Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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In Mathematics A (4MA1) Paper 1H

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IGCSE Mathematics 4MA1 1H Principal Examiners 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 in producing a full treatment for surds (Q17), differentiating functions (Q18) and completing the square, particularly for negative quadratics (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 20. Here some students either did not realise they had to use the formula for the <u>area</u> of sector, but instead used the formula for arc length.

Finding probabilities in a context (Q16), transformations of functions (Q21), gaining answers from histograms (Q22), and manipulation of algebra in later questions (Q23), proved to be challenging for many. Reverse percentage in a context (Q4), also caused difficulty for less able students.

Generally, problem solving, and questions assessing mathematical reasoning (Q2, Q5, and Q7) were tackled well.

Comments on individual questions

Question 1

(a) Most students were able to gain at least M1 by recognising that the sequence increased by adding 3 each time and hence writing $3n$ as part of their answer. Some students wrote $\pm 2n + 3$ or even $n - 2$. Other students did understand that the correct expression was $3n - 2$ but wrote their answer with a variable n on both sides of an equation as in $n = 3n - 2$, 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 $1 + (n - 1) \times 3$. 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 well by writing down 77 as the correct answer.

Question 2

Many students made a correct start on this probability problem by adding the probabilities of walking and travelling by bicycle. If they went on, which a good number did, to subtract this from 1 to find the probability of travelling by bus and car, they gained the first method mark. For the next mark, this value then needed to be divided by 3, as the probability of travelling by car was twice that of travelling by bus. However, a majority divided by 2 and were unable to progress correctly beyond this. Others did not divide at all and their working either stopped or became increasingly muddled. Those who did divide by 3 and correctly allocated the two probabilities, were generally able to work to produce the correct answer. Some students multiplied 0.18 by 450 giving 81 as an answer and were credited with 3 marks. A few wrote their answer incorrectly as a fraction, $\frac{162}{450}$, and lost the final accuracy mark.

Question 3

Most students who found the HCF, 36, 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. 12 and 24 were common wrong answers. Some students could not extract the HCF, even after finding all the factors. An answer of $2^2 \times 3^2$ was accepted for full marks.

Some students used their calculators to find the answer of 36 directly with no working. The presumption here was they had a calculator with the FACT facility to deliver the prime factors of 72 and 108 and hence gaining a clear advantage. The use of a calculator is not acceptable as the question clearly states, 'Show your working clearly'.

Question 4

Students answered this question in two different ways – those who used the correct method of division by 1.15 or those who used the incorrect method of multiplication by 1.15. Careful reading of the question would help students realise that the 15% is a percentage increase of the original number of kilometres that Ava drove (in March) and not 15% decrease of the given number of kilometres driven by Ava (in April). Many students made the familiar mistake of simply finding 15% of 943 and adding it, or multiplying 943 by 1.15 or 0.85

Question 5

There were about four methods to solve this problem. The two common methods were to find the interior angle or the exterior angle of the pentagon. Many students worked the interior angle of the polygon by dividing 540° by 5 or worked out the exterior angle by dividing 360° by 5 giving answers of 108° and 72° respectively. Many students could work out the value of 84° easily thus gaining a mark. The more able students used the idea that angles around a point add up to 360° to find the final answer of 156°. Students who labelled their diagram incorrectly ~~(~~e.g. decided that the interior angle *AED* was 72° lost all their marks.

Question 6

(a) Generally, this part was answered well, however, a common error was failing to simplify $-8m$ and $+5m$ 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 $m = 8$ or $n = -5$, this was not penalised 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 3. A failure to use brackets when multiplying both sides by 3 led to the loss of the first mark. Mistakes also crept in when some students attempted to gather their n 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 their 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 3, resulting in $5n + 2$. However, if they isolated their n and number terms correctly, subsequently they could still gain the second M mark.

Question 7

(a) Both parts were well answered.

(b) Students correctly explaining why *A* intersection *B* is a null set produced many correct responses. Most responses centred around the two sets having no members in common and others stating that all the numbers in set *C* are multiples of 3 and all the numbers in set *B* are prime. Beyond this, there were many muddled, ambiguous and wrong statements and numerous blanks whilst some did not recognise the empty set symbol. To gain the mark the "Yes" box had to be indicated.

