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Examiners' Report
Principal Examiner Feedback

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

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International GCSE Mathematics 4MA1 2H
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Those who were well prepared for this paper made a good attempt at all questions. It was good to see several students having a go at the grade 8 and 9 questions and gaining a couple of marks for these, even if they could not see the question all the way through.
The paper differentiated well.

Students tended to mainly show good working but some need to be reminded that when working is requested, they are unlikely to score marks without some working shown; this was especially true for Question 2 on fractions and Question 17 on surds.

Students should read questions carefully and follow the demand required eg in question 21b it was requested that students should gain their answers by drawing a suitable straight line on the graph; any answers gained from other methods were not accepted.

Students also need to ensure they learn appropriate terminology especially for work with circle theorems. Students must also know the difference between calculations needed for right angled triangles and for non-right angled triangles.

Question 1

In part (a) , most students demonstrated an understanding of the procedure to remove pairs of brackets and many completed the algebra correctly. Lost signs accounted for the greater proportion of errors both in the initial expansion and the subsequent simplification.

For part (b) a fair number gained 2 marks and a good number managed to get 1 mark for partial correct factorising or getting the correct term outside the brackets with two terms in *b* and *c* inside.

Question 2

On the whole, this question was very well answered as it was a familiar looking question.

Candidates need to be careful to show their simplification of similar fractions to get the full three marks. The majority were able to gain M1, many gained M2 but quite a few missed the final mark due to skipping the 189/72, not showing 21/8 or not showing the cancelling first.

Question 3

Part (a) was answered well with most candidates seeing that the linear scale factor from triangle *ABC* to triangle *PQR* was 3 and hence 16.5 ÷ 3 led to the correct answer of 5.5
In part b) allowances were made for inexact algebra notation so answers such as $3 \times x$ or $x \times 3$ gained the 1 mark available.

Question 4

Many candidates were unable to score full marks by recognising the lower bound was 17.75 and the upper bound was 18.25. A very common incorrect answer was to state the values 17.5 and 18.5 which gained 1 special case mark only.

Question 5

It is advisable with questions of this kind to show the result of using the map scale to find the length 3.5 cm to represent the distance 700 m. This would have saved a mark for the minority who did not draw this length with sufficient accuracy. In a small number of cases the distance drawn was significantly different from 3.5 cm; double this sometimes. The angle was usually measured reliably. Some read the wrong scale on their protractor and drew the line on a bearing of 70^o, some measured the angle of 110^o from due west, and a few marked other bearings, including some greater than 180^o

Question 6

The most popular approach to this question was to find the sum of probabilities for pink and white sweets and divide the result in the ratio 2 : 1 to find 0.3 and 0.15, values which were often shown in the table. Some answers ran into trouble at this point. Those who were able to use information about the red sweets to calculate the total number of sweets in the bag were usually able to work out the correct final answer, 0.15 × 80. Place value errors were sometimes seen in the working to find 80. There were also successful attempts using proportion, eg $\frac{28}{0.35} \times 0.15$ ..

Question 7

All three methods (factor trees, listing multiples and the table method) shown on the mark scheme were seen being used. The idea of factor trees was the most popular route here with most being able to do this correctly. Many students presented an answer of 7, their final answer showing a lack of understanding of the concept of LCM. Other mistakes often came with finding the final answer from multiplying all the prime factors from each of the three numbers. Some students left their answer in index form but most gave a numerical answer.

Question 8

Part (a) was answered well. Most students found the difference between the 2019 and 2018 figure and then expressed this as a percentage of the 2018 value. The most common mistake with this approach was to express the difference as a percentage of the 2019 value which was incorrect. A second approach was to divide 231 776 by 228 314 to obtain 1.015. Though this was often taken to a correct conclusion there were also plenty of mistakes in the final step to reach 1.5%.

In part (b) the students who were unable to recognise that this was an inverse percentage question gained no marks by attempting to reduce 231,776 by 7.7% from the calculation 231,776 x 0.923. Part marks were available for expressing the scale factor needed for an increase of 7.7% (ie 1.077 or 107.7). A few students did not round their final answer to 3 significant figures but a more accurate answer was accepted for full marks.

Question 9

This question was often answered well, some giving very clear and concise working. It is advisable to show the additions used to find the total frequency and the total number of points. This might have helped those who stated $49x$ for the total frequency and those who still think $0 \times 13 = 13$. Some used x instead of $3x$ when finding the total number of points whilst a few others simply plucked a value for x from somewhere. Not all students who obtained correct totals were able to form an equation using the mean, and those who did find this equation sometimes struggled to solve it correctly.

