Examiners' Report
Principal Examiner Feedback

Summer 2019

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

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Higher Tier Paper 2HR - 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. Questions set at grades 8 and 9 in particular, required students to explain their methods carefully, otherwise marks were withheld.

Generally, it was pleasing to note that candidates were decisive in their communication. There was very little crossed out or erased work. However, handwriting was sometimes very difficult to judge, particularly within algebra where *x* terms very often looked like n's, m's or even u's. Benefit of doubt was given in most cases. Similarly, distinguishing between 4 and 9 was sometimes difficult. In questions involving numerical calculations, typically trigonometry or Pythagoras, students should avoid excessive rounding of numbers in their working as this often affects the awarding of final accuracy marks.

Question 1

As expected, most students scored full marks on this first question. In Q1(a), any letter was acceptable in place of *x*. Occasional mistakes here included confusing the arrow head on the line drawn above the number line, particularly the fact that it pointed to a value just past the number 5. Hence answers such as $-3 < x < 5$ gained no marks. In Q1(b) the absence of the inequality sign was condoned for the method mark but was needed to be accurately stated for the accuracy mark.

Question 2

A variety of approaches were indicated on the mark scheme. Converting mixed fractions to improper fractions was the most common starting point. A full path was needed to gain 3 marks. This required stating that 35/12 = 2 11/12 at some stage if the improper fractions method was chosen. As is usual, decimal treatments gained no marks but this was rarely seen at higher level.

Question 3

This question scored well. Able students were familiar with the notion that a quadratic curve is symmetrical about a line x = a. Mistakes, where they did occur, included calculating y = – 3 at $x = -1$ [through the calculator stating $(-1)^2 = -1$] and drawing a straight horizontal line between (2,7) and (3,7). Some candidates drew line segments rather than trying to join the points with a curve, and again this was penalised by 1 mark.

Question 4

For an early question on the paper, Q4(b) performed unexpectedly poorly. Many candidates divided 525 by 100 instead of 10 000. A surprising number of students misread the question and calculated the area of triangle ABC by considering area scale factors.

Question 5

For students familiar with the idea of factorising quadratics, this question was a good source of marks. In some cases getting signs wrong leading to $(x - 4)(x + 9)$ yielded only the method mark and lost the accuracy mark.
A significant number of candidates interpreted the question as an equation to solve and used the quadratic formula correctly for an equation but gained 0 marks.

Question 6

Most students gained full marks here, and the vast majority were at least able to reach the statement P(mint) = 0.21. In some cases the probabilities of strawberry lollies and mint lollies were multiplied together rather than added. Final probability answers had to be given as a number rather than, say, a ratio. 0.53/1 was condoned as an answer.

Question 7

Most students broke this question down into stages starting with 55 ÷ 11 (=5) then calculating the number of matches won as 6 x 5 etc. rather than a direct approach (6/11 x 55). The correct final answer of 20 was easily the most common response.

Question 8

Weaker candidates missed the point about A and B being presented in index notation and proceeded to multiply out the index numbers at the start. Inevitably this didn't produce the final answer in Q8(a) or (b). Disappointingly, some students left their answers to Q8(a) and (b) in index form e.g. 3^2 x 53 x 7 in Q8 (a) and 3^4 x 5^4 x 7 x 11 in Q8(b). These responses only gained 50% of the available marks.
Students rarely used a Venn diagram to work out their answer. A common misconception was an answer of 7 as it is the biggest common prime number in the product of prime factors.

Question 9

Both components of this question scored well. In Q9(b) a number of candidates are still not aware of the existence of a standard form button on their calculator and many wrote down both numbers given as ordinary numbers. The calculator display for the answer was usually given as 750 000 000 and this required a final manual conversion to an answer in standard form.

Question 10

At higher level, many candidates recognised and used the economical method 150,000 x 0.82^3 to reach the correct answer. A variety of special cases rewarded candidates with 1 mark if they chose simple depreciation rather than compound depreciation. Many candidates wrote (1 – 18%) rather than (1 – 0.18) which meant credit could not be given if they got an answer incorrect. A surprising number of candidates misread 150 000 as 15 000. Care should be taken to ensure the correct number of zeros are used. In the case of genuine misreads the method marks can be awarded but the accuracy mark is withheld.

Question 11

This question proved accessible to most candidates, though some lost 1 mark by their choice of notation for their final answer. Examples of this include L = – 2*x* – 1 or just – 2*x* – 1. Some also lost a mark for giving a positive gradient in their final answer. A small number of candidates calculated the gradient incorrectly by change *x*/change *y*

Question 12

Most students were able to reach the correct value of BD = 1.6427 to reach the first 2 marks. The second phase of the question caused some a degree of difficulty as a result of AB usually being the denominator of a trigonometric equation. Accuracy marks were withheld through candidates rounding off too drastically, either part way, or throughout the question. Very able students were able to get to the correct answer directly by stating angle BAD was 48° and using the sine rule on triangle ABC.

Question 13

Q13(a) was executed well. Most candidates choosing to plot points correctly at the ends of each interval. Unlike quadratic curves, straight line segments are permissible here. The scale on the time axis caused some problems in Q13(c) with some students opting to draw a vertical line at 71 minutes rather than 72 minutes. Others forgot that the final answer in Q13(c) required a probability and left the answer as 13, 14 etc. In a minority of cases very able students opted to use linear interpolation in Q13(b) and (c).

