Examiners' Report
Principal Examiner Feedback

November 2022

Pearson Edexcel GCSE (9-1)
In Mathematics (1MA1)
Higher (Calculator) Paper 2H

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GCSE (9–1) Mathematics 1MA1

Principal Examiner Feedback – Higher Paper 2

Introduction

Much like in summer it was pleasing to see candidates being well prepared despite the disruption of previous years. Candidates are clearly well equipped for the exam and there was no evidence of students being impeded by not having equipment such as a calculator. It is worth noting though that candidates don't always take full advantage of their calculators and drop unnecessary marks by using mental methods.

Report on individual questions

Question 1

This scatter diagram question gives students a familiar starting point. Part (a) required them to identify the outlier on the diagram. The vast majority of students identified the correct point, but some were unable to correctly identify the coordinates, with (1, 2) being a reasonably common incorrect answer. In part (b) we were looking for the relationship between the two variables, and again this was answered well with suitable descriptions relating to one variable increasing as the other decreases. It was common to see a description of correlation, which was acceptable providing the word 'correlation' was used. 'Negative' alone did not gain the mark as the question was not asking them to describe the correlation. Part (c) was the standard question asking students to use the graph to interpolate the rainfall for a given number of hours of sunshine. It was surprising to see so few candidates drawing a line of best fit, although this was not needed to gain full marks. Many were able to get both marks by giving an answer in the range 3-4. Those who did use a line of best fit often gained only 1 or no marks as they were drawing their line too low and gaining an answer outside the given range.

Question 2

The side elevation on this question was more challenging than many candidates have seen in some time, and very few were able to score full marks. This was normally down to the hidden edge not being indicated with a dashed line which was needed to make the diagram fully correct. That aside many struggled to identify the other edges on the front face and those who scored one it was typically for drawing a rectangle 5 high by 3 wide.

Question 3

Linear sequences were being tested in this question, and again was a familiar question allowing many to score some good marks. Part (a) was asking for the nth term rule of the given sequence. Most candidates scored at least 1 for a sequence in the form $6n + c$ with a good number gaining both marks for a fully correct expression. Common incorrect answers were $n + 6$. $6n – 1$ and $7n + 6$. Part (b) required students to show if a particular number was in the sequence. The negative aspects of this sequence caused some problems, with many students generating a sequence by subtracting 8 rather than 6. A significant number of students on the higher paper used algebra to form and solve an equation, and most who did gained both marks. Incorrect approaches included using $n = 58$ in the formula.

Question 4
This is the first AO3 question on the paper and required 3 main processes. The first of which was to find the total area, and there were two marks assigned to this, the first for correctly finding 3 areas and the second for finding all 4. The second process was to find the number of bags of grass seed that is needed. This could be gained for finding this for a single area or a combination. Finally, the candidates had to round the number of bags up to gain the number needed to buy, and multiply by £10.95 to find the total cost.
Almost all candidates were able to gain some marks, even if just for correct areas. This was as often seen for 2 rectangles and the quadrant, as it was for 2 rectangles and the triangle. Most were then able to gain the mark for dividing by 14. The two major causes of errors were learners not having all four areas correct, as this was needed to gain the 3rd mark. The other common error was for candidates to not round the number of bags up to the nearest integer and so found a cost that was inaccurate.

Question 5
A straightforward question requiring candidates to use the cosine ratio to find a missing side. Typically candidates scored 2 marks or none. Those scoring none, normally chose the sine ratio, or tried to work with Pythagoras. Of those candidates who identified cosine correctly most gained 1 mark for a correct statement, but a small number struggled to rearrange the expression to correctly find *x*.

Question 6
This was another familiar style of question, the only complication being a different interest rate for each year. As is normal with this question, weaker students struggle to understand fully the compound nature of the question and work with simple interest. Those who did this normally gained 1 mark for finding 3%. Most of those who understood the question fully and worked with compound interest went on to score full marks. The few that didn't normally gave a final answer of £318.15, finding the value of the interest and not the investment.

Question 7
This 3-part Quadratic Graph question was answered generally well on the higher paper. Almost all candidates scored full marks in part (a) and part (b) for reading off the *y*-intercept and turning point correctly. Many were then unsure as to what the roots were and didn't gain marks in part (c). Some did gain 1 mark for identifying the roots on the graph, but being unable to read off the values to gain both marks. Some candidates tried to solve algebraically despite being told to use the graph - this approach gained no credit.

Question 8
This AO1 question required learners to be able to find a percentage increase. On the whole it was answered quite well, with many learners able to gain at least 1 mark for finding the profit, or for finding the new value as a percentage or decimal of the original. However, a significant number couldn't complete the method, either by finding the profit as a percentage of the original, or by subtracting 100 or 1 from their value, and thus didn’t gain the 2nd mark. A common error was to divide the profit by the selling price rather than the purchase price.

