Questions matter

GCSE

Mathematics

8300/3H: Paper 3 (calculator) Higher

Report on the Examination

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Contents

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Summary

Overall performance compared to last year

Most students were able to access the majority of the medium demand questions and were rewarded for good use of mathematics demonstrated at different levels of ability. There were very few non-attempts throughout the whole paper.

Access to the formula sheet helped eliminate errors owing to incorrect recall. Minimal miscopying of the formulae was seen. Some students were able to attempt higher demand topics which would normally have been too challenging for them to answer.

Students must continue to be encouraged to show their working clearly. Presentation and setting out of working were occasionally poor and for some students their digits 4 and 9 were often indistinguishable. Handwriting smaller than the font size of the printed question was often very difficult to read. Students must use pencil on diagrams and cross out work they do not wish to have marked with a single line when they have had more than one attempt. It was noticed that a ruler was more often used by students on graphs and diagrams than in previous series and this was a welcome improvement.

Miscopying numbers that were given in the question was commonly seen, especially when there were four or five digits. Some students miscopied their own work from line to line within a question.

It was apparent in some questions that a calculator was not used and errors in very basic arithmetic were frequently seen.

Topics where students excelled

- Drawing the next pattern in a sequence
- Using Pythagoras' theorem to find the length of the hypotenuse
- Drawing the side elevation of a cuboid given the front elevation
- Distance – speed – time calculations within a given context
- Calculating population density when given the formula
- Calculating probability outcomes
- Completing a tree diagram
- Using prime numbers with indices
- Evaluating a composite function
- Understanding invariant vertices

Topics where students struggled

- Using a tree diagram
- Writing down the roots of an equation given a quadratic graph
- Working out the equation of a perpendicular line
- Calculating and comparing relative frequencies
- Identifying triangles which are not congruent
- Working out the ratio for radius and height when volumes are equal
- Accurate use of the product rule for counting

Individual questions

Question 1(a)

This question was accessible to the vast majority of students. Occasionally the middle section of the pattern was drawn as 5 × 5 squares or 5 × 4 squares. Improved use of a ruler was seen and there were fewer freehand drawings.

Question 1(b)

Some students left their answer as a decimal or surd and did not gain the mark. An embedded response of $23^2 + 4$ was also marked as zero. Students should be reminded that two answers on the answer line will be marked as a choice and should be avoided.

Question 2

Only a small proportion of students did not gain full marks. Correct working that led to the decimal answer of 39.2 was seen in most of their responses. When errors were made, they tended to be:

- $31^2 - 24^2$
- arithmetic, for example $24^2 + 31^2 = 1402$
- using trigonometry rather than Pythagoras' theorem

Question 3

Most students correctly answered this question by recognising that three floors of the building had not been sampled. A common misunderstanding was interpreting the word 'floor' as referring to a floor covering in a flat and not the floor level of the building. Some students just gave the standard 'sample size is too small' answer, rather than considering the context of the question.

Question 4

A significant majority of students identified the first box as being the correct response.

Question 5

A rectangle with height 2 cm and width 7 cm was drawn by most students. Those who did not gain full marks often drew a rectangle with:

- height 3 cm and width 7 cm
- height 2 cm and width 3 cm

Pupils who used a pen and made an error on their drawing then found it difficult to identify the work they wanted to have marked.

Question 6(a)

Compared to previous series where the topic of distance-speed-time has been assessed, this question was very well answered by the majority of students. Common errors included:

- incorrect conversion of 1.5 km to metres, with 150 m often seen
- inaccurate recall and use of the distance-speed-time formula
- calculating 1500 × 1.25

A lack of working shown by some students led to marks being lost, especially if their distance conversion was incorrect. Pupils should be encouraged to think if their answer is realistic within the given context.

For example, if their answer was swimming 1.5 km in 1 minute and 20 seconds, they should be checking their working carefully to identify their error.

Question 6(b)

A significant majority of students identified the third box as being the correct response.

