Examiners' Report
Principal Examiner Feedback

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

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Following on from the November 2020 series, this 4MA1 paper was also sat in unusual circumstances. Only a few days after the UK entered a national lockdown, paper 1 of this series was sat by this cohort. It was pleasing to see them adapt very well to an everchanging situation and to their credit, each question was attempted well, even if not always successfully.

Students of the 4MA1 course are now familiar with new topics to the specification. It was pleasing to see a good number of these questions attempted by all students; inevitably the final few questions saw less success; simultaneous equations (Q19), inverse functions (Q22), vectors (Q23) and arithmetic series (Q24) proved to be particularly challenging.

1 Many students scored full marks and made a good start to the paper. Those who did not nearly always scored 1 mark for finding 3/10 (= 6048) or 7/10 (= 14,112) of 20,160. Unfortunately, many then went on to use 6048 with the ratio which gained no further credit. To score further, students needed to divide 14,112 by 16. The 3rd method mark was for a complete method and many who got to this stage went on to gain the full 4 marks. There were a significant number of students who managed to share 14,112 correctly into the ratio but then subtracted the wrong two values, gaining only 2 marks.

2 Part (a) of this grouped frequency question saw students needing to identify the modal class. Most were able to do this and identify the correct interval. There were a small number who were unsure of what to do and tried some calculations and wrote the resulting value on the answer line. It was pleasing to see many students pick up 4 marks on this familiar mean from a frequency table question in part (b). Of those that didn't, the most common incorrect methods were to find the correct products and intention to add but divide by 5, using the upper limit or class width for each interval in their products or to simply add together the mid interval values and divide by 5 or 80.

3 This problem-solving question saw many different methods attempted. The most common successful methods seen involved finding the volume of the water already pumped out or the volume of water left in tank. From there students needed to work with some sort of rate, whether it be dividing a volume by time or working out how many times the water pumped out divides into the water left. The 3rd method mark was for a complete method to find either the time to pump out the water left or the time to pump out all the water from when the container was full. The question was answered with varying degrees of success; of those that did not gain full marks common mistakes were to only add the 8.5 hours onto 10.30 and not 12.00 and to try and work with the volume of the 'whole' cuboid e.g. $60 \times 85 \times 125$.

4 For this two-part sets question students needed to understand the intersection and union notation. As has been common on previous series the intersection question was answered better than the union part. In (ii) common errors seen included listing extra numbers to the correct ones such as 20 while 24 was often missed. Some students also confused the two symbols and gave answers of 21, 23, 24, 25, 27, 29 for (i) and 21, 27 for (ii). However, the majority of students seemed very confident with the question with many correct responses seen.

5 In part (a) there were 2 marks available for a correct full factorisation and a good number of students were able to gain these for a correct answer. There were a number of ways students were able to gain 1 mark, generally for a correct partial factorisation from taking out at least 2 of the factors e.g. y^2 or $5y$. Part (b) required clear algebraic working and it was pleasing to see all students provide this and many went on to gain the correct answer and 3 marks. Of those that didn't, many failed to deal with the removal of the fraction; multiplying the left-hand side by 4 to gain $16 - 3x$ was a commonly seen mistake. These students could still go on to gain the second method mark if they correctly rearranged their equation from the form $ax + b = cx + d$ so that the x terms were on one side and the numerical terms were on the other.

6 Many students were able to gain 2 marks on this standard form question. For part (a), incorrect answers included failing to give the number in correct standard form e.g. 284×10^7. In part (b) common incorrect answers were 0.0025 or 25,000.

7 This two-part percentages question saw students tackle compound interest and reverse percentages. Part (a) was answered well with most able to give an answer in range for 3 marks. Of those that didn't, some picked up 1 mark for finding 3.5% or 103.5% of 40,000. Some students gained 0 marks for attempting a complete compound method but used an incorrect multiplier such as 3.5 or 1.35. For (b) the modal marks were 0 or 3. The most common incorrect method was to find 6.5% of 30,481 and add it on. Some students did obtain 1 mark for a statement such as 93.5% = 30,481.

8 This 3 mark perimeter question saw the full range of marks awarded. It was good to see many show a complete method and follow it through for full marks. Of those that didn't, there were still a good number who gained 1 or 2 marks by working with the arc lengths of the semicircles. Some calculated circumferences of full circles, forgetting to halve, and scored 1 mark. A common misconception seen was to work with area rather than circumference; such students gained 0 marks.

9 Part (a) of this algebra question saw many students gain 2 marks for a correct expansion. Of those that didn't, the most common errors were to evaluate 2^4 as 2 or 8 or the powers as 7 and 9 instead of 12 and 20 respectively. For the second part, (bi) and (bii) were linked in that the answer for (bii) needed to follow through from their factorisation in (bi). Many were able to gain the 2 marks in (bi) and follow through with answers of -9 and 4 for (bii). No credit was given for answers which did not come from the factorisation in part (bi).