Question 9

This question required candidates to rearrange one of the two equations, so that both were in the same form ($y = mx + c$ or $by = ax + c$) so that the gradient, or coefficients, can be compared. Most candidates attempted to manipulate one or the other of the equations, and mostly they were successful. Of those who successfully manipulated, most were able to draw a correct conclusion. A small number of candidates gained both marks by giving a full statement such as 3 divided by 6 is equal to ½ so both lines have the same gradient. Comparing the equations as they were given lead to incorrect conclusions that the gradients were different.

Question 10

This problem combined reverse percentages with repeated percentage change, and proved a challenge to many, but primarily in relation to the reverse percentage aspect. It was very common to see candidates using multipliers of 1.19 and 1.23 rather than dividing by 0.81 and 0.77. This led to no marks being awarded. Of those who understood the reverse percentage, most then went on to complete the process and gain both P marks, and then normally the accuracy mark also.

Question 11

This boxplot question required learners to be able to use a Cumulative Frequency curve to find the median and upper and lower quartiles. To gain all 3 marks, they had to draw a fully correct box-plot. 2 marks were awarded for drawing a box-plot with at least 3 correct values plotted. For those who were unable to plot a boxplot candidates could gain 1 mark for identifying one of the LQ, Median or UQ. A significant number of candidates gained some credit on this question, but it was disappointing to see that so many had no idea how to use the CF graph. There were a number of candidates who knew what a box plot was, but couldn't find the values from the graph and hence scored zero marks.

Question 12

Part (a) proved a real challenge to candidates and it is clear that many didn’t really understand iterative processes or how to use an iterative formula. Most tried to multiply 1.13 by the number of years, rather than raising to a power, and thus the majority of candidates scored no marks. The limited number of candidates who used the formula correctly were split into two groups, those who gained 1 mark for using the formula correctly once, and those who went on to gain both marks as they fully understood. In both these groups there were candidates who dealt with the constant alone, and looked to see when this became greater than 2, and candidates who chose a starting value (often 100) and worked till this value doubled. Both approaches were acceptable and seen as regularly as each other. The communication aspect of part (b) was approached well by many, with certainly more success than part (a). Many candidates correctly realised that by increasing the value of k would decrease the time taken.

Question 13

This is a topic that has not been assessed regularly, and it showed in the quality of candidates' responses. Very few candidates realised this required the use of Pythagoras. The most common incorrect response seen was to find the gradient of the line *AB*. It is evident that centres have not spent much time on the topic and further work is needed.

Question 14
A common set up of a question, but with a slightly different recurring decimal. This decimal meant that any two multiples could be used to make a terminating decimal. Also, with the value being greater than 1, it allowed candidates to work with the improper fraction, or just the fraction 14225. As it is November, it is possible that many candidates had not had a great deal of exposure to higher level content, but it was surprising to see so many who did not know how to approach this common style of question, with a significant proportion trying to work from the fraction to the decimal and having no success.
Candidates should take care with their algebra and show their working clearly. Some did not show their work to demonstrate the difference that they were trying to find. This was acceptable if a correct value was found, but many were unable to complete the subtraction and ended up scoring only 1 mark. It is important for candidates to remember to use their calculators at appropriate times.

Question 15
This is again a common style of question and one we have seen in recent series. With that in mind it was again unfortunate to see so many candidates with no real idea of how to approach this Peterson Capture Recapture question. A good number scored a single mark for a suitable fraction given, but just as many scored zero. This was normally due to them working with differences rather than ratios. Many were close to scoring the second mark, but often set up the two fractions as a product rather than an equation. Most of those who gained the second, went on to gain the third mark also. Some students gained 2 marks only for setting up a correct equation, but could not then rearrange to gain a correct answer, in particular when their unknown value was the denominator of a fraction.
In part (b), candidates had much greater success. A significant proportion realised that the population must be greater than 50 as Albie had already caught 55. Some of the wrong responses focused on tags falling off, or on the 40 who were tagged.

Question 16
In this inequalities question candidates had to first find the equations of the 4 lines. There was 1 mark for either of the horizontal or vertical lines, and then 1 mark each for the two diagonal lines. For these marks we could accept use of an equals sign, or any inequality symbol. The final mark was for then applying the correct inequalities to all four correct equations.
Most candidates gained some credit, even if this was just a single mark for $y = 6$ or $x = -3$. Candidates did however sometimes mix these two up, giving answers of $x = 6$ or $y = -3$. The line that caused the most problems was $y = -x2 + 1$ with most being unable to deduce this equation correctly, especially the negative gradient. It was very rare to see a fully correct response, with most candidates using the same symbol for all equations. Candidates who had no access to this question simply gave the points of intersection.

Question 17
A similar solids question, but with an added layer of difficulty. It was pleasing to see so many candidates get some credit. This was normally for either finding the volume scale factor (by dividing the two volumes) or for a process to find the height of **B**, or in a good number of cases, both scoring 2. However, very few candidates were able to take this further. Typically candidates tried to use a scale factor of 27 when working with areas and lengths and gained no further credit e.g. 10.8 ÷ 27. There were also occasions where more marks could have been scored had candidates been able to deal with the half in the area of a triangle. A shame that such a low level skill was denying candidates high grade marks.

