Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

November 2022

Pearson Edexcel GCSE (9-1)
In Mathematics (1MA1)
Higher (Calculator) Paper 3H

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GCSE Mathematics 1MA1
Principal Examiner Feedback – Higher Paper 3

Introduction

There were many very good scripts from candidates taking this paper. Less able candidates generally found the opportunity to demonstrate positive achievement in the first half of the paper and it appeared that most candidates seemed to have been entered appropriately for the higher tier. Candidates' work was generally clearly and logically presented. Where fully correct answers were not seen, examiners could often award some credit for correct methods and processes shown in working.

All questions were accessible to some candidates. Questions 1, 2, 3, 5, 6, 9 and 14(b) were answered well by most candidates whereas questions 17, 18, 20, 21, 23 - 26 attracted fully correct solutions from only a small proportion of candidates. Questions 4, 7(a), 10, 12 and 18 appeared to challenge a significant number of candidates at the ability levels they were aimed at and candidates are well advised to get more practice with these types of question. To balance this, it was encouraging see more candidates than expected get at least some marks for their answers to questions 9, 14(b), 19, 22 and 25.

REPORT ON INDIVIDUAL QUESTIONS

Question 1

Most candidates found this question to be a good introduction to the paper and scored both of the marks available. Successful candidates usually added 9 to both sides of the formula as a first step rather than the alternative of dividing throughout the formula by 3.
Nearly all candidates gained some credit for their answers. Where there were errors, a common response was $a = p + 9 \div 3$ which earned one mark for candidates who carried out the correct inverse operations but did not put brackets round the $p + 9$ or write it as a fraction.

Question 2

Candidates taking this paper could usually identify and describe what Rob had done wrong with sufficient clarity to score the available mark. It was enough for a candidate to say that Rob should have added the 3 and 5 together as a first step instead of dividing the 120 by the 3 and 5 separately. The small proportion of candidates who did not secure a mark here either did not appreciate just what was being asked and merely went ahead and divided 120 into the ratio 3:5 without explaining what Rob had done wrong or they gave an answer which was too vague to gain credit. Examiners noted that many candidates wrote that 8 needed to be divided by 120 and though this did not necessarily affect whether the mark was awarded or not, centres might like to address this error with candidates.

Question 3

A good discriminator between lower attaining candidates, this question attracted many fully correct solutions. However, there were also many errors made. The most common approach was to use a 2-way table. A frequency tree diagram approach was also seen quite often. These more structured approaches were generally more successful than attempts where candidates tried to work with the figures without a table or diagram. A few candidates who used a two-way table completed it correctly but then transferred the wrong entry to the answer line. Lower attaining candidates often limited themselves to earning one mark for working out the number of girls (choosing one language to study). This question did sometimes seem to attract working written randomly around the working space and without any indication of what it was for. This made it difficult for examiners to track the processes a candidate had followed.

Question 4

A good discriminator, most candidates were able to score at least 2 marks for showing how to get the total volume of 4 tanks. Only the lowest attaining candidates failed to use a correct formula for the volume of a tank. A few candidates used the diameter instead of the radius to work out the volume, in effect working out the value of πd^2h or sometimes πdh instead of πr^2h. Some candidates who left their volumes as a multiple of π, for example 256000π, then lost the π in the next step of their working. Correct attempts to use the ratio 1 : 100 were usually restricted to answers from higher attaining candidates and many candidates used 100 where they should have used 101 in their calculations. There was a wide range of possible approaches to answering the question and responses seen were very varied. The most common successful approach was to compare the volume of the 4 tanks with the amount of mixture that could be made with the available fertilizer.

Question 5

This question involving similar triangles was well answered by a majority of candidates.
Often there was little or no working seen. Where working was seen, the most common approach was to find the scale factor ($\frac{20}{5}$) of the enlargement, mapping the smaller triangle onto the bigger triangle, then use it to find the lengths required. This approach was usually successful.
It was rare to see the alternative method of using the ratio of two known sides, for example $\frac{AC}{BC} = \frac{5}{4}$. Some candidates tried to solve the problem by using “Pythagoras’ rule”.
The most common error seen in part (a) was for candidates to use a scale factor of $\frac{22}{4}$.
In part (b) the most frequently incorrect answer seen was 4.4.

