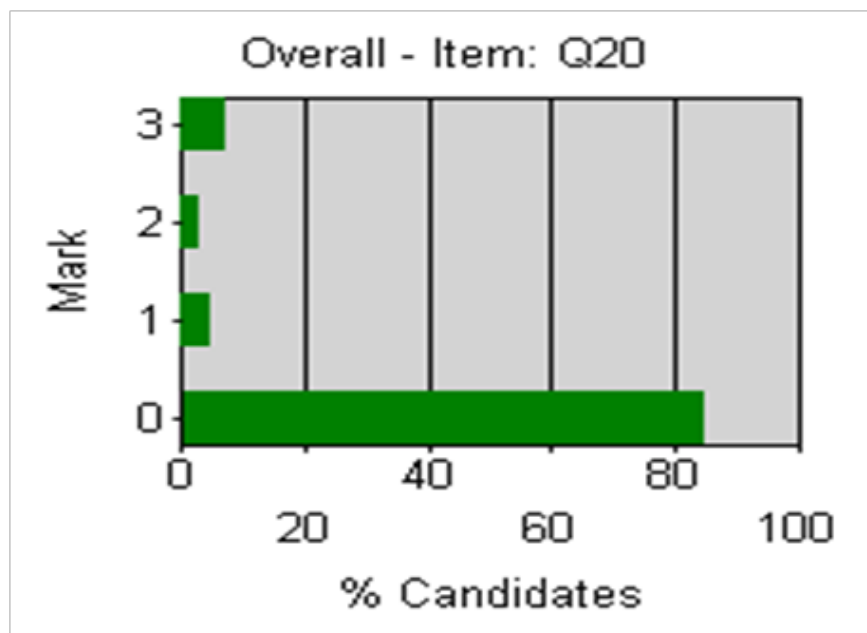


Constructing International GCSE mathematics papers

20 Given that $\frac{12 \times (\sqrt{8})^{2y+2}}{6 \times 4^{2y+1}}$ can be written in the form 2^p ,

find an expression for p in terms of y .

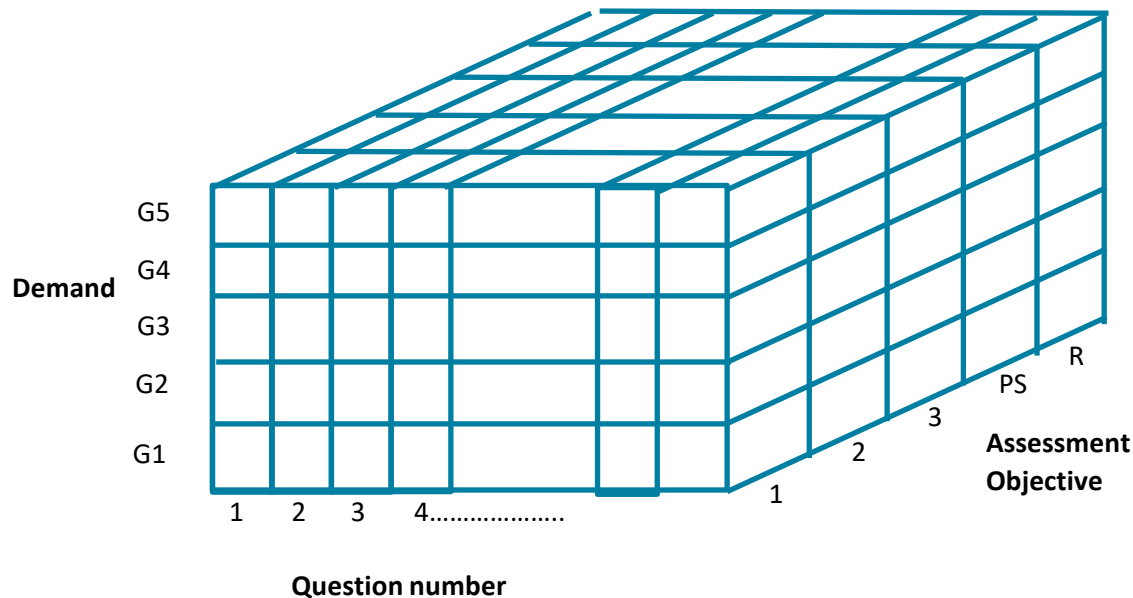
7% of the entry
got all 3 marks



Constructing International GCSE mathematics papers

A schematic diagram of the Foundation paper setting grid.

The grid we use is only 2-dimensional!



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



Constructing International GCSE mathematics papers

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

And

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

And

$$\sum PS \approx 25, \sum MR \approx 15 \text{ with } \sum PS + MR = 40$$

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 4

This has the overlap questions between the F tier paper and the H tier paper for June 2019 (and a little more)

(47 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.

The mark scheme is available for reference with the pack.

The totals for the AOs and reasoning and problem solving are shown.



Constructing International GCSE mathematics papers

Activity 4

This has the overlap questions between the F tier paper and the H tier paper for June 2019 (and a little more)

(47 marks)

.

Here is the grid that was actually used.
How much did you agree?



