Examiners' Report
Principal Examiner Feedback

November 2019

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Foundation (Calculator) Paper 2F

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GCSE (9 – 1) Mathematics – 1MA1
Principal Examiner Feedback – Foundation Paper 2

Introduction

Students generally did well on questions which asked them to perform standard calculations but found it more challenging when working in context. The majority of marks awarded for most students were for the earlier questions although some later questions were answered quite well. It was encouraging to see students 'having a go' rather than not trying at all.

Time calculations once again proved to be a challenge. Converting from minutes to hours (or from hours to hours and minutes) and adding on time (Q10) were weaknesses for a significant number of students. Working with scale and units of measurement (Q15) proved challenging as did writing an algebraic formula (Q18a). Another evident problem area for many students related to geometry. An isosceles triangle on its side (Q17) caused confusion for many, and volume alongside surface area (Q29) was beyond the skill set of the majority of students sitting this paper.

Examiners commented on an improvement in the quality of written responses in questions involving communication marks such as Q21 and Q24. Some students, though, need to be more explicit in their descriptions and use the correct mathematical language, e.g. 'angles on a straight line' or 'y-axis'.

It was pleasing to see that many students showed their working although some showed little more than the answers they gave. In questions with no answer line on which to write a final answer the working was often unclear with no obvious logical process. Setting out work clearly in problem solving questions not only makes it easier for an examiner to follow a student's method but it also means that the student can check their own working to find any errors. Irrelevant or redundant working can be crossed out but when students attempt to simplify an answer, they should not cross out the un-simplified answer as it cannot then gain any marks if it cannot be read.

Many students made good use of a calculator but some students chose long winded methods and carried out written calculations instead of using their calculators effectively. Students should be reminded to use their calculators where appropriate and not rely on non-calculator methods. Those using a calculator often showed no working, e.g. when finding percentages of quantitites, so if the results were incorrect then no method marks could be awarded. Premature rounding and truncating of numbers displayed on a calculator prevented some students from being awarded full marks.

Report on individual questions

Question 1

Most students were able to write the numbers in order of size.

Question 2

This question was answered well with many students able to write 8375 correct to the nearest thousand. The most common mistake was to attempt to write it to the nearest hundred.

Question 3

Most students were able to write 0.23 as a percentage.

Question 4

This question was well answered with most students able to find the square root of 17.64

Question 5

The majority of students were able to find the value of 6^5.

Question 6

This question was well attempted and a pleasing number of students were able to show a complete process to work out the number of tickets that were not sold. A common approach was to subtract the number of tickets that had not been sold (1274 ÷ 6.50) from the total number of seats in the cinema (14 × 15). The other common approach was to start by working out the total cost of all the seats in the cinema (14 × 15 × 6.50) and then subtract the total cost of the tickets that were sold (1274) to get 91. Dividing 91 by 6.50 completed the process. A common mistake made by students using this approach was to miss out the final step and give 91 as the answer.

Question 7

After working out 20 – 7 = 13 to find the number of sweets that Harry had left most students gave the correct fraction 13/20. Some students gave the answer in decimal form and lost the accuracy mark. A few students gave the answer as 7/20, the fraction of the sweets that Nadia had, and were awarded one mark. Those that made an arithmetic error could be awarded the method mark if 20 – 7 was shown but an incorrect answer such as 14/20 with no working meant that no mark could be awarded.

Question 8

Part (a) was answered very well. A few students misread the question and worked out the input for an output of 6.

Part (b) was also answered well. Instead of giving the answer as –20 or ÷3 some students omitted the operation and wrote just 20 or 3 in the number machine. They gained no mark.

Question 9

In part (a) the majority of students knew that the median was the middle number even if they tried to find the median without ordering the list. Those who gave the answer as 8.5 (middle of the unordered list) gained one mark. Most students did order the numbers with many then able to give the correct answer. Some attempts at ordering the list omitted one of the numbers, often one of the two 4s. A common error was to identify the two middle numbers as 4 and 6 and give an answer of 4 or 6 or 4, 6 or carry out an incorrect calculation such as 6 – 4 with the two numbers. Some students confused the averages and worked out the mean or the mode. A few found the range.

Part (b) was answered very well. Those who did not give the correct probability often gained one mark for a fraction with either the correct numerator or the correct denominator. A few students used incorrect notation for probability such as 2 : 6 and were awarded the method mark only. A common incorrect answer was 1/2. There were relatively few students who gave a likelihood rather than a probability as the answer.

In part (c) many students were able to use the information about the mode to identify one of the hidden numbers as 3 and gain the first mark. They then often went on to give the correct answer.

Some students showed 3 + 3 + 8 + 5 + 6 = 25 and 25 ÷ 5 = 5 in the working space but then gave 3, 5 as the answer and gained one mark only. It was common to see 3 on the answer line with a number other than 6 and no working out shown. Some students gained the first mark for working with the mean but did not use the mode to complete the solution.