Question 10

This question was done well by the majority. Methods were shown clearly for the most part and incorrect answers were usually down to arithmetic errors rather than misunderstandings. The absence of negative signs in the given equations certainly helped and students generally handled the decimal constants accurately. The most common approach was to subtract equations after equating the coefficients of x or, less frequently, y. It is wise for students to show clearly that it is their intention to subtract. Some students rewrite the equations at this point, omitting the variables with the same coefficient, and they were far more likely to make mistakes, especially adding the equations instead of subtracting. It is also wise for students to show clearly how they use the first value they find to work out the value of the second variable. Most do show the substitution and, dependent on a correct method to find the first value, they score a second method mark even if there is an arithmetical error in the value of the first variable. A smaller number of students approached the question by rearranging one of the equations and substituting into the other to eliminate a variable. This method was often completed successfully, more so than usual. It was pleasing to see that very few students opted to use trial and improvement or simply to write down answers without any working, neither of which gained credit.

Question 11

Work was often muddled and messy to mark with few angles labelled. The majority who attempted the question got the M1 for a correct interior or exterior angle for this polygon. Lots could then go no further. Students who were successful here were able to work with the quadrilateral and pentagon and the obvious symmetry. Several used the fact the x=y to calculate 54 rather than showing it. It would be beneficial to some students to use the diagram to write down the appropriate angles as relying on their annotations in working was often difficult to work out which angle they were referring to.

Question 12

Some students failed to recognise there were two stages to this question to gain full marks. Both “6” and “10^{40}” had to be raised to the power of 3. Many students frustratingly did this but then failed on the final stage by failing to put their answer in standard form, hence 216×10^{120} was commonly seen and it lost the final accuracy mark.

Question 13

A reasonable number of students knew what was required by this question and full marks were quite common. The most frequent mark was for $x \geq -1$, though it was not unusual to see

$y \geq -1$ or $x \leq -1$. The line $y = x$ was usually identified but the inequality was sometimes reversed. The equation of the third line was given but attempts were commonly made to rearrange it, often to the form $y \leq \frac{1}{2}x + 4$, sometimes making mistakes in the process, and occasionally using the wrong inequality sign. A surprising number of answers listed equations rather than inequalities, for which no marks were scored. Just a few answers listed integer points within the region. Marks were awarded for the use of $\leq$ and $\geq$ or for $<$ and $>$ as appropriate but it should be noted that the convention is for solid boundary lines to be inclusive.

Question 14

Although many students scored full marks, others were put off by the scenario of the question and started by (unnecessarily) calculating the length of *AC*. Others, rather than using the economical method of employing tan 5°, preferred to use the sine rule to find the extra height needed to be added to 2.6 m

Question 15

Generally, this question was well answered. A disappointing number of candidates did not order the data before attempting to find the quartiles. Common mistakes included not ordering the numbers or finding the range or the mean.

Question 16

Probably the most economical method of completing this question was to find angles *DFE* (=42°) and *EFG* (=90°) and gaining the correct answer of 48° by simply subtracting these two values.
Common mistakes were assuming that the chords *DF* and *EG* cut at right angles, or angles *GED* and/or *FDG* were 42°. In the main, incorrectly stated angles, either by labels or positions in the diagram were ignored, but marks were withheld for a correct answer of 48° if using these incorrect angles in an incorrect method.
Explaining reasons using correct mathematical language remains a problem with many candidates struggling to explain what they mean without using key phrases such as semi-circle, chord, segment etc.

Question 17

It was clear that some students used the functions on their calculators to simplify the surds, either writing $-6+4\sqrt{3}$ with no working or after working that made no progress. This scored no marks in a question that specified "show that". It was necessary to understand and demonstrate the procedure for rationalising the denominator to gain any credit. A reasonable number of students did this, though some used $\sqrt{3}+2$ as the multiplier, and many of them simplified the fraction sufficiently to score the second mark. Very few students were able to take the final step by writing $4\sqrt{3}$ as $\sqrt{48}$. Despite this, the question was answered better than similar questions in previous series.

Question 18

Several students were able to score well here with most choosing $(2n + 1)^2$ and $(2n + 3)^2$ as examples of squares of two consecutive odd numbers. Some failed to proceed any further in gaining marks by incorrect expansion(s) of brackets. Those who gained no marks sometimes started from the premise of expanding $(n + 1)^2$ and $(n + 3)^2$.
To justify the remainder of 2 when dividing by 8 we needed to see
$(8n^2 + 16n + 10) \div 8 = n^2 + 2n + 1 + 2/8$ or $8(n^2 + 2n + 1) + 2$ or $8n^2 + 2$ from the candidates opting to start with $(2n^2 – 1)^2$ and $(2n^2 + 1)^2$. A few students who achieved M1 M1 were not awarded A1 because their justification was inadequate.

Question19

Students often gained M1 for the 16 from correct working but many responses came from "12 + 4" which gained no marks because it was an incorrect method. Several students then added 3 but did not divide by the 2 to get the radius and so lost both the second M mark and the A mark. There were quite a few blank scripts and answers with students trying to find the area of a sector and multiplying all the digits seen together.