(c) It was seen that some students found the set notation hard to understand to gain the correct answer for set *D*. Credit was given for three correct values with no more than one incorrect **or** for four correct values with no more than one incorrect.

Question 8

This question often gained full marks. Many students substituted into the formula correctly, 1575 = (area) × 21 or $1575 = \pi \times r^2 \times 21$ and a majority rearranged correctly for the area obtaining 75 or for correctly rearranging for r or r^2. Once 75 was found the students used the given formula correctly to find the correct answer. Some students, having worked out 4.88… for the radius, proceeded to use πr^2 to find the area of the circle unnecessarily. A common error was to find the curved surface area of the cylinder or the total surface area of the cylinder and then use these values to find the pressure of the cylinder. Premature 'rounding', however, did lead to some students losing the final mark.

Question 9

(a) Many students wrote down the correct answer of 35 000 000

(b) Most students added 6 780 000 to 8.2×10^5 giving an answer of 7 600 000 thus gaining the first mark. Generally, students went on to give an answer in standard form. A common error was to subtract 6 780 000 from 8.2×10^5

Question 10

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

(c) The majority of students either scored full marks for the correct answer, $125a^{12}c^6$, or gained one mark out of two for getting two out of the three components correct by offering $125a^{12}$, or $125c^6$, or $a^{12}c^6$, as part of their answer.

Question 11

This question was answered very well with the overwhelming majority of students using Pythagoras to work out the length of *CM*. Many went on to gain full marks. Of those who lost marks, some added 9^2 to 6^2 which scored zero marks. Many students worked out the length of *CM* to be 6.7..and correctly rounded to 7. A small minority of students did not round their value and added 6.7 to the other lengths obtaining 36.7.. and then multiplying by 21.5 to find the total cost of the wood thus scoring 3 marks.

Some students worked out the area of the triangle. Some students worked out angle *CAM* and proceeded to work out CM using trigonometry.

Question 12

(a) This part of the question was generally answered well. Some students wrote down answers in the form $(2y \pm 1)(3y \pm 4)$ thus only gaining the first mark.

(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 $12x$ or $12x^2$. Overall, few made complete progress with this question, often leaving their final answer as $\frac{31x - 14x^2}{12x^2}$. There was clear evidence of incorrect cancelling throughout. Some students were quite careless in writing out their solution by giving the final answer as $\frac{31 - 14x}{12}$ 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 13

(a) The majority of students were able to correctly complete the probabilities on the tree diagram. Some gave decimals rather than fractions but rarely to the required accuracy. A substantial minority gave integer values to the branches rather than fractions. Some students lost marks by not labelling the second set of branches on the tree diagram correctly.

(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 14

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 0.45 to 1 and then not add 1 to 1.45 to obtain 2.45. Many students gained the first mark by writing down $B = 1.5C$ oe or $B = 1.45A$ oe.

Some students set up an equation, $A + 1.45A = 15\,435$, to find the value of A. Once the student had worked out 6300 (for Abel's savings) then they could easily work out 9135 (for Bahira's savings) gaining the first 3 marks. A common error at this stage was to multiply 9135 by 1.5 rather than divide by 1.5 to obtain the correct answer of 6090 (for Chanda's savings).

Question 15

(a) This part of the question was answered well. Many students writing the correct answer of 2

(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, $y(x-2) = 3x+1$ or $x(y-2) = 3y+1$. Full marks required an ability to rearrange equations. The latter was beyond many students, often because they did not grasp the principal of using factorisation to isolate the intended subject of the formula.

Question 16

It was encouraging to see many students accessing this question for one or two marks at least. Many students worked out *RRY* or *YYR* in any order. The more able students worked out that *RRY* and *YYR* 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 *RRR* and *YYY* then added these probabilities together, and subtracted this answer from 1. Another common incorrect approach was to find 3 × *RRR* and 3 × *YYY* and then add up these probabilities.