Question 10

Students who divided 8.40 by 0.024 had an efficient process to find the length of time spent in the car park in minutes and gained the first mark. This was the most common first step. Some students started by multiplying 0.024 by 60 to find that the cost per hour was 1.44 euros. Dividing 8.40 by 1.44 completed the process to find the length of time in hours and the first mark could be awarded. Some students used 1.44 in a build up method and attempted to reach 8.40 but few completed the method correctly. The next stage of the problem involved adding the length of time to 10 45. This was done by adding on 350 minutes in steps or by first converting it to 5 hours 50 minutes. However, this stage proved to be the downfall of many students. It was common to see 350 minutes converted to 3 hours 50 minutes or to see 5.83 (from 350 ÷ 60 or 8.40 ÷ 1.44) interpreted as 5 hours 83 minutes or 6 hours 23 minutes or 5 hours 8 minutes. Some of the students who added the length of time to 10 45 correctly gave the answer as 4 35 rather than as 4 35 pm or 16 35 and lost the accuracy mark. Students should be encouraged to use the time button on their calculator to deal with this type of question.

Question 11

In part (a) some students did not read the graph with sufficient care when changing 3 stones to kilograms. Answers such as 10.9 or 20 were quite common.

The most common approach seen to change 80 kilograms to stones in part (b) was reading from the graph at a factor of 80, which was often 40, and scaling up to 80. A few students used two values that sum to 80. The scale on the horizontal axis was often not read correctly and statements such as 40 kg = 6.1 stones or 10 kg = 1.3 stones were common. An answer outside the range 12.4 to 12.8 was awarded full marks if it came from a complete method that included a correct reading from the graph. Some students, for example, read from the graph to find 1 stone = 6 kg and then divided 80 by 6 to complete the method. Too many students gave an answer with little or no working out. When the answer was not in the range 12.4 to 12.8 marks could only be awarded if a complete method was shown. Students should be encouraged to show a clear method on the graph as, without this, incorrect conversions can be given no marks. Attempts at answering the question by extending the graph were usually unsuccessful.

Question 12

Many students gained the first mark for writing 1/10 and 3/5 as decimals or as percentages or for converting them to fractions with a common denominator. Those who used 0.1 and 0.6 tended to be more successful even though some students wrote out a list of decimals from 0.1 to 0.6 and were still unable to identify the halfway number as 0.35. Those who used fractions often struggled to complete the process and those using percentages sometimes failed to gain both marks because they gave 35 as the final answer. Some students gave the final answer as 3.5/10, not understanding that this is not an acceptable format for a fraction.

Question 13

Drawing a horizontal line and a vertical line both 6 squares in length should have been a straightforward start to the enlargement but a surprising number of students failed to gain at least one mark for drawing two of the sides correctly. Many of those who did make a correct start could not complete the enlargement correctly as the diagonal lines were often incorrectly drawn. It was noted that some students did not appear to have a ruler as their answer to this question was drawn freehand.

Question 14

Students that interpreted the two offers correctly were frequently able to find comparable values on which to base a decision. Many students found the cost of the same amount of compost for each offer, most often for 120 litres or for 40 litres. It was much less common to see students working out the cost per litre or the number of litres per £ for each offer. Having found comparable values students were usually able to make the correct decision. Those who worked with the number of litres per £ sometimes made the wrong decision. Some students interpreted the two offers correctly, for example 40 litres = £3.50 and 120 litres = £9, but gained only one mark because they did not find comparable values to support their decision. The offers were often not interpreted correctly. The first offer, for example, was often interpreted as 20 litres for £3.50 or 20 litres for £7. Some students simply worked out the cost of one bag for each offer and did not take the volume into account. Students should be encouraged to set out working clearly for questions like this one as it will be helpful to them if they can follow their own calculations and working when making their conclusion.

Question 15

This question was not answered particularly well. Many students were not able to use the scale correctly. The length of the plane was often multiplied by 24 instead of being divided by 24 and it was common for students to add 1 and 24 and then multiply or divide the length of the plane by 25. The conversion from metres to centimetres caused more problems than expected. Common mistakes were dividing by 100 instead of multiplying by 100 or using 1 metre = 10 centimetres or 1 metre = 1000 centimetres. Some students used the scale correctly and divided 19.2 by 24 to find the length of the scale model but forgot to convert their answer to centimetres. Many students gained just one mark for $19.2 \times 100 = 1920$.

