AQA

GCSE
Mathematics

8300/3H Paper 3 Higher
Report on the Examination

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General

Students attempting this higher tier paper had already been entered for the qualification in a previous series. Therefore, for many of them, the questions of highest mathematical demand were likely to present significant challenges. Many of these questions were not attempted by the students and there was a noticeable decline in performance as the level of demand increased through the paper. Generally scripts showed clear working and neatly presented diagrams, although there were examples of transcription errors and poor handwriting across the range of abilities. Recalling and using formulae correctly was still a major source of lost marks. The spread of total marks gained indicated that the paper discriminated between students of differing abilities.

Topics which were answered well included:

- expanding brackets
- identifying an error interval
- solving simultaneous equations
- percentage reduction within a context
- basic probability
- using a straight line graph
- commenting on the validity of a hypothesis
- using trigonometry in a 3D shape

Topics which students found difficult included:

- working out a reciprocal
- using a value of x or a coordinate to find an unknown in an equation
- reversing a percentage within a context
- using the product rule for counting
- describing an enlargement with a negative scale factor
- interpreting a speed-time graph
- calculating the area of a triangle using $\frac{1}{2}ab\sin C$
- vectors
- finding and using inverse and composite functions

Question 1

This question was answered correctly by two thirds of students with 13:50 the most popular incorrect choice. Probability and relative frequency should never be written as a ratio.

Question 2

Fewer than one half of the students selected the correct answer for this question with 3 being the most popular incorrect choice. The equation must be rearranged into $y = mx + c$ form before selecting the coefficient of x as the gradient.

Question 3

This question was well answered. Some students selected $2x$ as their answer as they had incorrectly simplified the positive and negative terms.

Question 4

This question was answered correctly by more than half of the students but $6.365 \leq x < 6.3749$ was the most popular incorrect choice. When using an error interval, the upper bound must be chosen carefully.

Question 5

Some students did not use the most straightforward method of solving these simultaneous equations and introduced unnecessary multiplying and manipulation of the equations. This often led to them making arithmetic and algebraic errors. The number of non-attempts was low but only just over half the students gained full marks. $8y = 4$ leading to $y = 2$ was a common error.

Question 6

Part (a) was well answered with a low number of non-attempts. Students who scored two marks generally gave £40.5 as their answer. It is important that correct money notation is used especially when the answer is transcribed from a calculator where the final zero would be missing. Incorrect methods included: splitting the packs of tiles and using a unitary method to buy exactly 100 tiles; not using the 25% reduction; using the 25% reduction on only one large pack; using the number of tiles as the cost (40 tiles turned into £40).

Part (b) was not well answered with only a few students giving an acceptable response which unambiguously identified that the addition of 15 and 6 was incorrect in the method. Many answers referred to perimeter or gave a description of how to find an area or calculated the area of the floor without subsequently dividing it by 1600

Question 7

Most students gained at least 1 mark for correctly drawing an 8 cm line within tolerance showing a good understanding of how to use the scale. Many construction arcs were missing or drawn in freehand which could only score a maximum of 1 mark. The students who used compasses correctly to identify the third vertex went on to score full marks.

Question 8

Part (a) was well answered with a low number of non-attempts and with most students gaining full marks. The most common errors included: adding or multiplying the two fractions, giving the answer as a fraction (e.g.32/83), working out 2/5 of 83 or 3/5 of 83. Students should be reminded to read the question carefully to establish whether they are working out a probability or using a probability to work out a relevant number.

Part (b) was also well answered, although some students gave their answer as the number of people (51) instead of the probability (51/83). There was evidence of poor arithmetic when working out 35 + 48 – 32 on this calculator allowed paper.