Question 7

This question was well answered and most students drew fully correct graphs with accurately plotted points joined by a ruled straight line. Those who did not score full marks usually plotted a point incorrectly or did not include the line. The graph of $y = 1 + \frac{1}{2}x$ was the most common incorrect answer. Students who did this usually still gained a mark if they had a labelled table of values. Some students used values of y from –2 to 4 and those who did not make a table of values rarely scored any marks for their graph. A sharp HB pencil would reduce the likelihood of the graph being out of tolerance.

Question 8

Many students answered this question fully correctly and showed clear working out. Some misreads occurred for the final calculation – either omitting the '4×' completely or using it as '4+'. Common errors included:

- using 0.45% to give $34 + 0.45 = 34.45$
- showing $34 + 45\%$ then trying to work out 45% of 34
- very basic arithmetic, for example $34 + 45 = 76$

Question 9

The vast majority of students gained full marks using Alternative Method 1 and showed their working out clearly and concisely. Common errors included:

- misreading 84 000 as 8400
- $4695 \div 2.6$
- $12\,000 \times 2.6$
- squaring 7 and then calculating $84\,000 \div 49$
- mixing methods without achieving correct comparable values
- ticking Town A with correct calculations

Question 10

This question was very well answered and few students gained no marks. Those who did not achieve full marks tended to either leave their answer as $\frac{93}{150}$ or work out 57 and stop.

Question 11

Most students answered this question correctly with a small minority not gaining both marks. A numerical value for π was sometimes used and this was not accepted.

Question 12(a)

The tree diagram was correctly completed by the vast majority of students. A few gave the probability for the second gold card as 0.5 and lost a mark.

Question 12(b)

Many students only gained part marks as they did not include the probability of both cards being gold in their calculation. Some miscopying of 0.0025 occurred and basic arithmetic errors meant the accuracy mark was often not awarded.

Question 13

There were few fully correct answers to this question arising from students not understanding how to correctly find and write down the roots of the equation. Common errors included:

- giving the coordinate of the y intercept or turning point
- writing answers as factors, for example $(x + 2.2)$
- writing answers as inequalities or coordinates
- inaccurate reading from the graph

Question 14

A significant majority of students gained full marks which was pleasing for a 'show that' question which involved angles and ratio. Two marks were generally given to students who used Alternative Method 2. They assumed and used the ratio 5 : 2 in their working but did not give all the method required for the accuracy mark to be awarded. Those who did not score any marks generally started the question by dividing 45° into ten parts instead of three.

Question 15(a)

This question was not well answered considering its position on the paper although many students gained part marks. Common errors and misconceptions included:

- using the ratio 1 : 3 as the fractions $\frac{1}{3}$ and $\frac{2}{3}$
- finding the midpoint
- basic arithmetic errors using negative values
- $(-5, 9) + (3, -7)$ leading to $(-2, 2)$

Some students attempted to work out the gradient and / or equation of the line *AC*. This may have gained them credit in part (b).

Question 15(b)

Relatively few students gained full marks on this question which required a standard process to be followed. Basic errors meant marks were lost by students who clearly knew how to work out the question correctly. These included:

- using change in x over change in y for the gradient
- using the incorrect coordinate for point *C*
- poor arithmetic when calculating the constant, for example $-7 = 1.5 + c$ leading to $c = -5.5$
- an incorrect calculation for the gradient of the perpendicular line

Question 16

Performance on this question was very poor with only a small minority of students gaining full marks. Many worked out 12 as the number of times a 5 should be rolled in theory and compared it to the actual frequency of 14. No reference was made to the relative frequency or theoretical probability. Some students gained part marks by showing $\frac{14}{72}$ and $\frac{1}{6}$ but then did not convert them into a comparable format.

Question 17(a)

This question was very well answered and a significant majority of students scored full marks. A few students correctly found $a = 2$ and $b = 5$ but then went on to work out $5^3 \times 2^2$. Attempting to calculate and use $\sqrt{200}$ or $\sqrt[3]{200}$ were occasionally seen.

Question 17(b)

The second answer was correct, but the majority of students incorrectly chose the fourth response.

