Examiners' Report
Principal Examiner Feedback

November 2024

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

Although the entry cohort in a November series is very different to that in a summer series, it was good to see many learners being able to at least attempt most questions. There were very few learners for whom it was evident that access to more than a few questions at the start of the paper was a real struggle. This is further evidence that centres' entry strategies are right for the learners.

Learners are showing good use of calculators throughout the paper, but there is evidence that some need further guidance, especially when multiple calculations need to be carried out. There were, however, very few cases of learners completing all their work on a calculator and not showing their working. This is great to see and allows learners to access the full range of marks when showing their working.

There was documentation of working being clearly set out from many learners. Questions that required a written explanation continue to cause issues for many, and again, like after previous series, it is suggested that centres spend time teaching learners to articulate their mathematics verbally and in written form.

Report on individual questions

Question 1

It was very common to see the correct answer on question 1. The use of a calculator is a familiar start for learners, and they did well. Those who didn't gain full marks often only square rooted the numerator rather than the whole fraction. As ever, some were able to gain 1 mark for a correct partial evaluation.

Question 2

This question was answered well by learners. Part (a) simply asked for the type of correlation, in this case 'positive'. Those who added further description, relating to strength for example, were still able to gain the mark. A small number of learners tried to explain the relationship between the variables. Learners should be encouraged to carefully read the demand before answering the question. Part (b) required a line of best fit to be drawn, and whilst many gained the mark, a significant number did not. Many simply joined the bottom left corner of the grid to the top right corner of the grid, which gained no credit. It was also common to see learners drawing a line of best fit that worked for the early points but not for all. Part (c) required use of the line of best fit, and those who had drawn an unsuitable line in part (b) were still able to use that and gain credit in part (c). The only real error seen in this part was from mis-reading the scale, here every 10 small squares represented a change in width of 5m. A common incorrect answer was to write 25.5 instead of 27.5

Question 3

The first problem solving question on the paper required learners to compare the cost of a chocolate bar in two different cities. This required them to find comparable amounts by weight or per unit cost, and to use a currency exchange.
The first mark was for a suitable start to the problem and could be gained by either converting one cost correctly, or by converting one item's weight, or by finding the weight per unit cost in one city. Many learners gained this first mark, which was really pleasing to see. A very good proportion were then able to gain a second mark for the process to find comparable figures. This required the amount to be comparable as well as the currency. This was a process mark so could be awarded even if arithmetic errors had occurred, providing clear working was seen. As mentioned in the introduction, learners are continuing to improve on this front and clear annotations were often provided.
The final mark was for having accurate comparable figures along with a correct conclusion. Conclusions were typically correct, except when learners working with the weight per unit cost. In this case the higher figure showed the better value and many who used this method misinterpreted this and gave London as their response.

Question 4

The first of the written response questions and one that did cause problems. In many cases, learners understood the errors but a lack of clarity in their response let them down. The first mark was for realising and articulating that 17 should only occur in the intersection and not in the set $A \cap B'$. Many simply said that 17 needed to be removed from *A*, which did not gain the credit as it was too ambiguous (17 obviously is in set *A*). The second mark was for realising that the number 1 was missing from the diagram and stating where it should be. Many failed to gain the credit as they said things such as 'include the other odd numbers' and needed to specify the 1. Also, those that said '1 needs to go outside' did not gain the mark as this could refer to outside of the rectangle.

Question 5

Another familiar question for learners and one they continue to do well on. Many learners gained full marks for a correct table of values and a correct graph. Those who were less successful often miscalculated the value for $x = -2$. This was almost certainly down to missing a bracket around $(-2)^2$ when inputting on their calculator. In this case learners normally gained 1 mark in part (a) and then the B1 in part (b) for plotting. Those who gained no marks typically tried to get the table to fit a linear pattern and had no values correct. Unlike the graph in summer, the minimum point was plotted here, rather than it being between 2 points, and learners do better in this case as we do not get a 'flat bottom' to the curve. The only real case of marks being dropped on the graph was either carelessness causing them to clearly miss one of the points plotted, or the use of line segments.