Question 6

In part (a), the great majority of candidates were able to complete the probability tree diagram successfully to score 2 marks. Some candidates gave 2 different probabilities for the probability of a candidate not winning the music quiz when both should have had the same value, 0.65.
Part (b) was also answered well and and a majority of candidates scored 2 marks for a fully correct answer. The most common error seen was the addition rather than multiplication of 0.3 and 0.35. Some candidates gave more than one combined outcome and, as a consequence, could not be awarded any marks for this part of the question.

Question 7

This question, involving change of units, was poorly answered by those candidates at which it was targetted. In particular, part (a) rarely attracted a correct answer. Attempts at part (b) were often more successful with the majority of candidates gaining at least one of the three marks available. Where both marks were not awarded for part (b) a good proportion of candidates scored one mark, usually for multiplying by 1000 and showing their conversion from kilometres to metres. A good number of candidates lost marks because they used 360 for 60 × 60 or because they divided by 60 instead of by 3600. Some other candidates multiplied by 3600 instead of dividing by it.

Question 8

Many candidates found this question to be straightforward and they scored all 3 marks. There were, however, a considerable proportion of candidates who could not be awarded any credit for their answers. Many of these candidates took the mean of all 50 people to be the mean of the women's mean and men's mean and wrote down the equation $\frac{182+x}{2}$ = 167.6 thereby assuming there were equal numbers of men and women. Some other candidates tried to work with the difference between 182 and 167.6. This was invariably unsuccessful. Candidates who did gain some but not all of the marks available usually worked out the total of the weights for the 20 men and/or for all 50 people but got no further.

Question 9

A high percentage of candidates showed a good understanding of standard form.
In part (a) nearly all candidates were able to convert from the number in standard form to an ordinary number.
A smaller proportion of candidates were successful in part (b) which involved a multi-stage calculation. A significant number of candidates scored only 1 mark out of the 2 marks available because they could work out the value of the numerical expression as an ordinary number but either did not attempt to put it in standard form or could not write it correctly in standard form. A significant number of candidates lost marks because they rounded prematurely.

Question 10

This question was quite well answered. It was expected that candidates would refer in some way to the change in signs needed for the last two terms in the expansion. The question asked “what is wrong with Peter’s working”. Candidates who simply gave a correct final answer had not responded to the question and so could not be awarded the mark. There were also many answers which were too vague. In particular, examiners regarded the response “he should expand the brackets first” as not giving sufficient clarity or detail to be deserving of the mark. Some candidates were concerned that the order of the two pairs of brackets should be the other way round.

Question 11

There were many fully correct answers to this question. However, a significant minority of candidates could not take into account all the information given and were awarded just one of the two marks available for listing a correct set of integers for x (or y). A small number of candidates tried to use inequality signs, therefore ignoring or not understanding the statement that “x and y are integers”.

Question 12

A minority of candidates scored both marks on this question. Most candidates were unable to appreciate that the question focused on truncation, rather than rounding and treated the question as if they had been told “1.2” was the result of a rounding process. As a result, they gave the bounds as 1.15 and 1.25. These bounds could not be given any credit. Where only 1 mark was scored, it was usually for the lower bound, 1.2(0).

Question 13

This question was quite well answered and descriptions of the mistakes made when the cumulative frequency graph was drawn were generally clearly described. There were two mistakes to identify, one mark for each. The mark for the missing label on the x-axis was awarded more frequently than the mark related to the error in plotting midpoints rather than upper boundaries. Many statements made by candidates were too vague. For example, “the graph is not labelled properly” and “the points are not plotted correctly” were often seen and could not be accepted. Reference to the x-axis or time axis and midpoints/endpoints was needed.

Question 14

A minority of candidates scored full marks for their responses to this question. However, most candidates were able to gain some marks and the question was a good discriminator between candidates who could manipulate algebraic expressions with accuracy and those who made errors.

A fully simplified expression was asked for in answering part (a) of this question. It was disappointing to see so few candidates being completely successful and it was much more usual for candidates to gain just one of the two marks available e.g. for $3x^{20}y^{24}$. A common error was for candidates to add the indices 20 and 24 and give their answer in the form cxy^{44}.

