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GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/04 Autumn 2021 series

Version 1

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

	Reports for the November 2021 series will provide a broad commentary about candidate performance, with the aim for them to be useful future teaching tools. As an exception for this series they will not contain any questions from the question paper nor examples of candidate responses.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

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Paper 4 series overview

J560/04 is a calculator paper and is the first paper in the Higher tier of the GCSE (9-1) Mathematics specification.

Candidates need to be able to use their calculator effectively, rounding their final responses correctly while retaining accuracy in intermediate results. They also need to be able to carry out mathematical methods correctly.

Candidates did very well on algebra, particularly solving the quadratic equations, both in the completing the square and in solving the simultaneous quadratic and linear equations. The main weakness was in geometry. The question on regions was not well answered and the trigonometry, in Q17 and Q19, contained many errors. Many could not recall and use the formula for the area of a trapezium in Q2.

Many candidates did not show sufficient working. For example, the formula to solve a quadratic equation would be written down and then the next line of working would give the two solutions with no intermediate steps shown. In Q1(b) many did not write down the number from their calculator before they tried to round it.

Questions 4, 5 and 17 involved problem solving and choosing the best method to solve each problem. The most efficient method was not always the easiest one. In Q5(a) many candidates tried to add the minutes on continuously but often made errors, whereas those who found the LCM were more successful. In Q17 it was more efficient to use the simpler sine rule twice than to use the cosine rule once.

Questions 4, 7 and 13 involved showing information in diagrammatic form. In Q4 it was much easier to draw the sample space diagram as a two-way table than to try to use probability theory. In Q7 candidates needed to understand the structure of a probability tree diagram. Q13 used a histogram with percentages but it proved easier to change them to frequencies, rather than continue to use percentages.

Candidates needed to maintain accuracy in their intermediate calculations and needed to know how to round or truncate figures to the required accuracy, especially in Q1(b), Q6(a), Q16(c)(i), Q17, Q19(a) and Q19(b).

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• answered each question as it was asked, giving answers to the required accuracy • structured their working in a logical manner which was easy to follow • used the appropriate methods correctly, choosing the most efficient methods in cases where there was a choice • displayed information accurately using diagrams • kept accuracy in their calculations.	• did not give the answer required or in the form asked for • presented working that was difficult to follow • used methods that took longer or were not appropriate • found it difficult to display information • rounded answers to calculations prematurely so lost accuracy.

Themes in candidate responses

Many candidates had difficulties recalling the formula for the area of a trapezium and the formula for the cosine rule.

	**AfL**	Some candidates attempted trial and improvement methods in some questions, and they were mostly unsuccessful. This technique is not tested in this qualification and there will always be more effective methods available. Many questions now require working to be shown and we usually expect to see an appropriate method. However if a candidate does have to use trialling then they should clearly show the number they are checking, the intermediate calculations and the final result which shows whether their test number was correct or not and in which direction they should look next. We also require a minimum of two complete trials.

Comments on responses by question type

Problem solving questions

This paper had a variety of AO3 questions. In Q4 the choice was between using probability theory, which was not easy, and drawing a sample space diagram, which many of candidates found very difficult. The best responses used a two-way table and it proved to be a very efficient method.

In Q5(a) many candidates attempted to repeatedly add the minutes onto the time but so many of them made errors that it proved to be an unsuitable method. The best responses involved candidates finding the LCM, converting it to hours and minutes which they found relatively easy and then adding that time on.

In Q5(b) some candidates found that both 3 and 5 were factors of the two numbers but they did not realise that 15 had to be a factor too.

Q19 involved understanding a diagram; drawing another diagram with the sides and angles marked on would have been helpful, but this was rarely seen. The question only involved trigonometry in right-angled triangles and the sine rule and the cosine rule were not required.

Reasoning questions

Q6 was a reasoning question. In Q6(a) candidates needed to produce three correct distinct figures to compare and then make the correct decision. It is not always the smallest number; when dividing the volume by the price it will be the largest number that is the best value.

In Q6(b) candidates had to find how much milk is needed first then work out how many cartons to buy of each size.

Q11 required a proof and candidates needed to give a reason; in this case it was the equal corresponding angles.

Q16 required information to be taken from a formula. In Q16(b) candidates were usually unable to find the percentage growth rate, usually giving 1.045 as the answer.

Q18(b) required candidates to make inferences from graphs and come to a conclusion about the shapes of new graphs.

Q19(a) required candidates to show that the figure is accurate by giving a figure with more accuracy.

Standard questions

Q1 is a standard calculator question with rounding and was answered quite well.

Q2 involves finding the area of a trapezium; candidates need to remember to halve their answer.

Q3 on indices was answered well.

Q7 on probability trees was not well answered. This could have been improved if candidates knew which probabilities to use and whether to add them or multiply them.

Q9 was an inverse percentage where most candidates calculated 15% of 1426 and subtracted that from 1426 instead of dividing by 1.15.

Q12(a) was a standard region question but candidates often wrote the inequalities the wrong way round.

In Q12(b) very few candidates were able to draw the line and write down the inequality.

In Q14, few candidates could 'complete the square'.

In Q15, on quadratic sequences, many candidates found the value of a but were unable to progress to b and c because they did not know how to subtract the values of $3a^2$.

Q20 is a standard multi-step question to solve a linear and a quadratic simultaneous equation. Many candidates started correctly but made an algebraic error so, instead of checking their working, they would start again with a slightly different method. The first method candidates used was often the correct method for this question.

Common misconceptions

	**Misconception**	In Q11 candidates need to show that two triangles have equal corresponding angles (AAA) to determine that they are similar. The proofs of congruence do not apply here.

	**Misconception**	Many candidates thought Q8 involved compound interest, so they attempted a solution using roots.

Key teaching and learning points – comments on improving performance

	**AfL**	It is important to know how to accurately round numbers because people do not always use long numbers effectively and we also use rounded numbers as estimates. We expect to see the answer to Q1(b) as a long decimal then rounded to three significant figures. In Q19(a) candidates need to write the answer to at least three decimal places to show that the given answer is accurate. Q16(c)(i) is useful to consider whether a decimal should be rounded or truncated when dealing with variables that take only integer values.

Guidance on using this paper as a mock

This paper can be used with confidence as a mock exam. When marking, teachers should be aware of the general guidance at the front of the mark scheme as well as the detailed guidance for each question. In particular, candidates may approach a problem with an alternate method other than that detailed on the mark scheme. In these cases full credit should be given for alternate correct approaches.

This paper has a good range of statistical diagrams: Q4, where a two-way table was the easiest way to answer it, Q7, based on tree diagrams and Q13, probably one of the harder types of questions on histograms.

This paper also has a good range of AO3 questions from the sample space question in Q4, to the use of LCM/HCF in Q5. In Q8 candidates have to find the rate of simple interest. Q10 allows the use of linear algebra to solve a problem. Q13 requires a multi-step approach to drawing a histogram and Q17 is a multi-step approach to solving a triangle. Q19 is a complex geometric question which needs 2D trigonometry only.

There is also a proof, Q11, in which candidates usually struggle, but this one is structured and so was more accessible.

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