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GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/06 Autumn 2020 series

Version 1

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 Autumn 2020 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 answers.

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 that caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

A full copy of the question paper and the mark scheme can be downloaded from OCR at https://www.ocr.org.uk/qualifications/gcse/mathematics-j560-from-2015/assessment/#gcse-question-papers-mark-schemes-and-reports.

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Paper 6 series overview

J560/06 is the third and final paper in the Higher tier of the GCSE (9-1) Mathematics specification.

The breadth of content examined, and the distribution of marks allocated to AO1, AO2 and AO3, are similar to J560/04 and J560/05.

To do well on this paper, candidates need to be confident and competent in all of the specification's content. They also need to be able to:

- use and apply standard techniques (AO1)
- reason, interpret and communicate mathematically (AO2)
- solve problems within mathematics and in other contexts (AO3).

Questions 1, 2, 5, 6 and 7 were also set on the Foundation tier paper J560/03.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• Performed almost all standard techniques and processes accurately (e.g. Q2, Q4, Q5, Q7, Q11, Q18 & Q21).	• Made errors in performing low-grade processes (e.g. Q1, Q2, Q4 & Q11(a)).
• Usually interpreted and communicated mathematics accurately. In particular, information presented in words or diagrams was understood and correct notation was used when presenting a mathematical argument (e.g. Q1, Q3 & Q15).	• Produced responses that lacked notation of an appropriate standard (e.g. Q9, Q11 & Q12).
• Produced clear solutions to multi-step tasks (e.g. Q6 & Q14).	• Showed poor setting out of multi-step tasks (e.g. Q6, Q11(a) & Q13).
	• Misinterpreted questions and information or did not follow instructions (e.g. Q7(b), Q12, Q15 & Q18).

Almost all candidates were able to show positive achievement. The omission rates for whole questions and parts of questions were low except for the least able candidates.

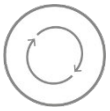
It appeared that candidates had sufficient time to complete the paper.

Comments on individual questions

Question 1 Scatter diagram

	**Misconception**	Many candidates produced their line of best fit on the scatter diagram by joining the bottom-left point to the top-right point, rather than taking account of the trend produced by all of the points. Some of the lines also stopped at the points rather than passing through them. In part (d), correct responses referred to the possibility that the trend may not continue or that the time of 7 hours was beyond the given data. However, most candidates simply implied that it was not appropriate to use the records because 7 hours was beyond the scale of the graph.

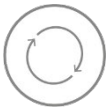
Question 3 Straight line graph in context

	**AfL**	To reduce the effect of accuracy errors when using conversion graphs, it is advisable to take readings that involve larger values and/or points that are more easily read. In this question, examples of the first are 150kwH costing £19 or 225kwH costing £28. An example of the second is 200kwH costing £25. Any of these when scaled-up to the requested cost of 450kwH produced an answer within the accepted tolerance. Some candidates used 50kwH costing £6, which is slightly off the line and resulted in an answer outside the tolerance, although the method marks could be scored. In part (b), candidates needed to choose between company A and company B. Many explanations were unsupported and circular, such as "B would have the steeper line because it will have a bigger gradient". With 3 marks allocated, candidates should be providing evidence such as "B would have the steeper line because 100kwH costs £14.30 (14.3p × 100) whereas for A it costs £12.50 (from the graph)".

Question 4 Estimating, exact answers, percentage error

	**Misconception**	Candidates were given an estimated answer of 64 in part (a). Most candidates started (b) by calculating the exact value accurately, with 46.1 to 46.11 being acceptable. However, when calculating the error in the estimated answer as a percentage of the exact answer, many candidates worked out 46.1 ÷ 64 [× 100], perhaps thinking they needed the numerator to be smaller than the denominator. Many candidates who started correctly with 64 ÷ 46.1 [× 100] gave wrong answers of 1.38 or 138. Candidates who found the error (64 – 46.1) first usually continued to the correct answer.

Question 6 Multi-step problem solving

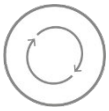
	**AfL**	The question gave information in m, cm, kg/m^3 and tonnes. To minimise the work required, candidates are advised to read through the whole question and identify which unit is used most frequently, then convert the other values into that unit. As the density was given in kg/m^3, the easiest route into the question is to find the volume in m^3 by changing the 1.8 cm into 0.018 m. The cm unit was put in bold in the question to try to help candidates avoid missing the change in unit, although many still performed 2.4 m × 1.2 m × 1.8 cm for their volume. Virtually all candidates who instead found the volume in cm^3 were either unable to convert this correctly to m^3 before using the density of 750 kg/m^3, or were unsuccessful in changing the density into kg/cm^3. However, further marks could be gained for converting 15 tonnes into kg correctly and then also if dividing that value by their mass. If candidates realise an interim

		answer may be wrong, they are advised to not necessarily abandon their attempts, but instead to show clear subsequent method using their answers.