Question 6

This was the second problem solving question and required learners to compare two percentage increases. It was generally answered well by most. The first mark was a simple one for either finding a correct difference or for a correct proportion. The next two marks were for finding, or showing the process to find, one, then both, correct percentage changes. Many were able to gain one, if not both, of these marks. The errors that stopped some were either choosing the new, rather than original, value as the denominator, or for those who didn't find the subtraction originally, for forgetting to subtract 100 from their percentage. For those who gained the 3 P marks, the C mark often followed for a correct comparison and conclusion. However, some candidates followed a correct comparison with an incorrect conclusion that Filip was wrong, muddling the interpretation of what they had found and that which they had been asked. Early rounding or truncating also could lead to losing this mark as candidates were unable to draw the correct conclusion, for example, rounding 11.84 to 12 and 1.53 to 2, and dividing these values. This meant they thought it was only 6 times greater and therefore Filip was wrong. Learners should be reminded of the risk of premature rounding.

Question 7

Another problem-solving question, and this one worth five marks. The first is for forming an appropriate equation using the information on the diagram. Either summing all sides to 72, or for equating the two equal sides. The second for the process to isolate the terms in x.
Many learners were able to gain both marks. It was more common to see the longer equation set to 72, but most were able to then manipulate the algebra and typically solve to find the value of x.
The next two marks were then for a process to find the area of the triangle. This could be done in two main ways. The first, and most common, was to use Pythagoras' theorem to find the perpendicular height of the triangle and then use the standard formula for the area of a triangle. The second method was to use either standard trigonometry or the cosine rule to find one of the angles in the triangle and then $\frac{1}{2}ab\sin C$ to find the area. These marks were less commonly earned than the previous two. Of those who attempted Pythagoras, many forgot to halve the base of the large triangle when finding the height. Even if was the case, the final mark could still be awarded if what they believed to be the height was clearly stated, and not one of the other lengths in the question. Those who attempted some forms of trigonometry were often the more accomplished mathematicians and as such typically went on to complete the question successfully.
Overall, the full range of marks was awarded and the majority scored at least 2.

Question 8

A slightly different approach to a standard form question which required learners to rearrange a simple formula to get the correct calculation. This was the cause of many learners losing the marks here as they completed the wrong calculation, either multiplying or dividing the wrong way round. Of those who were able to rearrange, all were able to gain at least one mark, either for stating the correct calculation, or for the digits 3125. A good number gained the second mark for correctly writing the answer in standard form, although some made an error changing 31 250 000 into standard form.

Question 9

This question required learners to show that a shape is not a square using geometrical reasoning. The first mark was for finding the interior or exterior angle of the regular nonagon. It was pleasing to see so many learners being able to do this. The second mark was then for a method to find the angle at ABC, or to find the angle sum around the point B assuming the shape was a square. The final mark required a correct method and conclusion. This was typically of the form of showing angle $ABC = 80$ and that it is not 90.
Those who were less successful often assumed there was another nonagon above the diagram and adjoining the side AD. This was incorrect and normally resulted in 0 marks.

Question 10

A standard simultaneous equation question and one that learners are familiar with. Centres, and therefore learners, have learned from previous series that clear algebraic working is required for full credit here and it was rare to award the SCB1 or SCB2 for correct answers without working.
Although we saw the full range of marks scored, those who gained M1 for a method to isolate normally got the second M1 for substitution at the least. Those who gained the first M1A1 for full method to find one value also then normally went on to gain full marks. There were exceptions to this, but not many.
As is ever the case with solving linear simultaneous equations, the major misconception comes in knowing whether to add or subtract the equations to eliminate, and a significant number of learners made the same mistake in this series.

Question 11

This enlargement question was a challenging one, and as a result many did not gain full marks. Those who achieved 1 mark typically did so for stating ‘enlargement’ along with a correct centre, using ‘ray lines’. The scale factor proved a real challenge to many, and if stated, was often given as 1.5. It is important that learners read the question carefully and realise which shape is the ‘object’ and which is the ‘image’. They must not assume that an enlargement is always increasing in size. The other error seen with the scale factor was to give an answer of -1.5.
We did see some cases of learners using ‘ray lines’ inaccurately and giving a centre that had decimal coordinates. This is an error that has not been evident much in the past.

Question 12

This shape problem had 4 stages, and each one was available to candidates, even with prior errors. The first step was to find the volume of the cylinder, which many struggled to do. There were various errors from finding the surface area to multiplying the radius by the height. The next mark was for using the volume and given density to find the mass. This value was then to be used to find the volume of the cube using a given density. The final step was to cube root the volume to find the length of the cube. Although many struggled with the initial volume, their working was clear enough to establish that the value they used for the next step was what they believed to be the volume. Given this was the case the second mark could be gained, and often was. As was the case with the next mark for the second use of the density formula. The final process mark for cube rooting, a bit like the first, was less often awarded. It was quite common to see candidates dividing by 3 or even 6 as a last step or square rooting.

Question 13

Much like question 4, in part (a) learners often struggled to articulate themselves clearly enough to gain this mark. Learners had two real avenues for a successful response. The first, and most common, was to work with $y = kx$ and show the value of k was not constant. To do this they needed to complete at least 2 calculations, and this was often not done, meaning the mark was not awarded. A second approach was to realise that the graph of $y = kx$ should pass through the origin, and that is not the case here. Fewer learners seemed to use this approach.
Part (b)(i) was a much more familiar question, and learners experienced more success. Many gaining at least one for setting up a correct equation, and then a good number using this to find the value of k, many of these then went on to gain the third mark too. The most common error seen was for learners to either just work with t, and not $\sqrt{t}$, or when rearranging they worked out $140 \times \sqrt{64}$ instead of $140 \div \sqrt{64}$.
In part (b)(ii) the most common wrong graph was a direct proportion graph for a linear relationship, but various other incorrect sketches of familiar shape were seen.

Question 14

A slightly more complex question than has often been seen testing the product rule for counting. There were two main approaches, the most common being to recognise that each of the 10 teams would play 9 games if playing each other team once and so to multiply 10 by 9, then multiply this total by 4 to reflect the fact that each team plays each other team 4 times. This method to 360 was seen and gained one mark. When using this method though learners needed to realise this was counting each game twice, and then halve to get the answer of 180. It was this step that was often missing.
The alternative method was to recognise the issue of double counting in the initial calculation for the total number of games when playing each other once. This led to a value of 45, which again would score the first mark. Those who followed this method were more likely to gain the second by multiplying by 4 as they had understood the difficult concept of halving in their first step.
However, the most common, and incorrect approach was to do $10 \times 10 \times 4$ and this gained no marks.

Question 15

Part (a) of question 15 was looking for an expression for the nth term of a quadratic sequence. This is a standard question with a standard 3-mark scheme. The first mark is for finding a constant second difference and recognising it is an expression in n^2. The second mark comes from working with $5n^2$ and finding the difference between that and the original sequence, or for getting as far as $5n^2 + 2n$. There was then an accuracy mark for the final expression. The alternative method working with the first and second difference along with the expression $'2a = ...'$ $'3a + b = ...'$ and $'a + b + c = ...'$ was seen and gained appropriate credit, although seen less frequently than in previous series. There was some success with 1 mark awarded, and a reasonable proportion going onto score 2 or even 3.

Part (b) was found less accessible and few understood how to substitute into the iterative formula. Some learners gained a mark, normally for $4 = 9k + k$ but then didn't know how to solve to find *k*, which meant that further marks could not be scored. Those who did find the value of *k*, often then went on to score both further marks. This was typically not the case only when they got mixed up with the numbering and gave the value of u_3 in place of u_4.

Question 16

This histogram question pulled together several different skills. Firstly, candidates had to find the frequencies for two completed bars on the histogram. They then had to use these to find the frequencies of the missing bars, then their frequency densities and finally draw the missing bars in.

Those who made a successful start to the question did so by finding at least one of the missing frequencies correctly. The second mark was then gained by subtracting the frequencies from 60 and halving to find the frequency for the two missing bars. Although a good number made a single error in reading the frequency density of the given bars, they were able to still gain the next two method marks. The final method mark was for a method to find the frequency density for one of the missing bars, or for drawing one bar correctly. We did see cases of correctly drawing the first bar, but then simply drawing the second at the same height.

