Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

Summer 2024

Pearson Edexcel GCSE (9 – 1)

In Mathematics (1MA1)

Higher (Non-Calculator) Paper 2H

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GCSE (9–1) Mathematics 1MA1

Principal Examiner Feedback – Higher Paper 2

Introduction

Most students showed attempts to answer most questions, and very few stopped early in the paper. This is really pleasing to see as it indicates that students are being appropriately entered at the appropriate tier of entry. There were questions of familiar style and content and this allowed the weakest to have some successes, whilst the harder questions allowed differentiation of the very strongest students.

Students continue to improve their ability to access problem solving questions, however, there is real evidence of students struggling to articulate their mathematics competently. Practice of mathematical discussions to aid the writing of explanations would benefit many.

As has been the case for a number of years now, there is little to no evidence of students being disadvantaged by a lack of equipment, and students continue to improve their skills on calculators. Students should be mindful to show all the stages of their working out, including that calculations they are entering into their calculator, in order that they can be awarded credit for correct processes and methods.

Report on individual questions

Question 1

This question was a straightforward Pythagoras theorem application and was a positive start for most students, with them gaining the two marks available. A small proportion of students, as is expected, mixed up the formula and worked as if they were finding the hypotenuse rather than one of the shorter sides. This typically resulted in no marks. Some knew to square and subtract but forgot to take the square root. These students were able to gain the first mark. Some attempted to use trigonometry but tended to get no further than trying to find a missing angle.

Question 2

Part (a) is another familiar question and was very well done. Most used factor trees to find the prime factor decomposition of 90. Some used a Venn diagram to good effect. Students were allowed to give their answer in expanded or in index form, and both were seen regularly. Only a small number listed the prime factors, rather than writing as a product, and this is something we have seen a real decrease in. These students scored 1 mark. As did the students who made a single arithmetic error in their trees. Unfortunately, those who ended branches on a composite, rather than prime, number typically scored zero.
Part (b) was only worth a single mark and students did not perform well. Many didn't know what to do to find the LCM with the numbers given in prime factor form. Those who gained

credit typically did it by writing them as ordinary numbers and listing multiples, or by drawing a Venn diagram. Many gave the HCF of 6 or gave 216 as an answer.

Question 3

On the whole, this small problem was answered well, but many were put off by the extra numbers in the question. The '5000' was simply there to show the same number of bottles were made both days, but many tried to use this figure in the formula, often in place of 72. There were also cases where students wrote $72 \div 6$ but then went on to use this in an incorrect calculation. This said, many did gain full credit for using the formula twice and subtracting to get an answer of 4.

Question 4

This question was the first main challenge of the paper, and it was just that for a good number.
The most common successful approach was to use the number and probability of yellow to find the total number of discs, followed by dividing by the ratio to get the number of red (and often blue) discs. It was then quite straight forward to work out the number of red discs.
Others did find success by working with the probability and ratio first to find the probability of red, and then with the total to get the number of red.
Some lost marks after working with ratio to gain the number of red and blue but didn't clearly identify the value for red and lost the final mark.
A significant number of students prematurely rounded or truncated their probability value, often working with 0.46 or 0.47 which resulted in incorrect values of 69 or 71 for the answer. Where it was clear from working that correct processes were being followed it was still possible for all process marks to be gained.

Question 5

Another familiar style of question, and again, many scored good marks. As it always the case in part (a) a number struggle to substitute negative numbers into quadratic equations, and so the y value when $x = -1$ was often incorrect. This then meant they could only score 1 at best in part (b). Those who completed the table correctly typically then scored both marks in (b). However, we are still seeing the same two errors we often see, line segments, rather than curves, and a 'flat bottom' to the graph. Both of these resulted in a lost mark for the graph.
Part (c) is always the lowest scoring, but a good number gained marks, and often 2. Those who had an incorrect graph in (b) could still gain both marks in (c) providing the graph led to 2 solutions when $y = 4$. Unfortunately, some were able to find both correct values for x, but lost a mark for poor notation, normally writing the solutions as coordinates.

