Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2022

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

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Summer 2022 Principal's Examiner Report
International GCSE Mathematics
4MA1 Paper 1H

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

Students were less successful in producing a full treatment for surds (Q16), differentiating functions in context (Q17) and completing the square, particularly for negative quadratics (Q24).

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 19. Here some students either did not realise they had to use the formula for the area of sector, but instead used the formula for arc length, or alternatively multiplied the wrong area by a factor of two.

Finding probabilities in a context, transformations of functions, gaining answers from histograms and manipulation of algebra in later questions, proved to be challenging for many. Reverse percentage in a context, (Q6a) also caused difficulty for less able students.

Generally, problem solving, and questions assessing mathematical reasoning (Q2, Q4, Q7, Q10, and Q13), were tackled well.

Question 1

(a) Most students were able to gain M1 by recognising that the sequence increased by adding 4 each time and hence writing $4n$ as part of their answer. Some students wrote $4n + 3$ or even $n + 4$. Other students did understand that the correct expression was $4n - 3$ but wrote their answer with a variable n on both sides of an equation as in $n = 4n - 3$, losing the accuracy mark in the process. Some students used the formula for the nth term of a sequence and credit was given if their answers were left in an unsimplified form, i.e in the form $1 + (n - 1) \times 4$. Students need to be encouraged to check their rule to see if it works for each term in the sequence.

(b) Many students answered this part of the question poorly. Some used their answer for part (a), not realizing that a different sequence had been offered. Answers left in an unsimplified form, e.g $3(2m) + 5$ gained the 1 mark available.

Question 2

Many students could work out the probability of the spinner landing on 2 or on 4 by calculating 1 – (0.26 + 0.18) then dividing by 2. It was interesting to see students employ different methods to find the final answer. The common approach was to work out 45 ÷ 0.18 to find the total number of spins as 250. Some students who worked out 250 did not know how to work out an estimate for the number of times the spinner will land on 4 and gave up. The more able students multiplied 250 by 0.28 to find the final answer of 70. A common incorrect method was to add 0.26 to 0.18 to find 0.44 and then divide by 2 to find 0.22 for the probability of the spinner landing on either 2 or 4. This lost the first mark, but they could often recover to find 250 later. These then lost the final two marks by multiplying 250 by 0.22. A few wrote their answer incorrectly as a fraction, (70/ 250) and lost the final accuracy mark.

Question 3

Both parts were well answered, although some students got the concepts of LCMs and HCFs mixed up.

(a) Most students who found the HCF, 28, in part (a) used either a factor tree or repeated division but a minority either used lists of factors or showed no working at all. Venn diagrams were occasionally used, usually successfully, in both parts (a) and (b). 7 and 14 were common wrong answers. Some students could not extract the HCF, even after finding all the factors. An answer of $2^2 \times 7$ was accepted for full marks.

(b) A range of approaches were also used to find the LCM. Expressing 60 and 72 as lists of multiples was the usual method but LCM = $\frac{60 \times 72}{HCF}$ was also seen occasionally. Several incorrect products were stated as a final answer including $2 \times 3^3 \times 5^2$, $2 \times 3^2 \times 5^2$, $2 \times 3^3 \times 5^3$ and $3^2 \times 5^2$. Again, a correct product ($2^3 \times 3^2 \times 5$) was accepted for full marks.

Question 4

For some students this was a challenging question early in the paper but was generally well answered. Most students set up the equation $7x + 3x + 8x = 360$ and solved for x to find 20°. After working out 20° they then showed a complete method by dividing 360° by the exterior angle (40°). Some students worked out the value of x and proceeded to divide 360° by 140° confusing interior and exterior angles. Some students used the sum of the interior angles formula incorrectly by writing $\frac{(x-2) \times 180}{x}$ thus finding the incorrect answer. A minority of students assumed that angles around a point add up to 180°.

Question 5

(a) Generally, this part was answered well, however, a common error was −10 or +10 rather than −24 in their final answer. Other students also had difficulty in simplifying $-6n + 4n$ 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 $n = 6$ or $n = -4$, this was not penalized provided the correct simplified expansion was seen beforehand.

