Examiners' Report
Principal Examiner Feedback

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Pearson Edexcel International GCSE
Mathematics A (4MA1)
Paper 2H

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<u>4MA1 paper 2H January 2021</u>

General Comments

Students who were well prepared for this paper were able to make a good attempt at all questions. Some of the topics were familiar with the usual harder, problem solving questions at the end causing more difficulty. However, it was pleasing to see some good attempts right up to the end of the paper.
Some students were over reliant on the calculator and so for the question on standard form we saw several statements of "Maths Error" where students obviously just wrote down what their calculator said.
Overall, working was shown and easy to follow through. There were instances of students doing more work than needed because they did not realise that for instance in Question 11 it would be easier to simplify terms first, before raising them to a power. Also, in Question 21 there were instances where students just multiplied all the numerators and then all the denominators without factorising and simplifying – this was a lot of unnecessary work and where errors generally were made.
Students need to take greater care when transposing answers from the body of the script to the answer line. For example, it was not uncommon to see the correct answer of $2x^2 + 29x$ in the working space and then $2x^2 + 29$ written on the answer line for question 5a.

Question 1

Most students understood that to work out the average speed you had to divide the distance of 429 km by time. However, many converted the time in hours to 399 minutes, and used this in their calculation, not taking note of the fact that the answer had to be in km per hour so that ×60 was omitted. Others struggled to convert the given time to hours with 6.39 being a common incorrect time used.

Question 2

This gave a good spread of marks, with few failing to score at all. Those who adopted a systematic approach usually found five correct numbers. Trial and improvement was more likely to score one or two marks. Some students felt that they could manipulate 7 to be the median by putting it in the middle of their list, regardless of the order of the numbers. Similarly, the range was sometimes taken to be the difference between the first and last numbers instead of the least and greatest values.
Candidates who did not put their answers in numerical order, often lost the mark for the median and answers such as 5,8,7,8,10 were relatively common.
There were a few instances where an attempt was made to involve the mean.
Several candidates gave six numbers rather than five.

Question 3

In part (a), those that first found the profit of \$55 tended to be more successful although some divided this by 520 rather than 465, only scoring 1 mark. Those who used the method of first doing 520 ÷ 465 (= 1.118) tended to not be able to complete the process to get the correct answer by doing (1.118 – 1) × 100. Many of these students could not then complete the process with 11.1% or 12% being a common incorrect answer. Others wrote 465/520 scoring 0 marks.

Part (b) tended to be better answered than part (a) with the correct answer of \$484 seen in most cases. Those who did not get the correct answer often wrote down 88% but unless they worked with this correctly, no marks could be scored. Some students found 12% of 550 (= \$66) but then added this on to 550 which meant they could only score 1 mark overall.

Question 4

This was answered quite well, especially the lines $x = 1.5$ and $y = x$. If all three lines were correct it was quite likely that the required area would be shaded. Either convention, shading **R** or everything except **R**, was accepted. Though labelling of lines and area was not normally required, it might have helped in some cases to avoid ambiguity.

Question 5

In part (a), most students understood the concept of multiplying each term inside the brackets by the term outside and many candidates gained full marks. The most common error was writing $-9x$ for the last term instead of $+ 9x$ which meant they lost a mark. It was also not uncommon to see the correct answer in the body of the working space with the incorrect answer on the answer line.

In part (b), many students gained full marks for this question. The most successful students were those who first wrote $y^5 \times y^n = y^{19}$. Not many students used the method of writing the linear equation $5 + n - 6 = 13$ to obtain their answer.

The inequality $t < 3$ in part (c) was generally found but the resulting representation on the number line was less well done. Many did not start with an open circle on 3 which meant they could not score. There was a mixture of responses here with some using arrows and others just using a line. Both were acceptable but, if using a line, the line did have to stretch as far as −5. Quite a few responses had the arrow going in wrong direction suggesting no understanding of the inequality sign. Many scored the mark for a correct answer following on from their incorrect inequality in part (i).

Question 6

For part (a) there was a pleasing response with over 80% of students knowing that a value raised to the power zero is equal to 1

For part (b) the occasional sight of "Maths Error" sums up the dismay of students who depend on their calculator for all numerical work. Being forced to handle large indices manually was too much for many students. A common first step was to ignore the powers of 10 and add 9.6 to 6.4, often then dividing by 3.2 to give 5×10^{281} or 5×10^{265}. Cancelling was rarely done successfully as a first step.

Many candidates realized that writing both terms in the numerator with the same power of 10 meant that they could be combined to give a single term, but only a few were able to successfully cancel the numbers and use rules of indices to obtain a correct answer.

A number left their response as $3 \times 10^{125} + 2 \times 10^{124}$.

Question 7

Various methods were used to get the correct answer. The most successful method was for finding the product of the mean and the frequency in each case and subtracting these two answers. Some candidates struggled to find the weight of the sixth pod with many doing 398 ÷ 5 and 401 ÷ 6 which scored no marks.

