Examiners' Report

Principal Examiner Feedback

Summer 2018

Pearson Edexcel International GCSE

In Mathematics A (4MA1) Paper 2HR

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Students who were well prepared for this paper were able to make a good attempt at all questions. It was encouraging to see some good attempts at topics new to this specification. Of these new questions, students were particularly successful in the question assessing pressure, force and area.

On the whole, working was shown and easy to follow through. Although a calculator was available for the paper, most students made a clear attempt to show the steps of their methods which led to potentially more marks being awarded.

The trigonometry question, number 10, leant itself to using the right-angled triangle formulae (*SOH CAH TOA*), but as the new specification does not contain these formulae on the Formulae Sheet a large proportion of students selected the Cosine rule or Sine rule instead. Using the quadratic formula to solve quadratic equations continues to be the preferred method of choice; factorising quadratic expressions remains a weakness.

1 The first question on this paper saw varying degrees of success for students. Most were able to pick up at least one mark, usually for giving two values with a range of 7 or sum of 23. Many students did gain two marks for the correct solution; the methods used varied between algebraic ones such as setting up two simultaneous equations and numerical ones where they tried different numbers with a difference of 7. Some students failed to realise that the question stated y was greater than x, therefore giving an answer of $x = 15$, $y = 8$.

2 It was pleasing to see that this question on a new topic was answered very well with the majority of students gaining 3 marks. Students clearly know how to find the area of a rectangle with almost all gaining the first mark for a method to do so. Of those few students who did not go on to achieve the correct answer, it was a failure to rearrange the formula successfully that was the most common error. Dividing the Pressure by Area to find Force led to students gaining only 1 mark.

3 This number question assessed familiar topics such as conversion of metric units, percentage change and fractions of amounts. It was pleasing to see almost all students use the correct conversion 1kg = 1000g to find the number of candles. From this point most students went on to score full marks with a correct answer. Of those that didn't, the most common issue was a failure to calculate either the remaining candles that would be sold at a reduced price, or the 20% reduction in price of these candles.

4 This algebra question saw students being assessed in several familiar skills and it was pleasing to see most gaining full marks on all parts. For part (a) the correct answer was seen for most solutions, with the most common error being a failure to simplify correctly once the two brackets had been expanded. For part (b), expanding and simplifying two brackets is clearly a strength of these students with almost all gaining the correct answer. Of those that didn't, a failure to simplify the x term correctly was the most common error. In part (c) most students were able to fully factorise the expression given, the most common error seen was a failure to spot the factor of 7 leading to 1 mark for an answer of $y(28y - 21)$. Part (d) was the first question on the paper where working was required to award full marks and it was pleasing to see students following this instruction and presenting their full method. For those students who did not gain full marks, expanding the bracket $4(3x + 1)$ to $12x + 1$ was the most common error.

5 A variety of methods were seen for this speed, distance, time question. Most students successfully converted 6 hours 42 minutes into hours e.g. $6\frac{42}{60}$ or 6.7 and then went onto multiply by 650 to gain the correct answer. A common error by those who didn't gain full marks was to incorrectly convert 6 hours 42 minutes to 6.42 hours; students should be reminded that there are not 100 minutes in an hour. Some students used an alternative method which was to find the number of km travelled in 1 minute ($10.8\dot{3}$) and then used this conversion to find the total distance travelled; as long as the accuracy of the decimal was preserved this led to full marks.

6 Another familiar question saw success for most students with compound interest. Most were able to apply the most efficient method ($20\,000 \times 1.015^3$) to gain full marks. Of those that didn't, the use of simple interest was the most common error; this could still lead to 1 mark for 900 or 20 900 found. A small number of students tried to use a year-by-year method; this invariably led to a correct answer. A number of students could not move from the annual interest percentage to the correct multiplier, 1.05 and 1.5 were common errors. A number tried to employ a memorised formula, without successfully inserting 1.5% into it.

7 Part (a) was answered with varying degrees of success. There were many students who did gain 2 marks for a correct answer; there were also many who only gained 1 mark for failing to simplify the whole expression correctly but did deal with the x or y term correctly. The most common errors seen were to subtract 20 and 4 instead of divide and to fail to cancel the x term at all. Part (b) saw more students gaining 2 marks for a correct rearrangement, those that didn't tended to gain 0 marks as they made an incorrect first step e.g. subtracting f from both sides to get $f - h$ on the left hand side instead of $h - f$.

