Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/06 Autumn 2021 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.

i	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.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Paper 6 series overview

J560/06 is a calculator paper and 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, 4, 5 and 6 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. Q1, Q2, Q7, Q13, Q14, Q16(b), Q18 • 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. Q6, Q8(b), Q9(b), Q10(a), Q16(c) • produced clear solutions to multi-step tasks. Q8(a), Q12, Q17.	• made errors in performing low-grade processes. Q3, Q8(a) • produced responses that lacked notation of an appropriate standard. Q1(c) • showed poor setting out of multi-step tasks. Q9(b), Q12, Q17 • misinterpreted questions and information or did not follow instructions. Q1(c), Q4, Q5(a), Q7, Q15, Q17.

Although the paper provided a good challenge for candidates, almost all were able to show some positive achievement. The omission rates for whole questions and parts of questions were low, except for the least able candidates and for Q15(b) (numerical method) and Q16(c) (kinematics interpretation). There was a very wide range of marks, from below 10 to above 90.

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

Q1 Standard form

	AfL	Although the vast majority of candidates scored at least five marks out of seven, the methods used were often inefficient. In part (b), candidates were required to order five numbers given in standard form. In such questions, it is usual for the marks to be given for the order, either fully correct or partially correct, rather than any working. Stronger responses were able to write down the correct order by focussing on the exponent; responses which scored lower converted all five numbers into ordinary form, sometimes with an error, to create their order. Similarly in part (c), where candidates needed to find the difference between two of the values, giving the final answer in standard form correct to 2 significant figures. While the ability to use the standard form facility on a calculator is expected, the numbers were chosen so that the calculator would usually show 14 900 as the answer. Those using this standard form facility reached 14 900 quickly and accurately, whereas those who converted the two numbers first took longer and made mistakes. Candidates of all abilities often did not give the answer in the required form, with 15 000 and 1.49×10^4 being very common.

Q3 Multiply out and simplify

More candidates simplified $3(x + 2) – (x – 1)$ to $2x + 5$ than obtained the correct answer of $2x + 7$.

Q4 Transformations

	Misconception **AfL**	In part (a), candidates were required to reflect a triangle in the line $x = 0$ but some candidates reflected in the x-axis. The three marks available in part (b) for describing fully a single transformation provided a clue that three pieces of information were required: enlargement, the centre, and the scale factor. Many responses were not full, and a few included a second transformation, often described by the candidate as a "move". Candidates are expected to use appropriate terminology, and so "reduction", "shrink", "÷ 4" etc. were not accepted.

Q5 Relative frequency calculations and interpretations

	Misconception	More than half of the candidates were unable to calculate relative frequencies correctly. Some responses included values greater than 1. A common wrong method was to divide the frequency by the dice score and then by 100 (i.e. ÷ 100, ÷ 200, ÷ 300 etc). In part (b)(i), few candidates were able to use evidence from the table correctly in support of an explanation that the dice might be biased. Most acceptable responses referenced the very large difference between the number of sixes and the number of twos being rolled, or similar. Even fewer candidates recognised the importance of sample size in part (b)(ii). Some candidates used the same evidence and argument for the dice being biased in part (b)(i) and for the dice being unbiased in part (b)(ii).

Q6 Simplifying two two-term ratios

	AfL	There have been several similar questions in the past but this was the first time that an algebraic element has been included. The success rate was very good, with half of the candidates scoring at least three marks out of four. The most common and productive strategy was to rewrite the two given ratios so that they had a common number of mints (usually indicated as 10). The required ratio could then be identified as $5n : 6n$ which scored three marks, the correct simplified answer being 5 : 6.

Q7 Constructions

Many candidates did not interpret "the same distance from side AB and side BC" as requiring the bisection of angle B.

In part (b), the bench was to be placed on the path, represented by the angle bisector. Most candidates who produced the correct constructions in (a) and (b) then shaded a region rather than indicating part of the line.

Q8 Time, distance, speed

	AfL	Candidates generally answered part (a) very well. Any errors made were usually when converting their decimal times in hours into minutes. Candidates ought to know as a fact that 1.5 hours is 90 minutes and not 150 minutes. Candidates have not often been asked to write an algebraic expression in a time/distance/speed context and many found this short "write down" question to be a challenge. The required response was $\frac{1000x}{3600}$ or a simplified equivalent. The question is assessing correct use of algebraic communication. Answers should **not** have units, such as m/s or km, in the middle of the expression and should **not** be written as a calculation, e.g. $1000 \times x \div 60 \div 60$.

Q9(b) Presenting arguments using bounds

	AfL	At least three different methods were seen in part (b)(i). Many of the responses were difficult to follow, with numbers and multiple attempts being scattered around the answer space. The difficulty in marking bounds problems like this one is that some numbers can represent two different objects. Candidates sometimes appeared to confuse themselves and compared two values for the wall. The best scripts included words like "wall" and "cupboard" to explain what the numbers represented. For example, "Wall could be 362.5 cm. Six cupboards could be 6 × 60.5 = 363 cm. Six cupboards > wall, so the cupboards will not fit." Note here, for example, that 363 cm on its own could be interpreted as the length of six cupboards or as the length of the wall, so the use of words is very helpful. In part (b)(ii), to find the upper bound of the space remaining, candidates should have been using both the upper bound of the wall and the lower bound of the cupboard. Most candidates only used one or none of the bounds in their calculation.

Q10(a) Showing a given answer in a polygon context

	AfL	Candidates were required to show that an angle marked on a diagram was 156°. In a "show" question, it is important that the candidate convinces the examiner that they can demonstrate each step and are not working backwards from the given answer. Obtaining 144 from 360 – 156 – 60, and then using 144 to obtain 156, is not acceptable. Instead, 144 should be seen to be derived, for example from $\frac{(10-2)\times 180}{10}$. The "show" can then be completed by 144 + 60 = 204 and 360 – 204 = 156, or equivalents.