Candidates usually scored well in part (b) which required the expansion of a product of three linear expressions to give a fully simplified cubic expression. Though there were some low attaining candidates who attempted to expand the product in one stage, working was usually shown in an organized way or a grid was used to show terms in the products. Errors were usually restricted to incorrect terms or difficulties in dealing with the signs when collecting terms together, rather than a flawed strategy. There were some candidates who omitted terms from their expansion. For candidates who did not give a fully correct answer, it was commonplace for them to earn 2 of the available marks in part (b).

Question15

Most candidates scored full marks for their answers to this question. The most common error seen was where candidates used 7, 13 and 5 in a sum, for example as 7 + 13 + 5, rather than in correct products. Candidates who gained one of the two marks usually did so for giving the correct product leading to 455 but could not complete the question successfully. Some candidates tried unsuccessfully to work backwards from the 555.

Question 16

The majority of candidates achieved some credit for their answers to this question by showing they could interpret the ratio given or by showing they understood that opposite angles in a cyclic quadrilateral sum to 180°. Many candidates showed they understood the ratio by marking the angles *EAC* and *ACE* as $2x$ and x respectively on the diagram. Examiners also accepted values for the size of these two angles, in the given ratio, to award this mark. Similarly, values for the opposite angles in quadrilateral *ABDE* which added to 180 were accepted as evidence for the use of the result that opposite angles of a cyclic quadrilateral add up to 180. A relatively small proportion of candidates could find a further connection between the angles in the quadrilateral and the angles in the triangle and so score more than 2 marks. Despite the guidance that all working needed to be shown, a number of candidates wrote down 40 as their answer but with a lack of supportive and persuasive working. These candidates could not be given full credit. In particular, examiners were concerned to see some candidates using results incorrectly, for example "angles on a straight line sum to 180°" to state that angles *EAB* and *DBC* sum to 180 or that angles *ABD* and *BDC* were alternate angles.

Question 17

It was relatively rare to see a fully correct solution to this question. However, many candidates were able to write at least one or all three of the relationships as a ratio or as an equation to gain one or two marks. Only higher attaining candidates could go on to link all four weights for example by giving the equations $\frac{2}{3}B + B = 3\left(\frac{3}{4}D + D\right)$, A = $\frac{2}{3}$B and C = $\frac{3}{4}$D. Some candidates spoiled their chances of getting the third mark by using the same variable, *x*, to represent two of the weights and gave an equation such as the one above with *x* substituted for both B and D. These candidates scored at least 3 of the 4 marks available. Any ratio equivalent to 42 : 63 : 15 : 20 was accepted and awarded full marks, for example 2.1 : 3.15 : 0.75 : 1. Using the common multiple 105 proved to be a successful strategy employed by some candidates.

Question 18

It is unfortunate that very few candidates used the working space for this question to draw a diagram to help them. Consequently, only a small number could identify the correct single transformation. Instead, many candidates suggested that the single transformation equivalent to two reflections would be another reflection or, bizarrely an enlargement, scale factor 3. Of those candidates who did identify the transformation as a translation, some gave the vector $\binom{4}{0}$ to describe the translation instead of $\binom{8}{0}$.

Question 19

A small proportion of lower attaining candidates merely added the three numbers 0.4, 7 and 8 given in the question and tried to work with this. In general, however, the question was quite well answered. When it was not completed successfully, examiners could usually award some credit to a candidate for showing a correct process to find the probability that a counter was red or green, (1 − 0.4 or 0.6). Many candidates went on to find the correct probability for picking a green counter (0.32), thus showing an understanding of how to apply the ratio, but were then unable to make the final link to multiply this by the number of trials (50).

Question 20

This question was not well done and there were few full proofs seen. Many candidates who attempted the question realised that they needed to consider the case of “SAS”. However, they more often than not failed to give sufficient justification to accompany the pairings of two sides or two angles. In particular, examiners could not accept “$AE = DE$” without any justification as this was merely writing a detail from the question. Instead, they needed to see “$AE = DE$ (given)” or equivalent. The pairing AC with DB needed to be accompanied by some justification related to the ratio 1:2:1 given in the question and the pairing of angle EAC with angle EDB needed to be accompanied with a justification related to the base angles of isosceles triangle ADE. A substantial number of candidates made progress with reasons but failed to explicitly say that this led to the equality of the lengths or angles involved. For example, it was not uncommon to see part of an explanation as to why the ratio lead to the fact that the lengths of AC and DE were the same without actually stating that $AC = DE$.

