Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

January 2020

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

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4MA1 2H January 2020 Principal Examiner's report

Introduction

This paper gave students, who were well prepared, ample opportunity to demonstrate positive achievement. Some challenging questions towards the end discriminated well and stretched the most able students.

Some students still need to heed the wording 'showing all your working' as on questions where this is requested no marks are awarded for merely seeing a correct answer.

For multi-stage questions, students should be reminded not to prematurely round their work as they can lose out on final accuracy marks.

Reading a question carefully and answering what is requested rather than what the student thinks is still something that needs work in many cases.

Question 1

(a) this part was done very well and most students gained the mark.
(b) The majority of students gained full marks on this question or if not then M1 for 7^{12}.
The main mistake was to divide 12 by 3 leading to an answer of 7^4, students must make their numbers clear as at times it was difficult to distinguish 9 from 4 in their final answer.
A few students gave their first step as 49^{12}, which although often leading to the correct answer, gained no marks because it showed a double mistake and a lack of understanding of indices.

Question 2

This question was the most poorly answered in the early part of the paper. The majority of responses used the relationship 100 cm =1 m to give the incorrect answer of 3240. Only a minority of answers recognised that the question was on units of volume rather than length. These students recognised that there are 100^3 cm^3 in 1m^3 and multiplied accordingly. Those who did nearly always arrived at the correct answer. A number of responses found the cube root of 32.4 then multiplied by 100, and then cubed the answer. This method although correct risks losing accuracy.

Question 3

Most students now know what is expected of them in a 'show that' question and it was pleasing to see many answers gaining full marks, clearly understanding the need to show either $\frac{127}{15} = 8\frac{7}{15}$ as their final stage or that $8\frac{7}{15} = \frac{127}{15}$ as the first stage of working.

Students who lost marks generally went straight from $\frac{14}{3} + \frac{19}{5}$ to $\frac{127}{15}$ failing to show $\frac{70}{15} + \frac{57}{15}$

Students who separated the whole numbers and fractions and dealt with them in two parts often did not have sufficient method for a 'show that' question, going straight from $\frac{10}{15}+\frac{12}{15}$ to $7\frac{22}{15}$, failing to show $\frac{22}{15}=1\frac{7}{15}$ and that 4 + 3 = 7.

Very few students did not know that a common denominator was needed, but those who scored no marks generally made an error with writing the fractions as improper fractions with $\frac{8}{3}$ seen instead of $\frac{14}{3}$.

Question 4

This was a well answered question where the majority of students scored full marks. Generally, they set up the original equation well and followed the steps through to reach the correct answer. There were some attempts to multiply ($4x + 10$) and ($x + 20$) and others ignored the third angle of 30 or failed to add $4x + x$ correctly.

Question 5

The majority of responses were able to draw the correct angle bisector with appropriate use of a compass, leaving construction arcs visible. The most common problem was not realising that arcs should be drawn from points equidistant from the base point *A*. A number of arcs were drawn with centres *B* and *C* which were not equidistant from *A*. The most common response that scored no marks involved drawing some arcs centre *A* but with no clear purpose. Some students appeared not to use a compass, and attempted to draw freehand arcs.

Question 6

This question was answered reasonably well with many candidates reaching the correct answer of 27. Most candidates arrived at 0.15 for the probability of picking a red, but many then didn't know how to finish the problem. A significant number of candidates were not sure how to deal with the ratio and divided 0.45 by 2 (or 4) thus gaining no further credit. There were very few students who used an algebraic approach to solve the problem.

Question 7

(a) Many correct responses were seen with the correct answer written as an inequality at the final stage. Those responses that did not work with inequalities often ended in the response $x = -1.5$, which scored the method mark only. A number of responses incorrectly concluded that $4 - 7$ was 3. A number of students appeared to conclude that as the solution was a negative number that they needed to reverse the inequality turning the correct solution of $x > -1.5$ into the incorrect $x < -1.5$.

(b)Those students who factorised generally gained full marks, although a few had correct factorisation but gave an answer of -8, 5 thus losing the final mark, with some writing the + and – in incorrect brackets for 1 mark.

There were a few who had the correct answer from factors with the incorrect sign, sometimes with the answers shown first which suggests answers have been obtained from calculators with candidates attempting to produce factors to fit the answers.
Those who used the formula did not fare as well, with many not able to deal with the negative 3, they often got M1 for substituting in the formula as one error was allowed as well as missing brackets round the -3 but then arrived at the incorrect answers gaining only one mark.
Although a number of students, despite having the incorrect substitution, were able to gain full marks by clearly understanding how to use their calculators.
In this question the answer alone gained no marks, if using their calculator students must remember to show the substitution into the quadratic formula.

