Examiners' Report
Principal Examiner Feedback

November 2021

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

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November 2021
Publications Code 1MA1_3F_2111_ER

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

Introduction

The overall quality of the presentation of work has not improved since last year, but there were some improvements in use of the 4 rules, use of calculators, and sometimes in working where money was being used in calculations. A recurrent error is where students prematurely round or truncate their figures, either their own figures or whilst in the process of taking them from the calculator, with such errors seen on Q10, Q14, Q19, Q22 and Q24. This usually resulted in lost accuracy marks and could also make questions more difficult than they were designed to be. There were too many attempts which were basically trial and improvement attempts, nearly always resulting in no marks; in some cases, the target number would have resulted in too many trials using that method. Students need to read the questions carefully. There remain a concerning number of cases where students miscopy their own figures, copy down the wrong figures from the question, or round figures almost randomly.

Approaches to questions that required some interpretation or explanation were well done on this paper. Question 15 was answered well, as was Q12(c). But in Q16 students did not seem to know a full description would require in terms of feature.

Within a broad range of questions, the paper was able to discriminate well. Weakest areas continue to be the application of ratios, scales and rates, but also algebraic manipulation and problem solving. Time remains a weakness, such as in Q11(a), but certainly in Q24, where the majority of the students were treating 1 min 40 sec as 1.4 for the purposes of calculation. There were significant weaknesses demonstrated in conversion of units in Q12(b), Q18 and Q24.

There were some topics for which students appeared not to have prepared well. These included working with ratios in Q13, fractions and millions in question 14, and conversion of units as in Q18. Q22, Q24 to Q28 were the more challenging questions for those striving to demonstrate ability at the highest grades available, and a significant proportion of students therefore failed to score on these questions.

The inclusion of working out to support answers remains an issue for many; but not only does working out need to be shown, it needs to be shown legibly, demonstrating the processes of calculation that are used. This is most important in longer questions, and in "show that" questions. Examiners reported frequent difficulty in interpreting complex poorly laid out responses in Q19, Q22 and particularly Q24.

Report on Individual Questions

Question 1

A well answered first question on the paper where most students gained the mark.

Question 2

Another well answered question. Where the mark was not gained by a small minority of students, values such as 2 and 3.5 were given. Some students wrote factors as paired products, which was acceptable.

Question 3

A question in which nearly all students gained the mark.

Question 4

Most students gave the correct response. A common error was to see $\frac{1}{6}$ changed to a decimal which resulted in a decimal answer. It was evident that these students did not appreciate that multiplying by $\frac{1}{6}$ is the same as dividing by 6.

Question 5

A well answered question. It is not clear whether inaccurate marks were as a result of ruler misuse or from not having a ruler.

Question 6

In part (a) the minority of students who answered incorrectly did so since they either only partly simplified, leaving in a × sign, or wrote part of the expression in index form, usually either ab^4 or 4^{ab}. In part (b) many students got $3x + 8$, but some tried to simplify further to $11x$.

Question 7

Those students who adopted a systematic approach to listing the outcomes were the ones who gained full marks most regularly. A common error was to repeat outcomes.

Question 8

This question was generally well answered with nearly all students gaining full marks. Most mistakes were in respect of accuracy of calculations rather than process, suggesting that some students were not using their calculator effectively, or perhaps did not have one. Those who just worked with one of each item were able to be awarded the first mark.

Question 9

There were many fully correct answers. Nearly all students gained at least 1 mark for placing the given values in the correct cells of the table. Early errors in calculations meant that these errors continued, and students failed to adjust their errors to match the given numbers. Weaker students gained 1 mark for either the first column or the total row or column.

Question 10

Successful students used their calculator to divide 300 by 4.85 and rounded down to find 61 books could be bought, but 61.8 rounded up to 62 was often seen. Unsuccessful approaches were to either round the book price to 1 significant figures and estimate, or to multiply 300 by 4.85 instead of divide. Build up methods using repeated addition rarely earned method marks, as multiple calculations increased the risk of errors and students did not always make it clear where the end point was.

Question 11

In part (a) most students used a non-calculator method and obtained the correct answer. It was obvious when calculators were used where an answer of 196 ÷ 603 = 3 h 26 min was seen. Many gained 1 mark for getting as far as 3 hours.
In part (b) it was very rare to see any correct answers. Some wrote down the formula triangle for speed distance but could not relate this to an algebraic expression. The closest many students got was $2x$, the most common incorrect algebraic answer.

