AQA
Realising potential

GCSE
Mathematics

8300/3H: Paper 3 (calculator) Higher

Report on the exam

Published: November 2023

Contents

The below table is interactive. You can press the control button click on the title of the question to go directly to that page.

Summary

Overall performance compared to last year

Most students were able to access the majority of the earlier questions and were rewarded for good use of mathematics demonstrated at different levels of ability. There were relatively few non-attempts in the first half of the paper. However, performance in the second half of the paper was very patchy for many students, showing significant gaps in their knowledge and skills. This is not unusual for a small November Higher tier cohort.

Access to the formula sheet eliminated errors owing to incorrect recall and minimal miscopying of formulae was seen. Some students were able to attempt demanding topics which would normally have been too challenging for them to answer: for example, when the sine rule and area of a triangle were required.

Students must continue to be encouraged to show their working clearly. Presentation and setting out of working were often poor. Handwriting smaller than the font size of the printed question was very difficult to read and often illegible. Students should use a 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 apparent in some questions that a calculator was not used and errors in very basic arithmetic were frequently seen.

Some students do not attempt the multiple-choice questions.

Topics where students excelled

- Using fractions within a given context
- Choosing and using cube and prime numbers
- Recurring decimals
- Trigonometry
- Completing a probability tree diagram
- Solving simultaneous equations

Topics where students struggled

- Using a vector diagram and vector sum to find unknown elements
- Proving two triangles are congruent
- Writing two algebraic fractions as a single fraction
- Using the surface area of a prism to find a missing length
- Writing a ratio in the form $a : b : c$ using given information
- Finding the total probability of winning a game from combinations of scores

Individual questions

Question 1

Many incorrect answers were given for this question with $n + 7$ the most commonly occurring. Some students thought the question was asking for the value of the next term and gave an answer of 34.

Question 2

This question was not well answered with fewer than a third of students giving the correct response. Some answers were written as decimals when a fraction had been specified. The main error arose from giving the scale factor as $\frac{3}{2}$ which would have been for square B being enlarged to square A. Negative answers were also seen. Fractions should not be written as 2|3 but using a horizontal line between numerator and denominator.

Question 3

Most students were able to score at least one mark on this question by correctly giving the lower bound as 7.5 It was common to see 8.4 or 8.49 written for the upper bound.

Question 4

This question was overcomplicated by some students who attempted to factorise and / or solve the equation. (–1, 0) was often given as their answer with just over a third of responses being correct.

Question 5

Relatively few students gained full marks on this question, with two marks out of four being the most common score. Stopping after calculating £31 200 as the total annual salary appeared to be the main reason why only two marks were scored or only stating that the increase was £1200. Build-up / build-down methods frequently showed arithmetic errors throughout the whole question. Some answers were just given as 4% without stating if this was an increase or decrease.

Question 6

This question was well answered with the majority of students gaining full marks and there were few non-attempts. When no marks were scored the first calculation was often shown as 29 760 ÷ 240 arising from a misunderstanding of the question. Miscopying of the given values was also apparent in some responses.

Question 7

Marks were predominantly lost in this question when 1 or 9 were given as prime numbers in the boxes on the right side of the calculation. Most students correctly used 27 as the third cube

number for the left side box. A list of prime numbers was not awarded any marks if the boxes were left empty or filled incorrectly.

Question 8

The majority of students circled the correct answer.

Question 9

Most students attempted this question and the majority gained full marks. Those who chose to use Pythagoras' theorem or the sine rule significantly overcomplicated the question. These responses often contained errors in rearranging the required formulae. Some students chose the incorrect trigonometric ratio to start with or overlooked the need to use the inverse function to find the angle.

Question 10

Part (a) Whilst this question was generally well answered, there were a significant number of students who interpreted it as a frequency tree and incorrectly placed the values 1 and 4, 3 and 7 onto the probability tree diagram. Some answers only had correct probabilities for Bag A, with those for Bag B either missing or a denominator of 9 was used (inferring non-replacement of discs chosen from one bag).