Question 16

For those that understood simple interest a common first step was to work out 1.8% of 4500. It was surprising to see some students using an inefficient build up method to work out 1.8% of 4500 on this calculator paper. They were often not successful. Some students took the 3 years into account at the start and worked out 5.4% of 4500. Having used a complete method to get 243 some students were not awarded the accuracy mark because they gave the final answer as 4743 or 4257. A common incorrect first step was to divide 4500 by 3 and assume that Maria invested £1500 each year. Many students treated this as a compound interest question rather than as a simple interest question and they could score at most one mark for a calculation of the form 4500×1.018^n. This was usually 4500×1.018 or 4500×1.018^3. Incorrect multipliers such as 1.8 or 1.18 were quite common. A significant number of students gave answers which were large compared to the initial amount invested. Students should be encouraged to consider whether their answers are reasonable in the context of the question.

Question 17

This question was not answered as well as might have been expected. Many students could not make the correct first step and identify the size of angle *ADB* as 64º. A common mistake was to identify the two equal angles in triangle *ADB* as angles *DAB* and *ABD* or as angles *ABD* and *ADB*. Those who did find *ADB* = 64º often failed to make any further progress. Even some of those who got as far as finding that angle *ABD* = 52º and angle *DBC* = 128º could not complete the method to find the size of the angle marked *x*. Students that annotated the diagram tended to be more successful than those that tried a more formal labelling angles approach. It was disappointing that relatively few students achieved the C mark for giving two correct reasons appropriate to their method. When reasons were given they were often incomplete and did not include a reference to angles. Reasons such as 'triangles add up to 180º' or 'a straight line is 180º' are insufficient. Many gave no reasons at all or incorrect reasons based on parallel lines. A significant number of students misunderstood 'angles on a straight line add to 180°' and applied it to angles that were at separate points along the line *ABC*.

Question 18

In part (a) it was pleasing that many students did manage to write a formula for T in terms of n even if it wasn't a fully correct formula that gained full marks. Students that started by writing down Chloe's age as $2n$ or Dan's age as $n – 5$ were awarded the first mark and tended to be the most successful. Common errors were expressing Chloe's age as n^2 or Dan's age as $5 – n$ or $–5n$. Students who used both $2n$ and $n – 5$ often went on to give a fully correct formula although some gave the answer as $n + 2n + n – 5$ or as $4n – 5$ and scored only two marks. Students with an incorrect expression for either Chloe's age or Dan's age were still able to get two marks for an answer such as $T = n + n^2 + n – 5$ or $T = n + 2n – 5n$. Some students failed to include the original n for Ben's age. Answers of $T = 2n – 5$ with no working were common and these gained the first mark only for T = a linear expression in n. Some students thought they had to work out a numerical answer.

Many students were unable to select the identity in part (b). A popular incorrect answer was the inequality $x + 7 \leq 12$.

Question 19

Many students were able to make progress with this question and gain at least one mark. This was awarded for finding the maximum number of batches of 16 biscuits for one ingredient or the amount of one ingredient needed for one biscuit or for doubling the quantities in the recipe in the first stage of a build-up method, e.g. 350 g butter, 150 g sugar, 500 g flour. Many students went on to gain the second mark for showing a process to find the maximum number of biscuits for one ingredient or for an answer of 32. Students should be aware that it is possible to make a non-integer number of batches unless the question states otherwise. Some of the students that used a unitary method of solution and showed a complete process rounded or truncated intermediate values and lost the accuracy mark.
A common incorrect start to the process was to add together quantities of the different ingredients. The presentation of work on this question was often poor with calculations spread all over the working space.

Question 20

Most of the students that substituted $f = 110$ into the formula obtained 452 and were awarded the first two marks. Many students, however, were not able to complete the solution by showing that the difference between 452 and the real height is less than 5% of the real height. Some made no attempt to do so. Others did make an attempt but could not show a complete method. Some found the difference of 10 but did not work with percentages whereas others found 5% of 442 but not the difference of 10. A common mistake was to find 5% of 452 instead of 5% of the real height. A significant number of students did not use the formula correctly and gained no marks. Attempts at solving an equation such as $442 = 4f + 12$ or $110 = 4f + 12$ were quite common. Some students thought that they needed to round values because of the word 'estimate'.

Question 21

It was pleasing that many students were able to identify at least one of the things wrong with the frequency polygon. Often this was the missing frequency label on the vertical axis or the fact that the first point has been plotted incorrectly but some students identified the line joining the first and last points. Statements were often too general or incomplete. A statement such as 'the points have been joined up wrong' does not identify what is wrong in the way the points have been joined up. Similarly 'the points have not all been plotted correctly' is not sufficient as it does not specify that it is the first point that has been plotted incorrectly. A common incorrect answer was that the scale on the horizontal axis should start at 0, not at 10. Some students suggested that the points should not be joined at all or that the points should have been joined with a curve. A number of students incorrectly referred to lines of best fit.