Question 7 Vectors

In this question, common errors were to have the components inverted or to not pay attention to the direction arrow. In part (b), the column vector for 4**b** was often given rather than the column vector for **b**.

Question 9 Proportion

	**AfL**	Most candidates were able to write a statement such as $y = kx$ and to find $k = 6$. It is always good practice to complete this working with the conclusion $y = 6x$. Candidates who gave interim answers in the form $y = 6x$ and $y = 5z$ were much more likely to reach the required final answer of $z = 6x/5$.

Question 11 Functions

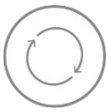
(a) While $3x + 15$ was usually seen, candidates often wrote $x + 11 \times 2$ instead of $2(x + 11)$. More able candidates found x by formal algebra, as was the intention when the question was set. Other candidates resorted to trials from the outset.

(b) Most found this part very difficult. Few candidates made worthwhile progress beyond writing $q(x + p)$.

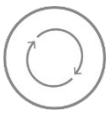
Question 12 Enumeration and probability

The clarity of presentation at all levels of ability was low. The four required combinations were rarely stated or indicated clearly. Going by the many wrong answers of 4/11, it seems that candidates did not recognise this as a combinations question, possibly through a table not being included and giving a hint. At Higher tier, a full listing of all possible combinations should not be necessary since the product method (i.e. 4 × 7) can be used.

Question 13 Area scale factors

	**Misconception**	Very few candidates recognised this as an area scale factor problem, with most candidates applying the length scale factor 3/2 to 8 cm^2. The correct length scale factor was actually 5/2 and so they should have been using the area scale factor of $(5/2)^2$.
	**AfL**	Only a few candidates scored full marks by using the area scale factor. However, multi-mark questions often lend themselves to more than one method of solution. A few candidates made progress by choosing dimensions for AB and the perpendicular from E to produce an area of 8 cm^2 for triangle ABE. They then attempted, with mixed success, to apply a length scale factor to find possible dimensions for triangle ACD and hence the area.

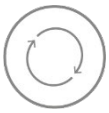
Question 14 Volume

	**AfL**	Many candidates scored 2 marks out of 5. They were able to set-up the required equation $\frac{1}{3}\pi r^2 \times 5r + \pi r^2 \times r = 225$, but could not make further progress. Candidates are advised to simplify expressions by gathering terms before trying to deal with multipliers like $\frac{1}{3}$, π and 5. Here, they should reach $\frac{8}{3}\pi r^3 = 225$. This context and type of cubic equation have arisen previously, but candidates are still having great difficulty in reaching a solution. Many tried to solve $r^3 = \ldots$ by trials or square rooting twice, rather than using the cube root function on their calculator.

Question 15 Combined probability

Many candidates appropriately chose to put the information on a tree diagram. However, the given probabilities were dependent on the age of the bus and many diagrams (and hence solutions) ignored the age entirely.

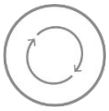
Question 18 and Question 19(b)(ii) Follow instructions

	**AfL**	Where a question includes a specific instruction, candidates should do as asked. Q18 stated "show full working" in bold. A correct answer without working was given 0 here, since some candidates could immediately get the answer by using a function on their calculator. Q19(b)(ii) stated "use the graph" in bold. Candidates who obtained answers by the formula, the equation solver facility on their calculator or who drew their own quadratic graph were given 0. The evidence required was their $y = ax + b$ line from part (b)(i) drawn on the given graph.

Question 20 Vectors

Many candidates scored the 2 marks for $\begin{pmatrix} 7 \\ 2k + 11 \end{pmatrix}$, but most equated this to $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ rather than $\begin{pmatrix} 7 \\ -7 \end{pmatrix}$.

Question 21 Algebraic fractions

	**AfL**	It is unlikely that an algebra question at GCSE will intentionally lead to a multi-term quartic polynomial. An important first consideration when faced with a question like this is to look for possible simplifications. Here, factorising $x^2 - 4$ first leads to much more straightforward algebra. Candidates who used $(x + 2)(x - 2)$ as their common denominator of all three fractions were much more successful than those using $(x + 2)(x - 2)(x^2 - 4)$.

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