Qualification Accredited

Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/02 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.

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.

November 2021 J560/02 overview

This non-calculator paper is the second of the three papers taken by Foundation candidates for J560 GCSE (9-1) Mathematics.

A good number of candidates demonstrated their knowledge and skills well, with clearly set out working and answers. In some cases, there was good evidence of checking.

Less well set out responses had working scattered over the page and if candidates do not make their intentions clear this can lead to markers faced with a choice of methods. If several restarts are made on a question, candidates should be encouraged to clearly indicate which attempt is meant to be considered. They should also be encouraged to cross out incorrect values and rewrite them, as overwriting can lead to doubt over the candidate's intention.

There was evidence of candidates employing trial and improvement methods (particularly in Q9, but also Q10(c), Q14, and Q23) rather than having correct methods for solving. A significant number employed addition rather than dividing correctly or subtracting with a column method.

There is still a tendency when dealing with division using the 'bus stop' method to get the numbers the wrong way around. This can also happen with subtraction between two numbers.

Foundation topics students often do find challenging such as solving inequalities, volumes of prisms, repeat percentages, drawing quadratic graphs and angles in parallel lines in an algebraic context again appeared difficult for many and were often not attempted at all. Similar to November 2020, there was evidence of students not responding to more questions than usual.

As in November 2020, many of these points are likely connected to the disrupted teaching and learning experienced by this cohort due to the Covid pandemic.

Candidates who did well on this paper generally did the following:	*Candidates who did less well on this paper generally did the following:*
• attempted all questions • read question instructions carefully • set out working clearly and logically • showed calculations for every step of their working (not just stating numerical results) • displayed secure mental arithmetic techniques.	• didn't respond to multiple question parts • ignored specific instructions within questions • overwrote figures and words, making answers difficult to interpret • steps for working through a problem were disorganised and unclear • made simple numerical errors in calculations.

Comments on student responses

Question 1

The majority of responses were correct in **(a)**. Incorrect answers were usually from other familiar polygons (e.g., 3, 4, 6 or 8 sides). Part **(b)** was also well answered, although a common incorrect answer was circular based pyramid. Other 3D shapes suggested were triangular prism, pyramid and sphere, but these were in the minority. Occasionally a 2D shape was given, such as rhombus or trapezium. Right-angled triangle featured most often in **(c)**, though a few picked up the mark also from stating scalene. Isosceles was by far the most common error. Some incorrect responses involved types of angles (such as acute, obtuse, 180 degrees) and others suggested equilateral or irregular, or just weren't quite there with for example, 'right handed triangle'.

Question 2

Part **(a)** was usually correct, with the common incorrect answer being −17. Part **(b)** also very well answered, with only occasionally the wrong sign or −6 seen.

Question 3

Using the written 'bus-stop' method of division in **(a)** mostly yielded the correct answer. Others attempted to do the calculation mentally, though this was more prone to error and often resulted in incorrect answers such as 3.2, 3.12 or 3.06. In **(b)** the multiplier of 0.6 provided some level of challenge. Those who attempted written working often gained full marks, giving the correct answer of 9 or commonly 9.0, or gained the M mark for figs 9, such as 90 or 0.9. The grid method was the most common approach, plus also the most successful. To avoid the decimal some students changed the calculation to 15 × 6, but often the answer was left as 90.

Question 4

Those who wrote down the decimal equivalent of ¼ in **(a)** were often able to identify the correct sign. In **(b)**, those who attempted to compare an equivalent number of place values by adding the extra zero on to 0.34 were more successful.

Question 5

This was generally answered correctly. The most common error in **(a)** was 10, from candidates just working from left to right disregarding BIDMAS. Successful candidates in **(b)** often made a number of attempts before settling on the correct solution. The majority only considered a pair of numbers to bracket rather than the triple that was required for the question.

Question 6

In **(a)** the majority were able to accurately identify $^4/_5$. Some that didn't gained B1 for 8/10. Cases of 'spoiling' $^4/_5$ were relatively rare. Unsuccessful attempts usually gave ¾ as an answer without showing any working. There were some cases of 'building up' rather than simplifying, e.g. 16/20 = 80/100 and quite often this was also changed into a percentage answer, such as 80%. Part **(b)** was more of a challenge. 4.5, 0.75 and 0.25 were often seen. Some gave their answer as a percentage.