Question 6

There were many different approaches seen to Question 6 which was really interesting to see. As the question was designed to lack structure, students had to plot a path through the problem themselves, and most did so with at least some success.

The most common approach was to use the starting ratio of 1 : 6 : 14, and then to find $\frac{3}{7}$ of 14 = 6, and to subtract and add to the ratio to give 7 : 6 : 8. The next step was to then find 12.5% of 8 = 1 and again subtract and add to give 7 : 7 :7 and show Tina was correct. However, some worked with the values as fractions of 14, and others scaled up the ratio to a different total and worked from there. All these methods were capable of gaining full marks, but the latter two often led to errors, either in arithmetic, or due to premature rounding. Some students lost marks, as although they were able to find $\frac{3}{7}$ and 12.5%, they either did so of the wrong values or added to the wrong values, or lost track of which values linked to which of the three people.
This is a question where working was required to gain credit and was asked for in the demand. Anyone giving a correct answer without supportive working would score zero.
Some students chose to use their oven values (in the ratio 1 : 6 : 14) which could also lead to full marks being given.

Question 7

There were three main ways of completing this problem. The first, and most common, was to form an equation by summing all angles to 360°. The second was to assume it was a trapezium and set one pair of co-interior angles to 180°, and the third was to set both pairs of co-interior angles equal to each other. An equation to equate one of these was needed to score any marks.
In the case of the first two approaches, to gain the final mark, substitution to show the angles were co-interior was required, as was some form of explanation. In the third approach an explanation was enough for the final mark.
Many students gained 3 marks by forming a suitable equation and solving to get $x = 25$. However, the final mark was often harder to come by, with the most common approach showing that if $x = 25$ the angle sum is 360° and hence it is a trapezium. Obviously, the angles summing to 360° is not sufficient to show it is a trapezium.
A notable amount of students added opposite angles equal to 180 to try to solve for x, showing they are unclear of the properties of a trapezium.

Question 8

There were two processes in this question, a use of scale and a use of the formula for the area of a triangle. The more successful students used the scale first on *RQ* to get a drawing length of 8 cm. This was then used correctly with the area of the scale drawing to find *PQ*, which was then scaled back up to get the real length.
The other method was to scale up the area first, and then use the real length of *RQ* to find the real length of *PQ*. This method was the better of the two as it seems to have less steps.

However, most who attempted this method only multiplied the area by the length scale factor of 5, not the area scale factor of 5^2, and as a result could only gain the one mark. It was common to see a correct scaling of 8 for the length together with an incorrect scaling of 140 for the area, and this was considered to be a choice of methods.

Question 9

Part (a) was answered well, as error intervals normally are. This is one of the new topics that students have taken to well.
Part (b) unfortunately, was answered less well. Students were required to recognise that there are an infinite number of values greater than 7.349 but still less than 7.350, and some did and articulated this well. Many didn't though, and it was common to see poorly worded explanation either contradicting themselves or being mathematically incorrect.

Question 10

This question started with an independent B mark for a correct expression for either sin *a* or tan *b*. It was pleasing to see so many students gaining this credit and then setting the values equal to each other to form an equation. Many did then struggle to solve this question and the process mark was a correct start to do so. To gain this, students had to have a correct process to clear both fractions or to write them with a common denominator with a correct matching numerator. A significant number formed the correct equation but didn't gain the P mark as they only multiplied the equations by 4, thus only clearing one denominator.
Those who were able to clear the denominators, often then went on to solve correctly and gave an answer of 1.25 or $\frac{5}{4}$.