No credit was given for writing their probabilities as $\frac{15}{20}\times\frac{14}{20}\times\frac{5}{20}$ or $\frac{5}{20}\times\frac{4}{20}\times\frac{15}{20}$ i.e. taking sweets with replacement

Question 17

Many students knew the correct process; to rationalise the denominator, and sensibly showed how to do this, and then showed an unsimplified answer of $\frac{8+4\sqrt{5}}{4}$. However, many students left their answer as this, or did some incorrect cancelling, - failing to appreciate there was one more step to do to get an answer of the required form of $a+\sqrt{b}$.

Errors seen from students in this question included using an incorrect multiplier to rationalise the denominator ~~(~~typically using $3-\sqrt{5}$ or simply entering the given fraction as a calculation into their calculator and copying the screen display - this approach scored no marks as working was requested.

Question 18

Students who appreciated that this question required calculus usually gained at least 2 marks by differentiating $y=x^3-40x+1$ correctly. Many students correctly equated their $\frac{dy}{dx}$ to 8 to gain the first 3 marks. Some students set $\frac{dy}{dx}$ equal to 0 and therefore could not gain this third method mark. Some students worked out only the positive value of *x* and ignoring the negative value of *x*. Some students did not realise when they square root, it should lead them to two values of *x* as the question asked for two points on the curve.

Question 19

Many students recognised that the first part of the question was the application of the sine rule. As such, most made a successful start to the problem. Many students substituted the correct values into the sine rule to give a value of 17.6 for *BD*. More able students identified the need to then use the cosine rule and they applied it accurately to reach the final answer of 75.6°. 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 20

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 correct expression for the area of the segment $\frac{60}{360} \times \pi r^2 - \frac{1}{2} r^2 \sin 60$ thus gaining the first mark and then correctly equated this expression to 38. However, weak algebraic manipulations of the equation lead to an incorrect equation for r or r^2.

Overall, the more able students progressed through the question and gained full marks. A trial and improvement approach was not an acceptable method.

Question 21

This question was answered well by the more able students, however, (12, – 4) was often seen in part (a).

Question 22

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, or on top of the appropriate bars. Students who did this inevitably reached the correct answer.

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.

A common error was to draw the bar between 0 and 15 (kilometres) with a height of 2.7 rather than between 5 and 15 kilometres.

Question 23

The formulae for the volume of a cone and the volume of a sphere are given on the formula sheet. Many students wrote down $\frac{1}{3}\pi \times (5x)^2 \times 6x$ or $\frac{1}{2} \times \frac{4}{3} \times \pi \times (2x)^3$ to gain the first mark. However, students are encouraged to use brackets when substituting into a formula. If the student had not placed brackets around the $5x$ they generally lost the next 4 marks of the question. Numerous candidates gained the first mark but did not complete the question successfully.

The second mark was gained when the correct equation was set up for the volume of the shape by equating their expression with 6948π. Some students forgot to include the π with 6948, however, a special case was considered for this mishap. Working was made considerably easier if students cancelled π from their correct equation at an earlier stage.

Weak algebraic manipulation was the main cause of not finding the correct value of x. There was a reasonably large quantity of blank scripts suggesting that students either found this question too difficult to attempt or that they had run out of time to answer.

Question 24

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

Students using the interior angle approach correctly substituted the values of *a* and *d* into the formula for the sum of an arithmetic series finding $\frac{n}{2}\left[2(84)+(n-1)(4)\right]$. 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 $(n + 45)(n - 4)$ before writing an incorrect answer of 4.

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 weak algebraic manipulation. Again, the more able students showed a clear method(s) leading to a correct answer of 7740.

A trial and improvement approach was not an acceptable method.

Question 25

This question was poorly attempted. Most students could not factorise by taking out –3 at the beginning before completing the square and the manipulation of algebra was also very poor. Some students who initially factorised correctly lost marks later due to missing brackets when attempting to complete the square. Other examples of incorrect factorisation were $-3(x^2 + 12x) + 17$… and to a lesser extent $3(x - 6x)^2$…. 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 to a problem
- be able to read graph scales accurately
- assign angles correctly to diagrams
- 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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