Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 1HR

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Principal Examiner’s report

Students who were well prepared for this paper were able to make a good attempt at a majority of questions.

Students were less successful with Pythagoras (Q4), enlargement (Q10), polygons (Q15), indices / completing the square (Q24) and trigonometry (Q25).

On the whole, working was shown and mostly easy to follow. Those students who produce untidy, unstructured written work to the extent that their writing is almost illegible risk losing marks. There were some instances where students failed to read the question properly; an example being question 15. Here, students did not realise they had to work out the interior angles or a hexagon.

Simplifying algebraic fractions, transformations, vectors and measurement bounds in later questions, proved to be challenging for many. Depreciation in a context, (Q9) also caused difficulty for less able students.

Generally, problem solving, and questions assessing mathematical reasoning were tackled well at the beginning of the paper.

Comments on individual questions

Question 1

This was very well answered with the vast majority gaining full marks. Most students used a factor tree or a table and there were very few arithmetic errors. Those students who did not gain full marks tended to give an answer that wasn't in index form as requested. These gained two marks if they had found all the correct prime factors. Those students who made arithmetic errors could gain one mark if they had at least two correct stages in prime factorisation. Students are reminded that for this type of question working must be shown, as many modern calculators have a FACT facility that produces answers directly.

Question 2

(a) This part was answered well by the students. It was relatively rare to see an incorrect response in this part of the question. It was encouraging to see candidates could interpret set *A* and it included the element “5”.

(b)This was answered well by the students. It was relatively rare to see an incorrect response in this part of the question. Many students clearly wrote down the 7 elements as required. It was encouraging to see students could interpret the concept of the union of 2 sets.

(c) A majority gained the one available mark but a significant number failed to read the information about the universal set and therefore thought 9 did belong to the set *C*. Some students stated that 9 was outside of the Venn diagram, as it was outside the sets *A*, *B*, *C*, implying a lack of understanding of Venn diagrams.

Question 3

Many students produced completely correct solutions to both parts of this question on proportionality.

In part (a), scale factors were the most popular approach, usually $GH = 4 \div 1.6$

In part (b), scale factors were still widely used but proportionality statements such as $\frac{BC}{9.6} = \frac{5.7}{6}$ also appeared regularly. Scale factors were sometimes used incorrectly, multiplying instead of dividing.

Question 4

This question was answered very well with the overwhelming majority of students using Pythagoras to calculate the diameter of the larger circle. Many went on to gain full marks. Of those who lost marks, many used the area of the semicircle or included *AC, CB* and *AB* in the perimeter, some neglected to divide the circumference by 2 or mistakenly used the value of 8.48… as the radius of the larger circle, rather than its diameter.

Similarly, some students used 6 as the radius of the smaller semicircles and neglected to divide the circumference by 2.

Question 5

Sometimes students used the wrong probability to estimate the number of games that Evie will lose. Students are advised to read questions carefully. Those who gave their final answer as $\frac{78}{300}$ only gained 1 of the 2 available marks.
It was encouraging to see that many students showed their reasoning clearly.

Question 6

Parts (a) and (b) were answered well, with very few mistakes.

(c) This was a standard indices question and answered well by most students. The most common error was to multiply 3 by 2 giving an answer of 6 rather than 9, the other mistake was to add the indices rather than to multiply.

Question 7

Part (a) was answered well. In part (b,) many incorrect solutions were seen, and the main incorrect answer was to write incorrect signs in the brackets e.g. $(y + 5)(y - 4)$ or $(y + 5)(y + 4)$ or $(y - 5)(y - 4)$; one mark was withheld for this. Some students tried to use the quadratic formula. Students should ensure they have the correct factors by multiplying back as a useful check for this type of question. Other incorrect answers such as $y(y - 9) + 20$ were also seen. A number of students factorised correctly, but then went on to solve the expression as though it were an equation equal to zero. Even though they weren't penalised for doing this, it does show that students should read the question carefully and reflect on whether or not it is an expression that needs factorising or an equation which needs solving.

Question 8

Part (a) was answered well, though occasionally 5600 was seen. In part (b), a majority of students were successful in this part of the question which involved a multi-stage calculation. A minority of students 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.

Question 9

The majority of the students gained full marks, often using 0.88 as a multiplier. Some students stated the correct answer, 477 030, but then subtracted 700 000 from it and gave the depreciation value, 222 970 as their answer; in this case they were penalised, and 2 marks were awarded. Simple interest was sometimes used, instead of depreciation; students who made this error generally scored 1 mark out of 3, usually for the depreciation value of the first year. In this examination series many students were writing $700\,000 \times (1 - 12\%)$; we did not award marks for this unless it gave a correct solution. $700\,000 \times (1 - 0.12)^3$ was worth 2 method marks. Students are encouraged to write down the correct notation so that marks can be awarded for their correct method.

Question 10

This question was generally answered well. If incorrect, most students reduced the shape successfully but did not draw it in the correct position, this was awarded 1 mark for having the shape in the correct size and orientation.