Question 8
Most students achieved some success with this question with many achieving the correct answer. Pythagoras' theorem was usually applied correctly, with just a few subtracting squares rather than adding them, though the length of AC was occasionally used as the radius, without halving it. The area of the triangle was also found well, but not always by the most obvious method of ½ x base x height. Typical errors were: 8 × 15, 8 × 17 and 8 + 15 + 17.
The mark scheme differentiated very well. All in all, a good fair question and accessible to all at some level.
The requirement to find areas of triangles in questions such as these is quite common. As such, all students need to be conversant with the methods available.

Question 9

Most students realised their answer needed to be in the form $2^a \times 3^b \times 5^c$ and possibly × 11 × 13 as well although a few wrote the sum rather than the product! Some tried to use some form of a diagram but this did not always lead to a correct answer. Others wrote the correct answer but then wrote 12 870 000 on the answer line, although they were not penalised for doing this. In general, the values of a, b and c tend to be correct but many did not include × 11 × 13 in their answer. Several students found the HCF rather than the LCM.

Question 10
A reasonable number of students understood what was required and quickly obtained a correct answer. Some others managed to salvage a mark for 4/5 × 3 and 0.24 × 4 but then failed to divide by 7 after adding these values. There were even a few who obtained a correct fraction, usually in the form 3.36/7 but were unable to simplify it correctly. Many had no viable plan to answer the question. A common attempt was just to add 4/5 and 0.24.
Some worked with 3 and 4 although others used other multiples. The majority were able to work out the overall proportions correctly and add them to get the correct answer.

Question 11

Most students struggled with this question although many were able to score 1 or 2 marks generally when they started with correctly applying the negative power to the bracket either by inverting the fraction or applying the index −2 to each term in the expression. However, it was surprising to see the squaring of the integers to be the process that let many students down when the variables were squared correctly. Many subtracted 2 from the powers in the bracket rather than multiplying by −2. Others scored 1 or 2 marks for getting parts of the answer $4t^4w^2$ correct.

Question 12
This question provided 2 straightforward marks for those who understood the meaning of interquartile range, though the use of 15/4 to find the position of the first quartile was a common mistake. Attempts by those who did not understand the term could best be described as inventive.

Question 13

Part (a)(i) was very well answered with almost all students scoring the mark. Many students gave a correct answer in part (a)(ii), or correctly followed through by subtracting their answer to (a)(i) from 180. By far the most common incorrect response was 124°, perhaps because the angle marked *n* looked similar in size to angle *POS*.
Another common misconception was interpreting *POST* as a cyclic quadrilateral, and giving an answer of 56, without realising that a cyclic quadrilateral must have all vertices touching the circumference.
Part (b) was not answered as well as expected with only ust over 50% gaining the mark. Some incorrect answers showing they incorrectly thought angle *QPO* was the same as angle *QOP*.

Question 14
For part (a) most students were familiar with this sort of equation, usually choosing to start by using a common denominator to subtract terms on the left. Predictably, $-5(3a - 7)$ frequently became $-15a - 35$, but it was still possible to score 2 marks by multiplying both sides by 20. Those who started with this multiplication sometimes failed to treat the left hand side correctly, stating $9a - 7 - 3a - 7 = 20 \times 4.55$. Other common errors were multiplying the numerators correctly but omitting the common denominator altogether and multiplying the numerator by its own denominator. Many scored full marks.
There was seldom a guess at $x = 4$ without working, which was pleasing. Most students now seem to understand the demand to show clear algebraic working.
Part (b) was a standard question but some students lack the algebraic skills to cope with it, failing at the first step. Many did score the first mark but did not clear the fraction successfully, trying instead to split the fraction on the right in various ways, or only doing a partial multiplication such as $3p^2 + c = ac + 8$. Not using brackets when multiplying by the denominator was a common error leading to an incorrect result.
There was further difficulty rearranging the equation so it was only the higher grade student who managed to complete the solution correctly.
A small but significant number were unable to do the first step and rather than squaring the p, square rooted instead.

Question 15

Many students started with the correct method in part (a), summing the frequencies of all five bars. However, a significant number used a frequency of 42 rather than the given 63 for the second bar. Students should be encouraged to write the numbers on the frequency density axis to help them with their calculations and even to include the frequency of each bar on the diagram. Many struggled with this question.
In part (b) it was rare to see a fully correct method. Some were able to score one mark for 64, generally from $(0.75 \times 24) + 30 + 16$, often seen as part of a fraction but very few went on to complete the process to get the correct answer. The few who did realise the need for a product of two probabilities often assumed that the first parcel had been replaced so the two probabilities were the same.

Question 16

Plenty of students were familiar with this topic, often completing the Venn diagram correctly for part (a). Others struggled to reconcile the 4, that was usually placed correctly, with the overlaps between each pair of sets, sometimes entering expressions like $13 - x$ in the second part of the intersection, and sometimes the full values of 10, 13 and 6. The number of students who studied none of the subjects was usually placed correctly outside the three circles.

