Examiner's Report

Principal Examiner Feedback

Summer 2018

Pearson Edexcel International GCSE

In Mathematics A (4MA0) Paper 4H

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General

Although there were many excellent performances including some with full marks, it is also true that some students displayed a woeful lack of ability at this level. Particularly surprising was the poor response to the geometry questions where, for example, a number of students made weak attempts at finding the volume of a cuboid, or at working out the area of a square. There is also evidence that some were confused by units, so that when asked to give an answer in m^2 they proceeded to square what should have been their final answer. It is clear that a substantial number of students default to use of the Sine Rule or Cosine Rule in even very simple right-angled triangle problems.

On the positive side, it was a pleasure to see students set up and solve equations – this was particularly the case in the probability question and in the question about the intersecting chords theorem.

Question 1

It was both surprising and disappointing to see so many students who either did not realise they had to work out the volume of water or were unable to use the correct formula to do so. It was not uncommon to see students work out 12×8 and use their answer of 96 as if it were a volume. Those that did work out the volume correctly almost always went on to get full marks.

Question 2

In part (a), many students did not understand that they had to do two fraction calculations with significant numbers just working out $\frac{2}{3} \times 120$ or less commonly $\frac{7}{8} \times 120$. Some students did realise that they had to use both fractions but did not understand the multiplicative process required. So either worked out the difference between $\frac{2}{3} \times 120$ and $\frac{7}{8} \times 120$ or between $\frac{2}{3}$ and $\frac{7}{8}$ or the sum of the two fractions and then multiplied by 120. It was nice to see a few students recognising that the most efficient way to find the answer was $\frac{2}{3}\times\frac{7}{8}\times120$

Part (b) was a standard convert to a percentage task which should not have troubled Higher Tier students. There were some, however, who seemed confused on what was required and tried to work out a percentage of, for example, the 42000. Others tried, often unsuccessfully, to work out the difference between 42000 and 31500 as a percentage.

For part (c) the clear majority of students were able to apply the formula given on the formula page and gain full marks for the correct answer of 11000. Some did not understand the instruction 'Give your answer in m^2' and either squared the 11000, or more puzzlingly, square rooted it.

Question 3

There were many students who were unable to gain full marks on part (a) of this question. Common incorrect approaches included:

- Dividing the number of students (50) by the number of rows (7)
- Dividing the total number of flights (135) by the number of rows (7)
- Dividing the total number of flights (135) by the sum of the numbers in the number of flights column (21)
- Calculating the total number of flights to be 147, by using $12 \times 0 = 12$ (sic)

Part (b) was generally well done

Question 4

This was a question about angles with parallel lines and in an equilateral triangle. It was shocking to see some students unable to see that angle GBE, for example, was 60^o. The most common approach which found the correct size of angle GED was to find angle EBC (84^o), then use alternate angles to find angle DEB, following by subtracting 60^0. A more direct approach was to use co-interior angles ABE and BED when the answer was obtained directly from $180^o - 60^o - 60^o - 36^o$. However, it was disappointing to see that many students have no understanding of alternate angles, equating angle BEG to $36°$ or thinking that co-interior angles were equal.

Although a fair proportion of students gained three marks, it was much rarer for them to go on and get the fourth mark by giving suitable reasons or using correct terminology.

Question 5

The theme of this question was ratio, with parts (a) and (b) being standard tasks. Generally, students at this tier were successful in gaining full marks, although in part (b) some divided the 630 by 5 to get 126 followed by doubling to get 252. They had applied the method for part (a) to part (b).

Part (c) was more of a challenge as students had to combine different pieces of information and then process it. The most direct approach is to compare 2×13.50 with 5×18 and then cancel down 27 and 90. Some used 0.5 and 1.25 which led to 6.75 and 22.5 but were then often unable to simplify their ratio. Even less successful were those who worked out $\frac{2}{7}$ of 13.50. Many students ignored the given ratio and just worked out the ratio of the unit costs.

Question 6

This was a standard area of a circle within a quadrilateral question. Many students were able to score full marks. However, it was surprising to see a number of students who could not work out the area of the square. Other students, happily few, worked out the circumference of the circle.