Question 14

In Q14(a) the more able students were able to go directly to the correct answer of x^9y^6, others produced $0.75x^9$ $0.75y^6$ or $0.75x^9y^6$ the latter 2 cases producing 1 mark instead of 2. In Q14(b) a common incorrect answer was *x*/2*y*. Candidates were able to pick up 1 method mark if 3^{2y} or 3^{-2y} was earlier seen.

Question 15

A variety of imaginative approaches were seen involving isosceles triangles and cyclic quadrilaterals were seen in a minority of cases, but most opted for the economical route of stating angle ABD = 49° and angle ABC = 90°. Reasons given should be precise and use the correct terminology. Many candidates could do the calculation but the geometric reasons were weak. Symbols in place of the words 'angle' and 'triangle' are not acceptable.

Question 16

If students understood the phrase 'inversely proportional to the square of *x*' they usually went on to secure full marks in Q16(a) and (b). If they did not they scored zero marks from the outset. Once $y = \frac{36}{x^2}$ had been established as an answer for Q16(a) some candidates had difficulty extracting x^2 as the subject in Q16(b).

Question 17

This question proved challenging for many. A significant number chose to demonstrate the proof by stating several numerical examples, and this gained no credit. Those who were able to establish a correct algebraic expression of $\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$ were often unable to do the necessary algebraic manipulation to bring this down to $(n + 1)^2$. In some imaginative cases, students opted for an original statement of $\frac{(n-1)n}{2} + \frac{n(n+1)}{2}$ and the consequential algebraic manipulation was much easier in reaching a final answer of n^2. In a number of cases candidates were seen to try to use the formula for an arithmetic series.

Question 18

Students who were unable to process questions on functions immediately lost 6 marks here. Answers had to be fully simplified to gain full marks in Q18(b). The inverse function in Q18(c) proved challenging as the variable *x* appeared in both the numerator and denominator of the original function. A few students, as a starting point, picked the function from Q18(b). No marks were awarded in Q18(d) unless a tangent had been drawn at $x = -0.5$ (or $x = +0.5$ through a misread). Some students knew the correct method but the differing scales on the *x* axis caused a problem and consequently answers were out of the permitted range.
Some interesting approaches were seen to finding the gradient of the tangent by applying $y = mx + c$ to either two points on the tangent line or one pair of points on the line and using the *y* intercept (rather than the standard rise/run approach).

Question 19

The starting point to gain any marks was to establish a correct equation leading to a radius value of 7.5 cm. A variety of acceptable methods were employed to calculate the length of the chord AB. This question discriminated well at the top grade boundaries because it involved drawing together several strands to reach the correct final answer. Students lost marks by calculating the area of the segment rather than the perimeter. Some students took the area of sector OAPB to be $\frac{25}{2}$ rather than $\frac{25\pi}{2}$ and, providing their working was correct, were able to pick up 4 method marks.
A surprising number of responses assumed that 80 degrees was a quarter or a third of a circle.

Question 20

Successful students were able to realise that to maximise the value of a quotient the numerator had to be as large as possible and the denominator as small as possible. Hence the gap between *a* and *b* had to be minimised by selecting appropriate upper and lower bounds accordingly.
Most responses gained at least 1 mark by stating at least one upper or lower bound correctly for one of the values, though many candidates used the actual numbers for *a* and *b* without attempting to state any upper or lower bounds.

Question 21

Many students opted to choose 900 cm^3 as their final answer by taking the area scale factor and multiplying this by the volume of B i.e. $\frac{240}{540}$ x 2025 and thus scored no marks.
More astute students probably realised that questions placed towards the end of any GCSE paper require a greater depth of computation.

Question 22

Students who failed at the onset to factorise the quadratic by extracting –2 inevitably ran into problems with later algebraic manipulation. This was a challenging question even for the most able and required precision at each stage to reach the final correct answer. A number of special case marks in the mark scheme rescued a significant number of students who had made minor errors part way through.

Question 23

This was arguably the most challenging question on the paper. The key to making some headway was reaching the point of calculating the perpendicular height of one of the triangular faces (typically ACD) and reaching a value of 13 cm. From there either the vertical height of the pyramid (AO) could be found or one of the slant edges (typically AC). Students who found a value of 13 cm and then ascribed it to a wrong length were penalised and significant marks withheld. Many students lost track of their own reasoning through untidy work. Candidates who drew the triangular face separately and labelled the midpoint of the base as a new letter, generally tended to do better.

Question 24

This question asked for working to be shown clearly. At grade 9 on an international GCSE paper, trial and improvement is an insufficient working method. Many able students were able to establish a correct algebraic equation based on either red or yellow marbles. Algebraic manipulation was then required to produce a correct quadratic equation. To gain full marks, the correct quadratic equation had to be reached and either the first stage in its solution written down or the correct answer stated. Correct factorisation or substitution into the quadratic formula or in rare cases the first stage in completing the square, all count as a first step in solving a quadratic equation. A significant number of students established a correct initial algebraic equation but were not able to manipulate this correctly into a quadratic for solving.
Students who found that 25 marbles fitted as an answer within the context of this question, and did no algebraic treatment, were not awarded any marks.