Question 21

Some candidates gave a very clear, correct and concise answer to this question by first completing the square in the form $4((x-7)^2 - 49)$ before giving an explanation how this leads to the given result. Examiners expected candidates to show the connection between $4((x-7)^2 - 49)$ and -196 as well as make a conclusion to gain the last mark. Only a very small proportion of candidates used the alternative form $(2x-14)^2 - 196$. Many candidates showed a lack of confidence in the process of completing the square and as a result were unable to gain marks because their algebra was full of errors.

Question 22

Fully correct answers to this question were rarely seen. However, a good number of candidates were able to score at least one mark for using a correct common denominator. Only the higher attaining candidates were able to work accurately and/or gain more than one mark for their responses. In particular mistakes were often made with signs when $-3(x^2 - 25)$ or equivalent was written as $-3x^2 - 75$. Much of the work seen showed little understanding of the method required to combine the 3 fractions concerned. For example, a significant number of candidates produced work involving expressions which were not fractions and could not be awarded any credit. $(2x + 3)(x + 5) + (x - 4)(x - 5)$ is an example of such an expression.

Question 23

For part (a) of this question, while there were attempts by a majority of candidates, few were correct. There were many more candidates who sketched the graph of $y = \mathrm{f}(x-2)$, that is, translated the graph to the right instead of to the left. Some candidates tried to sketch $y = \mathrm{f}(x) + 2$. Those candidates who did identify the correct translation invariably sketched a graph meeting the criteria in the mark scheme and so scored the mark available.
Part (b) also attracted an incorrect response from the majority of candidates who attempted the question. The incorrect response, $y = \mathrm{g}(-x)$ was seen more frequently than the correct answer $y = -\mathrm{g}(x)$.

Question 24

Many of the more high attaining candidates gained either partial or full credit for their answers to this question on vectors. The vector algebra seen was generally clearly presented with accurate simplification of expressions found. Most sudents who attempted the question gave a correct expression for either $\overrightarrow{CE}$ and/or $\overrightarrow{CF}$ in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$. Of those candidates who gained marks but who were not successful in proving that *CF* is parallel to *DP*, it was often just the last stage which went awry. Candidates are advised that they should show examiners how their working leads to a proof that the required result is true. In this case, a statement that $\overrightarrow{DP} = 2\,\overrightarrow{CF}$ or equivalent and a conclusion that therefore *CF* and *DP* are parallel was expected.

Question 25

Many candidates could make a successful start on the question by using a correct process to find the volume of the top part of the pyramid and so scored the first mark available. This was often the limit to any credit which examiners could give candidates. A common mistake was for candidates to use the average density in a misguided attempt to work out the volume of the bottom part of the pyramid. This was, by design, a challenging question and so, as expected there were only a small number of completely successful solutions seen.

Question 26

This question, not surprisingly attracted only a small proportion of fully correct answers. However, it is encouraging to report that a much higher proportion of candidates scored some credit for their attempts. Many candidates identified the need to use the angles of the heptagon and scored a mark for a correct process to find the size of each interior angle or the size of each exterior angle. A small number of candidates worked out the size of an angle but wrongly assigned it, for example marking 51.4° on the diagram as an interior angle. A good number of candidates also realised that they needed to form an equation by using the area of the triangle, given as 30 cm^2 in order to make progress towards finding the length of GB. Some candidates did this successfully but few candidates were able to get any further.

Summary

Based on their performance on this paper, candidates are offered the following advice:

- carry out a common sense check on the answers to calculations
- read questions where a written explanation is expected very carefully and check your answer matches the question asked
- practise less straightforward problems which involve working with a combination of algebra or geometry or probability with ratio
- improve your skills in dealing with the conversion of units
- ensure you know how to write down an error interval when a number has been truncated
- practice writing proofs of congruence in geometry

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