Question 11

The more able students were able to gain full marks. Many students gained 1 mark as they could use the mass and density to find the volume of the cuboid. Alternatively, they could use the formula for the volume of a cuboid and put it equal to their attempt to find the volume, for example, $4 \times 5 \times w = 250$. Some students were unable to use volume / mass / density relationship correctly. A very common error was to multiply the mass by the density in an attempt to find the volume and some students divided the density by the mass. Some students found the correct volume but surprisingly could not continue with question as they had no strategy to find *w*.

Question 12

(a) ‘Show that’ questions always prove challenging to many students. A majority of students understood that total probabilities add up to 1. The students who took an algebraic approach tended to be the most successful in proving that $x + y = 0.19$. The students who took a numerical approach tended to gain one mark as they did not write down $x + y = 0.19$ to complete the proof.

(b) Nearly all students attempted this question with the majority choosing elimination as their method. Nearly all recognised the need to have equal *x* or *y* coefficients in the two equations, however some then chose the wrong operation to eliminate a variable, and so were not credited. Those that found the value of one variable generally went on to use substitution successfully to find the value of the second variable. A number of students used substitution from the start, mainly with success. Students recognised the need for working so although this could be solved using the calculator there were very few attempts without working. Many concise solutions were seen.

Question 13

In part (a), the majority of students were able to correctly complete the probabilities on the tree diagram. Part (b) was usually done well. Just a few students added probabilities, producing a probability value greater than one.

Question 14

(a) In many cases, the cumulative frequency table was completed accurately by the majority with very few errors seen.

(b) The plotting of the cumulative frequencies was extremely well done, with the majority plotting end points accurately and joining with a smooth curve or line segments. Very few plotted mid points and only a very small number of students drew a 'squashed' cumulative frequency curve. A very small number drew histograms or bar charts or a line of best fit.

(c) Most students were able to gain the mark for the median.

(d) Fewer students were successful in finding the interquartile range. Students who drew horizontal lines at 20 and 60 and then drew vertical lines from the cumulative frequency diagram then misread the scale on the horizontal axis. It is important that candidates clearly show the method that they used to find the interquartile range so that a method mark can be awarded.

Question 15

The students who realised that they had to start with finding the sum of the interior angles of a hexagon (or work with the exterior angles) generally went on to gain full marks. However, having got as far as 720, some students then either only subtracted four of the known angles of the hexagon, (omitting the 90°) or made an arithmetic error in their subsequent calculation. Some started by working out 180 × 6, it wasn't clear if this error was because they thought that they were working with an octagon or if they believed that this was the correct method to work out the sum of the interior angles of a hexagon. A common incorrect method was to add the five interior angles of the hexagon and then subtract 360. Some just added interior angles or, less often, exterior angles, gaining no marks.

The answer of 8 could be gained from assuming that *AB* splits reflex angle GBC into 2 equal angles of 135° each, and then assuming angle *BCD* is also 135°. Using angles on a straight line the students worked out the exterior angle of the polygon to be 45°. The student carried out the correct calculation of 360 ÷ 45 to obtain 8. This was awarded SCB1 as the method is incorrect.

Question 16

Many students scored full marks here with an excellent appreciation of the steps needed to convert recurring decimals to fractions. Two methods were commonly seen: working with

$1000x$ and $10x$ and working with $100x$ and x. Most students scored both marks with this method, but a few did not give the intermediate fraction 17.5/99 or omitted the conclusion of 35/198 and thus losing the final mark.

Other students did not subtract two recurring decimals that would result in a terminating decimal or whole number. Some students lost marks because they did not demonstrate an appreciation of the recurring pattern – if they did not use dots or lines to demonstrate the recurring part of the numbers, we needed to see values given to at least 5 sf, which some students did not do.

Students who were not confident on this topic, generally tried to use their calculators to demonstrate that the fraction and the recurring decimal were the same. This clearly scored no marks as the question clearly asked students to use an algebraic approach.

Question 17

(a) Most students showed an understanding of proportion, and most were able to at least get an expression for k if not all three marks. The majority of those that didn't get marks mistook the problem for a direct proportion one and tried to multiply k by r^2 rather than divide or failed to spot that the r was squared.

(b) The students who wrote down a formula in the form $F = \frac{k}{r^2}$ in part (a) and substituted $r = 48$ into their equation tended to gain the one mark.

Question 18

The correct reasoning process needed to answer this question was $\frac{47.5}{1.35}$ and $\frac{52.5}{1.25}$. Responses tended to fall into three groups (i) students who followed the processes shown above (generally gained full marks), (ii) students who knew something about lower bounds and upper bounds but could not apply the reasoning correctly to maximise or minimise the cost (1 or 2 marks) and (iii) candidates who had little or no idea of bounds (those who worked out an answer using the values given in the question).