Question 9

This question was not well answered with more than half of the students gaining no marks. Generally, they were unable to identify the initial key step of working out the difference in the angles for women and men (30^o) and dividing 450 by this value to find the number of people per degree which was represented on the pie chart (15). Common errors included: linking 450 to 65^o, 35^o or 100^o, using 450 as the total number of people, using a build-up method where 30^o is interpreted and used as 30% = 450

Question 10

Fewer than one half of the students selected the correct answer for this question with ×2 being the most popular incorrect choice. Most likely this arose because a number was selected, divided by 2 and then multiplied by 4, giving an answer which was double their starting value and reference to the formula for density was completely overlooked.

Question 11

This question was not well answered with 35% of the students gaining no marks and a further 40% only gaining 1 mark. Many students worked out the square root of 512 rather than the cube root, but most did not understand how to calculate the reciprocal of 0.4. Some students who reached the stage of showing the ratio 8 : 2.5 then stopped or were unable to write their answer in the required form of n : 1 with 20 : 1 commonly seen. The students who initially wrote 0.4 as 2/5 or 4/10 were more successful at finding the correct reciprocal.

Question 12

This question was well attempted and just under half the students gained full marks. 1 mark was awarded for working out the lower rate of pay (£8) but some of the students who correctly worked out this value were unable to use the same method to find the higher rate of pay (£14). There were many unrealistic answers given (e.g. £280 basic, £350 higher so difference £70) and students should be encouraged to check whether they have sensible values within the context of the question. Common errors included: 350 ÷ 40 = 8.75, misreading the scale on the vertical axis.

Question 13

Part (a) was not well answered and less than a third of students gave sufficient evidence to gain full marks on this 'show how' question. There were many arithmetic errors when using the data from the table and incorrect evaluation of 11 × 12 was commonly seen; or the use of multiplication by 11 instead of 12. Many students were unable to link their calculations to supporting the statement or just ignored this completely. Examples of this included: working out 10.4 and making no further progress, stating 'read 100 books in a year in total', working out 124.8 and not linking it to 100 books, not working out the number of books read for all five people.

Part (b) was well attempted with most students gaining at least one mark. Students should be reminded not to give the same reason twice and to avoid contradicting a correct statement. Common incorrect / irrelevant reasons included: people might lie, the results are wrong, need to use a diagram, months have different days in them, Paul's result proves she is wrong.

Question 14

This question discriminated well across the range of abilities. Many were unable to use the coordinate to work out the value of a and either made up their own value or ignored it and attempted to plot $y = x^3$ There were many errors in plotting the points even when a table had been used and correct values were seen. Points were either not joined up, had a line passing somewhere near them or had a feathered / sketched line drawn in. The point at (–1, 1) was often plotted incorrectly and the equation $y = x^3 + x$ used to work out values in a table. Students should be reminded that if they have points which cannot be plotted on the printed grid they should go back and check their working out.

Question 15

Most students were unable to access this question as they did not understand the process of how tax is calculated and the word 'next' confused them in this context. Few students gained full marks. Many gained 1 mark for calculating £7500 were then unable to progress correctly to the next stage of the calculation as they mainly worked out 40% of £112 500. Some students used a Trial and Improvement approach but usually made no progress and so gained no marks. Occasionally a reverse percentage calculation was attempted but £9260 was often used instead of the correct value of £1760

Question 16

Part (a) was correctly answered by one quarter of the students which does show some minor improvement in performance on a question that used the product rule for counting. After calculating the correct answer of 2016, some students subsequently divided by four, which was penalised. Other common errors included: adding up the four numbers or writing the answer as a probability.

Part (b) showed similar performance to part (a) and the same misconceptions and errors occurred. Incorrect subsequent working was penalised and some students only reduced the number of labourers or plumbers instead of reducing both numbers.

Question 17

This question was not well answered and it was not attempted by a significant number of students. Difficulties were encountered in correctly substituting the values into f(x). Many errors were seen in evaluating the answers: either the expression was incorrectly entered into a calculator, or BIDMAS was not used if the students were performing a mental calculation. Students needed to show 268 and 126 and state that Jenny was incorrect to gain full marks. Many students did not understand function notation.