8 This problem solving Pythagoras question saw most students gain full marks. The key to success appearing to be drawing a diagram; those that did realised the nature of the problem and applied Pythagoras' Theorem accordingly. The most common incorrect methods seen were to simply add 200 and 160 or to use Pythagoras' Theorem incorrectly e.g. to subtract the two squares rather than add; both methods led to students gaining 0 marks.

9 This geometry question was answered very well with the majority of students gaining full marks. Many knew how to find either the interior or exterior angle of both shapes and were able to then go on to complete their method. Some students assumed *CFG* was a straight line leading to them incorrectly calculating angle *BFC* as 45°. The other most common error was to calculate the interior angles of the pentagon and octagon as 72° and 45° respectively which led to 0 marks.

10 In this question students needed to recognise that a right angled triangle should be created, the most efficient method being to drop a perpendicular down from *C* onto the line *AD*. The first mark was gained for a method to calculate the missing length on the new triangle; most students picked up this mark. From there students had to use a trigonometric statement to find one of the angles in the triangle, those that did this successfully usually went on to gain full marks for this question. Some students were not able to use the inverse trigonometric functions isolate their variable once they had a correct trigonometric statement. Amongst the many difficulties caused by applying the cosine rule was of incorrect substitution, and in the use of the sine rule the required angle was the ambiguous case of the sine rule.

11 For part (a) most students were able to identify the modal class including the correct notation. Part (b) was also answered well with most students able to complete the cumulative frequency table. In part (c) the majority of students gained 2 marks for a correct cumulative frequency graph. For those that didn't 1 mark was often seen, with (500,115) regularly being plotted incorrectly at (500,110). Some students were not familiar with the nature of a cumulative frequency curve and drew a straight line or something that resembled a histogram. Some students also believed the maximum cumulative frequency was 100 (despite a correct table in (b)) and therefore gained no marks for two incorrectly plotted points at (500,100) and (600,100). Part (d) saw a number of students gaining 2 marks either for an answer in range or for a correct answer following through from their cumulative frequency graph (method must have been seen). The most commonly incorrect method seen was to subtract 30 from 90; a significant number of students estimated the median. Part (e) saw more success with a large proportion of students able to gain 2 marks for a correct answer following through from their cumulative frequency curve, although a number simply stated the cumulative frequency value from the curve without finding the number of families above this value.

12 This angles question asked for clear working and it was pleasing to see all students follow this instruction and show all the steps of their method. A large number of students were able to gain the correct answer of 53°. Of those that didn't, many gained 1 mark for identifying a correct angle (usually *OAB* or *OCB*, often marked on the diagram). The most common incorrect method seen was to calculate *COA* as 2×74; this led to 0 marks.

13 On the whole, students were unable to relate the gradient of $\mathbf{L}_1$ to the gradient of $\mathbf{L}_2$ along with the fact that the two lines are perpendicular. Many students worked with the gradient of $\mathbf{L}_2$ as −2 (as if parallel); this could have led to 2 marks through the special case if the method was completed correctly. There were a significant number of students who correctly calculated the gradient of $\mathbf{L}_2$ and went on to substitute this along with (4,7) into an equation. Of those who calculated the correct equation of the line, a number of students substituted x as 0, not y. A small number of students did go onto to gain 4 marks, which was pleasing to see.

14 This algebraic indices question saw many students gaining either 0 marks or 3 marks. For those that gained the full 3 marks, many clear algebraic methods were seen. There were a small number of students who appeared to gain the correct answer through a trial and improvement method. The students who picked up 0 marks were unable to begin their solution and unable to work with the indices; $128 = 8^{3x}$ was a commonly seen incorrect first step.

15 Part (i) saw around 50% of responses given a correct answer; a common incorrect answer was the 4 values written as a set rather than summing them e.g. {1, 3, 7, 8}. Parts (ii) and (iii) saw very little success with students clearly struggling to come to terms with the concept of a compliment and a union.

16 This challenging 4 mark probability question rarely saw students picking up more than 1 mark. Students needed to recognise the conditional nature of the probability and consider the different possible combinations for taking three counters and the sum of the numbers of the counters being odd. Some students picked up the first mark by multiplying three fractions with denominators 6, 7, 8 but rarely were the next three marks gained. Many students tried to list all the different possible successful combinations e.g. 2, 2, 5 or 1, 1, 5; this method usually led to 0 marks. Some students considered the question to be with replacement; again this usually led to 0 marks despite a special case meaning 1 or 2 marks were available if the method was followed correctly.

