Questions matter

GCSE
Mathematics
8300/3H

Report on the Examination

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Summary

Overall performance compared to last year

The paper was generally well attempted and accessible to students who were targeting the grades available on the Higher tier. Only two questions had a significant proportion of non-attempts.

Some topics later in the paper had been thoroughly learnt and performed better than in previous series. However, questions on probability and relative frequency were not well answered. There were few fully correct answers on proof questions where precise reasons needed to be given. Many students wrote down anything they could remember whether it was relevant to the question or not.

Basic arithmetic errors continued to be commonly seen on this calculator allowed paper. Build-up methods rarely gained part marks as correct working was not shown. Once again, the writing of digits 4 and 9 was often poor and sometimes indistinguishable from each other.

Correct recall of relevant facts and formulae not provided on the Insert was generally poor and students should be encouraged to learn these more accurately.

Topics where students excelled

- solving a linear equation
- factorising using the difference of two squares
- calculating a repeated percentage increase
- sharing in a given ratio
- using trigonometry to find a length
- listing correct combinations
- completing a Venn diagram
- using and completing a histogram

Topics where students struggled

- calculating a density
- naming a polygon using given criteria
- completing a relative frequency graph from given data
- giving correct reasons for a geometric proof
- working out a perpendicular gradient from two points
- working out the midpoint of a line
- using a Venn diagram to calculate probability
- finding an average speed using the area under a speed-time graph
- using an iterative formula to find individual values and a solution to 5 decimal places

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Individual questions

Question 1

A significant majority of students gave the correct answer. Those who were not awarded any marks tended to multiply both sides of the equation by $\frac{2}{5}$ which resulted in an answer of 2.8

An unsimplified final answer did not gain the accuracy mark, for example $\frac{87.5}{5}$

Question 2

Approximately two thirds of students gave a correct factorisation of the quadratic expression. Common incorrect answers included:

- $(x+2)(x-8)$
- $(x-8)(x-8)$
- $x(x-16)$
- $(x-4)^2$

Question 3

This question was very well answered with many students using decimal multipliers correctly and efficiently. Build-up methods often failed to gain any part marks as working out was not shown. Common errors when full marks were not awarded included:

- taking 25% from 160
- adding 10% of 160 instead of 10% of 200
- using a single combined multiplier of 1.35
- build-up using 35%

Question 4

Considering the position on the paper and level of demand, this question was not well answered with many students misreading or misinterpreting the given information. Common errors in working out included:

- finding $\frac{3}{5} \times 180$ as a first step
- using a multiplier of 0.55 for 45%
- calculating 45% of £810
- 430 + 243 instead of 380 + 243 for the final answer

Question 5

Just over half the students were awarded full marks and the question discriminated quite well across the range of abilities in this series. Poor use or no use of brackets led to marks not being given, for example $2 \times 3b - 5 + 7 = 6b + 2$ scored M0A0. Some responses showed

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algebraic multiplication of terms which significantly overcomplicated the question and gained no marks. Choosing a value for b also gained no marks.

Question 6

This question was very well answered with a significant majority of students being awarded full marks. The two main errors which occurred after the first method mark was scored were:

- calculating $180 \div 12$ and not using 360^{o} at all
- working out $4 \times 12 = 48$ for the final answer

Question 7

This question was also very well answered by most students. Those who used Alternative method 2 with $\cos 25$ or $\sin 65$ rarely made correct progress after scoring the first method mark. There were a small number of non-attempts.

Question 8a

Considering the position on the paper, this question was not well answered, although it discriminated across the range of abilities with many part marks being awarded. Common errors which prevented marks being scored included:

- incorrect recall of the formula for the volume of a cylinder
- incorrect use of the formula for the volume of a cylinder
- incorrect recall of the formula for density
- not giving any units
- giving incorrect units

$7.6 \times 2.5 = 19$ followed by $170 \div 19$ was a very common response which gained the second method mark.

Question 8b

The correct answer was selected by just over half of the students. The incorrect choice of the first box 'The density is greater than the answer to part (a)' was almost as popular.

Question 9

Only a small proportion of students were awarded full marks on this question and about half scored only one mark. Some calculated correct values but then ticked the 'No' box. A common incorrect calculation was $1092 \div 6$ Those who used Alternative Method 2 were generally more successful in scoring marks.

Question 10

Few students gave the correct answer but wrote down the name of any polygon they could recall. It was possible that many thought a regular polygon had to have four or more sides, and did not consider that the answer could be an equilateral triangle.

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Question 11a

This question was not well answered with half of the students not being awarded any marks. A small proportion gained full marks. A relative frequency of 0.2 was often used for the last two points on the graph. Inaccurately plotted and poorly joined or un-joined points resulted in easy marks being lost.

Question 11b

Some students gained this mark even if they did not score in part (a). Common incorrect methods and answers included:

- using 9 throws instead of 10 for each group
- working out the mean of all five relative frequency values
- $\frac{2}{50}$

Question 12a

This question was quite well answered, and a majority of students were awarded full marks. There were few non-attempts and only a small proportion of responses gained no marks. Common errors included:

- repeating one or more combinations
- C or D in 1st position
- A in 4th position

Question 12b

Surprisingly few correct answers were given. Some students assumed that a product of probabilities was needed. $\frac{4}{9}$ was a very common incorrect answer for when the ABCD combination already given in the table was not included in the total number of possible combinations.

Question 12c

Fewer than half of the students selected the correct answer, and each of the incorrect choices were equally popular.

Question 13

The majority of students selected the correct graph. The most common incorrect choice was graph C, which showed the straight line with a negative gradient.