Question 11

Cumulative frequency is another familiar topic and proved a good opportunity for students to show their data handling skills. A large proportion of students scored full marks in (a) and (b) for completing the table and drawing the diagram. We do still see some students lose a mark on the graph for either plotting on mid-points rather than endpoints or for simply not joining the points. Either curves or straight-line segments were accepted.
Parts (c) and (d) required interpretation of the graph, and part (d) was typically done better. For the IQR we saw students not reading off at the correct values on the CF axis (often at 10 and 50 or 20 and 40, not 15 and 45) but this number does seem to be coming down each series. In part (d) it was not uncommon to find students reading off the graph correctly, but then failing to find the difference to 60.
It is worth noting that students could score full marks in parts (c) and (d) even if the graph was incorrect. To do this their processes must be correct, and the graph must have had no negative gradient.

Question 12

As is often the case with inverse proportion, a significant number lost all marks as they worked with $f = kd^2$ rather than $f = \frac{k}{d^2}$. Those who got the format of this relationship correct typically scored 1 if not 2 marks in part (a). Some found the correct constant but didn't state the equation correctly (including their found value of 224) and so didn't gain the accuracy.

In part (b) students had to use the equation found in part (a). The equation did not need to be fully correct, but it did have to be in the form $f = \frac{k}{d^2}$. Again, those who had the correct form typically scored well in part (b).

Question 13

Students gained the first mark for at least two correct boundaries, normally, but not always, for $y = -3$ and $x = 2$. The second mark was harder to gain, but again many did. This could be gained for drawing the remaining two boundaries or one more correct boundary **and** shading correct for at least two correct boundaries. The second of these was probably seen more often. A fully correct region identified was needed to gain the C1, and although not scored by a majority, it was scored by a significant minority.

Question 14

This question tested two topics that were new to 1MA1 and students are now scoring some good marks. In part (a) a tangent needed to be drawn and the gradient calculated. Many gained the first mark for drawing the tangent, and of those a significant number gained the second mark for a correct method to find the gradient. Unfortunately, many who did this, lost the third mark due to a missing negative sign in their answer. Weaker students read off at $x = 5$ and either multiplied or divided these two values, and thus scored zero. In this question, if no tangent was drawn, no marks could be scored.
In part (b) a method to find the area under the curve was required and a pleasing number attempted this with trapezia. This was also seen in terms of triangle and rectangles, which was perfectly acceptable. To gain the first mark, a single correct area of a trapezium (or rectangle and triangle) was required, with a complete method needed for the second M mark. Those who used rectangles whose height was the point where the middle of the bar crossed the graph could also gain full credit here, and normally did. This method led to an answer of 78 compared to the 79 got from the other.
Quite a few found the area under the tangent or had problems reading from the scale, but method marks could still be gained if this was limited to just one error.

Question 15

A slightly different style of surds question to the ones we have seen previously, but it was approached well by students. A good number of the stronger students gained the first mark for a method to rationalise, and many of these then gained the second mark. However, some who had the correct algebra leading to the answer, attempted to simplify further often to expressions such as $\frac{\sqrt{a}}{a}$. This further incorrect working was not ignored and lost the A mark. Some students worked with a prime number, such as 3, in place of a. These students were able to gain the M1 if their method to rationalise was correct. The most common error was in trying to rationalise using $\sqrt{a} + 1$ rather than $\sqrt{a} - 1$.

Question 16

It was pleasing to see just how many gained the first mark of this question for getting the critical values. It obviously helped that the quadratic was already factorised but pleasing nonetheless. Unfortunately, a significant number had the values of 5 and −0.75 rather than −5 and 0.75 and they gained no marks.
Of those who got the critical values it was about 50 : 50 as to who would go on to gain the second mark. This mark was lost either because they were written with '=' or with an incorrect inequality symbol and sometimes as $-5 < 0 < \frac{3}{4}$
Some attempted to expand the quadratic as a first step. This almost always led to a score of zero. Many tried to solve using the quadratic formula and often used in incorrectly.

Question 17

This question was attempted by most, but only the stronger students were able to score. The first mark was for working with the volume scale factors of **L** and **M** to find the length scale factors, and the second similarly to work with the area scale factors of **M** and **P** to find the length scale factors. Both of these processes required students to take some form of root, and it is perhaps not surprising that students were better when the square root was involved. Many of the students who were able to find the 2 separate length scale factors or ratios, were then unsure as to how to combine them and scored no further credit. Those who did know, typically scored both the 3rd and 4th marks. The A mark was 'or equivalent' and we saw numerous acceptable possibilities, including 9.6 : 12 : 4 which had non-integer values.

Question 18

Students were awarded at least one mark for a correct probability for a second or third counter, and these were often seen in probability trees.
Students were able to gain the second mark or the third mark or both for a correct product for either 2 reds and 1 green or for 3 reds, with fewer showing the need to add the probabilities rather than multiplying. The problem normally came in the final step for a full process as students often missed one or two of the possible ways of getting 2 reds and a green, and so their process was incomplete.
There was an alternative approach seen which involved looking at how many possible combinations of 3 counters there are, and how many combinations involved no yellow counter. These two values were then combined to find a probability. Another alternative was to notice that any possible selection of the three counters from the reds and greens was valid, and since only one green was available, this led quickly to the correct answer.
There was also credit given for the students who dealt with the counters being replaced but did all the correct products and added. This was in the form of a Special Case B2.

Question 19

The first mark was for finding $\overrightarrow{CB}$ or $\overrightarrow{BC}$ in terms of **a** and **b**. the second then required them to apply the ratio of 4 : 5 correctly to this. These marks were awarded relatively often, although some did apply the ratio incorrectly, normally when working from *N* to either *C* or *B*.
The last two marks were for an un-simplified and then a simplified expression for $\overrightarrow{MN}$. Again, a good number gained the third mark, and of these a significant number were able to simplify correctly. This is a place where using a calculator to simplify coefficients might have been a good idea. This step normally involves working with fractions and negatives, and most students attempted it manually.
In part (b) students had to recognise that $\overrightarrow{MN}$ was not a multiple of $\overrightarrow{OB}$. It was clear that many did actually understand that point, but lots struggled to articulate themselves accurately and so lost the communication mark.

Question 20

Completing the square is always a topic that many struggle with, especially, if like here, the coefficient of x^2 is greater than 1. We saw a decent number gain a mark for taking out a factor of 2, and many were then able to find the $(x-3)^2$term, but very few were able to complete the process and gain the second. If they did, most gained the final mark, except for a few with the correct values but incorrect signs. Some were able to deduce the first coordinate of $x = 3$, which gained them 1 mark, but were then unable to find the second coordinate.

Question 21

Another topic testing the very top end, and test it did. Few scored both marks for a fully correct graph, but we did see credit given fairly often for a correct translation. Some of those who gained for the translation reflected in the *x*-axis rather than the *y*-axis. In some cases, the minimum point was transformed correctly but all the other points were slightly incorrect.

Question 22

The final question required students to prove that two tangents from a fixed point are equal in length. Most attempted this using congruency, with varying degrees of success. As it was a proof, it required reasons to be given at each stage, and although a good number knew the facts, they did not give correct, or complete reasons and struggled to gain any credit. It is important again that students practise stating the geometric properties and reasons.
There was an alternative method seen using isosceles triangles, and this too was able to gain credit when complete reasons were given. When this method was used it was common for the marks to be lost for writing only isosceles rather than isosceles triangle.
Alternate segment theorem was also a possible approach and was an efficient method. Other errors include claiming that *OP* bisected the angle with no justification for this, describing the relationship without actually stating that, e.g. *OA* = *OB*.

Summary

Based on the performance on this paper, students should:

- Ensure they know how and when to use a calculator efficiently, but not to forget manual methods. Use of brackets and edit function will help with substitution on a calculator.
- Practise articulating their mathematics in verbal discussions to aid them in written responses.
- Use tables and diagrams to extract information from a question so they can better navigate through the problem.
- Know the relationships between volume, area and length scale factors.
- Provide unambiguous explanation whenever required by the question.
- Cross out any work they do not wish the examiners to mark, leaving one clear solution.
- Whenever possible use accurate figures without prematurely rounding or truncating in presenting work.

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