Question 18

Many students selected the responses with the signs transposed.

Question 19

Part (a) was not well answered. Many responses started by using Pythagoras' theorem to find length *BH* and either made no further progress to work out the size of the angle, or lost accuracy by premature rounding. Some students used the sine rule with limited success and many examples of poor notation were seen, which did not gain the method mark if a final correct answer was not achieved (e.g. tan = 8/13 or tan 8/13).

Part (b) was not well answered, even though follow through was available from part (a). There was a high percentage of non-attempts even when the student had given an answer in part (a). Common incorrect responses included: 180 – their answer from part (a), giving the same answer as part (a), restarting the question again with Pythagoras' theorem or incorrect trigonometry.

Question 20

Students who drew a triangle onto the diagram and realised they needed to use Pythagoras' theorem were more likely to choose the correct answer on this question. The most popular incorrect answer was 1.

Question 21

This question required students to correctly use two different ratios within the context of volumes of bottles and glasses. For many, it presented a significant challenge and only 20% scored full marks. Some students gained the first mark by correctly working out the volume of one small bottle as 450 ml but were then unable to make any further progress. Many students wrote down the fractions 4/7, 7/4, 4/11 or 7/11 but did not use these in any relevant mathematical process. Questions containing ratio at this level of demand continue to present difficulties for students, especially in establishing a correct first stage of working.

Question 22

Only a few students were able to gain any marks on this question as most of them did not understand how to use the fact that $x = 5$ was the **only** solution to the given quadratic equation. Many substituted 5 into the quadratic equation and stopped at $25 + 5b + c = 0$ which gained no marks. Students need to be familiar with the words; 'solution', 'factor' and 'root', and to correctly distinguish between each of them mathematically.

Question 23

Performance has been gradually improving on this type of ratio question and it was encouraging that 40% of students chose the correct response. The most common incorrect answer was 1/6 where the two fractions had been multiplied together.

Question 24

This question was not well answered. The poor performance was mainly because students did not use a single transformation in their description, rather opting to use the combination of a rotation and an enlargement. Those who did use only an enlargement often gave an incorrect scale factor of 0.5, 2 or –2. Students should be reminded that the word enlargement should be used and not 'reduces', 'shrinks', 'condenses', 'de-larged', 'gets smaller' etc.

Question 25

This question proved to be very challenging as most students were unaware of the need to find the area under the speed-time graph. Many used a speed / distance / time approach and once again there was evidence of using 100 minutes in an hour. Those students who did attempt to find the area of one or more regions on the graph often misread values from the axes, did not correctly work out the area of a triangle or overlooked that the speed was in km/h and the time in minutes. Incorrect recall of the formula for the area of a trapezium was also common.

Question 26

Part (a) was not well answered by most students. Many responses assumed the triangle to be right-angled or used the cosine rule to find the length of the missing side. Some students who did calculate the correct area subsequently made errors by overlooking the need to multiply the area by 6 or in rounding the number of bottles required down to 12.

Part (b) was not well answered. Many responses assumed both triangles to be right-angled or the triangle on the left to be isosceles. Some students recognised the need to use the cosine and sine rules but were unable to recall the formulae correctly. The cosine rule was often used unnecessarily in part (a) and then overlooked in part (b). Students must not make assumptions about shapes or geometry; and should be reminded that 'not drawn accurately' is telling them not to measure lengths or angles on the diagrams but to only use the values and facts given.

Question 27

This question proved to be too challenging for most students.

Question 28

There were many non-attempts of this question. Those scoring 1 mark gained this from working out the composite function fg(x) or correctly evaluating fg(4). Some students wrote the inverse function as 1/f(x) and many answers of 107 or 1/107 were seen. Functions continue to be a high demand topic which many students find difficult although there have been some improvements in performance in recent series.

Mark Ranges and Award of Grades

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