Question 14

A very small number of students gained full marks on this question with about half the cohort being awarded the first two marks using either alternative method. Correct reasons proved to be particularly challenging, and although some statements were given, these were often incorrect or irrelevant to this question. Some students split the pentagon into three triangles but made no progress after finding 540^{o}.

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Common errors included:

- using 450^{o} for the interior angles of a pentagon
- finding $x = 42$, but then using $144 + 42$ and $138 + 90$ to attempt to show lines *AB* and *DC* were parallel

Question 15

This question discriminated across the range of abilities with a spread of marks being awarded. Students using Alternative method 3 sometimes rounded prematurely and then did not get an exact answer of 550. Some attempted a calculation using the formula for density. Common errors included:

- a first step of $30 + 27.5$ or $165 + 30$
- an additional final step of $550 + 165$ which was considered as incorrect further working and the accuracy mark was not given

Question 16a

Only a small proportion of students were awarded full marks and more than half the cohort did not score or attempt the question. Marks were also lost through poor use of negatives in working out. Common errors included:

- finding 8 and -5, then giving $(8, -5)$ on the answer line
- finding $-\frac{5}{8}$ then giving $-\frac{8}{5}$ on the answer line
- finding the equation of the line *AC*
- using $\frac{\text{change in } x}{\text{change in } y}$ for the gradient of *AC*

Question 16b

This question was not well answered with fewer than a third of the students scoring any marks. Some attempted another gradient calculation or tried working with an equation of a straight line. There appeared to be a general misunderstanding that the coordinates of the intersection of lines *AC* and *BD* was the midpoint of *AC*.

Question 17a

Few students gained no marks on this question and the performance was significantly above that which was expected. Learning of this topic has improved noticeably in recent series. The only recurring error was 59 being written for only Syrup when it should have been 47.

Question 17b

This question performed significantly below that which was expected with a very small minority of students scoring any marks, and only a handful being awarded full marks. A common incorrect calculation was $\frac{12}{36} \times \frac{24}{36} = \frac{2}{9}$ Some unsuccessful attempts using a tree diagram were seen and a calculation using all 100 ice creams was also quite common.

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Question 18

A good spread of marks was awarded for this question, and a significant majority of students scored at least 3 marks. The performance of the question was above that which was expected and represented improved learning of this topic. Common errors included:

- misreading of the scales, especially for 0.08 on the frequency density axis
- misreading the table
- using midpoints when calculating the frequency density
- extending the final bar to 360
- working out 0.7×50 or 0.2×50 for the missing frequency values

Question 19

Few students gave two correct criticisms of the graph and the question was not well answered. Many irrelevant, incorrect or ambiguous criticisms were given, which commonly included:

- should not touch x or y axes
- should start at (0, 0)
- should be a straight line or curving the other way
- y intercept is wrong
- referring to $x \geq 0$ as not being shown or correct
- referring to incorrect labelling or not enough labelling

Question 20

This question was poorly answered and required a thorough level of learning for this topic. Few students gained full marks, although more than a third were awarded one mark for correctly identifying one of the relevant angles in terms of x or y. Some students still referred to 'angle *C*' or 'angle *AC*' instead of using correct notation. There were no attempts using Alternative method 3. Other common errors or misinterpretations included:

- stating and attempting to use the alternate segment theorem
- assuming quadrilateral *CDEF* was a kite
- choosing random values for x and y
- stating any circle theorem
- assuming that some or all of the angles in the cyclic quadrilateral were 90^{o}

Question 21a

More than half the students were awarded at least two marks on this question. This was above the prediction and indicated that careful learning of this topic has improved the general performance. Common errors included:

- starting with an incorrect proportionality equation, for example $y \propto x^2$ or $y \propto \frac{1}{x}$
- finding $k = 8$ but without substituting back into the equation
- leaving the $\propto$ symbol in the final answer
- incorrect rearranging to find the constant
- incorrect calculation of the constant

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Question 21b

Students who gained 2 or 3 marks in part (a) tended to answer part (b) correctly. Follow through was only available if an equation with the correct proportionality, but incorrect constant was used.

Question 22a

For many students, this high demand question would have been above their target grade and therefore not easily accessible. The topic has been poorly answered in the past, and this continued to be the case on this paper. However, some fully correct answers with accurate working and neat setting-out were seen. Common errors included:

- using the speed at each hour and working out their mean value
- not using a single area for estimating under the curve
- drawing a tangent to the curve to find a gradient
- using 2.5×50 or 1.5×50 for the area of the triangles

Question 22b

There were very few correct responses to this question. The students who were unable to gain marks in part (a) were highly unlikely to answer part (b) correctly, even when follow through was potentially available. Many referred to a tangent, gradient or deceleration based on their incorrect understanding of the question.

Question 23

This question was not well answered and about one third of the students were awarded any marks. Some correctly recalled the need to use Pythagoras' theorem and gained one mark. A very small proportion gave a fully correct answer. Common errors and misunderstandings included:

- rounding the radius to 6.7
- $3^2 + 6^2 = 81$
- $x^2 + y^2 = 36$
- $y = 3x + 6$
- working out the gradient or equation of the line for *OP*

Question 24a

About one third of the students were awarded full marks which showed improved learning of this topic and was above expectation. Those who gained one mark often calculated x_3 and x_4 instead of x_2 and x_3. Common errors included:

- not rounding to 5 decimal places as required
- incorrect rounding to 5 decimal places
- using $\sqrt[3]{\ }$ instead of $\sqrt[3]{\ }$

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Question 24b

The majority of students either did not attempt this question or gave an incorrect answer. It discriminated between those who had learnt this topic and those who had not.

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