(b) Many students gained all 3 marks for this question, demonstrating an excellent understanding of, and ability to manipulate the algebra in this linear equation. Students often cleared the fraction by multiplying the LHS by 4. A failure to use brackets when multiplying both sides by 4 led to the loss of the first mark. Mistakes also crept in when some students attempted to gather their x or number terms; adding instead of subtracting or vice versa. Students who multiplied the LHS incorrectly were still given credit for gathering their x and number terms correctly using <u>their</u> 4-term equation.

Students who used the alternative method given in the mark scheme and separated the right side of the equation into two fractions, were generally unable to do so correctly. It was common for students to divide only one term by 4, resulting in $0.75x - 5$. However, if they isolated their x and number terms correctly, subsequently they could still gain the second M mark.

Question 6

(a) Many students were successful in this question where they understood that the given value had already been increased by 4%. The incorrect method of finding 4% of 634 400 and then subtracting or adding was seen. Careful reading of the question would help students realise that the 4% is a percentage of the original price and not 4% of the given price. Many students worked out 610 000 but did not answer the question regarding the service charge band, thus losing the accuracy mark.

(b) This part of the question was answered well. Many students realised that they needed to subtract 15% from 100% to find 85%. A correct method was used to find 0.7225 or 72.25 by multiplying 0.85 by 0.85. Some students lost marks as they did not realise, they had to subtract from 1 or 100% to find the final answer. Some students found 0.2775 and then did not give their final answer as a percentage. Some students nominated and used an initial amount of their choice to find the percentage depreciation.

Question 7

This question often gained full marks. Many students substituted into the given formula correctly, $1.4 = \frac{72}{(area)}$ and a majority rearranged correctly for the area obtaining $\frac{72}{1.4}$ or 51.4. A minority of students rearranged incorrectly, 72 × 1.4, thus losing the final 3 marks of the question. Once 51.4 was found the students multiplied this by 18 to find the correct answer. Some students, having worked out 51.4, proceeded to equate this to πr^2 and unnecessarily worked out the radius. Their final step was to substitute this radius value into the formula for the volume of a cylinder to obtain the correct answer. Premature 'rounding', however, did lead to some students losing the final mark.

Question 8

Parts (a) and (b) were answered well.

Question 9

Parts (a) and (b) were answered well.

(c) The majority of students either scored full marks for the correct answer, $8k^6m^{12}$, or gained one mark out of two for getting two out of the three components correct by offering $8k^6$ or $8m^{12}$ or k^6m^{12} as part of their answer.

Question 10

This was a challenging question. Many students did not realise that they had to find the length of a line segment using $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Generally, students who had worked out ±8 and ±15 went on to successfully find the distance between the two centres of the circles, using Pythagoras. Those students who attempted to solve this by scale drawing were usually unsuccessful.

Once the students had worked out 17 as their answer to part (a), they often realised that this was less than the sum of the radii (19) and hence the circles must overlap.

Question 11

(a) Those students who recognised that this question involved a difference of two squares usually gained full marks. Students gained one mark for writing $(3x \pm 2y)(3x \pm 2y)$ or $(3x)^2 - (2y)^2$. It was disappointing to see answers such as, $(9x - 4y)(x + y)$ or $x(9x) - y(4y)$ for example.

(b) Many students found this part of the question difficult. Most understood a common denominator was required and attempted to find one. This usually resulted in a denominator of 32*x.* Overall, few made complete progress with this question, often leaving their final answer as $\frac{20x-24}{32x}$. There was clear evidence of incorrect cancelling throughout. A failure to deal with the

negative sign was a common occurrence. Some students incorrectly wrote their solution by giving the final answer as $\frac{5x-6}{8}$ omitting the *x* in the denominator.
It was disappointing to see candidates failing to score at all because they attempted to expand the brackets in the numerator **and** to work with a common denominator, all in a single step.

