Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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International GCSE Mathematics 4MA1 1H Principal Examiners' Report

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

Students were less successful in converting a recurring decimal into an algebraic fraction and being able to do differentiation in the context of a problem.

On the whole, working was shown and usually easy to follow. There were some instances where students failed to read the question properly, for example, in question 5 some students did not realise that $4L$ not $5L$ or $5W$ not $4W$ represented the length and width of the rectangle respectively. This was despite a diagram of 1 tile illustrating which was the length (L) and the width (W).

Finding the density, volume of a cylinder, taking readings from a cumulative frequency graph, bounds and vectors seemed to be weaknesses for many students. Operations involving negative numbers, in an early question, also caused difficulty for less able students.

Generally, problem solving and questions assessing mathematical reasoning were tackled well.

Question 1

(a) Simplifying $e^8 \div e^2$ provided a high number of candidates the opportunity to gain the one mark for this question. The most common errors were to divide or add the indices or to state the correct power as a number on the answer line without the base e.

(b) Generally, this part was answered well, however, a common error was -2 rather than -3; some students also had difficulty in simplifying $-3x + x$ correctly. Overall, the errors made were usually down to poor arithmetic skills when dealing with negative numbers. A small minority of students expanded the brackets correctly and then proceeded to solve the original quadratic putting $x = 3$ or $x = -1$ on the answer line.

Question 2

This was a straightforward Pythagoras question which the majority answered well. While some students appreciated the need to square the given values and then subtract, some squared the values and added them, denying them any marks. A surprisingly a minority of students simply used the given values in a variety of ways, for example adding the lengths or doubling them or multiplying them, strategies that clearly led nowhere. A few attempted to use trigonometry to find an angle, but not anything beyond this, and, somewhat inevitably, their efforts did not lead to any degree of success.

Question 3

(a) The calculation of $\frac{4}{9} \times 54$ was a straightforward question for many students, who were able to gain two marks. Showing the correct calculation alone scored M1. Some students tried to convert $\frac{4}{9}$ into a decimal such as 0.4 or 0.44. Those who wrote down that $\frac{4}{9} = 0.4$

or 0.44 and then multiplied 0.4 or 0.44 with 54 could gain the first mark providing clear and full working was shown.”. Only where this approach was evident from clear and full working being shown, were students usually able to gain one method mark. Students who just did 0.4×54 did not gain any marks.

(b) Generally, this part of the question was challenging to many students. The most successful students were those that used an algebraic approach or worked with equivalent fractions to obtain the total of 30 white fish and then subtracted 24 from 30. A common error was to divide 54 by 2 obtaining 27 and then subtracting 24 giving an answer of 3. This was seen on numerous occasions. Students are encouraged to read the question carefully.

Question 4

Many students could gain the first 2 marks quite easily by working out the area of the door and then working out the area of the window by using the formula for a full circle or a semi-circle correctly. Some students then subtracted the area of a full circle from the area of the rectangle which was an incorrect method to find the required area. Common errors were using the radius as 0.5 or using $2\pi r$ to find the circumference rather than the area. Many students went on to find the amount of varnish required for one coat. Students should read the question carefully as the amount of varnish required was for two coats.

Question 5

There were many blank responses to this question. Many students found the area of one tile by simply dividing 1620 by 9 to find 180 to gain 1 mark and then failed to make any further progress. To make headway into the question, candidates needed to set up two equations in terms of L and W and then form an equation in one variable only. It was quite disappointing to see many candidates not being able to set up two equations. Some common errors were to form incorrect equations such as $5L = 4W$ (rather than $4L = 5W$) or $4L \times (L \times W)$ or $5W \times (L \times W)$, which gained no marks. Some students wrote down two correct equations and then made errors in substitution, such as $4L \times (5W + W)$, thus not gaining the third mark.