Part (b) Nearly half of student answers gained full marks. In many other responses, the correct probabilities had been chosen from the tree diagram in part (a) but the values were then added instead of being multiplied. Follow through marks were available if both probabilities for Green from part (a) were correctly multiplied in part (b).

Question 11

This question was very well answered by the majority of students. Responses which did not score any marks were generally started by attempting to add the two equations, which often resulted in $10x = 148$. Some students understood the need to eliminate $2y$ but then incorrectly showed $7x = 100$ or $3x = 48$ in their next step of working.

Question 12

Incorrectly interpreting "p is three times r" was a common error when answering this question which then often lead to the calculation $108 \div 3$. $108 \div 2 = 54$ was also routinely seen amongst responses which gained no marks. Some students scored the first mark by writing a correct interior or exterior angle of the triangle on the diagram.

Question 13

Part (a) A majority of students gave the correct answer of 21 although some wrote it within a fraction which did not score the mark. 37 was commonly incorrectly chosen as it was the greatest frequency.

Part (b) Whilst there were many correct responses for this question, common errors included:

- selecting incorrect groups for addition

- calculating $37 + 18 = 45$
- 55 written on the answer line with no probability seen

Part (c) Students who recalled how to correctly calculate frequency density values generally proceeded to draw a correct histogram. There were many other methods attempted using midpoint or cumulative frequency values, along with frequency polygons plotted on a modified vertical axis. As a general principle, if a student thinks that the data does not fit onto the printed scale, they should be reviewing their chosen method rather than relabelling the axes.

Question 14

Part (a) If the correct values were substituted into the formula for both pyramids then most students correctly progressed to gain both marks. The accuracy mark was not awarded for this 'Show that' question if decimal values were used for the subtraction of the volumes with a different number of decimal places for each volume: for example, $341.333 - 83.3 = 258$ scored M1A0. A surprising number of students did not use 8×8 or 5×5 for the square base areas of the pyramids, but just used 8 and 5 and therefore did not score any marks.

Part (b) This question was well attempted but many students only gained one mark as their calculation stopped short at 312 or 405, and they overlooked the final stage of working out required to reach the correct answer of 54 cm^3. There was some evidence that the formula for density could not be recalled accurately, or rearranged correctly into the form that was required to answer this question: 7.5×2340 was a common incorrect first step of working.

Question 15

This question was not well answered with the majority of students not gaining any marks. Some were unable to correctly use the diagram to find the vector $\begin{pmatrix} 8 \\ 5 \end{pmatrix}$ and others did not use the vector sum $2\mathbf{a} + \mathbf{b}$ appropriately. Errors also occurred when solving the equations $2m - 4 = 8$ or $6 + p = 5$

Question 16

Some very good responses were given for this question using correct algebra and applying Pythagoras' theorem accurately. A final answer for the diameter *PQ* or not given as a decimal did not gain the accuracy mark. Common misconceptions were:

- $a^2 + b^2 = 10^2$ without using the same letter
- trying to work with πr^2
- stating radius is 5 from using $\frac{10}{2}$

Question 17

A very small proportion of students answered this question correctly and many responses overcomplicated the required method. Attempting to complete the square, giving the answer as an inequality or writing $\frac{a-b}{2}$ were commonly seen.

Question 18

There were a good number of fully correct answers showing accurate algebra which was neatly presented. Marks were lost for the common errors of:

- incorrect cancellation of the powers
- attempting to move powers inside the brackets
- moving the multiplier of 2 inside the brackets incorrectly, eg $(2x + 8)^2$
- dividing through by 2 for the final answer

Question 19

Questions requiring geometric proof tend to be poorly answered and this trend continued. Part marks were scored by a reasonable number of students who gave one or more correct statements. The question was commonly misinterpreted as requiring circle theorems. There were a very small number of fully correct, unambiguous answers which contained correct reasoning. These students showed good understanding and knowledge of the methodology for proof. To improve performance on this type of question, students should be reminded of the following:

- use correct notation for lengths: $A = C$ is not acceptable for $AE = CE$
- use correct notation for angles: angle E = angle E is not acceptable for angle AEB = angle CED
- ensure accompanying statements are correct and unambiguous

Question 20

The majority of students scored at least one mark on this question for correctly expanding the brackets. Rearranging the equation onto one side was then problematic for many and some were unable to progress after finding the correct quadratic equation. Students who used the quadratic formula were generally successful in obtaining the correct solutions. Marks were lost when the quadratic equation was factorised incorrectly into two brackets, with $(2x + 6)(x + 3)$ commonly seen.

Question 21

Part (a) Slightly under half of the students circled the correct answer of shape D. Shape B was the most popular incorrect choice.

Part (b) Performance improved on this topic when compared to previous series. Students were guided to draw a tangent on the graph which resulted in more marks being awarded. However, marks were lost by making basic errors which included:

- no tangent being drawn
- inaccurate tangent being drawn
- incorrect reading from the vertical scale
- incorrect gradient calculation, using $\frac{x}{y}$

Question 22

Most students attempted this question but many were unable to find a suitable common denominator and combine the fractions appropriately. There were a considerable number of correct answers which were then further processed incorrectly: for example, to $\frac{29}{10a}$. In these instances the accuracy mark was not awarded.

Question 23

This high demand question was very poorly answered and also had the highest proportion of non-attempts for this paper. The students who scored full marks should be commended for good use of algebra and for generally setting out their work clearly. Many of the students who did attempt the question without being awarded any marks, interpreted it as a volume calculation. One mark was awarded for finding the surface area of one rectangular face. However, creating the full equation for surface area and rearranging it in terms of x^2 proved to be too challenging for most of the cohort.

Question 24

This question discriminated well across the range of abilities from full marks down to non-attempts. Provision of the two formulae that were needed (on the insert) allowed some students to gain marks which might not have been accessible to them if learning and accurate recall of formulae were necessary. Main errors which prevented some students from gaining more marks included:

- being unable to correctly rearrange the sine rule to make side *AC* the subject
- using $\frac{1}{2}$ × base × height to find the area with the values 24 and 20.8
- using the incorrect combination of sides and angle in the formula for area

Question 25

Most students were unable to approach this question correctly. Some lists of numbers were seen where one of the given criteria was met, but this was not sufficient to gain a mark. There were very few formal or logical methods shown in the working out. An easy mark was lost by those who gave their final answer as
18 : 20 : 24 or 4.5 : 5 : 6

Question 26

This high demand question was attempted by most students but the majority were unable to score any marks. Some responses overlooked the non-replacement of tiles in the game. Many of the students who scored two marks did not progress further as they ignored the six different ways of scoring a total of 10 from three discs. Complicated diagrams were often drawn unnecessarily and they did not gain any marks unless accompanied by a correct calculation.

Question 27

Part (a) Only a small proportion of students gained the mark and the most common incorrect answers were $\begin{pmatrix}-2\\0\end{pmatrix}$ or $\begin{pmatrix}0\\-2\end{pmatrix}$. Some students attempted to expand the brackets or just cubed x and –2 and then gave $\begin{pmatrix}x^3\\-8\end{pmatrix}$ as their answer.

Part (b) Drawing a sketch was beneficial to many students in finding the correct answer as they were able to visualise the gradient and intercept of the reflected graph. Incorrect responses included:

- $y = 5x - 4$
- $y = -5x - 4$
- $x = 5y + 4$

Further support

Mark ranges and award of grades

Grade boundaries and cumulative percentage grades are available on the results statistics page of our website.

Enhanced Results Analysis (ERA)

Use our exam results analysis tool to create and customise as many different reports for comparison as you like.

Professional development

Attend one of our feedback courses where you can review example responses from students and commentaries from our examiners.

.

Contact us

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

Tel: 0161 957 3852

Email: maths@aqa.org.uk

aqa.org.uk