10 This trigonometry question saw a variety of different methods used. Some used SOH CAH TOA, some used the Sine Rule and Pythagoras' Theorem was also seen regularly. Most who found both *AB* and *AD* then obtained the 4 marks for an answer in the acceptable range. Some students were awarded the first 2 method marks but gained no further marks; some only added the two lengths found, others included only one of the sides measuring 7.46…. Some students were unable to write a correct trig ratio and therefore gained 0 marks, while others were able to make a correct start with a trig ratio for *AB* or *AD* but then could not rearrange correctly to make further progress.

11 It was pleasing to see many students pick up 2 marks for correctly finding an estimate of the median in range. Part (b) saw more varied success. Many were able to gain the first method mark for dividing 93.75 by 3.75 (= 25). It was then a case of subtracting this value from 90 and using 65 on the cumulative frequency graph. Some students were able to do this but a good number read 25 off the graph instead and picked up no further marks.

12 Part (a) was a 3 mark algebraic fractions question and saw the full range of marks awarded. Some were able to express both fractions correctly with a common denominator, write the fractions as a single fraction and then simplify to gain the correct answer. Of those that did not gain the 3 marks, the most common error was in the expansion of the second bracket and expanding $-3(x-2)$ to $-3x-6$. Common incorrect methods worth 0 marks included not finding a common denominator at all or finding a common denominator but using 4 and -3 as the numerators. In part (b) students were required to expand and simplify 3 linear factors. The most common method seen was to expand the brackets and multiply the result by $2x$; if done successfully 3 marks could be gained. If 3 marks were not gained it was common to see errors made with the final term, either given as $-30x$ or $+30$. A small number of students were not able to deal with the first step and attempted to multiply both brackets by $2x$, gaining 0 marks. A number of students arrived at the fully correct simplified expression and then identified 2 as a common factor and divided each term by 2; these students lost the accuracy mark.

13 Part (a) saw students required to find the gradient of a line between two points. The full range of marks were awarded as students struggled to deal with the negative aspect of the numbers. Some were able to correctly find the difference in y and the difference in x and divide to gain an answer of -3 for 2 marks. Others struggled with the signs but still managed to obtain an answer of 3, which gained 1 mark, as did giving the correct gradient as part of an expression or equation, which was seen often. Some were unable to deal with the problem correctly at all, often dividing x by y, gaining 0 marks. In (b) the only acceptable answer was ¼ or equivalent; if the correct gradient was found this was often seen given as part of an expression or equation, gaining 0 marks.

14 This 5-mark probability question saw many students score full marks in both parts. Most were able to pick up 2 marks in part (a) for a correct answer of 0.54 or equivalent. For part (b) students needed to find two products, win/lose and lose/win, and find the sum of these two values. Many were able to do this correctly and gain 3 marks. Some found one or both correct products but could not deal with them correctly, e.g. multiplying the products together was seen often.

15 The mark scheme for this 3 mark bounds question began with a B mark for any correct bound for 9.6 or 3.8 or 1.84 and many were able to gain this mark. The next mark required students to substitute 3 values within the ranges given in the mark scheme into the formula, and if done correctly gave an answer of 3.215… which could be rounded to 3.22. Answers within the range 3.21 – 3.22 were accepted as long as from correct working, for example the use of 9.64 instead of 9.65 was seen often which led to an answer of 3.209… or 3.21, which is in range but only gained 2 marks as the A mark was withheld due to the answer not coming from correct working. Common solutions worth 0 marks were to use 9.6, 3.8 and 1.84 and then trying to find a bound for this answer.

16 There were a variety of methods seen for this 5 mark trigonometry question. Most were able to make a correct start and substitute correctly into the Cosine Rule for *BC*. Some got into difficulties for the next mark and could not deal with the order of operations to solve for *BC*. Regardless of whether students had gained 1 or 2 marks so far, the 3rd and 4th M marks could be obtained for a complete method to find angle *ABC* or *ACB*. Some students gained the 3rd method mark for a correct trig statement involving angle *ABC* or *ACB* but were then unable to rearrange this to gain the 4th method mark; a failure to recognise the need to use $\sin^{-1}$ was often seen. Scoring all 4 method marks left them one step away from the final answer of 140, the range 140 – 140.4 was acceptable for 5 marks. Some students gave an answer of 40 or 20, missing out the final step, gaining 4 out of 5 marks.

17 To make any progress on this question students needed to achieve a correct expression for the volume of the solid in terms of x. If done successfully, the second M mark could be gained by equating this expression to $1/3\pi y$. The third mark was an A mark and required a lot more work and could be achieved by correctly writing y in terms x. A good number were able to get to this stage but no further, not realising that calculus was required to complete their solution. Some did differentiate and equate to 0; found that $x = 4$ but then did not substitute back in to find the maximum value of V. There were some who achieved an answer of 320 without differentiating, but this did not gain full marks as the final A mark was dependent on having clear workings shown for all three method marks.

