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Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/03 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.

> 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.

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November 2021 J560/03 overview

This is the third paper overall and the second of two calculator papers that students should sit. Most candidates seemed unprepared to answer the full range of questions within the paper and often many of the questions from Q16 onwards were either poorly answered or not attempted. Total marks in the thirties and below were common.

Many candidates showed use of their calculators, with only a minority using non-calculator methods to complete calculations. Many also candidates seemed to have the use of a ruler and sometimes of a sharp pencil.

Topics responded to well in the paper were:

- simple statistical representation and interpretation
- simple ratio
- simple sets
- use and interpretation of standard form numbers.

Topics responded to weakly in the paper were:

- problem solving
- geometry, surface area and transformations
- algebraic simplification, rearrangement and terminology
- the straight line ($y = mx + c$)
- Pythagoras' theorem.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• answered questions efficiently, showing a clear strategy for each question • answered 'Explain…' or 'Give a reason…' questions with brief, but clear, mathematical reasons • showed all steps in working when answering questions that stated 'You must show all your working' or 'Show how you decide' • showed understanding and familiarity with using problem solving skills • showed good drawing skills.	• demonstrated a poor understanding of algebraic processes • used trial and improvement methods • gave non-mathematical explanations • did not show all steps in working (particularly when answering questions that state 'Show…') • did not demonstrate good problem solving skills, e.g. not planning a route through a problem solving task • drew freehand or inaccurate drawings • did not read the question carefully • could not distinguish between an expression, an inequality, an equation and an identity • were unfamiliar with conversion between metric measurements • confused volume with area.

Comments on student responses

Question 1

This was generally well answered. A few candidates did not read the question carefully enough and gave responses related to the wrong year group. In part **(a)(i)**, a common error was 8, probably from miscounting. In part **(d)**, some candidates wrote a ratio of 20 : 45 and scored zero marks.

Question 2

This was correctly answered by many, but 15 was a common incorrect response to part **(a)**, where the candidate did not close the bracket before typing '+ 29' in their calculator.

Question 3

This problem solving question was the first to demand a strategy. Many candidates did achieve the correct answer, but a sizeable minority did not.

	AfL	Many candidates did not annotate stages in the solution and organised their working poorly. Candidates should practice presenting solutions.

The best candidates showed working with annotation to indicate the coin denomination, the number of coins and the value, together with the total. Some candidates worked with percentages rather than numbers of coins and could not get a value. Many changed the fraction to a percentage before finding the number of 10p coins. Some found the number of 10p coins, subtracted the result from 150 and then found 30% of the result. A few candidates gave decimal numbers of coins, clearly not taking into account the context. Some candidates attached '£' to their numbers of coins.

Question 4

Candidates here often had the correct answer for part **(a)**, though a considerable number of 'thirds' were seen (presumably as it was one section from 3 sections). In **(b)**, stronger candidates clearly stated that the number of wins had gone from ¼ to ½ thus showing improvement, but some mixed outcomes and did not compare like with like, such as saying that losses were ½ and now wins are ½.

Question 5

This question saw many good responses. The better candidates gave 1.17 × 600 using an efficient method. Quite a number of methods finding 10%, 5%, 1%, etc. were seen, but many of these foundered when insufficient parts to make 17% were added. 102 was a common answer that scored 1 mark, but suggested the candidate had not read the question carefully.

?	**Misconception**	Some candidates thought that 17% could be found by dividing by 17.

Question 6

This was a poorly answered problem solving question. Few gave the correct answer for either part. Many did not attempt the second part. Most wrong answers revealed little knowledge of the geometry of triangles or quadrilaterals. Answers of 45, 45, 45, 45 and 90, 90, 90, 90 and 60, 60, 60, 60 were common for part **(a)**. In part **(b)**, few drew the other diagonal to create two different triangles. Some candidates had clearly measured the angles despite being told the diagram was not to scale.

Question 7

This was usually correct, though a response of 12 minutes was common, as well as also 6 minutes.