Question 18(a)

Too many students missed out lines of working for this 'show that' question. Many basic errors in rearranging the sine rule to give $\sin x = \ldots$ occurred. No marks were awarded if only $x = 64°$ was used in the sine rule. Some students correctly worked through to show $\sin x = 0.9013\ldots$ and then went straight to $x = 64°$ without showing a more accurate value.
Pupils should be reminded that they must show every step of working in a 'show that' question to be awarded full marks. They must not only write down answers as they work through their method line by line.

Question 18(b)

Many students identified that this was a different triangle but struggled to put this fact into words sufficiently. Vague responses referring to sides and angles in different / wrong places did not score. Often, if the word 'opposite' had been included, the mark would have been given. Students who understood congruency tended to use ASA and SSA to correctly state that the two triangles were not congruent.

Question 19(a)

A majority of students gained full marks and many others were awarded one mark for correctly finding g(6) to be 17. When errors were made they tended to be:

- multiplying the functions
- working out 17×3
- working out $6\text{g}(x)$
- writing $4(x - 3) - 7$ or working out gf(6)
- making basic mistakes in arithmetic, for example $17 - 3 = 15$

Question 19(b)

It was pleasing to see improved performance on a function question that assessed algebraic manipulation and the solution of a quadratic equation. For this high demand question a significant number of students gained full marks showing accurate and elegant algebra. A good number of students were awarded part marks for either setting up the equation correctly or solving their quadratic equation correctly. Common errors where easy marks were lost included:

- expanding $(x-3)^2$ to x^2-9 or x^2+9
- incorrectly rearranging $x^2-6x+9=4x-7$ to a 3-term quadratic equation
- stopping at $x^2-10x+16$
- stopping at $(x-8)(x-2)$
- putting -10^2 into the quadratic formula instead of $(-10)^2$
- getting to $x^2=10x-16$ and then square rooting both sides

Trial and improvement attempts were unsuccessful as normally only one solution was found (if any) and no part marks were available. Some students appeared to spend a lot of time using this approach and gained no credit.

Question 20

This high demand double-proportionality question was well attempted by students and a significant number achieved full marks. Clearly it is a topic which has been learnt accurately by many pupils. Part marks were awarded to a good percentage of students who either worked out one or both of the equations but were unable to progress further in the question. There were surprisingly few non-attempts. Some common errors included:

- starting with $R \propto Q^2$ or $R \propto Q^{-1}$
- mistakes in rearranging, for example $10=\frac{c}{9}$ giving $c=\frac{10}{9}$

Trial and improvement or numerical ratio methods were generally unsuccessful and no part marks were available if these were attempted.

Question 21(a)

A small proportion of students gained full marks and a larger proportion of them scored two marks. This was because they were unable to correctly convert their relationship for r and h ($4r = 3h$) into the correct ratio (3 : 4). Many students could not correctly recall the formula for the volume of a cylinder. Substituting values into the formulae gained no credit as this high-demand question was testing the ability to simplify algebraically.

Question 21(b)

The main error students made in attempting this question was using $3r^2$ instead of $(3r)^2$. Consequently, it was poorly answered often leading to an incorrect answer of 6. Some students successfully substituted values into the formula and achieved 18, but no part marks were available for this process.

Question 22

This question was quite well attempted considering its position on the paper and was correctly answered by more students than expected. Students who had learnt the product rule for counting gave the correct method and answer. Many attempts at creating lists of codes were seen alongside incorrect calculations. Common misconceptions and errors included:

- working out probabilities
- assuming digits were repeated
- $5 \times 4 \times 3 \times 2 \times 1 = 120$
- $5! = 120$
- $1 \times 3 \times 5 \times 7 \times 9 = 945$
- $4 \times 5 = 20$

Question 23

The second answer was correct, and the majority of students chose this response. An answer of 1 was the most common incorrect choice.

Question 24

Expanding the brackets and comparing coefficients was not commonly seen, with students attempting this question by completing the square. There were surprisingly few non-attempts for this high-demand last question on the paper. A pleasing number of students gained full marks. Some Special Cases were included in the mark scheme, where students demonstrated an understanding of the method of completing the square. The working they showed would not have been awarded marks from the main mark scheme but deserved some credit.

Further support

Mark ranges and award of grades
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Professional development
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Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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