AQA

GCSE
MATHEMATICS

8300/3H: Paper 3 (Calculator) Higher
Report on the Examination

8300
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General

Most students completed the paper within the time allowed and there were very few questions with a significant number of non-attempts, predominantly being the questions of highest mathematical demand. Many scripts showed clear working and neatly presented diagrams, although there were examples of transcription errors and poor handwriting across the range of abilities. Students continued to attempt a question more than once without indicating their final answer. Recalling and using formulae correctly was still a major source of lost marks. Some students are still not indicating any answer for the multiple-choice questions. The spread of total marks gained indicated that the paper discriminated well between students of differing abilities.

Topics which were answered well included:

- use of fractions
- lowest common multiple
- drawing an enlargement
- using the density formula
- rearranging a linear equation
- expanding brackets
- compound interest
- mean of a set of numbers
- Venn diagrams

Topics which students found difficult included:

- using bounds within a money context
- drawing a vector
- simplifying an algebraic fraction using indices
- finding areas of sectors using algebra
- using the quadratic formula
- problem solving using ratio within a money context
- sketching an exponential function
- describing transformations with invariant points
- using a composite function
- equation of a circle
- finding the average acceleration from a speed-time graph and stating the units

Question 1

This question was very well answered and the incorrect fractions were chosen equally by students.

Question 2

One third of students selected an incorrect answer for this question with $\frac{6}{10}$ being the most popular incorrect choice.

Question 3

This question was answered correctly by 80% of students showing an improved understanding of a question about lowest common multiple. However, the other 20 % predominantly selected 5 as their answer having continued to confuse the LCM with highest common factor.

Question 4

This question was very well answered by a majority of students and –5 and 3 were the very popular incorrect choices.

Question 5

A significant percentage of students gained full marks on this question and many of the responses were drawn accurately in pencil using a ruler. Some students lost a mark by not drawing their triangle within the tolerance of $\pm \frac{1}{4}$ square for the base and height. A centre of enlargement was not required, so time was lost by those students who chose their own and drew on construction lines. The main error was enlarging the triangle by a scale factor of $1\frac{1}{2}$.

Question 6

A relatively small number of students scored full marks on this question with about half scoring two marks out of three. For two marks, the answer of 9.50 + 6.75 = 16.25 was most frequently seen and for one mark, 9.50 + 7 = 16.50 was very popular. The majority of students did not consider the upper bounds within the context of money and some use of recurring decimal notation was seen.

Question 7

Generally, this question was well answered with a fully correct table including the units seen in a majority of responses. However, some answers were given without any units or incorrect units and the formula for density was not always recalled or used correctly, eg density for J given as 48 × 8 = 384 and then the volume for K as 384 ÷ 78 = 4.92.

Question 8

This question was very well answered, showing that a majority of students can accurately rearrange a linear equation. The most common incorrect choices involved the subtraction of 2 from y or division of y by 3 as the first step of rearranging.

Question 9

More than half the students gained full marks on this question with the majority using an algebraic approach. The most successful responses used *PQ* as the unknown and formed an equation equalling 170. Marks were lost in the subsequent simplifying and solving steps with $4x + 10 = 170$ commonly seen. $PQ = PR + 10$, $PR = 10 \times PQ$ and $PR = 2 \times QR$ were common initial errors made by the students who gained no marks. A trial and improvement approach rarely gained more than one mark, unless it was fully correct.

Question 10

This question was well answered with almost all students having some success. For both offers, some students worked with simple interest and concluded that the offers were the same and Mia was correct. A few students incorrectly used a percentage decrease method. Those students who used a build-up technique on this calculator paper often made arithmetic errors with the large numbers involved. The most successful students used percentage increase multipliers and remembered to make a decision at the end of their working.

Question 11

Two thirds of students gained full marks on this question, which showed they had a good understanding of the principles being examined. Errors were made at the first stage by dividing 564 by 3 rather than by 4, and not using brackets appropriately when adding up the values in Set A before dividing by 4. Some students did not understand how to apply the ratio correctly to the mean of Set A and then to Set B, and therefore made no progress beyond gaining the first mark.

Question 12

More than half of the responses were fully correct on this question. Most students who correctly worked out the value for c went on to gain full marks. Some lost the final accuracy mark by not writing out the full equation on the answer line with '$y =$' omitted. Arithmetic errors were commonly seen in finding the value of c after substituting numbers into the equation. Some students tried to draw a graph and others wrote down $y = 4x + c$ and made no further progress.

Question 13

This question was one of the most poorly answered on the paper with part (b) only having a small percentage of fully correct responses. Many answers of 2**a** were seen in part (a) with students not recognising the need for a minus sign to show the direction of the vector was reversed. The main errors in part (b) included: vectors **c** and **d** connected incorrectly, no directions or incorrect directions indicated on the vectors, **c** and **d** drawn but **c** – **d** not connected / shown, no attempt at a vector sum.

Question 14

Just over half the students made the correct choice for this question. The remaining students predominantly chose either of the first two statements and assumed that the ratio represented the total number of children in each class.

Question 15

This question was quite well answered and discriminated well between students. Poor notation for b^3 was commonly seen and it was often difficult to establish whether it was positioned on the numerator or denominator. Multiplication signs should not have been included in the final simplified answer and students were penalised for introducing addition or subtraction.

Question 16

This question was the least well answered on the paper with very few students gaining full marks. The main algebraic error was writing $(1.5r)^2$ as $1.5r^2$ for Sector A and many responses omitted x, r or π. Students who did not use an algebraic approach and chose their own values for x and r gained no marks.

Question 17

This question was well answered with a majority of students gaining full marks. The main errors included: finding 6 7 3 2 but giving an answer of 18; finding 6 7 3 2 and giving the range as 6 – 2 = 4; leaving the answer as the relative frequency of 0.025; and multiplying each Sample by 800.

Question 18

Part (a) was well answered with the equation correctly expanded and rearranged. The main errors were the omission of '= 0' on the answer line or +4 appearing on the left-hand side of the equation.

Part (b) was not well answered with many students gaining no marks, although the number of non-attempts was low. The quadratic formula was not recalled or used correctly by a significant number of students. Missing brackets and missing minus signs were one of the main reasons for gaining 0 marks. Students should be reminded that if their calculator shows an error when finding the square root of a number, they should go back and check their working. Other methods to solve the quadratic were generally unsuccessful and it was overlooked that the question was giving guidance to use the quadratic formula by saying 'Give your answers to 2 decimal places'.

Question 19

To gain marks on this question, students needed to identify two different errors on the box plot and use accurate values in their answers. Comments that stated 'the median is wrong' or 'the upper quartile is plotted at 17 minutes' were not awarded any marks. Other common errors included: comments that the values in the table were incorrect; IQR is 15 or 16; stating that the scale is wrong or hard to read; using 10.30 minutes for $10\frac{1}{2}$ minutes; and finding one error and stating it twice.

Question 20

Part (a) was answered correctly by a minority of students but many others showed they understood the process that was required. However, they had misread the first line of the question and incorrectly started with $d \propto \sqrt{v}$ or a different proportionality equation for which no marks were available. Other common errors included: keeping a proportionality symbol after introducing the constant; incorrectly rearranging to find the value of the constant; and not writing the final equation on the answer line with the value of the constant substituted.

Part (b) allowed follow through from part (a) if the method was using $d = kv^2$. More students gained full marks than in part (a), as they were allowed to use their incorrect value of k. The number of non-attempts was quite high for the position of this question on the paper.

Question 21

This question was not well answered by most students and more than half of the responses gained no marks. Fully correct methods often started by finding the cost of one litre of blue paint and one litre of yellow paint, before applying the 7:3 ratio for the cost of green paint. Common incorrect methods included: working with £305 (the cost of one blue container and one yellow container); using a ratio of 350:60 for green paint; using a ratio of 50:20 for green paint; multiplying volume by cost; and ignoring the 7:3 ratio completely. Many students had several attempts at this question and their working was difficult to follow with calculations scattered over the page. Students should set out their working carefully and logically to aid their performance on this type of multi-step question.