Question 8

Responses here often managed 1 mark for one correct term, generally for $4t$ as it did not involve dealing with negatives. Responses of $4t – 8u$ were not uncommon, but answers of $4t2u$, $–6t – 8u$ and $4t + 8u$ were also seen.

Question 9

This saw many correct, or nearly correct, responses. Sometimes candidates misplaced one element or repeated it, scoring 2 marks. Poorer responses saw candidates place no elements outside the two sets. In part **(b)**, most candidates chose the second diagram. When they appreciated that there could be no odd multiples of 2 (recognising the properties of the elements of the respective sets) both marks were scored. Some candidates chose Venn diagram 1, saying that it was clearer to see what was happening, which scored no marks.

Question 10

This was a very poorly answered problem solving question and revealed poor understanding of surface area and volume.

?	**Misconception**	Many candidates did not have a strategy to respond to this question and confused area with volume.

The standard wrong response was along the lines of '1 cube = 3 × 3 × 3 = 27 so 4 cubes = 27 × 4 = 108'. Many candidates gave ambiguous working such as 1 cube = 3 + 3 + 3 = 9, which was condoned as 3 × 3 = 9 (cm^2) for the surface area of a face. Some gave 9 × 6 × 2 = 162, from the overall dimensions of the shape. Few meaningful annotations were seen.

Question 11

The responses to all parts were very patchy and it seemed as if many candidates might have been just making a random selection. The best answered part was **(b)**, where many correctly identified an inequality.

Question 12

This was poorly answered. Few candidates showed complete stages in their rearrangement and many went straight to a solution (often $w = 2P + 2h$). Some candidates wrote '÷ 2' but instead subtracted 2 from individual terms. Some candidates wrote '$– 2h$', but then added $2h$ to the left-hand side. Many incorrect methods were seen that disregarded algebraic rules, such as '$P = 2w + 2h$ (subtract 2 giving) $P = w + h$'.

Question 13

This problem solving question was attempted by most candidates and many scored some marks. Many however did not score the first B1 for converting from metres to centimetres or vice versa. The general error was to think that there are 10 cm in 1 m and so 280 cm was a common error.

?	**Misconception**	Some candidates though that there were 10 or 1000 cm in 1 metre.

Most candidates scored a mark for dividing 28 m by 60 cm, in some form. It was regrettable to see many candidates attempt this division by repeated subtraction, even for candidates with 2800 cm or even 28000 cm; such inefficient methods lead to errors and wasted time. Some candidates found 46.66… in some form and truncated this to the nearest integer for a further mark.

Question 14

This was the first of the questions common with the corresponding Higher tier paper (J560/06). Here in the Foundation paper many answered parts **(a)** and **(b)** correctly and also scored some marks on **(c)**.

?	**Misconception**	Some candidates thought that the index indicated the number of zeros in the answer.

In part **(c)**, many scored the first mark for subtracting the correct values, but very few correctly rounded to 2 significant figures and even fewer wrote this in standard form correctly. A number attempted to subtract the standard form numbers in the wrong order.

Question 15

A number of candidates answered part **(a)** correctly using the appropriate method. A common error was to divide £760 by 3, but more unexpected means were also employed. Part **(b)** was rarely correct and many candidates used the same method as in **(a)**, i.e. £36 ÷ 8, or 36 ÷ 2. Thus £18 was a common wrong answer.

Question 16

Few candidates drew the correct reflection in **(a)**. Some drew a reflection in the *x*-axis to score 1 mark. Many answers were translations, but rotations and forms of stretch were also seen. In part **(b)** very few correct descriptions were seen. Occasionally the word 'enlargement' was seen, but few scale factors were given or correct. Providing the centre of enlargement was even less frequent. Words like 'shrunk' and 'reduced' are not acceptable and neither is 'divided by 4' instead of '¼'.