Question 7

Part **(a)** was a difficult part for many and some attempts showed no understanding of a mixed number. A significant number left this question blank. Some that understood what a mixed number looked like gave incorrect answers of 1 3/3 by separating the 13 into 1 and 3, or in a similar vein 103/3. In **(b)(i)** many attempts understood the need for a common denominator, with use of 3 × 9 seen the most, leading to 21/27 that was awarded credit. A few realised they could just alter $^{1}/_{3}$ to $^{3}/_{9}$ leading to the expected answer of $^{7}/_{9}$. By far the most frequent incorrect answer was $^{5}/_{12}$, which came from the common error of adding numerators and adding denominators. Some started **(b)(ii)** by setting up 3/1 ÷ 1/3 = 3/1 × 3/1 but then gave the answer 9/1, which is not complete. Others knew to change the division to multiplication, but made errors by either not flipping the second fraction (leading to an answer of 3/3 or 1) or flipping the wrong fraction (leading to an answer of 1/9). As with **(a)**, a significant number left this question blank.

Question 8

Occasionally the function machine was misunderstood in **(a)** and the input of 2 was interpreted by changing the first operation box to '+2'. Otherwise, this part was well answered, with just a few numerical errors made in otherwise correct methods. In **(b)** many candidates identified that it would be necessary to follow the function machine in reverse, but several made numerical errors. Use of '÷ 7' was more common than '− 3'. Some showed the correct complete inverse string, but then copied 9 to the answer line rather than 6. Of candidates who didn't identify the need to use inverse functions, a very common error was to use 63 as the input rather than the output number.

Question 9

Given that this was a large-mark problem-solving question, there was a lot of accurate work seen with many candidates scoring 4 or 5 marks. The basis of this question involved the four operations (predominantly subtraction and division), though it was evident that many candidates were lacking confidence in using standard written strategies to perform these calculations, particularly in division. Instead, candidates often opted for trial and improvement methods, coupled with repeated addition. They were still able to score reasonably well as the method marks allowed for arithmetic errors, so as long as they clearly showed what they were trying to do they didn't lose method marks. However, many struggled to correctly subtract and divide relatively simple numbers.

	AfL	Candidates need to be reminded of the importance of looking at the given units and ensuring their final answer is appropriate. In this question several candidates lost a mark for giving 0.72 as a final answer.

Question 10

Simplification of the given ratio in **(a)** often started with dividing both parts by two. As this led to a decimal for one part, it was rare for the correct answer to be achieved. Those that started dividing both parts by 5 had mixed success. Some gained a method mark for reaching 15 : 40, but others struggled with the division, resulting in errors such as 15 : 20. In **(b)** many identified the correct method of 100 ÷ 12 × 18. Fewer looked to simplify this to an easier calculation of 100 ÷ 2 × 3, so errors or premature rounding occurred when attempting to divide 100 by 12. The method often adopted in **(c)** was to systematically work up in 50g amounts to 225g of butter. Many were able to reach 48 pancakes with ease, but then struggled to appreciate they could still half the quantity of pancakes enabling them to get to 54. Others used amounts for 2 eggs to reach 60 pancakes. Occasionally 225 ÷ 50 or 10 ÷ 2 was seen, but then there was unsuccessful progress beyond this.

Question 11

In **(a)**, candidates who worked systematically did well. The most common error was placing Sam in one of the first three columns, missing the information in the question that Sam always had to be in 4th place. This led to a number of incorrect combinations and often caused confusion and repeat arrangements. Candidates tended to do well in **(b)** by following through from their table. Word or ratios responses were not credited, but these were few in number. A small number of candidates counted the number of runners in the arrangements, leading to an incorrect denominator of 24 for the probability.

Question 12

Many found this difficult and few were able to use the ratio statement to calculate the length of the rectangle. A wide variety of possible rectangle lengths were suggested, some of these not connected to any of the values given. Many calculated the full perimeter of the rectangle and the pentagon and added these together, or included the internal common side. Some were confused between lengths and finding areas. A significant number did not attempt this question.