Question 7

Parts (a) and (b) were well answered. Nearly every student could expand the brackets correctly and it was very rare to see a wrong answer to the powers.

Part (c) was a test of whether students could assemble a simple expression. Many could do so; they were able to identify x, $x + 4$ and $3(x + 4)$ and then produce an expression for the sum. An expression of the form $x + x + 4 + 3(x + 4)$ was sufficient for full marks, but many students helpfully went on to simplify this to $5x + 16$. On the rare occasions when they incorrectly simplified their original correct expression, students were not penalised.

It was disappointing to see some very poor algebra. These ranged from the careless $3 \times 3x + 4$ to the very poor $4x$, or even $x4$, instead of the correct $x + 4$

Question 8

Many students were able to calculate the correct missing values. By far the most common error was with $x = -2$ where $y = 1$ was often erroneously found. Plotting of points was generally done accurately and points joined with a smooth curve, although a number of students missed the point (3,-1) and a few lost a mark by using line segments. Many were able to identify the minimum value of *y* on the curve.

Question 9

I was pleasing to see that there were many correct solutions to this trigonometric problem. Many students did not take the most direct route of finding the lengths of *AM* and *AC* followed by tan. Those students tended to use the sine rule or cosine rule available from the formula page to work out the length of *CM*. Some even used the sine rule in the right-angled triangle *AMC*. There were many cases of students losing marks through premature approximation. A common example of this was when students found the length of *AB* as 8.66, then often rounded this to 8.7. This resulted in *AM* being 4.35 and meant that even if they used the succinct tan method their answer was outside the acceptable range. Of course, with more complex methods, the inaccuracies accumulated such that final answers were well outside the acceptable range.

Question 10

Part (a) was generally well done. Many students showed a good understanding of column vectors and were able to get the 2 marks. Others had only a vague idea, confusing vectors with coordinates and in addition not writing their answers in the correct form. Part (b) proved much more of a challenge. Despite this, many students showed that they understood the implications of parallelism and how the addition of column vectors related to translations of points. Of those that did not give a fully correct answer, many were able to find the correct column vector for the vector DC.

Question 11

Part (a) was generally well answered. Most students saw that they had to form an equation of the form $\pi \times 1.2^2 \times h = 10$. A few students who did this then subtracted the $\pi \times 1.2^2$ from 10 rather than dividing into 10. Other students simply worked out $\pi \times 1.2^2 \times 10$.

Part (b) proved to be much more challenging. Many students were either unable to or more commonly did not notice that they had to change units. As such they tended to end up with an answer of approximately 3.53 or 3530 which should have alerted them to there being an error somewhere. Some even then proceeded to write this in standard form. A few successful students changed the 0.15 mm to 0.00015 m and then continued to get the correct answer. It was very rare to see a correct area conversion. When an attempt was made this was often to assume $1000 \text{ mm}^2 = 1$ m.

Question 12

Most students recognised that they had to write the fractions over a common denominator – in this case 6. Most used brackets sensibly and were able to score the first mark. Thereafter things did not go so well as when they attempted to write their answer as a single fraction the numerator was often written as $3x - 9 - 2x + 8$ leading to $x - 1$ rather than $3x - 9 - 2x - 8$ followed by $x - 17$. Some candidates, confusing solving an equation with simplifying an expression, multiplied through by 6.

Question 13

It was pleasing to see students applying $(a + b)^2 = a^2 + 2ab + b^2$ to produce an accurate and succinct simplification of the given expressions. However, more was expected than just this simplification, so answers left as $5n^2 + 5$ did not get the third mark. Students were expected to give a reason why this expression was a multiple of 5. This included factorising to $5(n^2 + 1)$ or stating that 5 was a factor of the first and second terms. Common errors included $2n^2$ from the expansion of the first term and -1 in the second term.

Question 14

Many students were able to show the correct answer to part (a). They had learned and could apply differentiation of sums of positive powers of x. It was pleasing to see many students being able to apply their knowledge of derivates to begin to find the location of the turning points by solving, for example, the equation $3x^2 - 12 = 0$. Some were able to use the diagram as a clue to there being 2 roots but many only gave one, the positive root, $x = 2$, for example. Nevertheless, most students went on to substitute their solution(s) in the original cubic equation to find the corresponding y coordinate(s).