Question 12

In part (a) there were, surprisingly, too many instances of students incorrectly measuring the distance between Shelton and Trilby. Failure to indicate where their measurements came from resulted in lost marks for many. For example, those who just estimated (or prematurely rounded) their distance to 3 cm but did not indicate this was the distance between Shelton and Trilby could not be credited any marks. This was not uncommon. Some measured accurately and then failed to use the scale correctly. Common incorrect answers were 35 × 2 = 70, or doing 2 × 20 then adding on 0.5 = 40.5

There were far fewer correct answers to part (b). When 1 mark was awarded, it was usually for finding 6000 but failing to convert to metres. Knowledge of unit conversion remains a weakness.

Question 13

In part (a) the most common incorrect answer was obtained by writing 2 : 3 as 66%. Students using equivalent ratios and recognising they needed $\frac{2}{5}$ or 20% did much better.

Part (b) was answered better than part (a), with many students able to link the percentage to the ratio. It is evidence that a number of students incorrectly carried forward information from part (a). The majority of correct answers were given as 1 : 4 or 2 : 8. One mark was awarded to those students who did not get this far, but did show sufficient understanding to get to 80.

Question 14

The most successful method here was to exclude zeros and work with 600 rather than 600,000,000. A number lost the final accuracy mark by virtue of recording an incorrect number of zeros even though the non-zero digits through their working were correct. Some students only gained 1 mark since they got as far as 520 (million) but failed to then subtract this from 600. Very few realised they could use $\frac{2}{15}$ to get to the answer.

Premature rounding again lost students marks as it was not uncommon to see $\frac{13}{15}$ converted to 86% meaning their final answer was then incorrect. Many of those trying to find 86% using build up methods soon got into difficulties.

Question 15

Many students gained the mark here, usually by explaining that the angles did not add up to 360. There were some confused answers, with some students believing that the angles could not be duplicated (eg there cannot be 2 angles of 23) or not making a choice and suggesting that the angles sum might be 180 *or* 360.

Question 16

Students began to struggle from this point on in the paper. There were hardly any correct answers in this question. Those who attempted the question frequently gave "enlargement" as the transformation, but to gain marks this had to be accompanied by a further feature, and it was here that students had difficulty. The scale factor given was usually 3 instead of 4, and few regarded it necessary to give a centre point for the enlargement.

Question 17

In part (a) many students correctly expanded the first part of the bracket to get y^2 but did not then multiply y by 5 to obtain $5y$.

Part (b) was less well answered. An incorrect factor of 4 was commonly seen outside the bracket.

In part (c) more students found success. It was pleasing to see the layout of the process to solve the equation clearly structured. Some students were more confident at expanding brackets than at solving equation algebraically, though some who expanded incorrectly were able to access the mark for rearranging their equation ready for solution. Unsuccessful efforts included those who tried a trial and improvement approach of substituting a variety of numbers into the equation.

Responses to part (d) were varied. Some secured full marks, but rarely. Most commonly students processed the numerical term but then multiplied the indices. Some failed to recognise that the lone e or f had an index of 1. Those who correctly remembered the rules of indices frequently wrote $9e^3f^4$

Question 18

Probably the worse answered question on the paper. Lots of 100 and 1000, with the correct answer of 10 000 very rare.

Question 19

Most students found this question a challenge. A significant minority of students chose to estimate the length of the side of the shaded square, guessing it was about 8 or 9cm, with some even measuring it on the diagram. Of those who gained some marks, they chose either a solution using area calculation, or Pythagoras. The former approach was more successful; many gained a mark for 8×8 alone. Those who chose to use Pythagoras and remembered the relevant formula to use, usually went on to gain the first 2 marks, but then became unstuck, sometimes leaving their answer as $\sqrt{34}$ or 5.83. Those prematurely rounding their calculations when processing Pythagoras frequently lost the accuracy mark as their answer was then outside the required range.

The easiest mark to obtain in this question was the independent units mark. Yet many failed to get it, either because they used cm as their unit, or most commonly because they failed to state units at all with their answer.

Question 20

This question was answered well, though performance was poor compared to previous years. Many lost a mark due to the omission of a number or failed to order the leaves correctly. The key was often missing, or incomplete.