Question 12
(a) The majority of students were able to correctly complete the probabilities on the tree diagram. Some gave fractions rather than probabilities. A student could lose one mark by labelling the branch which had probabilities 0.3 and 0.7 as 0.6 and 0.4.
(b) This part was usually done well, sometimes taking advantage of the follow through from the tree diagram for full marks. Just a few students added probabilities, producing a probability value greater than one.

Question 13
Whilst many correct answers were seen, some students were unable to successfully navigate their way through this problem. It was not uncommon, for example, to see students add $\frac{3}{8}$ with 45% to obtain either $\frac{33}{40}$ or 82.5 or 0.825 and then not realising they had to subtract from 1 or 100%. Students who obtained $\frac{7}{40}$ then correctly went on to find $2320 (the total cost of the holiday). Some students gave their final answer as 2320 thus losing the final two marks. A common incorrect approach was to write down $\frac{3}{8}$ + 45(%) + 406 = total cost and then try to manipulate their working to find the answer. Students are encouraged to read the question carefully and show their working.

Question 14
(a) This part of the question was answered well. Credit was given for leaving their answer as $\frac{20}{4}$ but students should give their answer as a single number.
(b) Those who knew how to find the inverse of a function sometimes found the algebraic techniques required too challenging, particularly, collecting like terms in order to factorise. Such students usually scored one mark for getting as far as, for example, $y(x-6)=2x$ or $x(y-6)=2y$. Full marks required an ability to rearrange equations. The latter was beyond some students, often because they did not grasp the principal of using factorisation to isolate the intended subject of the formula.

Question 15

It was encouraging to see many students accessing this question for one or two marks at least. Many students worked out *DDD* or *WLL* in any order. The more able students worked out that *WLL* could be a combination in 3 different ways and then went on to find the correct answer. Some students simply worked out the probabilities for *DDD* and *WLL* then added these probabilities together to find 0.137. Another common incorrect approach was to find 3 × *DDD* and 3 × *WLL* and then add up these probabilities to reach 0.411.

Question 16

This was a challenging question for many students. It is well known that modern calculators can manipulate surds and produce results automatically. Therefore, steps had to be shown to get the LHS to be in the form of the RHS. Many students had difficulty in rationalising the denominator of $\frac{12}{\sqrt{2}+1}$ by not multiplying the numerator and denominator by $\frac{\sqrt{2}+1}{\sqrt{2}+1}$. The correct expression was directly possible from the calculator, so it was surprising how many gave an incorrect answer. Students had also to show that $(\sqrt{2})^5$ was equal to $4\sqrt{2}$ or $2\sqrt{8}$ or $\sqrt{32}$, for the first method mark. Students who rationalised the denominator to find $12\sqrt{2}+12$ and then simplified their expression to $8\sqrt{2}+12$ or $12\sqrt{2}-\sqrt{32}$ had difficulty reaching the same surd form as the RHS

Question 17

Students who understood that the question required $s = 4t^2 + \frac{125}{t}$ to be differentiated usually managed to successfully obtain $8t$ but many found dealing with $\frac{125}{t}$ a step too far. Many students did not understand that $\frac{125}{t}$ had to be written as $125t^{-1}$ and then differentiated. A common incorrect expression written for $\frac{125}{t}$ was $125t$ and that was differentiated giving an incorrect formula of $v = 8t + 125$.

Students who obtained $v = 8t - 125t^{-1}$ and then equated this to zero did not have the algebraic skills required to rearrange the equation to reach $t = 2.5$

There were some excellent responses from more able students showing a clear method to reach an answer of 75.

Question 18

Many students recognised that the first part of the question was the application of the cosine rule. As such, most made a successful start to the problem. Many students substituted the correct values into the cosine rule to give a value of 18.6 for *AC*. More able students identified the need to then use the sine rule and they applied it accurately to reach the final answer of 28.2°. Other methods were equally prevalent including a second application of the cosine rule. It was pleasing to see many students writing their methods clearly.

The students are reminded that the formula for the cosine rule and the sine rule is given on the formula sheet as some students quoted the cosine rule and/or the sine rule incorrectly.