Question 20

It was anticipated that most students scoring full marks would start by finding the correct scale on the frequency density axis and from this generate the correct frequencies of 3, 8, 5, (12), and 2 tomato plants corresponding to the correct height intervals. Many students chose this method. Others chose, with varying degrees of success, to use ratios (eg number of small squares or larger squares). This method needed to find the ratio of the plants in the 75 → 85 cm interval (12) to the number of plants in the other intervals (18) using areas, to find the total number of plants (30). Other valid methods method were also pursued which, if they led to the correct answer (1/6), gained full marks.

Question 21

In part (a) many students were able to identify solutions to the equation and write down the values accurately to 1 decimal place. There was also much evidence that the quadratic formula was being used either to obtain or to check these solutions. This often led to answers being given to more than 1 decimal place and this was penalised. Students should be aware that algebraic answers may receive no credit when the question demands that a graphical method is required. There were some instances of answers being stated incorrectly using coordinates, (–0.2, 0) and (2.2, 0) or (–0.2, 2.2) for instance.

The quadratic formula was often used in part (b) of the question too. No credit was given for answers obtained in this way. The question clearly demanded that values should be found graphically by drawing an appropriate straight line, emphasising that working should be shown clearly. Consequently, it was necessary to see the equation $y = –2x + 1$ to justify a correct method. This was very rarely achieved. Attempts to avoid finding this equation included drawing another curve, usually $y = x^2 – x –1$, and finding solutions using the quadratic formula and using them to draw a straight line. A common mistake amongst those who understood that they had to find the relationship between the two equations was to subtract $(2x^2-4x-1)-(x^2-x-1)$ to get x^2-3x and then to draw a second curve, $y=x^2-3x$.

Question 22

A large proportion could not set up the initial inequality but successfully worked with the correct quadratic to find the solutions (an equal of mix of factorisation and quadratic formula) so gained 3 marks. A significant number of candidates set up and expanded an expression for the area of the rectangle but did not include 75 to make an equation or inequality at all, so they could not gain any marks. A common incorrect final answer for 4 marks was to give $-6.5 < x < 6$ as the solutions from the quadratic were –6.5 and 6

Question 23

Most students managed to gain at least the 1st mark for this question. Those that didn't usually had an incorrectly placed 1.6 in the cosine rule. Few students appreciated the need to work with an obtuse, rather than an acute angle, so were limited to 2 marks for working with 54.2 degrees. Many students showed correct use of the sine rule but with the incorrect angle. Those who managed to get to the correct angle of 36.2 often went onto score full marks but 180 – 54.2 – 18 =107 degrees led to the common incorrect answer of 3.19

Question 24

Here was an easy source of two marks, for those students familiar with calculus; by obtaining correct expressions for the velocity and the acceleration in terms of *t*. At this stage incorrect notation (d*y*/d*x* etc.) was not penalised. Most students who got this far were unable to appreciate that when a particle reverses its direction it is momentarily at rest, and hence its velocity is zero for specific values of *t*. As a result, the correct answer of (a =) 36 was rarely seen.

Question 25

A reasonable number of students had sufficient understanding of functions to know roughly what the questions required, starting with $x = 5 + 6y - y^2$ and then trying to find an expression for *y*. Some attempts failed to recognise this as a quadratic in *y*. They made no progress despite many attempts to manipulate the algebra. A few tried to use the quadratic formula but they often struggled to obtain a correct expression for *y*, failing to grasp that the constant term in the formula was $5 - x$ and not just *x*. Completing the square was by far the most successful approach, usually scoring 2 marks for $(y-3)^2$ and 14. The negative y^2 caused difficulty and signs were often lost. This led to equations such as $x=-(y-3)^2+4$ and $y=3\pm\sqrt{14+x}$ Those who did manage to achieve $y=3\pm\sqrt{14-x}$ sometimes forgot to eliminate the negative square root when giving the final answer. The last part of the question had to follow on from an answer in the same form as the correct answer. Many did not understand what was needed, sometimes repeating $x \geq 3$, the domain given in the question, but it was also good to see numerous correct responses from those who understood the question, sometimes after minor errors in part (a). Most remembered to use ≤ rather than <

Question 26

A lot of blank answers were the most common outcome for this question. Those who could get started managed to set up the two equations with the correct variable *m* (many used *n*) but were unable to get any further. Common errors were substituting 39 in for *m* instead of the sum or using formula for term instead of sum.   Students must remember that the formula sheet has the formula for the sum of an Arithmetic series as the first item on the list!

Based on their performance on this paper, students should:

- Ensure they show working when requested eg Question 2 and Question 17
- On a ‘Prove that’ question , eg Question 18, students should confirm the result they are trying to prove
- Use economical methods eg if using right angled triangles, normal trig rather than the sine rule or cosine rule are often easier
- Know circle theorems with relevant words for parts of the circle
- Show angles on diagrams or clearly label the angles you are finding in the working space
- Remember that various formula are written on page 2 of the paper
- Know the difference between the method to find LCM and HCF

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