Question 8

(a) The majority of students achieved full marks on this question. They showed a clear understanding of percentage change and found the correct values. Some mistakes were made by dividing $\frac{500}{45}$ and $\frac{545}{47}$ or by using the wrong denominator for percentage change, $\frac{45}{545}\times100$ and $\frac{47}{592}\times100$. A few students simply compared the difference in price, concluding that 47 was the greater increase.
(b) This was less well answered with many unable to understand that they needed to divide 952 by 85% rather than find 15% of 952. Those who managed the first step often went on to score full marks but a significant proportion found 1120 then failed to subtract 952 to find the discount.

Question 9

The majority of responses correctly identified that mass = density × volume and arrived at the correct answer. A much smaller number of responses used the incorrect relationship most often dividing volume by density.

Question 10

This question was answered a lot better than similar questions in previous seasons, with many candidates gaining full marks for the answer of 180. The vast majority of candidates gained at least 1 mark for either dividing by 1000 or multiplying by 60.

Question 11

This question was answered very well with the overwhelming majority of candidates using Pythagoras to calculate the diameter of the circle. Many went on to gain full marks. Of those who lost marks, many used the area of the semicircle or included AC in the perimeter, some neglected to divide the circumference by 2 or mistakenly used the value of 8 as the radius of the circle.

Question 12

There were many varied methods to solve this question, many of which are given on the mark scheme.
Most students gained one mark for converting at least one of the currencies, however after that they just subtracted values to compare, gaining no further marks.
Few students wrote what they were calculating (eg cost per litre) and just wrote the calculations.
A significant number gained the correct values to compare but they then chose the wrong oil company, this was particular true if litres/Dollar or litres/Krone were found as students failed to realise that the largest answer was the better value.
Those student who compared amounts using a multiplier of 43/21 or 21/43 generally arrived at the correct answer with correct figures.
The weakest students either copied the figures in the question out or converted them to standard form but didn't do any calculations with them.

Question 13

The majority of students were awarded the first method mark for identifying either angle CAD = 28^{o} or angle ACD = 90^{o}, possibly just marked on the diagram. Many managed a second mark for angle BDC = 30^{o} though a common mistake was to assume that angle CAD = 32^{o} or angle ACB = 28^{o}. Incorrect labels for angles were sometimes seen. A clear reason for each step of working, using the technical vocabulary required, was rarely seen. Some managed one appropriate circle theorem to gain a third mark, usually by stating 'angles in the same segment are equal' or 'angle in a semicircle is 90^{o}'. 'Angles subtended by the same arc' was often given as a reason, failing to specify 'at the circumference'.

Question 14

Many fully correct responses were seen to this two part question. Correct answers were nearly always seen for the first branch of the probability tree in part (a), although some responses were simply the numbers of large and small glasses, not the probability of picking them. Correct probabilities for the second set chosen were not always given. Some responses assumed the same pair could be picked regardless of the first pick, while a significant number of students seemed to think that only 18 pairs were available for the second pick. Those candidates who had a fully correct tree in part (a) nearly always calculated the probability of two pairs of small glasses being picked correctly in part (b). Those who had the wrong probability for the second branch usually scored the method mark available following through from part (a). Some students incorrectly added rather than multiplied probabilities. A small number of responses worked with decimals rather than fractions – and usually worked with sufficiently accurate probabilities to score the available marks.

Question 15

Very few candidates gained full marks on this question and there seemed to be no pattern in the answers offered, leading to the conclusion that most candidates were simply guessing! A popular incorrect answer was A, B, E with candidates not recognising the square in the denominator.

Question 16

This question was answered reasonably well with most candidates gaining at least 1 mark for squaring the expression. Some candidates attempted to remove the fraction but failed to use brackets correctly, but many did remove the fraction correctly, thus gaining a second mark, but then appeared to lose their way not realising that they had to isolate the x terms. A surprising number of candidates, however, went on to gain the correct answer, suggesting that this predictable technique has been well drilled.

Question 17

Many students failed to realise an algebraic proof was need here and just substituted values in an attempt at a proof.
If an attempt at an algebraic proof was made students often got full marks, although a number lost the final mark by failing to state that $2n + 1$ or equivalent is an odd number.
The mistakes were generally made when students tried to take the larger number from the smaller ie $n^2 - (n + 1)^2$ not realising that their answer was $-2n - 1$. In this question incorrect algebra was penalised.

Question 18

(a) Most students attempted this question although they often failed to demonstrate any understanding of histograms, sometimes just totalling bar heights. Those who associated areas with frequency generally made progress, though mistakes were common, especially reading scales. The boundary between the third and the fourth bar was often taken to be 25 instead of 24. A mark was frequently awarded for 46, the number of customers who spent between 17 minutes and 35 minutes in the supermarket, but many failed to realise that they also needed the total number of customers in order to form a proportion.
(b) Students were more successful with this part of the question. The most common method was to work out areas and simplify the fraction. A minority lost the final mark by leaving decimals in the numerator or by rounding 43.2 to 43. The most frequently seen error was to divide by the whole total of 120 rather than the total frequency of 72 for the given condition. Very few realised that they could simply work with the time intervals $\frac{45-36}{45-30}$ because only a single bar was involved.