Question 17

This common question was rarely answered correctly. The relative frequencies were often incorrect or not attempted. Many candidates divided the number on the die by the number of throws, or vice versa. In part **(b)(i)** some candidates did score a mark for recognising that the results for 2, 4 and 6 were **very** different from that which should be expected, but few gave the expected outcome of 50 (or the relative frequencies) for each number. Most could not answer **(b)** and only referred to reasons such as results being random.

Question 18

Many candidates gained 1 or 2 marks for part **(a)**. A few chose the two correct values. Some chose the two correct and one other to score 1 mark and some chose one correct and one incorrect to score 0 marks. Part **(b)** was almost never correctly answered, although a very few did give the correct upper limit in part **(b)(ii)**.

Question 19

Candidates were more successful with part **(a)** than part **(b)**, but generally the question was not well answered.

	AfL	Practise solving and discussing problem solving question, considering strategies and conclusions.

A number of candidates scored 2 marks in part **(a)** for dividing 210 by 40 and truncating the result to five letters, although some did not truncate and only scored 1 mark. Some tried forms of trial and improvement, but were rarely successful. Some multiplied 210 by 40. In part **(b)** some conversions of time units were seen to score a mark. Some correct and creative solutions were seen, but these were very few in number. Some candidates just tried to write an explanation with no calculations to back it up.

Question 20

Many candidates attempted the question and 65 was the common answer among those who did. There were very few attempts to use Pythagoras' theorem to find the length of DC. Most candidates who did attempt a solution performed random calculations with the given values such as 5 + 13 + 5 + 13 or 2 × 5 × 2 × 13 or $\frac{5\times13}{2}$, as though it was a triangle. Attempting to use $A=\pi r^2$ was also seen.

Question 21

This was not well answered. In part **(a)**, very few candidates gave a correct gradient, sometimes giving $2x$ or $2x – 1$. In part **(b)** the correct equation was sometimes given, but $y = x – 1$ was a popular incorrect response. Almost no correct responses to part **(b)(ii)** were given. Sometimes responses hinted at some understanding, but these were poorly stated. A common error was to think that adding all the numbers used gave the greatest gradient. Part **(c)** was often blank or just a statement that the line would pass above/through/below the point, but with no supporting evidence. Very few considered substituting the values in the equation of the line, suggesting little appreciation of why an equation can define a line.

Question 22

This question was rarely answered correctly. Few could construct the equation using the given expressions for lengths and forming areas. Many tried to find a solution from the given equation in part **(a)**, but few could correctly solve the equation in part **(b)**. A small number of candidates gained marks for a correct root found by trial and improvement. As there were rarely solutions in **(b)**, part **(c)** could not often be answered. In part **(d)**, very few thought of substituting values (even their incorrect ones) to find an area and length.

Question 23

Few candidates had techniques to solve this question. Some did write an answer, the most popular being 1 : 3 or $1n : 3n$.

Common misconceptions seen in this paper

That 17% may be found by dividing an amount by 17.

That there are 10, or 1000, cm in a metre.

Misunderstanding the nature of volume and area.

That the index in a standard form number indicates the number of zeros when converted to an ordinary number.

Key teaching and learning points – comments on improving performance

- Practise reading the question and extracting key points.
- Practise good calculator usage and familiarity with the functions.
- Practise interpretation of all sorts of diagrams.
- Practise questions that ask for a reason, deciding on the evidence and what mathematical facts pertain to the situation. Discuss candidates' reasons and their cogency.
- Practise drawing transformations using tracing paper and describing them using key properties.
- Practise developing problem solving strategies. Do this as a group, discussing different strategies and their effectiveness. Solve problems and compare the strategies used, discussing the results.
- Revise algebraic rules and processes.
- Use practical experiments in probability, considering the outcomes.
- Do practical work with shapes made from cubes and consider the surface area and volume of different combinations.

Guidance on using this paper as a mock

This paper is useful for all well prepared candidates.

Question 6 and Question 10 will likely challenge students, since in the actual assessment many candidates showed poor understanding of properties of shape and understanding area and volume.

Questions 22 and 23 will likely only be accessed by more able candidates.

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