For many students the 50 metres caused problems as it was given to the nearest 5 metres. Students who worked out $\frac{47.5}{1.35} = 35.18...$ went on to multiply this value by 8.65 not realising the number of fence panels needed to be rounded up to 36 therefore only gaining 2 marks.

Question 19

Most students who showed some understanding of vectors generally by working out the column vectors $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$ or $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$ but were unable to offer a correct method for finding the magnitude of $\overrightarrow{AC}$ for Pru. This could be simply by not understanding the meaning of 'magnitude'. The students had difficulty finding the magnitudes of $\overrightarrow{AB}$ and $\overrightarrow{BC}$. Students should take care writing down the square of negative numbers as they should be enclosing these numbers in brackets.

Question 20

(a) Relatively few students showed a full understanding of the relationship between transformations of curves and their equations. Most commonly, $y = 2f(x)$ was taken to indicate multiplying by 2 to the x value to obtain an answer of (6, 5) in part (i). Similarly, the x was often subtracted in part (ii) to give (–4, 5). Many students found part (iii) very difficult and blank responses were common.

(b) Very few students gained any marks on this question, with many left blank or the original equation just copied out. All that was required was x to be replaced by $(x - 2)$ and then the expression expanded and simplified. For those who did attempt this question $(x + 2)$ instead of $(x - 2)$ was a common incorrect first step. Even when a correct first step was made, the final answer required the form $y = ax^2 + bx + c$ for full marks. Some students completed the square first, and then applied the transformation with varying results.

Question 21

(a) The differentiation was usually correct for those who knew what they were meant to do. This was often the only 2 marks scored for the whole question.

(b) Only a few candidates wrote down the initial inequality, $3x^2 - 4x - 9 > 0$ despite the fact that subsequent working suggested that they were trying to solve the correct inequality. Students would be well advised in future to write down the inequality in this type of question in order to proceed with the question. They were a number of correct solutions seen but, too often only one critical value was given, or the incorrect inequalities given.

Question 22

This question was essentially finding the area of the blocks covering 55 to 75years, dividing this by the total area of the histogram and converting to a percentage. Sometimes elaborate ways were employed to achieve this, including counting small squares etc. An added complication arose when the final block (50 to 75 years) had to be split into unequal parts.

Question 23

The combination of skills needed to complete this question made it difficult so fully correct answers were rare. Many students could not factorise $x^2 - 4$ and / or $4x^2 - 7x - 2$. As they could not factorise, the rest of the question was beyond the reach for the majority of students. Many students who did get to the stage $(x+2)(x-2) \div \frac{(4x+1)(x-2)}{x}$ did not invert the second fraction to obtain $(x+2)(x-2) \times \frac{x}{(4x+1)(x-2)}$ so lost the second mark. Also, students who did get to the stage $\frac{x(x+2)}{(4x+1)} - 2x$ could not then find the common denominator and so lost the final two marks.

Many students did not recognise the need to factorise, a fundamental approach to working with algebraic fractions; instead, they chose to multiply out the various expressions, often being left with unwieldy numerators and denominators that prevented further progress. Students who did factorise correctly, did not always cancel fully and again encountered problems with further manipulation as a result. There were a significant number of students who were penalised for not recognising that they had to multiply the first two fractions before subtracting the third.

Question 24

This was a very challenging question for many students, and one that scored the lowest marks. Even the most able students gained 4 rather than 5 marks as they tended not consider the restriction on n.

This question was targeting the assessment objective on indices and without seeing this work no marks were awarded. The key to answering the question was to realise that $16^x = 2^{4x}$ and $8 = 2^3$ and then by considering powers of 2 meant you needed to add the indices. Many students were able to gain 1 mark but there were many more that scored 0 marks. Some students managed to reach the stage $n = x^2 + 4x + 3$ to gain 2 marks but did not know what to do next.

The next step required completing the square and then expressing x in terms of n. Many unfortunately chose to factorise the quadratic which led nowhere. Many students could not identify the restriction for the final mark, using the fact that the question initially stated that $x > 0$

Question 25

This question was a challenging one and aimed at the top end of the ability range. The students had to equate the area of the triangle to the given algebraic area to find the value of x. Fortunately, if completed correctly, what seemed to be heading for a quadratic equation reduced to a linear one. Many students did not succeed in finding the value of x, because they found the manipulation of algebra difficult. Once the student had found the value of x, it was simply the application of the cosine rule and the sine rule to find angle ABC.

Students often worked out the acute angle of ABC but did not subtract from 180° to work out the obtuse angle which was made clear on the diagram.

Summary

Based on their performance in this paper, students should:

- be able use formulae given on formula sheet correctly. Also, to be aware of which formulae are given,
- be able to find the magnitude of a vector,
- be able to read graph scales accurately,
- read the question carefully and review their answer to ensure that the question set is the one that has been answered and that their answer is of a reasonable size.
- make sure that their working is to a sufficient degree of accuracy that does not affect the required accuracy of the final answer.

- make their writing legible and their reasoning easy to follow
- students must, when asked, show their working or risk gaining no marks despite correct answers