Question 13

In **(a)** most stated that Reece was correct because the numbers multiplied to 20. It was common to see a factor tree, but most ignored the part that stated the answer had to be in index form. The correct answer in **(b)** was only very rarely seen. A wide range of responses were given, including some candidates stating 3 even though many of these went on to correctly identify 2^3 as 8 in part (c). This last part was far more successful. Candidates seemed solidly prepared on squares, cubes and roots. Where candidates didn't achieve full marks a very large proportion gained at least 1 mark for either $\sqrt{81} = 9$ or, more commonly, 23 = 8. A common error was $81 \times 8 = 648$, which did gain 1 mark. Some candidates made a computational error when attempting $9 \times 2 \times 2 \times 2$, if they hadn't calculated 2^3 as 8 separately.

Question 14

Candidates who were organised generally scored 3 or 4 marks. There were a few errors in converting between ml and litres and candidates incorrectly converting 5 litres to 500 ml often struggled, as this implied that after one week more than 80% had been used up. Most attempted 450×9, although some grid methods had errors, especially when a column or row was used for 0 yet multiplication by 0 was performed the same as multiplication by 1. Many used repeat addition and errors occurred where the 450s didn't line up and carried figures were lost or added to the wrong units. Those doing 10×450 and then subtracting 450 were much more likely to get to the correct 4050. Finding a comparison figure to 4050 proved more difficult. Many assumed 4050 was 80% and so the mechanic was correct. In these cases, no attempt to specify the 80% of 5000 or 5 litres was made. Instead of comparing their 4050 and 80% of 5000, a number of candidates worked out 450 as a percentage of 500. In general, many candidates showed they understood the requirement, however candidates struggled if they weren't confident in converting from ml to litres and vice versa, or weren't able to be precise in deciding whether an amount is 'over 80%'.

Question 15

Solving an inequality proved challenging for the majority of candidates and many seemed unaware that the standard algebraic techniques to solve an equation could be used here. A small number attempted it as an equation, resulting in the answer of $x = 3$. A few started correctly, but stopped at $2x + 10 < 16$. A number of embedded single answers were seen, for example $2(1 + 5) = 12 < 16$. Common algebraic errors lead to responses such as $x + 5 = 5x$, $2x + 10 = 12x$, and $2(x + 5) = 2x + 5$. The most efficient first step of $x + 5 = 8$ was rarely seen.

Question 16

The correct graph was often chosen in **(a)**. Choice E was the most common error, suggesting some knowledge that direct proportion produces a straight line. Candidates were much less successful with their choice in **(b)**. Some recognised the aspect that the graph needed to decrease, but incorrectly chose B.

Question 17

Few candidates provided a plan view in part **(a)**. Many just copied the shape, or both a rectangle and triangle were drawn. Others made an attempt at the net of the prism. A lot of views were drawn diagonally on the grid and the correct dimensions of any rectangles offered were rare. In **(b)**, most seemed to be trying various combinations of the numbers from the diagram (usually multiplying) without looking at cross sectional area. Successful attempts were very rare. Many candidates were unable to make a start in part **(c)** and those who did often struggled to progress beyond 72 ÷ 2. Some incorrectly thought the next step was 36 ÷ 4. Both **(b)** and **(c)** had very high rates of no response.

Question 18

Although many plotted all four points accurately, a significant number confused the *x* and *y* coordinates (although not consistently, as often just (38, 50) would be reversed). A few plotted points within the squares, rather than on gridlines. A common error in **(b)** was to state 'negative'. Rather than just stating 'positive', there were many that described the relationship with comments such as 'it's going up', 'the higher you got in Jan the higher you'll get in Feb' or 'they did better in February'. In **(c)(i)**, (70, 86) was the most commonly given incorrect answer. Many circled the table rather than the point on the scatter graph, which showed they understood the concept of the question even if they hadn't read the instruction to circle the point on the graph. Only a few candidates had success with to part **(c)(ii)**. A small number subtracted their two values and gained M1. For those that recognised a division was required, 66 was usually in the denominator instead of 30. Of the few that achieved the correct result, often a 'build up' method of percentages was used rather than a division, e.g. 10% of 30 = 3, 20% = 6, 100% = 30 so 36 = 100 + 20, etc. It was very rare to see a scoring statement in **(d)**. The majority just referred to how he could have done better or worse on the day, or wrote 'yes, it's a good estimate'. Some referred to the 'lack of correlation, therefore it wouldn't be a good estimate' rather than commenting on a score of 79 being beyond the given data values.