Part (c) proved to be challenging because it combined several ideas. Firstly, students had to understand that the gradient of the curve at $(1, 7)$ is the value of the derivative when $x = 1$. Secondly, they had to know that the gradient of the curve at $(1, 7)$ is equal to the gradient of the tangent to the curve at that point. They could then use that value in, for example, the standard equation $y = mx + c$ to find c by substituting $x = 1$ and $y = 7$

Question 15

Students did not score as many marks on part (a) as they should have. This was mainly due to an incorrect structure for their tree diagram – that is one which did not have the correct binary structure. This point has been made in previous principal examiner reports and does not seem to be understood by many students. Part (b) was generally well answered with most students multiplying together the appropriate probabilities.

Part (c) proved to be quite challenging. Successful students generally used one of two approaches. The more common was to set up an equation for N such as $\frac{6}{9}\times\frac{N+5}{N+9}=\frac{1}{2}$ and then solve this equation – usually algebraically – but sometimes by using trial values. Many students did try this but often had an incorrect expression for the number of black beads in bag Y; a common misconception being $\frac{N+5}{9}$ as the probability of a black ball from bag Y.

Less common, but equally impressive, was to argue that the probability of a black ball from bag B was $\frac{1}{2}\times\frac{9}{6}=\frac{3}{4}$ so for every white ball there were 3 black. From this, it was easy to find there must be 12 black balls and hence 7 were added.

Question16

Students who started with the correct algebraic formula of $v=k\sqrt{E}$ generally gained all 4 marks. They were able to substitute the given information and find the value of k. Using k, they were then able to progress and work out the correct value of v. A substantial number of students used the incorrect formula $v=kE^2$. They were given 0 marks.

Question 17

Many students were able to score at least one mark on part (a). This was usually the '6' placed in the correct position. A common incorrect answer was to place '9' instead of '7' in the correct part of the diagram.

Students were much less successful in answering part (b). There was evidence from some attempts that the students had not appreciated that the numbers in the Venn diagram referred to numbers of elements and not to elements themselves. For example, answers such as $\{0, 2, 3, 4, 7, 8\}$ were seen for part (b)(i). There was little evidence of students using a method – for example by shading the appropriate regions.

Question 18

The intersecting chords theorem did not seem to be well-known. There were many who had an inkling but who used $PB \times AB = PC \times CD$. Successful students were able to apply knowledge of the correct rule with the information that CD was twice the length of AB. This led to a linear equation which was relatively easy to solve. The final steps in calculating the length of PD then followed directly. There were some students who had a partially correct approach, typically writing $6(6+CD) = 7(7 + AB)$ but could never make the connection between the lengths of AB and CD. Some resorted to trial values but these were very rarely successful.

Question 19

Students who understood the relationship between frequency and frequency density or equivalently between area and frequency generally scored at least 2 or 3 marks. Many did, in fact, score 4 or 5 marks in this case as they were able to apply suitable techniques to this multistep question. Some students made their method very difficult to follow if they were working directly with area as often they did not state what their unit of area was. Good students often stated, for example, that $1\ \text{cm}^2$ represents 20 farms or that 1 small square represents 0.8 farms.

A few students worked solely with area of the columns and lost marks because they never attempted to convert to appropriate frequencies.

Question 20

It was pleasing to see some well laid out answers to this demanding question. A successful student was able first to see that the given expression had, sooner or later, to be written in terms of powers of 2 in both numerator and denominator. Although many did realise this, students often were unable to work with the precision that was required. One common error was to replace $\sqrt{8}$ by $2\sqrt{2}$, presumably from the calculator, but then to write $\sqrt{8}^{y+1}$ as $2\left(\sqrt{2}\right)^{y+1}$. There were many students who showed no understanding of powers and rewrote the denominator as 24^{2y+1} or used 96 in the numerator.

Summary

Based on their performance in this paper, students should:

- Learn how to display binary tree diagrams where the structure starts with 2 branches then has 4 branches to follow
- Avoid use of the Sine Rule and Cosine Rule in right-angled triangles
- Learn and apply $(a + b)^2 = a^2 + 2ab + b^2$
- Read a question carefully to see whether a change of units is involved