Q11(b) Combining probabilities

Not many candidates scored more than one mark out of five. The most successful approach was to consider this as a tree diagram problem, making the demand similar to examples set on previous papers which have often been answered well. What made this question different was that the probabilities needed to be extracted from the Venn diagram in part (a) rather than being explicitly given. Follow through marks were available but many candidates did not proceed beyond a few jottings. Out of those that did make some progress, common errors were adding probabilities rather than multiplying; only considering one pair of branches; and not reducing the denominator of the probability to 29 for the second student.

Q12 Showing a given answer in a multi-step density/volume/surface area context problem

	AfL	Candidates were required to show that the surface area of a sphere was 46.9 cm^2, correct to 3 significant figures. There were many good responses, with some candidates scoring at least five marks out of six. When required to show an answer to a specified accuracy, it is important to find and state the answer to a greater accuracy to show that the final calculation has been performed correctly. So, in this question, it was not sufficient to just write the surface area calculation and then the answer 46.9. The best scripts retained the full value of the intermediate answers, thus avoiding possible inaccuracies through premature rounding. There were three distinct steps involved in the solution: density, mass and volume; finding the radius from the volume; finding the surface area. The presentation of many scripts was very good, and the use of a few words was helpful and better than elsewhere on the paper. The cube root step when finding the radius from the volume was performed much more successfully than in recent series.

Q14(a) Proportion

	AfL	Most candidates were able to write a statement such as $y=\frac{k}{\sqrt{x}}$ and to find k = 30. It is always good practice to complete this working with the conclusion $y=\frac{30}{\sqrt{x}}$, and this was required for the full three marks.

Q15 Solving a cubic equation by a numerical method

	Misconception	A sizeable number of candidates believed the quadratic formula could be adapted to solve a cubic equation.
	AfL	When asked to show that a solution lies between two given values, it is not enough to just perform two calculations; a correct concluding statement either in words (e.g. "change in sign") or symbols (e.g. $^{-}3 < 0 < 11$) is also required for full marks. When asked to find the solution to an equation correct to a given accuracy using a numerical method, it is not sufficient to only test x values of that given accuracy. Many candidates tested $x = 2.3$ and $x = 2.4$, and chose $x = 2.3$ for their final answer. This scored three marks out of four. For full marks, they should also be testing a value such as $x = 2.35$ to make that decision. Part (b) included the qualifier "You must show your working". This was used to minimise the advantage provided by a calculator having a polynomial equation solver facility. A few unsupported responses of $x = 2.3$ were seen and given one mark only.

Q17 Multi-step problem solving involving Pythagoras

Many candidates made little worthwhile progress. To score any marks candidates needed to realise that the use of Pythagoras was essential in solving the problem. It was evident from the values used and the triangles sketched on the given diagram that many candidates were using triangles that were not part of the surface area.

Only the very most able candidates used Pythagoras on the triangle with vertices E, O and the midpoint of BC, which immediately leads to the area of the triangle. A few able candidates eventually and correctly reached the same place after using Pythagoras three times in finding BD, BO, BE and then E to the midpoint of BC. Many candidates started by trying to find BE but took length BO as 2.8 cm – these candidates scored a maximum of one mark.

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.

Supporting you

Review of results

If any of your students' results are not as expected, you may wish to consider one of our review of results services. For full information about the options available visit the OCR website.

Supporting you through 2021-2022

Our priority is supporting you and your students this autumn and to support you as you prepare for summer 2022 exams. We'll update our website information regularly with resources, guidance and key information.

Take a look at our support for:

- Teachers
- Students
- Exams officers

Keep up-to-date

We are sending a weekly roundup to tell you about important updates. You can also sign up for your subject specific updates. If you haven't already, sign up here.

OCR Professional Development

Attend one of our popular CPD courses to hear directly from a senior assessor or drop in to a Q&A session. All our courses for the academic year 2021-2022 are being delivered live via an online platform, so you can attend from any location.

Please find details for all our courses on the relevant subject page on our website or visit OCR professional development.

Signed up for Exambuilder?

ExamBuilder is the question builder platform for a range of our GCSE, A Level, Cambridge Nationals, Cambridge Technicals and Functional Skills qualifications. See the full list of available qualifications in the sign up form.

ExamBuilder is **free for all OCR centres** with an Interchange account and gives you unlimited users per centre. We need an Interchange username to validate the identity of your centre's first user account for ExamBuilder.

If you do not have an Interchange account please contact your centre administrator (usually the Exams Officer) to request a username, or nominate an existing Interchange user in your department.

Supporting you

Active Results

Review students' exam performance with our free online results analysis tool.

For the Autumn 2021 series, results analysis is available for GCSE English Language, GCSE Mathematics and Cambridge Nationals (moderated units) only.

It allows you to:

- review and run analysis reports on exam performance
- analyse results at question and/or topic level
- compare your centre with OCR national averages
- identify trends across the centre
- facilitate effective planning and delivery of courses
- identify areas of the curriculum where students excel or struggle
- help pinpoint strengths and weaknesses of students and teaching departments.

Find out more at ocr.org.uk/activeresults.

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on
01223 553998

Alternatively, you can email us on
support@ocr.org.uk

For more information visit
- **ocr.org.uk/qualifications/resource-finder**
- **ocr.org.uk**
- **/ocrexams**
- **/ocrexams**
- **/company/ocr**
- **/ocrexams**

We really value your feedback

Click to send us an autogenerated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email address will not be used or shared for any marketing purposes.

I like this **I dislike this**

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT