Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2023

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

There was evidence of good work across the cohort sitting this Higher paper and as such it appears that candidates had been entered for the appropriate tier. Candidates were well prepared and able to access questions throughout the paper. Weaker candidates found success in the first half of the paper and a number of familiar style questions helped throughout.

There was evidence of calculator use from all candidates and it is pleasing to see that centres are ensuring no one is disadvantaged through lack of equipment. Compared to last year, it seems candidates are getting better at using their calculators, but there is still evidence of many rounding prematurely often leading to answers outside of the given range.

It was also good to see candidates taking on advice from previous series and showing their working. Candidates would benefit however from being clearer in their working and structuring it or annotating, rather than the haphazard working we sometimes see.

REPORT ON INDIVIDUAL QUESTIONS

Question 1

Part (a) provided a very familiar start and was answered very well. It is clear however that candidates are attempting the calculation in a single step. This is of course perfectly acceptable, but it leads to them either getting full marks, or no marks, as no~~t~~ intermediate or partial calculations are seen. Part (b) was again answered well, but some candidates were unaware of what is acceptable when asked for a ‘value’. In this case we needed to see a decimal or a fraction that did not include any decimal values within it. For example, simply writing $\frac{1}{0.625}$ was not acceptable.

Question 2

Another very familiar question and one that was answered well by almost all. The most common error leading to 0 marks was to see an incomplete factor tree, that is where a branch ended with a composite number and not a prime number. The most common method was to draw a factor tree. Some responses included commas or addition signs between the prime factors instead of multiplication, showing a lack of understanding of 'product'. On some papers it was difficult to distinguish between multiplication and addition signs so pupils should take more care with presentation. There were also some arithmetic errors such as 3 x 3 = 6 which had clearly not been checked and sometimes pupils wrote the wrong power of 2.

Question 3

The first reasoning question that required a written explanation and one that was typically answered well. Most recognised that the red counters represented a third of the total and not a half. As is often the case on such response questions, the clarity of candidates' explanations sometimes led to them not being credited the mark. Some candidates gave a correct explanation but then lost the mark with the inclusion of inaccurate figures or comments which contradicted their explanation; for communication marks the statement must be fully correct. Giving students the opportunity to talk and write using correct mathematical language will benefit many. Their ability to explain varied but most were able to state that the number of red counters should be 16 rather than 24. Those who used fractions in their explanation or described that the ratio would then be 1: 1 showed a good understanding of the mistake which had been made. Another common way forward was to assume that if there were 24 red, then there would have to be 48 blue and then the total of 72 would be more than the given total of counters in the bag. Explanations often lacked clarity and did not refer to the numbers in the question. There was also some carelessness over using the correct order of numbers in division with 3 divided by 48. Some also failed to express their reasoning unambiguously, such as only mentioning the number of blue counters, rather than focusing on the red.

Question 4

In part (a) many candidates gained the mark for a correct answer, although some are still unclear on the meaning of the inequality symbols; something that is surprising at Higher level. Part (b) was generally answered well, but we saw the typical error of the shading being the incorrect way round on the circles. In this case candidates gained one of the two marks. A number of candidates drew their line on the number line which made marking trickier. Where partial marks were awarded, in most cases, it was for a correct line drawn with incorrect end points.
In part (c), most were able to gain some credit with many getting at least 2 for finding the critical value. However, the fraction in the inequality caused problems for a significant proportion of learners. Those who attempted to work with the fraction first, typically scored no marks as they failed to multiply or divide all 3 terms or failed to deal with the inverse of multiplying by $\frac{2}{5}$.
Those who started with the -4 first often fared better. It was pleasing however to see fewer candidates losing marks for using '=' rather than '<'.

Question 5

This was the first problem solving question on the paper and almost all candidates gained some credit. There were three steps in setting up an equation to solve. Finding an expression for the area of each shape, assigning the '10' as a plus or minus to one of the terms, and putting an equation together. Typically, candidates got 2 of these 3 parts correct. Normally either failing to half for the triangle or adding 10 to the triangle rather than subtracting. The mark scheme this time was generous here and allowed candidates to miss the brackets from the expression for the area of the rectangle for all three method marks, meaning many candidates were able to score well. Those who formed the correct equation, did then gain the final mark for the correct answer.

Question 6

This was another problem solving question and another with good success for candidates. Many were able to gain all 3 marks for a correct answer. Those who didn't score full marks normally scored at least one for a correct process, either finding 57% or starting to work with the ratio. It was evident though, that a lot of candidates do not have efficient calculator strategies with many using build-up methods for percentage, rather than just multiplying by 0.57 or equivalent.

Question 7

This is now a familiar question, and one that was answered very well. Candidates typically do better on this version of the error interval question, rather than when tested on truncation.

Question 8

Unlike with Question 6, there were fewer candidates attempting build up methods here for the percentages, which was good to see. There were still a disappointing number of candidates working with simple rather than compound interest and these were able to score a maximum of 2 of the 4 marks on offer. Overall though we saw a significant number of candidates showing efficient methods and gaining all 4 marks. Use of the formula sheet was evident in some candidates' responses.

Question 9

This was the first of the Higher only questions and another familiar one for candidates. Most scored 2 marks in part (a), for a suitable cumulative frequency graph drawn, or at least one for consistent plotting in the intervals usually plotting at the midpoints. However, it was surprising to see so many candidates failing to get the mark for finding the median. Some read the graph at 50, presumably working with 50% being the middle, but there were also many candidates reading off at more inexplicable values such as 45 and 60.

Question 10

A significant number of candidates tried to overcomplicate part (a) often carrying out complex calculations, when the answer was much simpler. A number of candidates worked out $\frac{15}{60} \times \frac{16}{61}$ adding the result of the first throw of the dice to the table for the second probability. These candidates were given full credit for this response. Part (b) was the second explanation question, and again clarity was lacking for some. It was common to see responses such as "the bigger the value the more accurate", or "it must be bigger" without any reference to 60 or part (a) and in these cases no mark was awarded.

Question 11

This is a question often seen on paper 1, but it was answered quite well by many, with it not being uncommon to award 4 marks. With it appearing on a calculator paper though, it meant some candidates used their scientific calculators to solve. Unfortunately, these candidates had not paid attention to the demand of the question which asked for algebra. Without supporting algebra, the correct answers were awarded a Special case B2. It is vital that candidates read the demand carefully to ensure they are answering the questions as they are intended to.
Of those who did use algebra, it was typical to award at least 2 marks, for a correct method to eliminate (often condoning a single arithmetic error) and for substituting correctly to find the second value. The main issue with the substitution method was subtracting a negative e.g. $18y - (-8y) = 10y$ was a very common error.

Question 12

This problem-solving question was answered really well, with a good proportion getting 2 or even all 4 marks. Many spotted the need for Pythagoras and typically gained the 2 marks for a full process. There were a number then that used the formula for the circumference incorrectly and used the wrong value of radius or diameter and gained no further credit. Some candidates also calculated area instead of circumference, particularly disappointing given the formula are on the Exam Aid given to candidates for this series. Those who did not spot the need for Pythagoras unfortunately scored no marks unless they applied trigonometry correctly.

Question 13

This trigonometry question proved to be a challenge for many as they either attempted to use the cosine rule to find the length *BC*, but substituted incorrectly, or they attempted the sine rule but incorrectly linked the side *AB* with the angle *BAC* rather than *ACB*. In all these cases candidates typically scored zero marks. We did see candidates though who were able to correctly use the sine rule to find *ACB* and those that did normally then gained the last 2 marks for a process to find *BAC* and a correct answer.
Greater care in labelling the sides and angles of the triangle prior to substitution into one of the formulae would have helped many to not make the mistakes they did. Some assumed the triangle was right angled and tried Pythagoras' theorem to find the missing side. Most candidates who used the correct method gained full marks - in these cases the working out tended to be neater and more logical than those who did not gain full marks.

Question 14

A straightforward algebra question that allowed many to score some credit. Even some of the weaker candidates were able to gain one mark for correctly factorising the numerator of the fraction, the coefficient of x^2 being more than 1 caused more issues but still a significant number went on to gain all 3 marks. Unfortunately, quite a few candidates got their signs wrong on the numerator, eg $(x+3)(x-2)$ which often then led to an incorrectly factorised denominator as they were looking for a common factor.

Question 15

Quadratic sequences have become a familiar topic now, and it is pleasing to see so many candidates being able to gain marks. This year we have seen a significant number of candidates using the formula approach to find the values of *a*, *b* and *c* in the expression $an^2 + bn + c$ compared to previous years. This did often bring success, but it was also evident that some had not fully understood this approach. It was common to award 2 marks for candidates working with n^2 and getting as far as the sequence 2, 5, 8, … or seeing $n^2 + 3n$. There was a lot more variety in responses where students used the *n* squared term to find the difference between that and the sequence. Often students found the difference as -2, -5, -8 resulting in an incorrect *n*th term. We did also see an increase in candidates working with different variables, normally *x*, which was able to gain full credit. However, a surprising number worked in two variables, such as $n^2 + 3x - 1$, and these candidates were unable to get full marks.

Question 16

It was clear that histograms is a topic that many candidates continue to find difficult, and so many were unable to draw the missing bar correctly. Very few worked with frequency density and the fact so many achieved a single mark was down to the bar ranging from 20 to 30 hours having the same class width as the one going from 30 to 40, and candidates found the correct frequency for that bar using the difference in heights. Very few written calculations were seen in part (a). Students should be encouraged to write working down such as how to calculate the scale. Values were given in the question, so a simple calculation of 28 divided by the class width would have got a mark. These errors continued into part (b) where again we saw few fully correct responses, although some candidates gained 1 mark for summing 3 out of 4 correct frequencies.

Question 17

Clear algebraic working was lacking for a good number of candidates in part (a) and was the cause of them not gaining the mark, particularly not showing $x^4 = x^2 + 5$. Those that clearly showed each step in the rearrangement were rewarded.
In part (b) many were able to gain some credit for use of the iteration formula, but many went beyond the requested value of x_3 and lost the accuracy mark. Some candidates also found the values of x_1, x_2, and x_3, and then found the mean of these 3 values and gave this as their answer,

losing the accuracy mark. In terms of substitution, it is worth noting here, like with use of the quadratic formula, that ensuring the lid of the square root sign extends fully is important to show correct substitution.

Question 18

This ratio problem proved to be one of the most challenging on the paper for candidates. A pleasing number did make a start to working with the ratio, normally working with $a : c = 3 : 5$ or $b : c = 5 : 3$. However, then next step of equating the c element of the ratios proved too challenging for many. Others tried more complex methods working with ratios that contained numbers as variables, but struggled to complete any working that was worthy of credit. The most efficient method led to a ratio of $a : b : c = 9 : 25 : 15$ which would have gained 2 marks, it is only a single step from there to get to 34:40 and hence 17:20.

Question 19

Many candidates, including some of the weaker ones, were able to gain a mark here for a suitable bound, it was good to see that they were applying their knowledge of error intervals into a more complex context. However, many then struggled to select the correct bound in their expression for $\sin(x)$ and so gained no further credit. Candidates who did select the correct bounds and achieved 2 marks, typically then did gain the final mark, although a number forgot to find the inverse sine and were left with an answer of 0.731... rather than 46.989… Some candidates attempted the question in the incorrect order and worked with $\sin(x)$ and then attempted to find bounds of this answer. This method gained no marks.

Question 20

A slightly more straightforward vector problem allowed a good number of candidates to gain 1 or even 2 marks, for working with $\overrightarrow{RO}$ or $\overrightarrow{OR}$ and then applying the ratio to find $\overrightarrow{MO}$ or $\overrightarrow{MR}$. Unfortunately, many selected the incorrect vectors to add to gain the third mark, and it may be worth candidates writing out a clear vector expression such as $\overrightarrow{MT} = \frac{2}{5}\overrightarrow{RO} + \overrightarrow{OT}$ before working in terms of **a** and **b**. The other areas that caused candidates to lose marks were not clearly assigning their vectors, and much like in Question 5, not working correctly with brackets. At this grade the mark scheme is less lenient to incorrect algebra compared to earlier in the paper.

Question 21

Transformations of functions is always a topic that candidates find challenging, and although relatively straight forward compared to some recent examples, that proved the case again here. Part (a), dealing with a translation, was typically answered with more success, with a good number gaining the mark. However, part (b), the reflection, was less well answered and it was common to see responses such as a reflection in the x-axis or a rotation of 180° about the origin.

Question 22

Whilst only being 2 marks, this probability problem was probably found to be the hardest on the paper for students. Very few were able to gain any credit. To gain a single mark they had to either write an expression for getting all blue, or all red for *n* trials. It was this element that challenged students, with many giving examples for 2 or possibly 3 years, but not the generalisation that the mark scheme demanded, we did on occasion see elements such as $\frac{4}{5}^{n}$ but without the brackets, no credit could be given. A fully correct expression was needed for both marks, typically given as $1 - \left(\frac{4}{5}\right)^{n} - \left(\frac{1}{5}\right)^{n}$ but also seen as $1 - \frac{4^{n} + 1}{5^{n}}$ which is a correct simplified form.

Question 23

Many candidates were caught out but the relatively familiar figures of 1, 8 and 27, and thought they had to work with cubing numbers. However, candidates had to find the length scale factor of the 3 triangles from the given ratio as 1:3:6 to gain the first mark, whereas many worked with the 1:2:3. Once they had the correct ratio of lengths they could then work out the correct ratio of areas for the 3 triangles to get 1:9:36. From here they had to work out the ratio of the areas of the 3 shapes, 2 of which were trapezia not triangles. There were a number of excellent responses, some working as above and others working nicely with algebra. There were also a number of candidates that gave lengths to the parallel sides and perpendicular height and worked correctly with areas.

Question 24

The final question on the paper was a challenging shape problem requiring candidates to find an expression for the area of an unfamiliar shape. The most common approach was to split the shape into a square and 4 identical triangles. By doing this and correctly identifying an angle inside or outside of the triangle, candidates were able to gain the first mark. To gain the second and third they needed an expression for the area of one of the triangles, or the length of the side of the square. The former was awarded more regularly, as many spotted that the triangles were right-angles and isosceles. The length of the square proved more challenging as it involved using Pythagoras and surds. The final process mark was to put it altogether to form an expression for the total area, before simplifying it to the given form. Although there were some excellent responses, some candidates were let down by the accuracy of their algebra, and we also saw candidates guessing the value of *p*, but without supporting algebra, this gained no credit. A successful method seen, other than the square and four triangles split, was to split the shape into 8 triangles, 2 trapezia and 1 rectangle. Several responses started with finding the hypotenuse of the small triangle or the area but did not get beyond this. There was evidence that candidates were not very confident at manipulating numbers inside a square root. Some had trouble with

simplifying $\sqrt{2a^2}$ to $a\sqrt{2}$ after using Pythagoras theorem to find the length of the hypotenuse of the small triangle.
If candidates did correctly expand the expression for the area of the square and added on the triangle areas, they were usually able to work backwards from the final answer to rearrange their expression correctly.

Summary

Based on the performance on this paper, students should:

- ensure they are using efficient calculator methods

- take extra care when working in algebra and show each step carefully, and remember the importance of brackets and the length of the lid on root signs

- spend more time interpreting statistical diagrams such as cumulative frequency curves and histograms with unequal class intervals

- read the demand of questions carefully so as to fully understand what the question expects in terms of approach for answering, and also the form in which the answer is expected

- remember that trial and improvement methods should be discouraged

- work on geometrical topics such as the sine rule and ensure that angles are labelled correctly, either using 3 letter notation or on the diagram if introducing a new variable such as *x*

- ensure candidates are fully prepared for the planned withdrawal of the exam aid for future series

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