Question 21

In part (a) most students identified (100,18) as the outlier. A significant minority incorrectly gave (18,100) as the point.

Part (b) was less well answered than in previous years. Those who drew a line of best fit usually gained both marks as they went on to give an answer in the required range. But more often students relied on a guess, placing points near to the given points, or made some attempt to read off from 370. These approaches were far less successful and usually resulted in an answer outside the required range, such as 12 or 15.

Part (c) was answered well for a response type question, but students need to be reminded to state "yes" or "no". Many students gave a reason which recognised the outlier could be ignored when commenting on correlation.

Question 22

The majority of the students were only able to gain 1 mark. This was for adding the parts of the ratio or for noting that the weight of the cheese would be 1000g. Some got no further than this although they did produce a large amount of spurious working out. Many divided 6000 by 175 or multiplied 600 by 2.25 not having realised that they needed to calculate the weight of cheese required first. Again, premature rounding played a part in some incorrect calculations.

Question 23

In part (a) most students secured the mark for this question. As this was a calculator paper many students may have correctly processed this value using a calculator.

Only a minority of students secured the mark for part (b). There were many answers indicating that students had a limited knowledge of negative indices in standard form.

In part (c) many of the responses scored one mark for 4730, either by entering the calculation into the calculator or converting to 4200 + 530 but did not secure the accuracy mark by recognising that the answer needed to be in standard form.

Question 24

Many students made a correct first step of 2400 ÷ 8 = 300 but then misunderstood the subsequent value as 300 minutes rather than 300 lots of 1 minute and 40 seconds. Conversions involving time caused problems for the majority of students who went on to multiply 300 by 1.4 rather than multiplying by 1.666666 to reach the value of 500. A few struggled to work with 2.2 gallons, even on calculator paper. A significant number multiplied 4.54 by 2 (instead of 2.2), some then trying to adjust their answers by adding on values such as 0.2, but by this stage marks were lost. Use of 2 rather than 2.2 was incorrect processing as this figure was given in the question. The different types of units involved within the question often overwhelmed students who were then unsure of the resultant units they were dealing with. Solutions to this problem were often very disorganised; examiners found it quite difficult to follow the working whist searching to see if credit could be given.

Question 25

Many students left this question blank or gave poor responses. Some students managed to gain 1 mark for finding the next term of the sequence, or for taking a step to use their (incorrect) fifth term in working towards a value for a. These included a significant minority who thought the fifth term was $7a$ and then gained a mark for 228 ÷ (1+2+3+5+7). Some students used a trial and improvement method but these were unsuccessful.

Question 26

In part (a) many students were aware that probabilities should sum to 1 and it was not uncommon to therefore see two figures presented as their answer which added to 0.8; 0.6 and 0.2 were common. Splitting this so that one number was 0.2 more than the other proved impossible for many.
Part (b) was even less well answered, indeed left unanswered by many. A significant number tried to find the number of counters for each colour but were unsuccessful, not knowing to simply divide by 0.15

Some students tried $18 \div 0.15$ but then went on with other incorrect methods. $0.15 \times 18 = 2.7$ was a popular answer. Build up approaches were again evident, always unsuccessful.

Question 27

Few students were able to recall the formula for either the area of a triangle or the area of a circle, and as a result could not access any marks in this question. Predictably the most common incorrect answer for the triangle was 64. Students were more successful with the area of the circle. When the formula for the area of a circle was correct, they were normally successful although some forgot to square 8, some squaring the π and then multiplying by 8. A small number of students incorrectly used 16 as their radius or failed to divide the area of the circle by 4 to give a quarter circle. The right-angled triangle confused some students who used Pythagoras in an attempt to calculate the length of the hypotenuse rather than calculate the area.

Question 28

This question was not attempted by the majority of students. Of those who did attempt it, the most popular response was to sketch the line $y = x$ or a quadratic graph. In some instances, students attempted to plot the graph using a table of values but failed to draw the graph due to the lack of numbers on the axis; in a few cases an attempt was made to draw the graph in just one quadrant.

Summary

Based on their performance on this paper, students should

- show all working out and ensure that their written work is legible
- transcribe figures taken from the question correctly
- avoid rounding or truncating answers to calculations and use the most accurate values where appropriate
- practice working with time and conversion of all types of metric units, including units of area
- practice questions assessing algebraic manipulation and derivation, application of ratios, scaling and rates

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