Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Foundation (Calculator) Paper 3F

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GCSE (9 – 1) Mathematics – 1MA1
Principal Examiner Feedback – Foundation Paper 3

Introduction

Centres are congratulated for the preparations they clearly undertook in preparing candidates for this paper. Overall, the quality of work was an improvement on the previous summer, with candidates showing their working to a greater degree. This enabled examiners to better consider the evidence for the award of marks.

However, the overall quality of the presentation of work has not improved. Of greatest concern is the proportion of work that is spoilt by miscopying of figures, either from the given question, or candidates who miscopy their own figures in working. This was most prolific in questions 5, 10, 12, 14, 23, 27 and both parts of 28 but was also seen in other questions. Poorly written (sometimes overwritten) figures prevented the award of marks significantly in questions 5 and 20.

There was little evidence that candidates did not have a calculator for this paper but there were many occasions when break-down methods were used in attempts to work out percentages, usually far less successful than a more direct approach using a calculator method. Although in most cases candidates used their calculator accurately, there were also instances seen where candidates prematurely rounded or truncated their figures, either their own figures or whilst in the process of taking them from the calculator, or the question. This was frequently seen in questions 12, 14, 19, 21 and 25. In most cases these errors prevent the award of any accuracy marks (A, B or C marks).

Most candidates demonstrated good use of both ruler and protractor though they need to ensure that these are used accurately. There were some surprising errors shown in questions 13 and 17 where evidence suggest that candidates either did not have a ruler or were using a ruler incorrectly.

Within a broad range of questions, the paper was able to discriminate well with nearly all candidates showing a broad range of proficiency across the specification content. Weakest areas continue to be the application of ratios, scales and rates, but also algebraic manipulation and problem solving. Time remains a weakness as in question 10, where some candidates were using their calculator inappropriately.

Questions which were slightly different and required more thought, caused immediate problems for many, even in the earlier part of the paper. This includes questions 12b, 14, 15 and 19. Question 24, 27 and 28 were the more challenging questions for those striving to demonstrate ability at the highest grades available.

The inclusion of working out to support answers remains an issue for many. Not only does working out need to be shown, it needs to be shown legibly, demonstrating the processes of the calculation used. This is most important in longer questions. Examiners reported frequent difficulty in interpreting complex responses, poorly laid out, in questions 10, 12, 14, 19 and particularly 21 and 24. Candidates occasionally gave their answers embedded in an expression in questions 11, 18 and 23, but full marks could not be awarded unless their embedded (correct) answer was highlighted (a different number was usually provided on the answer line). Confusing and contradictory work was also seen regularly in question 22.

REPORT ON INDIVIDUAL QUESTIONS.

Question 1

This question was answered correctly by most candidates. In cases where zero marks were awarded it was most likely to be because of extra zeros which showed a lack of understanding of place value, for example 30001007 or 31007.

Question 2

This was generally very well answered. Some candidates showed misunderstanding by giving a fraction out of 100. A common incorrect answer was 3.

Question 3

This question was well answered. Most candidates were able to state the correct answer of $4m$. Weaker students wrote the answer incorrectly as m^4.

Question 4

Common incorrect answers of 400 or 40000 were seen, from a misunderstanding of how many grams there are in a kilogram.

Question 5

This question was answered well. Those that didn't get the mark generally ordered the two negative numbers incorrectly, though some only wrote down four of the numbers.

Question 6

In part (a) very few incorrect answers were seen. A common incorrect answer was 288 where they worked out the length of each side and multiplied these all together, usually showing $6 \times 2 \times 4 \times 1 \times 2 \times 3 = 288$
In part (b) the perimeter caused more issues when candidates missed some sides or double counted some sides.
Some candidates confused area and perimeter by giving the answers the wrong way around, for which no marks could be awarded.

Question 7

Part (a) of this question was not particularly well answered with many struggling to choose between "likely" and "evens" (with many crossings out and changes of mind seen).
Even when the correct probability of $\frac{2}{4}$ was seen candidates tended to go from this to 'likely' as their answer.

In part (b) an answer of 'certain' was commonly seen. Many candidates showed misunderstanding of the 'less than 4' element of the question by stating 'impossible', probably as there was no 4 on the spinner. These were by far the most common responses. Some gave an incorrect answer of 'likely'.

In part (c) there were many correct answers of 0.6 Not all candidates showed working, but this was not required to gain marks. Candidates mostly stated their answer as a decimal, with very few giving the fraction or percentage equivalent.

Question 8

In part (a) there were many incorrect answers. Some recognised the shape was a 2-D quadrilateral but were unable to state the description in full; equilateral, quadrilateral and rectangle were common incorrect answers. Other candidates gave the name of a 3D shape, with both cube and cuboid common.
In part (b) there were a mixture of responses. Many candidates gave a 2D shape name instead of a 3D solid. Those who recognised it was a 3D shape usually gave a correct response. The most common were rectangular prism and cuboid.