Question 19

This question had a very mixed response and was a good differentiator at the top end of the grades. Students could recall the formula for the area of a sector and the area of a circle. Some students correctly found the area of the sector as $\pi \times (r+7)^2 \times \frac{45}{360}$ and the area of the circle as $\pi \times (r-2)^2$ then set up a correct equation. However, weak algebraic manipulations of the equation lead to an incorrect quadratic equation. At this stage the students gained two marks. It was encouraging to see students using the quadratic formula to work out the value of the radius thus gaining a mark. Some students worked out the correct values of *r* and then incorrectly wrote down the value of *r* as 0.2.

Some less able students equated their equations to zero and tried to solve the quadratic giving answers of 2 and –7 or used the formula for the arc length to try to set up an equation.

Overall, the more able students progressed through the question and gained full marks. However, even many able students did not spot that their algebra could be simplified considerably by cancelling terms at an early stage. Hence π was present until the very final stages in many cases. A trial and improvement approach was not an acceptable method.

Question 20

In part (i) those students who realised the transformation represented a translation of $\binom{2}{0}$ gave the correct coordinates. Many students left this question blank failing to understand the topic of transformations when applied to functions.

In part (ii) many students did not identify that the transformation was a stretch in the *y* direction. Only the more able students gained this mark. Again, there were many blank responses.

Question 21

Many correct answers were seen from those students who appreciated that the area of each bar is proportional to frequencies in histograms. Most students made some attempt at answering the question and sometimes produced a mass of figures, but it was not always clear as to what the figures represented; it is incumbent on the student to ensure that they make their method of solution clear. Usually ,the most efficient method was to correctly calculate the frequency density values and put these on the vertical axis. Students who did this inevitably reached the correct answer, although there was still some misinterpretation of the range required in the question.

Several students used the vertical scale as a frequency scale thereby ignoring the column width, this often led to incorrect answers being seen, and hence students were unable to earn any credit.

Question 22

The formula for the curved surface area of a cone is given on the formula sheet. Many students used this to set up the equation $580\pi = \pi \times 20 \times l$ and found the value of l (slant height) as 29 gaining the first two marks. A common error at this stage was to write the equation as $580 = \pi \times 20 \times l$ and then finding an incorrect value of l (= 9.23). Unfortunately, this led to all consequent marks being lost as the student's slant height was less than the radius of the cone. Students who found the correct slant height (l) progressed to find the height of the cone by using Pythagoras theorem. For the fourth method mark a complete method was required to work out the volume of the solid which was achieved successfully by more able students. The most common slip was to miss out the π in $\frac{16\,000}{3}\pi$ or in 2800π leading to an incorrect answer. Some students gave their answer as a truncated decimal, 8133.3, losing the final accuracy mark as the requirement was for an exact answer.

Question 23

There were two approaches to this question: using exterior angles or using interior angles.

Students using the interior angle approach identified the common difference as being –2 and the first term as 177 and then correctly substituted into the formula for the sum of an arithmetic series finding $\frac{n}{2}[2(177)+(n-1)(-2)]$. The weaker students equated this to 360° and then tried to formulate a quadratic equation. The more able students obtained the correct equation by equating the sum to $(n-2)\times 180$ and then setting up a correct quadratic equation. Some students factorised incorrectly and obtained $(n+18)(n-20)$ before writing an incorrect answer of 20.

Other students noticed a neater method by considering the exterior angles and then making their formula for the sum of exterior angles equal to 360°

Many students were let down by their knowledge of algebraic manipulation. Again, the more able students showed a clear method(s) leading to a correct answer of 18.

A trial and improvement approach was not an acceptable method.

Question 24

This question was not well attempted. Most students could not factorise by taking out $-q$ at the beginning before completing the square and the manipulation of algebra was also difficult for many. Some students who initially factorised correctly lost marks later due to missing brackets when attempting to complete the square. Other examples of incorrect factorization were $-q(x^2 - 12x) + q$... and to a lesser extent $q(x - 6x)^2$... these being quite common. Generally, this part of the paper was left unattempted by many.

Only a minority of students gained full marks here.

Summary

Based on their performance in this paper, students should:

- be able use formula given on formula sheet correctly
- 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 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

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