Constructing International GCSE mathematics papers

| Qu.No | Specification Content Reference / Topic Area / Sub Topic | | Marker | Marks | Specification | | | | Problem solving | Math reason |
|-------|--|---|--------|-------|---------------|---------|------------|-----------|-----------------|-------------|
| | Spec Ref | Description | | | A01 Number | Algebra | A02 SSM | A03 HD | | |
| 1 | F6.2C | Mean from grouped frequency table | 1 | 4 | | | | 4 | | |
| 2 | F4.5B, F4.5D | Construction | 1 | 2 | | | 2 | | | |
| 3 | F1.5B, F1.5C, F1.5D | Sets | 1,3,1 | 4 | 4 | | | | | 3 |
| 4 | F2.3C, F4.10E | Cylinder | 2 | 2 | | 1 | 1 | | | |
| 5 | F1.6E, F1.6F | Percentages | 1 | 8 | 8 | | | | 5 | |
| 6 | F4.11A | Similar triangles | 1,1 | 4 | | | 4 | | | |
| 7 | F6.2B | Reverse mean | 1 | 3 | | | | 3 | 3 | |
| 8 | F4.9A | Converting speed | 1 | 3 | | | 3 | | | |
| 9 | F2.6A | Simultaneous equations - linear | 1 | 3 | | 3 | | | | 3 |
| 10 | F3.3H, F2.8E | $y=mx+c$, inequalities | 2,1 | 4 | | 4 | | | | 2 |
| 11 | F1.9A, H1.9A, H1.6A | Standard form, repeated percentage change | 2,1,2 | 6 | 6 | | | | | 2 |
| 12 | F4.8ABC, F4.9B | Trig perimeter | 1 | 4 | | | 4 | | 4 | |
| | | | | | | | | | | |
| | | | | 47 | 18 | 8 | 14 | 7 | 12 | 10 |



Improving student's ability in reasoning and problem solving

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



Improving student's ability in reasoning and problem solving

Here are some suggestions:

- start them young!
- Build into the faculty plan the importance of reasoning and problem solving permeating maths lessons
- This could come in the faculty Scheme of Work
- Make sure that any summative assessments (e.g. end of term tests) have questions on reasoning and problem solving



Improving student's ability in reasoning and problem solving

Here are some suggestions:

- use suitable processes in class where possible (e.g. questioning for reasoning)
- insist that students provide reasons in all geometry problems (even if the question does not ask for it)
- encourage different approaches (where appropriate) in solving a problem
- improve student's knowledge of the mathematics they meet – short tests, short questions – increases fluency



Improving student's ability in reasoning and problem solving

Here are some suggestions:

- 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 reasoning and problem solving

EDEXCEL 2000

Task 3

Syllabus 1385

Mathematics GCSE

Patterns with Fractions

I + H

Consider the sequence of fractions

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \dots$$

The **difference** between **Consecutive Fractions** is:

$$\frac{1}{6}, \frac{1}{12}, \frac{1}{20}, \frac{1}{30}, \dots$$

The **next difference** between **Consecutive Fractions** is:

$$\frac{1}{12}, \frac{1}{30}, \dots$$

INVESTIGATE FURTHER DIFFERENCES



Improving student's ability in reasoning and problem solving

Here are some suggestions:

- find and use suitable resources
- 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 reasoning and problem solving

Adapting 'standard' questions to make them problem solving.

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



Calculate the mean value of x



Improving student's ability in reasoning and problem solving

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 reasoning and problem solving

Adapting 'standard' questions to make them problem solving.

Solve $x^2 - 4x - 6 = 0$



Solve $x^2 - 4x - 6 = 0$



Solve $x^2 - 4x - 6 = 0$



Improving student's ability in reasoning and problem solving

Adapting 'standard' questions to make them problem solving.

Solve $x^2 - 4x - 6 = 0$



Solve $(x - 3)^2 - 4(x - 3) - 6 = 0$

Solve $x^2 - 4x - 6 = 0$



Given $x^2 - ax - a^2 = 0$
express x in terms of a

Solve $x^2 - 4x - 6 = 0$



Given $y = x^2 - 4x - 6$
Express x in terms of y



Support Overview

Free Support

Getting Started
Guide & Scheme of
Work

Getting Ready to
Teach Events

Subject
interpretation of
transferable skills

Subject Advisor

ResultsPlus

Regional Support
Manager

Additional support for selected subjects

**Curriculum
Matched
Publishing**

Lesson plans

Exemplar Marked
Responses

Topic booklets &
Subject guides

Additional SAMs

Exam Wizard



Other useful links

1. Grade Boundaries

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

Results statistics summarise the overall grade outcomes of candidates sitting Pearson Edexcel examinations.

3. Progress to University

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<https://qualifications.pearson.com/en/support/Services/ResultsPlus.html>



- Free tool for teachers containing a bank of past paper questions to help create their own bespoke mock exams and tests to focus on particular topic areas as needed
- Use existing mark schemes for accurate marking
- Use existing examiner report for insight
- Use the results to understand where students need more support, informing teaching strategies.



Contact your dedicated Subject Advisor

Subject Advisor details

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ALWAYS LEARNING