Question 22

Part (a) was correctly answered by nearly all the students which showed an improved understanding of Venn diagrams from previous series.

Part (b) was also very well answered, although $\frac{8}{29}$ was the most popular incorrect choice where students did not take into account that the selected student would come from the 15 who own a dog.

Question 23

This question was not well answered with many students not gaining any marks. It was necessary for their sketch to pass through the point (0,1). The most popular incorrect answer was a curve drawn wholly above $y = 2^x$. Marks were lost when multiple curves were drawn or when curves passed through or touched the x-axis for $x < 0$. Students should be reminded that a sketch must be completed neatly, showing the important features clearly, eg shape, axis crossing points.

Question 24

This question was not well answered with many students not gaining any marks. Errors were made interpreting the question and 20 cm was commonly used as the diagonal across the base of the cuboid. The base area was often unnecessarily split into two dimensions for the length and width of the cuboid, with 10 × 15 a popular choice. The sine rule was also used by some students to find the height of the cuboid.

Question 25

Both parts of this question were not well answered with only a third of the students gaining full marks in either part. Fewer students gave answers using more than one transformation, but it appeared that the words ‘mapped’ and ‘invariant point’ were not widely understood.

Part (a) was often incorrectly described as a rotation and the line $y = 1$ was omitted or incorrectly stated. The words ‘flip’, ‘turned over’ and ‘mirrored’ were not acceptable to describe a reflection.

Part (b) had a large percentage of non-attempts and some students gave a long description of where each individual vertex would move. The centre of rotation was commonly omitted from otherwise correct responses. The word ‘turn’ was not acceptable to describe a rotation.

Question 26

This question was not well answered and continued the trend seen in other series on this specification when the topic of functions has been examined. The most common errors included: multiplying or adding the two functions as the first step, writing $(16 – x)^3 = 24$, incorrectly rearranging to $x^3 = 24 – 16$ and substituting in numbers as $16 – 24^3$. Some students were also unable to correctly evaluate $\sqrt[3]{–8}$ on this calculator allowed paper.

Question 27

This question had one of the lowest numbers of completely correct solutions, although more than half of the students gained some marks. It was very clear that if the cosine rule had been recalled and used correctly, then the proportion of fully correct answers would have been significantly higher. It was disappointing to see responses where the student understood the method they needed to use (cosine rule) but were unable to make any further correct progress. Many students correctly stated the radius of the larger circle to be 12 but a significant number were not able to interpret the equation of the circle. Common errors included: using 144 as the radius for the larger

circle; using 80 and 64 as the radii of the circles; using right-angled triangle trigonometry; and incorrectly rearranging the cosine rule to find the angle *AOB.* Students should be reminded that if their calculator shows an error when trying to find the angle using the cosine rule, they should go back and check their working.

Question 28

Part (a) was well attempted with over half the students gaining some marks and just under a third achieving full marks. The most successful students cut the diagram into three distinct regions and used a triangle from 9 to 12 seconds. This gave an overestimate for the final region and a total of 67.5 m for their three areas. Errors occurred when: students cut the diagram into too many strips; misread the vertical scale; used a tangent to the curve; used many small areas under the curve; and did not calculate the areas of triangles and trapezia correctly. Students who did not gain any marks often quoted a distance – speed – time relationship without understanding that the area under the speed-time graph would give them the distance.

Part (b) had relatively few non-attempts for the last question on the paper, but students had limited success in gaining marks. Very few showed an understanding of how to calculate the average acceleration from the graph. Some students calculated the acceleration for 0 to 5 seconds and for 5 to 9 seconds and then worked out the mean as 0.925. Many answers either had no units or stated incorrect units.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.