A few candidates set up $4L = 5W$ and wrote down the factors of 180. Using trial and improvement, students deduced that the equation is satisfied when $L = 15$ and $W = 12$, a correct answer by this method gained full marks.

Question 6

Students found this question challenging. The more able students gained full marks, setting up simultaneous equations and solving them correctly by elimination or substitution. Some gained a mark for forming two equations but then had no strategy for solving them. Others resorted to trial and improvement, normally with little or no success. Those who did have a strategy often made simple arithmetical errors or did not know whether to add or subtract the two linear equations. Students had to start with an algebraic method leading to a correct equation with one unknown to gain the second method mark. There were many non-algebraic attempts which tended to achieve little or no success. It was quite common, for example, to see $1.96/8 = 0.245$ then $20 \times 0.245 = 4.9$, making the incorrect assumption that the cost of an apple is the same as the cost of a pear. “Show your working clearly” implies that the awarding of the accuracy marks is dependent on gaining the method marks.

Question 7

Most students used the factor tree method in their responses to this question. Some students interpreted 3.6×10^3 as 360 or 36 000. Though most students appeared to understand what they needed to do, regrettably many of their attempts were spoiled by weak arithmetic. Students who completed the factor tree successfully sometimes listed the prime factors but did not express their answer as a product or failed to use powers so could not be awarded the mark assigned for a fully correct answer.

Question 8

To gain all the marks, students needed to appreciate that this was a “reverse percentage” problem in that we are taking 22% of a figure we do not yet know i.e. the total population of Australia. Many students were not able to demonstrate this and as such scored no marks. Some students started with $5.48 \div 22$ but did not multiply by 100 to find the total population thus gaining the first mark. Some worked in millions, for example, using the population of Sydney as 5 480 000, but this was not penalised. It was disappointing to see students not being able to convert 22% into 0.22 or an equivalent fraction.

Question 9

(i) Students who were comfortable with the pair of inequality signs found the question to be straightforward. They solved the inequalities by operating simultaneously on both ends and were able to write down the solution almost immediately. Some worked with one end of the inequality only, ending up with, for example, $-3.5 \leq x < 4$ or $-2 \leq x < 8$ or $-4 \leq x < 4$. The weaker students could not deal with both ends of the inequality effectively, apparently not understanding the algebra required. Some did separate the inequalities and were successful occasionally. To gain full marks a correct 'double' inequality was needed with correct notation.

(ii) There were many correct responses to this part. Some students, having achieved 1 or 2 marks in (i), lost marks by not indicating the correct open or closed circles for the end points around (their) -2 and $+4$ or not drawing a single line.

Question 10

The more able students were able to gain full marks. Many students gained 2 marks as they could use the mass and density to find the volume of the cylinder, or they could use the formula for the volume of a cylinder and put it equal to their attempt to find the volume. Some students were unable to use volume = mass ÷ density. 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 volume but could not continue with question as they had no strategy to find the height of the cylinder. The most common errors were to use $2\pi r$ in place of $\pi r^2 h$ and to use the formula for the curved surface area instead of the volume formula. The formula for a volume of a cylinder is given on the formulae sheet.

Question 11

(a) 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) Fewer students were successful in finding the number of runners between 42 minutes and 52 minutes. Some drew lines at 42 and 52 and then drew horizontal lines from the cumulative frequency diagram but then misread the scale on the vertical axis. A very common error was drawing vertical lines at 41 and 51 minutes. It is important that candidates show clearly the method that they used to find the number of runners. Many candidates failed to read the scale correctly; writing their values on the vertical axis would help with clarity. Candidates should be encouraged to take care reading scales, especially those that are different on the horizontal axis and on the vertical axis.

Question 12

(a) There were many successful methods which gained full marks. The majority of these started with tan $\tan 20 = \frac{100}{d}$. This was rearranged well but some students lost marks with expressions such as such as $d = 100 \times \tan 20$ or $d = \frac{\tan 20}{100}$. Some students left their answer as 274, through truncation rather than rounding, thus losing the final accuracy mark.