17 Part (a) saw a familiar 2 mark algebraic recurring decimal question. Many students gained one mark for finding two appropriate recurring decimals, with $1000x$ and $10x$ being the most commonly seen pair. The majority of students then went on to gain 2 marks with a complete solution. In part (b) students needed to show clear surd methods to gain credit. Solutions needed to begin with the simplification of the two surds individually or rationalising the denominator. With the remainder of the marks being dependent some students were unable to pick up any marks as they did not show a correct first step. It was pleasing to see a large number of students picking up 2 or 3 marks for reaching $2\sqrt{15}$ or $\sqrt{60}$ respectively.

18 It was pleasing to see some students gain full marks on what was a complicated simultaneous equations question. Unfortunately, many students could not get past the first mark, a successful substitution of $x = 2y – 3$ into the quadratic equation as many students could not expand and simplify correctly to gain the next mark; in particular many students failed to multiply the $(2y – 3)^2$ expansion by 2. This led to a quadratic expression in y. A significant number of students then solved this quadratic as if it were a quadratic in x, or factorised as if it were a quadratic in x, so they found neither correct pair of values. Some students did show a correct method to gain the correct x and y values but failed to pair them appropriately, which was unfortunate.

19 This bounds question saw the majority of students gaining either 0, 1 or 3 marks. For those that gained 0 marks, the upper and lower bounds for p, q and t were not found and students generally substituted in the values given in the question. Those that gained 1 mark usually selected the wrong bound to substitute into the formula; it was common to see 6.35 used for q and 0.275 used for t. Of those students who selected the correct values, almost all went onto to gain the full 3 marks.

20 The first mark awarded on this question was for a first step to finding the critical values, with factorisation and the quadratic formula being the most common methods seen. Many students were able to find the correct critical values and therefore gain 2 marks, but then went no further with their method. For those that did, it was pleasing to see a significant number of students go on to gain all 4 marks following a correct interpretation of the inequalities. There were some students who could not use the correct notation for an inequality solution of this type and tried to write their solution as one continuous inequality; this could still gain 1 mark. Drawing a quick sketch led in most cases to students identifying that the solution was two distinct regions.

21 Graphical transformations is certainly a topic this cohort needs to work on. For part (a) some students recognised the nature of the graph being stretched by a scale factor of 2 and managed to gain 1 mark for plotting the point (1, 6). However, very few went on to gain 2 marks. In part (b) very little success was seen, those students that gained 1 mark usually did so through the special case, correctly drawing a reflection in the x-axis. Many students did recognise the need to reflect the graph but were unclear as to where the line of symmetry should be placed.

22 This algebraic fractions question required students to initially factorise and write two subtracted fractions over a common denominator. Most students were able to do at least one of these successfully and pick up 1 or 2 marks. However if students did not do these steps successfully they were unable to pick up any more marks; there were many incorrect steps seen after this such as expanding both numerator and denominator to obtain polynomials up to degree 4. However, there were some students who were able to go on to gain the correct answer; some of these expanded and simplified their denominator which was unnecessary but not penalised.

23 It was pleasing to see a large number of students gaining some marks on this 5 mark question. Most successful solutions began with a diagram; a correct one gained 1 mark. Many students incorrectly located point *E* as the midpoint of *OB* rather than the line extended. Students were then able to go onto find one of the vectors *CD, DE* or *CE* which gained 3 marks. If students were able to find 2 of these 3 they picked up the 4th mark and many students were successful with this. Those that did were then able to convert this into full marks with a concluding statement about the relationship between their two vectors and *C*, *D* and *E* being a straight line.

24 A large number of students were able to pick up 1 mark for part (a) by finding either the value of p or the value of q. Unfortunately the nature of the quadratic expression – the fact that the x^2 term was negative – meant that many students were unable to go on to gain the second mark. Part (b) saw the majority of students who attempted the question completely ignore the instructions in the stem and try to expand the brackets instead of using their answer to part (a). This rarely led to students picking up marks as a correct simplified quadratic equation was not seen, most errors involved failing to apply a negative sign to the whole expansion of $(y+3)^2$. Those students who did use their answer to (a) usually score several marks; it was pleasing to see some students gaining 3 marks (follow through) even though they did not gain 2 marks in part (a). Part (c) saw a variety of methods attempted, including completing the square and calculus, with varying degrees of success.

Summary

Based on their performance in this paper, students should:

- check the variable being solved for in a quadratic equation, especially in simultaneous equation questions
- not expand brackets in an algebraic simplification question
- ensure they use the most efficient method to solve questions involving trigonometry
- practise new topics such as graphical transformation of functions
- remember that there are 60 minutes in an hour, not 100

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