Question 22

This question was answered surprisingly poorly with many students unable to complete the error interval correctly. Those who used 127.5 as the lower value sometimes used 128.4 as the upper value. Answers that used integers, such as $128 \leq \text{length} < 130$ or $127 \leq \text{length} < 129$, were very common. In many responses the number on the left of the error interval was larger than the number on the right.

Question 23

Many students successfully started by using the ratio 3 : 7 to find the number of stamps that Tom and Adam each had before Tom bought some stamps from Adam. There were some students who divided 240 by 3 and by 7 instead of by 10 but most used a correct process and found that Tom started with 72 stamps and Adam with 168 stamps. Those who then used the ratio 3 : 5 correctly to find that Tom finished with 90 stamps and Adam with 150 stamps usually went on to give the correct answer. There were many students, however, who did not use the ratio 3 : 5 correctly. Instead of working out $240 \div 8 = 30$ they used 24 (from $240 \div 10$). It was common to see $7 - 5 = 2$ followed by 2×24 and a final answer of 48.

Question 24

Part (i) was answered quite well with many students able to work out how many sports bags Stan should order. Those who showed a correct process usually gave the correct answer.

Students were far less successful in part (ii) where they were asked to write down an assumption they had made. Acceptable statements were based on the assumption that Stan's sample is representative. Although some students explained how this could have affected their answer this was not required for the mark to be awarded. Many students gave a criticism of Stan's sampling rather than an assumption they had made. Some simply described the calculation they had carried out in part (i).

Question 25

Both parts of this question were poorly answered.

Relatively few students were able to identify the graph with equation $y = x^3$ in part (a). It was perhaps to be expected that many students would choose graph B instead of graph F but it was surprising that both graph A and graph E were very popular incorrect choices.

In part (b) graph F was a popular incorrect choice for the graph with equation $y = 1/x$.

Question 26

This question was not answered well. It was disappointing that many students could not find at least two terms by substituting values of n. Many of those that did attempt to find terms of each sequence did not generate sufficient terms to satisfy the demand of the question. Some students found that the number 31 is in both sequences but did not show that that there is only one number that is in both sequences by generating the first five terms of the first sequence and the first six terms of the second sequence. Errors in generating terms using $2n^2 - 1$ were often the result of using an incorrect order of operations, most often finding $2n$ and then squaring.

Question 27

Many students were able to enter the calculation into a calculator to obtain 0.0456 and they were awarded the method mark. The question required the answer to be given in standard form but it was common to see 0.0456 given as the final answer. Those who did attempt to write 0.0456 in standard form were often unsuccessful. Some students did not show 0.0456 but scored one mark for an answer of the form 4.56×10^n with an incorrect value of n. Some students made hard work of this question and attempted to convert to ordinary numbers before doing the calculation. They usually got into difficulties.

Question 28

This question was generally answered quite well and it was pleasing that many students were able to gain the first mark for finding the number of workers used each day by Ali's company or by Hayley's company. Most went on to give a fully correct solution. Having found the two correct values (18 and 24) a few students did not complete the process by subtracting 18 from 24. Some students could not use the formula correctly and a common error was to work out 720 × 40 and 720 × 30.

Question 29

This question proved to be beyond most students on this Foundation tier paper and it was frequently not attempted. Many that did make an attempt were unable to do anything other than find the volume of the cuboid. On its own, this was insufficient to gain any marks. Many of the students who appreciated the need to work out the surface area of the cuboid could not show a complete process to do so. A common mistake was to include either four 6 by 18 faces or four 8 by 18 faces in the surface area calculation. Relatively few students were able to progress beyond a surface area calculation to find the side length of the cube but it was pleasing that some who did so were able to carry on and give a fully correct solution.

Question 30

This question was answered poorly with relatively few students showing an understanding of vector arithmetic. Some students scored the first method mark for 5 – 2 × 3 or 2 – 2 × – 1. When $\begin{pmatrix}5\\2\end{pmatrix}-\begin{pmatrix}6\\-2\end{pmatrix}$ was seen it was often not simplified correctly with errors usually occurring in the *y* component. Students that scored the second mark for simplifying to $\begin{pmatrix}-1\\4\end{pmatrix}$ were rarely able to achieve the final mark for drawing the vector. Some students attempted to find the vector **a** – 2**b** by drawing but most could not manage even the first step. At all stages of the question the drawing of vectors was extremely poor and very few students drew any kind of correct vector.

Summary

Based on their performance on this paper, students should:

- practise working with time, converting from minutes to hours and vice versa
- learn how to read and interpret scales on graphs, particularly those where 1 small square is not 1 or 0.1
- ensure that they know how to use their calculator
- practise finding missing angles with isosceles triangles in various orientations
- understand the difference between simple interest and compound interest
- practise working with algebra in formulating expressions or formulae and in substituting into formulae
- practise using and drawing column vectors

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