For part (b) many students gained the first mark for using their Venn diagram correctly, usually going on to find $x = 13$ if their diagram was correct. It was then common to see this as an answer or, more commonly, 26, or sometimes $26 - (2 + 4 + 6)$, but only a minority gave the correct value. The most common incorrect answer was 4, following on from numbers 4, 6, 10, 13, 24 and 11 on the Venn diagram.

Question 17

It was encouraging to see many students attempt part (a) with many scoring a mark for the correct method to find the area of the trapezium. A further method mark was scored by many for adding the correct surface areas of at least 4 faces. The most common error was to not use Pythagoras to find the length of *AB* by using 20 and 4.5 which meant they were unable to correctly find the area of the two rectangular sides. A number of candidates worked out the area of the trapezium but then multiplied by the depth to find volume.

Part (b) was less well done with $\sqrt{24^2 + 37^2}$ being a common incorrect calculation which meant no marks could be scored. Those that recognised they needed to use $(37 - 4.5)$ generally went on to get the correct answer but this was seldom seen. Very few students knew which angle they needed to find and so inevitably scored no marks.

Question 18

The absence of a diagram probably added to the mystery of this question. Sensibly, many students drew their own diagrams, though these did not always help. Vectors were often written down and usually helped to find the value of *b*, but it was the traditional method of looking at the equation of *BC,* after considering perpendicular gradients, that led to a value for *a.*

There were very few completely correct solutions to this, but sometimes candidates were able to gain three marks by calculating gradients and finding the value for b.

Some got the 14 but no gradients. Others got the gradients but failed to correctly apply and get the correct coordinates

For part (b), student diagrams were more helpful in identifying what was needed in this part of the question. Many scored a mark for the length of *AB* and the more confident students were happy to use their value of *a* to score a second mark for a method to find the length of *BC*.

Question 19

It is pleasing to see the improvement in responses on differentiation and it was encouraging to see so many students able to score at least 3 marks. Most students could differentiate *s* correctly with many of these going on to find the correct value(s) for *t*. Unfortunately, many stopped at this point. Many others after successfully finding *v* went on to differentiate again, putting this expression for the acceleration = 0 to try to find *t*. These students were only able to score at most 1 mark. Those who use the formula to solve a quadratic need to be more careful regarding signs.

Question 20

This question was aimed at students at the top of the grade range so it is not surprising that it was not accessible to many. The question was made more difficult by candidates not defining their variables clearly. This caused confusion for themselves as they tried to use the same variable for both length AB and length PQ.

The most common mark was for an expression in one variable for the area of triangle *PQR*. Much more work was needed to find the area of the hexagon and to form an equation using the given value for the shaded area. Details tended to get lost in this working and there was sometimes confusion in relating the side length *PQ* and *AB*. It is worth noticing that a neat solution is possible using the fact that the area of the hexagon is $6 \times 1.5^2 \times$ the area of triangle *PQR*, but this approach was very rarely seen.

Some candidates split the hexagon into 4 triangles and treated them as similar to triangle PQR, ignoring the fact that the angles were not the same. Those who split the hexagon into equilateral triangles were more likely to be successful, as those who used a rectangle, and two isosceles triangles were often unable to calculate the height of the rectangle.

Some tried to use the angle properties of a hexagon.

Question 21

Many students were able to score the first two marks for factorising at least 2 of the quadratics correctly. However, most did not appreciate the need for a common denominator throughout to proceed further. Even though many of those who scored the first two marks for factorising went on to cancel brackets they did not then go on to write $(x - 7)$ as a fraction using the common denominator of $(5x + 2)$.

Those that did not start the whole process by factorising tended to get themselves in a real muddle with complex expressions that invariably went wrong.

Question 22

This demanding question often provided 2 or 3 marks for those who persevered to attempt it, but only a small minority found the final answer correctly. A range of methods were seen to find *AD*, sine rule, cosine rule (most common) and simple trigonometry. All were likely to give a correct length and lead to an accurate perimeter for triangle *OAD*, with better accuracy than usual with the cosine rule calculation. There were also some good attempts to find the length of the arc *BC*. Occasionally candidates slipped up and used $\frac{50}{360}\pi r^2$ rather than $\frac{50}{360}\times 2\pi r$. The expression for arc *BC* was the only mark scored by some students. All or parts of the sides *OB* and *OC* were sometimes omitted when trying to form an equation to find x, but most of those with correct previous working used their results to write down the full equation. It was certainly not trivial to process this equation to obtain an accurate answer, but a few talented individuals did succeed. A common total for the question was 3 marks.

Summary

Based on their performance in this paper, students should:

- Know how to work with time in hours, for example 6 hours 39 mins = 6.65 hours
- Take care with signs when using the formula to solve a quadratic equation
- read the question carefully and review their answer to ensure that the question set is the one that has been answered
- make sure that their working is to a sufficient degree of accuracy that does not affect the required accuracy of the answer.
- Use correct notation when showing the range of values for an inequality on a number line
- Know circle formulae and in particular not get mixed up with the formula for area and the formula for circumference

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