Using the 'bus stop' method for division

In several question parts this series, knowledge of which way to place numbers in the 'bus stop' method for division was insecure. Many base this decision on whichever number is the smaller of the two, rather than knowing what they want to divide by. In Q18 here, there were instances where it was difficult to identify whether a candidate intended a correct method of percentage change or not.

Question 19

Almost all Foundation candidates found this question challenging. The few that were successful in gaining some marks worked with a starting 'wage' and this helped some gain the confidence to continue through the question. These candidates worked through the process of adding 10% and then finding 10% of the new wage and adding that also. If they chose their starting value well (e.g. £100) to give themselves simpler calculations, they were often able to go on to state the correct increase of 21%. It was rare to see use of the multiplier of 1.12. There was a high rate of no response.

Question 20

Candidates who gained credit here multiplied length and width of the rectangle together, mostly using the exact dimensions of 4.9 and 4.1. A further mark was earned for dividing 198.5 (or their estimate of this) by the answer to their area. Some used perimeter, or just added together the length and width, scoring 0. Very few gained 3 or 4 marks here, since the key component of this question (to work out an **estimate** of the pressure) was largely ignored. This was another question with a significant number of no response.

	AfL	Candidates need to take particular note of key information written **in bold** in questions. When they see a question ask them to **estimate**, they should be rounding any values in the question to one significant figure before attempting any calculations.

Question 21

Few were able to complete the table in **(a)** fully correctly. A number of errors were seen, either due to the squaring or the use of negative numbers. Common errors included (0, 0), (-3, -6), (-3, 12), (-3, 3) and (-3, -3). Many appeared unfamiliar with drawing a quadratic graph as required in **(b)** and a significant number of no responses were seen. Those plotting points usually did so correctly from their table, although a number of untidy plots involving 'large blobs' were seen. Few appreciated that these plots should be joined in a smooth continuous curve; some used straight lines, but many didn't join their points at all. As **(c)** relied on the drawing of a curve, correct methods and answers were rarely seen. Those who had drawn a curve did not appreciate that the line $y = 2$ also needed to be drawn in order to solve the equation by using the intersection points. A number of candidates attempted to solve this part using algebra, rearranging the equation to $x^2 = 5$ and some solved this to reach $x = \sqrt{5}$. However, as the question stated 'Use your graph', this was a method that did not gain credit.

Question 22

A common error in **(a)** was to assume that this survey was just about 15 year olds, or looking at a sample of people 'around' 15. Lots of scoring responses were along the lines of them being in school at this time. Incorrect responses referred to playing video games at that time rather than surveying video game use. Few mentioned the sample size being low. Some incorrectly thought that the sample would be unreliable if there were any people who didn't play computer games in it, whilst others referred to not asking everyone. In **(b)**, few gave 3 valid reasons. The main scoring responses suggested changing the time of the survey to after school or at a weekend. A minority mentioned equal amounts in each age group, similarly, increasing the sample size. Quite a few referred to using an online survey. Those that did identify that obtaining the sample was the nub of the question sometimes made the error of only wanting a sample with people who played lots of games/went to game stores or suggested going to a school; they mostly did not consider that this would bias the sample. Other non-scoring responses included collect basic information such as age and hours played or to present the data once collected (e.g. in a graph or chart). Other suggestions involved changing the journalist's survey parameters (e.g. survey more age ranges (not just 2)), which wasn't answering the question regarding sampling.

Question 23

Almost all candidates did not identify that the intention of this question was to form an equation. A few displayed some evidence that suggested there was an understanding that corresponding angles were equal. Identifying $x + 85 + y = 180$ and/or $2x + 30 + y = 180$ was seen and even solved simultaneously, but this was very rare. More commonly the two expressions $x + 85$ and $2x + 30$ were added together, leading to $3x + 115$ and this was a dead end for most. There were a small number of candidates who tried to use a trial an error approach, but for most this didn't progress very far. The majority made use of the fact that angles on a straight line add up to 180°, but this was often with a value that they hadn't identified as x. Those clearly identifying their value of x were able to go on and earn method marks for substituting this value in to either expression and proceeding to find their y.

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