Question 19

In part (a) an answer was required using the same gradient, with a different value than 7 for c (Including 0). Most responses were correct although some students stated $y = -4x + c$ rather than an alternative numerical value. A small number of responses used the perpendicular gradient not recognising the key aspect of parallel lines. In part (b) many responses scored at least 3 of the 4 available marks – often failing to change a correct equation into the required form with integer coefficients. Most candidates identified that the first step required the calculation of the gradient of L. Some students did not realise that they then needed to use the relationship between the gradients of a line, and the gradient of a line perpendicular to it. Those who used this relationship usually were credited, even if their original gradient was incorrect. Nearly all responses worked with a correct version of the equation of a line and substituted the point (−6, 4), in order to find the full equation of the required line.

Question 20

If a candidate knew to rationalise the denominator they were usually able to complete the question successfully. Some had obtained the correct answer from their calculator but without the working this gained no credit. Many tried to simplify but were unsuccessful and some had no idea how to start or did not attempt the question.

Question 21

(a) Relatively few students showed a full understanding of the relationship between transformations of curves and their equations. Most commonly, $y = \mathrm{f}(x+4)$ was taken to indicate adding 4 to the x value to obtain an answer of (8, 6) in part (i). Similarly, the x was often doubled in part (ii) to give (8, 6) again.
(b) Very few students gained any marks on this question, with many left blank or the original equation just copied out. Given that there was no simplification needed those that did understand all that was required was $(x - 4)$ and +6 gained full marks.
For those who did attempt this question $(x + 4)$ instead of $(x - 4)$ was a common incorrect answer, along with $y + 6$ instead of $y - 6$. Even if this was correct the final answer required $y =$ for full marks.
A few students gained a mark from $y = x^2 + 3x + 10$
Fully correct answers were usually done by completing the square first.
Clearly a topic that many centres do not tackle.

Question 22

Most students substituted for y rather than x, with many gaining a correct equation and hence full marks.
Only a few noticed they would have a much simpler problem if they rearranged the linear equation and substituted for x instead of y. This meant that the common error of dealing with $-2y$ was not an issue and they were far likelier to score full marks.
Students who could not access the question often wrote down something irrelevant as a guess.
The main error was in multiplying out $-2(x + 2)$ often leading to $-2x + 4$ and hence the incorrect equation. If the equation was incorrect then provided M1 was awarded, a number of students gained an extra mark by showing substitution or factorisation of their equation.
A few students lost the final mark as they failed to find the correct corresponding y or x values.

Question 23

This was a challenging question. There were many muddled attempts but, for those with some knowledge of vectors, the first mark was reasonably straightforward for finding. The most common error at this stage was confusion of signs and the direction of vectors. This often led to

$\overrightarrow{PM} = \frac{7}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}$. Better notation and use of brackets might also have helped to avoid some of the mistakes.
Varied attempts were made to compare vectors along the line AM but these did not always lead to the correct ratio. There were also students who managed to write down a correct ratio following incorrect working.

Question 24

Fully correct responses were rare for this question. The majority of responses scored a mark for correctly expressing the fraction in the bracket over a common denominator. Far fewer responses recognised the need to factorise the expression for the other algebraic fraction. A number of responses correctly factorised $6x^2 - 17x + 5$, but very few could correctly factorise $9x-4x^3$, even those who recognised the difference of two squares then incorrectly wrote $x(2x - 3)(2x - 3)$ or lost the x in the factorisation. The minority of students who correctly factorised all the fractions then usually obtained the simplest form for the calculation. Many candidates produced a series of expansions that were in no way beneficial.

Question 25

Poorly answered questions. Few students seemed to realise this was the sum of a series question which makes one wonder if students are being exposed to this type of question in practice. Students were able to gain an easy B mark by identifying the time period but again this was badly answered with most students opting for 49. The mark scheme allowed for a fully correct equation but with n = 49 to get M1 and this allowed some students to pick up at least 1 mark.
A common incorrect response was $49(50 + k) = 33125$ so $k = 626$
Students should refer to the formula at the front of the paper and know how to use it correctly.

Question 26

There were many 3 or 4 mark responses here, the final 2 marks were difficult to access making this question a good differentiator.
A large proportion of candidates recognised they needed the volume of a cone formula and were able to substitute correctly and then find the radius, although a few rounded this to 8 which lost accuracy marks in the final stages.
A significant number then went on to find the correct slant height and arc length or area of sector.
However not many students appreciated how to continue from here.
There were a reasonably large quantity of blank scripts suggesting that candidates either found this question too difficult to attempt or that they had run out of time to answer.

Based on their performance on this paper, students should:

- Know the difference between compound and simple interest
- Show clear working at all times
- Learn circle theorems with the correct working
- Practise the cosine rule and get the order of operations correct
- Know how to use the formulae at the front of the paper
- Improve their knowledge of use of the calculator and do not prematurely round
- Practice non-calculator methods eg fractions and surds
- Know how linear, area and volume formulae and conversions are related

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