Question 9

In part (a) the majority of candidates ordered the numbers successfully and went on to find the median correctly. A number of candidates calculated the mean instead.
Part (b) was well answered.
Part (c) was also well answered. Candidates were able to correctly scale the *y*-axis and then plot four bars, at the correct height, as well as label them. Those that did not gain full marks tended to lose a mark for an incorrect scale or missing bar labels or another mistake, such as misplacing the linear scale within the square, rather than on the grid lines, which sometimes led to confusion in drawing their own bars. Some candidates used the values from the table to label the axis, i.e 1, 5, 7, 9 without the appropriate scaling.

Question 10

This question was well done by the majority of candidates with most gaining 3 or 4 marks. Most showed they needed to add all the times to 8.30 but for many this was not a strong point thus losing the C mark as their figures were not accurate. A lot of students obtained an answer of 9.15 rather than 10.15 for the first calculation when adding 1 hour 45 minutes to 8.30. Candidates also lost marks for forgetting the rest period when calculating the final time. A very efficient process seen on quite a few occasions was to add the times to give 3 hr 25m and then add that to 8.30, leading directly to 11.55. Mistakes crept in when carrying times over the hour, or when they attempted to use their calculators to do the arithmetic, or from arithmetic errors.

Question 11

Overall an excellent response from the majority of students correctly answering the question. Most students answered by subtracting 7 then dividing by 5. The use of inverse operations was a common approach to this question with candidates choosing to work numerically rather than algebraically. Very little algebra was seen here, though there were some trial and improvement approaches. A common mistake was to put the answer 65 from the execution of just one inverse operation rather than two. Candidates sometimes carried out the calculation on their calculator without showing their working but checked their solution and showed it, proving that their answer was correct. Occasionally a function machine approach was used but this was not as successful as the other methods shown. Sometimes candidates lost the final mark for only showing their answer embedded in the expression.

Question 12

In part (a) most candidates answered correctly. A common error was for candidates to write the size of the angle, 150 degrees, instead of merit and some candidates wrote no response here.
In part (b) the most common approach was to work out the angle for one student and then divide each angle separately, summing the results. Of those who didn't score full marks the method was usually correct and so an incorrect answer was due to an arithmetic error. Some found 2, 5 and 10 but added these to get 15 instead of 7, losing 2 marks.
The more efficient approach of a single calculation $\frac{360}{105}\times 7$ was rarely seen. A common incorrect expression was 360 ÷ 4. Occasionally candidates found the percentage for each sector but rounded too early, leading to the loss of the accuracy mark.

Question 13

Both parts of (a) were generally answered well with candidates demonstrating that they were able to read the initial information from the graph, though a significant minority struggled to read the scale on the graph correctly, sometimes reading the wrong scale and giving the answer 10 in (i). Others offered nothing close to 30, with 65 and 95 not uncommon.
In part (b) many candidates were able to draw a horizontal line at the correct length to indicate Daniel resting and most went on to draw a diagonal line back to the x-axis with a ruler. Candidates who did not use a ruler were not penalised provided that their line appeared straight. Those who had not drawn a horizontal line or drew a horizontal line of incorrect length were still able to understand that the diagonal line should be drawn to 1600 on the x-axis.
In part (c) candidates used their correct diagonal line OR the information provided to correctly arrive at the average speed of 35 miles per hour. It was rare to see a candidate use "their" incorrect diagonal line to try and calculate the average speed, however the few candidates that were able to do this were rewarded for demonstrating this correct process. In this final part, there were some candidates who were able to write the formula, but were unable to substitute their values correctly, and others who were unable to manipulate it correctly or were confused with the concept of time and/or units.

Question 14

Failing to understand what the question was asking and a lack of working both contributed to this being a poorly answered question. Many candidates started the process with quantity divided by cost, thus finding 20 boxes per £1 and 27 bags per £1. They were then unable to progress any further, usually calculating 27 – 20 to arrive at the common incorrect answer of 7p. Those who started with cost divided by quantity nearly all gained a mark for showing 0.05 or 5 for one box. For the bag, when candidates failed to show working and only gave the figure 0.03 or 0.04 their penalty was the eventual loss of an accuracy mark, at the very least. Examiners needed to be able to see where the 0.03 or 0.04 came from in order to award marks for working. Those who did show their calculations up to this stage often did not show the subtraction and struggled with using the correct units, getting no further than 0.01296, 0.013, 0.02, 2, 0.01 or 1p thus losing the accuracy mark.

Question 15

Most candidates were able to utilise the ratio and scale up the 35 to 140 with many of them then realising that they had to sum the two parts to arrive at the correct answer. Those that did sum the two parts were rewarded with the method mark and nearly all candidates were then able to secure the accuracy mark. However, not all candidates were able to do this and left their answer as 140 scoring no marks.