Question 17

This was the stage of the paper where the level of demand poses a challenge to many learners. That said, most did at least make a good attempt at question 17, and we saw plenty achieving the first mark for writing at least two of the fractions correctly with a common denominator. The second mark proved more challenging as they had to have all fractions with a common denominator and numerators expanded. There was normally an error here, often due to the two negatives in the final fraction. We saw very few examples of learners being able to complete the algebra to the required result of $\frac{2}{y}$.

Question 18

There were two main methods to approach this proof, and we saw a few fully successful attempts. The first method was to prove congruence of triangles *AOB* and *COB*, using SSS, and therefore prove that angles *CBO* and *ABO* are equal. Or they could extend *BO* to a point on the circumference, *D*, forming a diameter. This allowed proof on congruence of triangles *ABD* and *CBD* using RHS. In either case we rarely saw more than one mark being awarded for stating a single pair of equal sides.
The second approach was longer, and even less successful. This method used a series of isosceles triangles and matching base angles. First recognising *ABC* is an isosceles triangle and so *BAC* and *ACB* are equal. The next step was to recognise *AOC* as isosceles due to the two radii and therefore *OCA* and *OAC* are equal. Next, learners had to use these two found angles to show that *OCB* and *OAB* are equal. The final step being to recognise that *AOB* and *COB* are isosceles and as *OCA* and *OAC* are equal then so are *OBC* and *OBA*. Much like the first method, it was rare to see more than a single mark awarded.

Question 19

This was a particularly challenging bounds problem. The difficulty arose here due to the complexity of the denominator. Here they needed an upper bound of *a* paired with a lower bound for *c* or visa versa, and that is what we failed to see.
Many gained the B1 for at least one correct bound. We often saw all 6, or at least 4. Learners struggled most with the bounds for *w*. however when it came to find the bounds for *T*, learners typically used all upper bounds, or all lower bounds and therefore no further marks could be awarded.

Question 20

Although there were not as many steps as we often see on a 3D trigonometry problem here, many candidates struggled to make a start to the question. The first step to find *FC* proved conceptually too difficult and many either didn't attempt, or used a method that would lead to *VC* not *FC*. This could then lead to *FC* with a second step using Pythagoras, but this was normally missing.
If learners did find FC, they then had to use the ratio to find *MC* along with Pythagoras to form an equation for the side length. Alternatively, they could use *MC* along with either the $60°$ or $30°$ angle and trigonometry. Neither were seen often, but those who got this far generally gained the accuracy mark.

Question 21

Learners had two routes into the problem. They could work with gradients and the fact that perpendicular gradients have a product of -1 to form an equation to be solved. Alternatively, they could use Pythagoras to form an equation. This did lead to 4 expressions to each be squared, expanded and then summed leading to 12 terms. The sheer quantity of terms often leads to mistakes in manipulation and simplification. The presence of having to deal with multiple negative signs also proved a challenge.

Where learners did have some success it was normally for a single correct gradient. From there most learners didn’t know how to proceed further.

Question 22

The final question was a probability problem in which learners had to generate their own expressions without any scaffolding provided in the question. Many tried to work simply with numerical probabilities, and this scored zero.
To gain the first mark a correct second probability was needed, and this did need to include algebra. The second mark was for a correct product, either for both red, both yellow, or one of each. The third mark was for forming a correct equation. Those who gained the first two, often failed to gain this mark as they only worked with one product and not two.
The final two marks came from manipulating the algebra into an equation to solve (either quadratic or linear), and then the correct answer.

Summary

Based on the performance on this paper, learners/centres should:

- Spend time learning how to describe the various regions in Venn diagrams clearly, ideally using set notation.
- Practise articulating their mathematics in verbal discussions to aid them in written responses.
- Learn the shapes of common graphs. In particular remembering quadratic graphs are curves and not a series of line segments.
- With transformations take care to read the question carefully so they know which shape is the object and which is the image. Also, that if asked for a single transformation giving two will result in zero marks.
- Continue to work on annotating working clearly, especially in extended problem questions, to ensure all marks can be awarded.
- Practise further working with iterative formulae.
- Whenever possible use accurate figures without prematurely rounding or truncating in calculations and only round at the final stage.
- Practise working with multiple negative signs when working with algebra.

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