(b) Many students did not realise that they had to use the value of *d* from part (a). Some of the students who did use their value *d* obtained 128 from $275 \times \tan 25$ then forgot to subtract 100 so only gaining the first mark. Some students tried to find the hypotenuse of the triangle by using Pythagoras and credit was given for this approach. It was not unusual to see the Sine Rule or the Cosine Rule used and at times, obtaining no marks. Working was often easy to follow but some attempts provided a challenge to markers, especially when they covered all the available space without showing any sequence to their working.

Question 13

Combining the sine rule with error bounds confused many students. It was common to see them concentrating on the sine rule, using the given values, and then attempting to give an upper bound for their answer. Those who understood that it was necessary to apply error bounds to *XZ* and the two angles usually scored B1 but rarely picked the correct upper and lower bounds to use in the sine rule. A typical error with the error bounds was using 129.5° or 130.5° for the 130°.

Question 14

(a) This part was usually well answered by those who understand vector notation. A significant number of students did not attempt this question. Where it was attempted, responses could only rarely be given any credit, and usually only in part (i). Students showed little understanding of how to approach questions such as this. Vector expressions were often not clearly expressed either in terms of directed line segments, using capital letters, or in terms of **a** and/or **b**. A small number of students could write down a correct vector expression for $\overrightarrow{AB}$ and so gained one mark but they could not usually write an expression accurately in terms of **a** and/or **b** for $\overrightarrow{KI}$ and $\overrightarrow{LD}$.

(b) This question was quite poorly done with very few students getting full marks. The most common method leading to a correct answer was to split the shaded area into 18 congruent triangles to *OAB*. Those who attempted this question by considering scale factors often failed to appreciate the need to square the linear scale factor of 2 and hence gave the area of the outer hexagon *GHIJKL* as 60 rather than 120.

Question 15

(a) The tree diagram was successfully completed by most students although there were some students who tried to do it without replacement. Writing the probabilities on the second branch out of 8, for example.

(b) Many students could gain the first mark by writing down one of the probabilities from $\left(\frac{2}{9}\times\frac{3}{9}\right)$ or $\left(\frac{3}{9}\times\frac{2}{9}\right)$ or $\left(\frac{4}{9}\times\frac{4}{9}\right)$. However, some students did not find all the required probabilities or did not add them together so losing the final 2 marks.

(c) This part of the question was challenging to the students as they needed to find all the combinations after 3 games such that Magnus and Garry have the same number of points. Some students did find $\left(\frac{2}{9}\times\frac{4}{9}\times\frac{3}{9}\right)$ or $\left(\frac{4}{9}\times\frac{4}{9}\times\frac{4}{9}\right)$ then added them together but did not realise that the combination of $\left(\frac{2}{9}\times\frac{4}{9}\times\frac{3}{9}\right)$ occurred 6 times.

Question 16

(a) There were relatively few fully complete and correct solutions to this question. Many students did not use an algebraic approach when trying to find the value of *x*. The main approach was to label the section where all three intersected as *x* and then start subtracting *x* from 18 and *x* from 11. Many candidates found this difficult and could not label the Venn diagram. It was disappointing to see students not setting up an equation and then solving it for *x*. Many students tried a trial and improvement approach but rarely succeeded in this way.

(b) As this was a follow through, many students who did not write down an answer in (a) could still gain marks in this part of the question. It was encouraging to see students using their understanding of Venn diagrams with their answer to part (a) to gain one or two follow through marks. Where a value 0 is found, in this case the number of students who passed English only, students are advised to write this on the Venn diagram rather than leaving a blank space.

(c) The more able candidates who understood conditional probability gained the mark.