18 This question saw mixed results for this cohort. Most realised that the brackets needed to be expanded and gained M1 for an expansion with at least 3 out of 4 or all 3 terms correct. It was then a case of comparing coefficients with the right-hand side and a good number were able to gain the B mark for $y = 3$. The correct value for x was seen less often and was also dependent on the M mark being achieved. Common incorrect solutions were to try to substitute values in for x on the left-hand side and expand – this method was not credited as students needed to work with algebra.

19 This question testing simultaneous equations involving a quadratic equation aims to test understanding at the highest grades. The initial substitution proved challenging, with many unable to deal with the negative aspect of $1 - 2y$ once substituted into the quadratic equation. Most wisely chose to make x the subject of the linear equation, but those that went down the route of making y the subject of the linear equation usually ran into difficulties, failing to deal with the denominator correctly when squaring on the right-hand side of the quadratic. If a correct simplified quadratic was achieved for M1A1 for either x or y, students often went on to gain the full 5 marks. Of those that didn't, some gained the correct values but did not pair them correctly, while others found a pair of values for x or y but then did not substitute back in to gain the other 2 values; both these solutions gained 4 out of 5 marks.

20 Students were generally more successful on this 3 mark question which saw a good number able to deal with the scale factors or ratios correctly in order to gain full marks for an answer of 630. Many scored 0 or 1. For the former, many tried to work with 4352/1836 or 1836/4352 as their scale factor e.g. failing to cube root and then square. For the 1 mark solutions, many were able to gain the correct linear scale factor, but then did not square this value when finding the surface area for **A**.

21 Part (a) saw varying degrees of success; most students scored 0 or 2 marks. For those that scored 0, common incorrect answers seen were (−6, 15) and (−3, 15) respectively. In part (b) there were two B marks available for the correct values of a and b. The correct value for a was seen more often than b, with 180 being a common incorrect value for b. Students could gain B1 for an answer of $a = -2$ and $b = -90$ but this was not seen often.

22 There were 3 different mark schemes for this question but the most commonly seen method worthy of credit was the first scheme. Students needed to correctly complete the square in an equation in terms of y and x – either was accepted as the subject as is common practice on inverse functions questions. The second mark was an A mark and could be achieved by changing the subject of their initial rearrangement – an incorrect sign was accepted before the square root as was ±. The final mark was for recognising that the range was $f^{-1} \leq 4$ and therefore the negative square root was needed – very few managed to achieve this final mark. This question was generally not well answered. Many seemed not to know what to do and were unable to get started.

23 The first 2 of the 6 marks available for this vectors questions were relatively accessible for most. The first method mark was for finding $\overrightarrow{AB}$ or $\overrightarrow{BA}$ or $\overrightarrow{AM}$ or $\overrightarrow{MA}$ or $\overrightarrow{BM}$ or $\overrightarrow{MB}$ and the second for finding $\overrightarrow{OM}$ or $\overrightarrow{MO}$ or $\overrightarrow{AN}$ or $\overrightarrow{NA}$. Many were able to gain at least one of these marks. From there less success was seen as students needed to use a constant to find $\overrightarrow{OP}$ or $\overrightarrow{PO}$ or $\overrightarrow{MP}$ or $\overrightarrow{PM}$. The fourth method mark was for setting up an equation for $\overrightarrow{OP}$ or $\overrightarrow{MP}$ and then to gain 5 marks this equation needed to be solved. To gain the accuracy mark the value of this constant needed to be interpreted correctly to arrive at a ratio of 4 : 1. Very few managed to gain full marks and some answers of 4 : 1 were seen without a supporting method (the A mark was dependent on M3), presumably from measuring and estimating the ratio.

24 For this arithmetic series question the first mark was for correctly using the S_n formula for a series with $2n$ terms. To gain the second mark this needed to be equated to $4 \times S_n$ for a series with n terms. For the third mark a correct linear expression in a and d was needed to be found and many struggled to get to this stage. The correct answer was for $d/2$ and those that managed to reach it needed to have supported it with a creditworthy method as the A mark was dependent on M2. Some students chose a value for n such as 1 – this method gained no credit.

Summary

Based on their performance in this paper, students should:

- Practise simplifying expressions with terms such as $-3(2y - 4)$ as many fail to obtain $-6y + 12$.
- Work on finding the gradient between two points.
- Practise calculus problems where a maximum value needs to be found and recognising that differentiation will be needed.
- Practise solving simultaneous equations, one linear and one quadratic, in particular where the substitution then requires an expansion involving a negative algebraic term e.g. $(1 - 2y)^2$
- Recognise that to find the inverse function for a quadratic equation, completing the square or another appropriate method will be needed.

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