Question 18
Having access to a formula sheet has definitely helped students with this question, which was answered very well. Most candidates were able to use the given formula to find the area, and typically scored both marks. For those that only scored 1 it was normally due to incorrect rounding. Candidates should remember to write out unrounded answers first as this will normally gain the accuracy mark. It will be interesting to see if success on this topic drops when the formula sheet is removed. Common incorrect methods including treated the triangle as right-angled and doing ½ × base × height and using the Cosine Rule to find the missing side.

Question 19
Again, a high proportion of learners trying to use the formula would suggest that the additional information provided was well used. Those using the formula had very mixed results. It was evident that many candidates were not confident in their substitution, and missing signs, short root notation and short fraction notation led not only to incorrect answers but often to the withholding of marks.
Those who attempted factorisation typically struggled, probably down to the coefficient of x^2 being 6. All that said, a significant proportion of candidates scored 2 or 3 marks, for either one or two correct values given. Again, it is important that candidates remember when rounding values such as 23 one decimal place is not enough, and as such an answer given of 0.6 (without first seeing 2/3 or $0.\dot{6}$) did not get credit.

Question 20
Three dimensional Pythagoras and Trigonometry is always a challenging subject for candidates, and so it proved again. However, it was good to see many make a start and gain some credit. A decent number of candidates were able to complete a process to find *AF* using Pythagoras. It is worth noting, that at this grade a full process was required for a single mark, whereas at a lower level we may see 2 marks for Pythagoras. The step that troubled many was knowing to, and how to, find *FH*. Many took the base to be square and incorrectly used Pythagoras rather than Trigonometry. Of those who recognised the need to use trigonometry, far too many chose the wrong ratio, and were unable to gain further credit. The final step was for a correct trigonometry statement involving angle *FAH*. This was however, dependent on the processes for any values used in this step being correct, which was normally not the case.

Question 21
Well into the Grade 8 questions on the paper and it is not surprising that fewer candidates are now scoring marks. For part (a), failure to draw a tangent at t = 17.5 meant that no marks could be scored at all. It was very common to just see $\frac{10.5}{17.5}$ which came from reading the volume at t = 17.5, and this scored zero. Those who drew a suitable tangent often then went on to score full marks for an answer in range. However, some were unable to use the scale correctly and then lost marks for their method to find the gradient. Part (b) showed improvements on previous series, and there were many suitable descriptions of what the gradient represented although students still relate this answer to a correlation type response. ‘Acceleration’ was a commonly seen incorrect answer.

Question 22
This functions question required candidates to first find a composite function, and then to find the inverse function. A pleasing number of candidates were able to find the composite function. Those who were unsuccessful typically gave $\sqrt[3]{2x}$ + 3 as their incorrect composite. However, the second mark here was not dependent upon the first, so providing a composite function was found (correct or not), the second mark could be awarded if the first step to find the inverse was correct. Again, a good number of candidates were able to get this mark.

Question 23
Candidates really struggled to gain full marks with this question, and it was primarily down to time conversion that was required.
A pleasing proportion had enough of an understanding of bounds to gain at least one mark for one correct bound either for distance, or for time in minutes and seconds, or just in seconds.
The second mark was for either correctly finding a bound for time in hours, or for a correct process to find a bound in kilometres per minute or kilometres per second. Those working in minutes often struggled here as they gave their time as 31.485 or 31.475, which is clearly incorrect.
The final process mark was for working in kilometres per hour, but was normally only seen when candidates had found the time in hours first. Due to premature rounding in the question, many who had gained the first 3 marks could not then gain the accuracy mark as their answer was outside of the acceptable range.
The C mark was only awarded to a handful of candidates as so few were able to communicate that the value of *V* was 20 correct to 2 significant figures as both bounds agree.

Question 24
As with some of the other higher grade questions, a pleasing number of candidates gained some credit on Question 24. The first mark here was to find the gradient of the radius, and was seen both as 43 and as 2.82.1. The second mark was for a method to find the gradient of the tangent using -1m where the *m* came from the correct method. The final method mark was for substitution of the given coordinate into a suitable equation. In these first steps, many who gained the first went on to gain the second, and often the third mark. The most common errors were to forget the minus sign when working with the gradient of the tangent, or for using the wrong gradient when substituting in.
Very few candidates were then able to gain the accuracy mark as they were unable to rearrange the equation into the stated form, normally with *a*, *b* and *c* being left as fractions or decimals. It is unclear if this was due to not reading the question correctly or for being unable to complete the manipulation.

Summary

Based on their performance on this paper, students/ centres should:

- Make use of calculators where applicable rather than relying on mental method
- Understand the difference between standard and reverse percentage and the method for compound percentages
- Not prematurely round
- Encourage pupils to mark significant points and lines on diagrams and graphs, in order to gain method marks that are available
- Further practice finding length and gradient between two given points, emphasising the difference between the two things being found
- Learn to use and apply basic geometrical formulae such as the area of a triangle = ½ × base × height. This will be particularly important once the use of the formulae sheet is no longer available for students
- Interpreting values such as the median and quartiles from cumulative frequency graphs
- Understand that to estimate the gradient of a curve, a tangent must be drawn at the point in question to gain any credit

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