Question 17

(a) This part was, not surprisingly, less well answered with $(6y - 5)(y + 1)$ or $(6y \pm 1)(y \pm 5)$ being a common incorrect answer. There were many very poor attempts to factorise and some tried to simplify the expression. Those that did attempt the question tended to try to factorise the first two terms with $y(6y - 1) - 5$ being a common incorrect response. Many who had the correct values in two brackets failed to have the correct signs.

(b) Marks on this question were well spread with less able students struggling to start. A large number of students were able to remove the denominator, and expand the left-hand side correctly but were then unable to gather the f terms correctly on one side of the equation. Some students made simple errors, such as losing signs or missing out brackets. Those who did gather the f terms correctly usually found an acceptable expression for f with relatively few continuing with incorrect cancellation. Generally, many students were able to manipulate the denominator and then failed to get the second method mark because they incorrectly expanded the brackets/executed the multiplication. A complete answer must include the "$f =$", which was sometimes omitted.

(c) This part of the question was poorly attempted. The majority of students could not factorise before completing the square and the manipulation of algebra was very poor. Some students who factorised correctly lost marks due to missing brackets when attempting to complete the square, for example, $4(x-1)^2 - 1 + 7$, $4(x - 2)^2$ … and to a lesser extent $4(x - 4)^2$ were quite common. was seen on numerous occasions. Generally, this part of the question was left unattempted by many.

Question 18

Using x to represent a recurring digit made this question very difficult for students to understand. Some attempts replaced x by a value and others failed to interpret the meaning of the recurring decimal, all scoring nothing. Many managed to take the first step of an algebraic method to score M1, often reaching the answer $\frac{4x-4}{90}$. The key was to understand that $4x$ in the context of this question was $40 + x$. There were a few very clever methods used.

Question 19

(a) This was a very challenging question to many students. Many students could set up the linear equation, $3x + 2y = 100$, for the perimeter of the rectangle to gain the first mark. Many students had difficulty in finding the area of the triangle. Students who used the sine rule for the area of the triangle were generally successful, however, a minority of students found $\frac{3x^2}{2}$ rather than $\frac{x^2\sqrt{3}}{2}$. The height of the triangle was sometimes taken to be $\frac{1}{2}x$. The students who found the total area of the pentagon for the second mark, then found the manipulation of the algebra difficult as they could not reach the required expression of *R*. When the required answer is given, it is necessary to show all steps of working very clearly.

(b)(i) This question was often left blank. Those who did make an attempt often failed to realise that differentiation was involved. Those who did use calculus often made mistakes. Many students could not differentiate to find the value of *x* when *R* was its maximum value. A common error was to equate the expression *R* with 0 which clearly was incorrect. Students should be encouraged to attempt this part as the expression for *R* was given even though they could not show it in part (a). In a small number of cases the correct answer was reached by considering the line of symmetry of *R* which was, of course, a quadratic.

(ii) This was very poorly attempted and the majority of students did not appreciate that they were dealing with a quadratic with a negative coefficient of x^2 and hence the stationary point was a maximum.

Question 20

A large number of students did not know how to start this question. However, it was pleasantly surprising to see a number of correct solutions from the most able students. Some easier marks were accessible by students finding the midpoint of *AB* or the gradient of *AB* or the gradient of the perpendicular to *AB*. Only the most able students could find the area of the triangle *ABC*. This was often done by sketching the lines on a diagram and then using the diagram to find some lengths of triangle *ABC*. A variety of methods could have been used to find the area, helped by the fact that *AC* was perpendicular to *CB*.

Summary

Based on their performance in this paper, students should:

- be able to set up simultaneous equations in the context of a problem
- be able to interpret error bounds
- be able to apply differentiation in the context of a problem
- be able to read graph scales accurately
- read the question carefully and review their answer(s) to ensure that the question set is the one that has been answered and their answer(s) represent a reasonable size
- make sure that their working is to a sufficient degree of accuracy that does not affect the required accuracy of the answer.
- Students must, when asked, show their working or risk gaining no marks despite correct answers

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