Question 16

Centres are encouraged to reinforce learning in this type of question at this level as it tends to be less successfully answered. Candidates found it difficult to isolate the single transformation of "rotation" and this stopped them from securing any marks. Some candidates did not use the correct mathematical language and chose to use the word "turn", others spoiling their answers by combining two or more transformations. The fully correct response, to gain two marks, required candidates to state rotation with an angle of 90 (direction only required for an angle of 270) and a centre of rotation. Some spoilt their description by stating a "Rotation clockwise of 90º" which of course was a rotation from **B** to **A**, rather than from **A** to **B**.

Question 17

It was disappointing to find that this question was answered so poorly with many candidates leaving this blank. Whether this was due to the absence of a ruler and protractor is unknown. The correct distance was the most successful part of their answers although indicating where exactly their point was sometimes led to confusion. The bearing was very poorly done with candidates often using the N line, which could be due to a failure to use a protractor correctly; certainly, there was evidence of some candidates using the wrong "63" on their protractor.

Question 18

Candidates who were confident with their algebra often gained full marks. The most common approach involved expanding brackets whilst initial division by 4 was rare but successful when used. Candidates who expanded the brackets correctly, generally went on to answer the question well, although some mistakenly subtracted 12 from both sides, rather than adding. Other approaches such as trial and error or dividing both sides by 4 were also successful although less commonly used. When candidates failed to expand the bracket, they often failed to score any marks at all, choosing to guess an answer or to incorrectly remove the −3 first. A common mistake was to see $8x – 12 = 20$ turning into $8x = 8$ and then $x = 1$ given as the answer. There were cases of embedded answers shown within algebraic expressions.

Question 19

This question was attempted by most candidates, but few achieved full marks. Many candidates gained 1 mark, often by calculating 450 ÷ 6 and getting an answer of 75; or for finding '450 is 15% of 3000'. Unfortunately, many candidates were not able to progress past this point in their calculations and gained no further marks. Some candidates were able to take the calculation further but failed to finish the calculation giving final answers of 0.025 or 1.025. A common incorrect approach was to consider this to be a compound interest question and to use the compound interest formula.

Question 20

In parts (a) and (b), most candidates had learnt and understood the index laws and were able to apply these and arrive at the correct solutions. The common misconceptions of adding for part (a) or multiplying for part (b) were observed. It was also common to see variations of these with multiple variable terms such as $2m$ or $2x$ followed by an index.
In part (c) candidates that were able to multiply out the brackets and arrive at one correct term were rewarded with a method mark. Singular mistakes or responses that were spoiled by adding the two terms together gained no further credit. However, those that were able to multiply correctly through both terms and state these two terms secured the accuracy mark. No credit was given for simply multiplying by ‘4’.

Question 21

A large proportion of candidates were able to secure a mark for commencing this problem by taking into consideration the two cups of coffee by doubling one of the other stated values, or by multiplying by 10.6 to take into consideration the amount of coffee required for one cup of coffee. These two steps could have been completed after working with the proportion of the 800 people (68%) that would drink coffee. In order to progress with this problem, candidates had to work with the 68% and in most cases, this was completed by working out how many people this was. Although they could use calculators for this paper, a significant number of candidates chose to compute this by demonstrating a build-up method. When this was done correctly, most went on to arrive at the correct solution of 11532.8. Where candidates did not show all stages of their working and simply stated correct and incorrect percentage values that they then added, no marks or no further marks were able to be awarded. Generally, partitioning methods frequently led to error, but those using a more direct approach, typically by multiplying by 0.68, usually went on to work the percentage out correctly.
In part (b) responses of "there will not be enough coffee" or "more coffee will be needed" or similar equivalent responses were rewarded with the communication mark. Some candidates chose to recalculate the problem and chose to work out the new total of people drinking coffee or the new weight of coffee required. When they did this correctly this also secured this last mark. Candidates should be encouraged to generalise so that they do not have to complete additional unnecessary work, particularly when there was only one mark to be gained. It was encouraging to see many correct responses to this part.

Question 22

There were three marks available for calculating each of the three angles in triangle *ACD*. There was an easy one step calculation using "angles on a straight line" to calculate angle *ADC* = 70. Some candidates then spoiled their work by then using the stated fact (isosceles triangle) to state the other two angles as 70 and 40. In order to complete this problem, candidates had to use a parallel line fact to work out another angle around point *C*, which they did by either directly calculating angle *ACD* or by finding another angle at the point that allowed another simple angle fact to be used to state angle *ACD* = 55. The final angle required the sum of angles in a triangle to deduce angle *CAD* = 55.
The communication marks were awarded for stating a parallel line fact and/or another simple angle fact that was linked to their method. Both were required to secure the final two marks of this five-mark problem. On this occasion it was not necessary to state that the triangle *ACD* was isosceles or what this meant. Very few students were able to state a parallel line

reason. "Parallel lines are the same" was often seen as an incorrect answer. The use of correct angle notation was rare.
It should be noted that while most candidate's work was linked and sequential, some work was spoiled by not naming angles or naming angles ambiguously. Candidates should be encouraged to write their angles on the diagram, which is not ambiguous unless contradicted by alternative working.

Question 23

It was rare to see a fully correct answer to this question. The majority of successful answers were found by $14 \times 5 = 70$ and then dividing by 4. Many students did not grasp the question at all or recognise that the answer must be larger. By far the most common answer seen was 11.2, the result of $14 \div 5$ and then multiplying by 4. Some simply added their result from $14 \div 5$ to 14, giving 16.8. Some students tried to convert to minutes, which was rarely successful.

Question 24

Most candidates struggled to access this question. Many confused the two skills and some stated the multiple as the factor and vice versa, confused by the terms "lowest" and "highest". At this level the numbers chosen for this problem also hindered candidates further. Hardly any tried to find factor pairs for part (a), however some did start to list multiples to find the solution for the second part. In part (b) most were rewarded with the method mark, but not many went far enough, or without error, to arrive at the solution of 15876. It was pleasing to see that more candidates, than in previous sessions, chose to utilise Venn diagrams and prime factor decomposition to solve these two questions. However, again many confused the two skills, and many were unable to use their Venn diagram to actually arrive at the two solutions required. Common incorrect answers were 7 in part (a), using the highest prime factor, and 3 in part (b) using the lowest prime factor. Those who gained full marks mostly did so using the Venn diagram method, rather than listing multiples.

Question 25

There was mixed success with this question. The majority of students successfully started this question by dividing 67205600 by 11.9 to find the number of seconds, thereby gaining P1, but were then unable to convert this to days. Few students calculated $60 \times 60 \times 24$ separately and the minority of students who successfully went on to find the correct answer often did the conversion to days in stages. Common errors in the time conversion were to omit one or more of the numbers, or to multiply when they should have divided and vice versa. Some students saw the m^3 and incorrectly surmised that they needed to cube 11.9.

Question 26

Most candidates answered part (a) correctly. Some wrote the x and y coordinates the wrong way round, and a few listed the roots, which should be the answer for part (b)
Part (b) was poorly answered with most candidates leaving the question blank or writing different numbers between -2 and 3 that were not within the required range. Common mistakes included writing in co-ordinate form. even when they had the correct figure. Some students wrote -2, the intercept on the y axis, or tried to isolate x and solve the equation using algebra, not noticing they are asked to estimate by using the graph. A common incorrect

answer was (−2,2). The proportion of blank answers shows that many candidates were poorly prepared and did not understand how to find roots from a quadratic graph.

Question 27

A significant number of students started with the formula density = mass/volume or showed a correct formula triangle but then were unable to rearrange to make mass the subject. Of those who arrived at the correct formula, mass = density × volume, and could substitute the values required correctly, most gained full marks for 648, with very few gaining just the method mark for 72 × 9. The most common incorrect answer was 8 coming from the division 72 ÷ 9. A significant number of candidates were confused by the units cm^3 and cubed the 9 and the 72. Overall, it was encouraging to see so many gaining marks in this question, so late in the paper.

Question 28

Part (a) was not answered particularly well. The requirement to write the ratio in the form 1: n seemed to confuse many with few students achieving both marks. The majority attempted to convert both values into ordinary numbers with 9000 being the common error at this stage. Those that did convert the values correctly often failed to write them as a ratio losing both marks. Generally candidates found it hard to simplify to the 1 : n form with many at this point not realising they needed to divide both values by 90 000.
In part (b) candidates found more success. Perhaps having a calculator made it more accessible to the students as the vast majority attempted to give an answer. It was pleasing to see how many students were able to convert standard form numbers into ordinary numbers though some clearly did not use their calculators to help them with this. This was by far the most successful approach to answering this question correctly with the majority who did the conversion gaining full marks. Where students did not get full marks, most were able to gain one mark for having no more than one error in the order, or for converting into ordinary numbers. A common incorrect approach was to put them in order by their index number.

Summary

On the evidence of performance on this paper, students need to:

- Written work needs to be legible for examiners to consider awarding marks. Figures taken from the question, and taken from candidate’s own work, need to be transcribed accurately.

- Candidates need to be trained to avoid rounding or truncating answers to calculations, and to use the most accurate values where possible.

- There is a continued need for emphasis to be given to algebraic manipulation and derivation, and application of ratios, scaling and rates, and time in preparing for future examinations.

- Candidates need to be trained to use their calculators for working with percentages, rather than always using a break-down / partitioned approach.

- The inclusion of working out to support answers continues to need emphasis.

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