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Examiners' Report
Principal Examiner Feedback

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International GCSE Mathematics
4MA1 1H Principal Examiner's Report

Candidates who were well prepared for this paper were able to make a good attempt at all questions.

Candidates were less successful in applying the formulae for area of a trapezium and summation of a series, to a problem.

On the whole, working was shown and easy to follow through. There were some instances where candidates failed to read the question properly. For example, in question 9 some candidates did not realise that this is a reverse percentage.

Finding the compound interest, probability, surds, algebraic manipulation and bounds seemed to be a weakness for many candidates. Operations involving negative numbers also caused difficulty.

Generally, problem solving and questions assessing mathematical reasoning were tackled well.

Question 1

Part (a) was answered well by the candidates. It was relatively rare to see an incorrect response in this part of the question. It was encouraging to see candidates could interpret set $A \cap B$.

Part (b) was answered well by the candidates. It was relatively rare to see an incorrect response in this part of the question. Many candidates clearly wrote down the eight numbers as required. It was encouraging to see candidates could interpret set B'.

Part (c) was mostly answered well. Many candidates did write $\frac{3}{14}$, however, some candidates were able to score 1 mark for writing down $\frac{3}{a}$ or $\frac{b}{14}$ provided the probability was less than 1 ($\frac{3}{a}$ was much more common than $\frac{b}{14}$).

Question 2

Candidates found this to be a tough question at the beginning of the paper. Higher grade candidates reliably found a correct answer but those in the target range struggled to organise all of the details correctly. Many candidates could gain at least one mark from this question. Different approaches were taken to calculate the total number of toys made in one day which was 22 500. A variety of other irrelevant and somewhat confused attempts made regular appearances. A common error made by candidates was that they assumed that there were 360 seconds in one hour. Some candidates used 24 hours in the day. Candidates need to recall how to convert hours to seconds. Often a student found 22 500 then they divided by 0.002 rather than multiplying by 0.002. Some candidates miscopied the probability as 0.02.

Question 3

This question was answered well. For those who attempted the question, a fully correct graph was often seen. Although it's disappointing to see a number of candidates who plot the correct points and don't put a line through them. A few candidates made errors such as wrongly plotting one of the points, but these were generally able to gain 2 marks for a correct line through at least three of the correct points. Mistakes were generally with the negative *x* values, often leading to jagged or curved lines. A small minority gained just one mark for a line drawn with a negative gradient going through (0, 7) or for a line in the wrong place, but with the correct gradient. Some candidates did not extend their lines through the full range of values specified, losing 1 mark as a result.

Question 4

This question was generally answered poorly by the majority of the candidates. Many candidates could not work out the value of *x* or stated that the value of *x* was the median value of 9. It was encouraging to see a few candidates setting up an equation such as $\frac{4+7+x+10+2y}{6}=11$ and then going on to solve for *y* when $x = 8$ or when *x* may be a number $7 < x < 10$. Some candidates opted for a trial and error approach and some were able to reach the correct final answer. However, a common incorrect approach was to write $\frac{4+7+9+10+18+18}{6}=11$. Thus, it was, however, quite common to see $x = 9$ and $y = 18$ given as the final answer. Candidates should take care reading the question; some stated the formula for the mean but set it equal to 9 (the value of the median) while others used 5 as the denominator despite 6 values being stated in the question.

Question 5

Part (a) was well answered. Some candidates wrote down 0.057 or 000.57 or 5700 as incorrect answers sometimes written as $\frac{57}{10\,000}$.

Part (b) was well answered however some candidates wrote down incorrect answers such as 8^5 or 8×10^{-5}

In part (c), many correct answers were seen, usually without any intermediate working. Those who didn't get the correct answer often gained one mark for showing the digits 455 or for working out the numerator as 273 000. Many candidates, though, made hard work of this question which could have been done easily with the correct use of a calculator. Many converted the values to ordinary numbers to do the calculation causing them to lose their way.

Question 6

This question posed some difficulties for some candidates. There were a lot of distance, speed, time triangles, but not all were correct and those that were written in the correct orientation were not always used correctly. Some candidates tried to convert 100 km into metres and 28 440 km/h into m/s. The most common error seen was to write down 28 440 ÷ 100. Some candidates calculated 100 ÷ 28440 as 0.004 i.e. rounding prematurely thus eventually losing the accuracy mark. Once again, there was evidence of poor numerical skills with the initial part of the question. Many candidates were not sure whether to work out 100 ÷ 28440 or 28440 ÷ 100 as they are used to dividing large numbers by small numbers.

A few candidates did not use their calculator and tried to round the given figures; this was not appropriate for this question. If candidates are expected to estimate they will be told to do so in the question.

However, there were many good responses seen with many arriving at the correct answer from correct working.

Question 7

In part (a), many candidates were able to score full marks, and many others scored at least one mark for expanding the brackets to obtain $20 - 5x$

Some candidates had difficulty in isolating the terms on either side of the equation. Candidates wrote down $20 - 5x = 7 - 3x$ but some could not isolate the x terms and the numbers. Common errors were based on fundamental misunderstandings of algebraic processes, e.g.,
$-5x - 3x = 7 - 20$, $3x - 5x = 20 - 7$, incorrectly moving terms from one side of the equation to the other side, usually by not changing the sign of the term.

As the question clearly states 'Show clear algebraic working', some of those candidates who attempted to find the solution by trial and improvement gained no marks.

In part (b), it was encouraging to see a fair number of correct responses for factorising a two term expression with common factors. Where full marks were not awarded, others gained one for a correct partial factorisation with at least two factors outside the bracket (especially using 4 instead of 8) or having the correct factor outside the bracket. There were also many and varied incorrect attempts. There were also many non-responses. Some candidates simply attempted to combine the two terms through a mix of addition and multiplication, showing a lack of familiarity with the concept of factorising two terms.

In part (c), many incorrect answers were seen and the main incorrect answer was to write the signs the wrong way round in the brackets e.g. $(y - 6)(y - 8)$ or $(y - 6)(y + 8)$ or $(y + 6)(y + 8)$; one mark was awarded for this. Many candidates found this part difficult and then could not answer the second part of this question. Some candidates tried to factorise again or try to use the quadratic formula. Candidates should ensure they have the correct factors by multiplying back as a useful check for this type of question. Candidates failed to recognise that the word **hence** meant that they must use their previous answer to solve the equation.

Question 8

This question was only accessible to candidates who were able to calculate the sum of interior angles of a polygon. Some candidates could not recall $(n-2)\times 180$ or use the method of triangles to work out the sum of the interior angles. As a consequence, many candidates scored no marks. Those who were able to make a start usually attempted to find *x* by a numerical approach, rather than forming an equation. A correct equation was enough for the second mark but a complete numerical method was required for this mark. Many candidates found 1302 but did not know how to continue with the question. A common incorrect approach was for candidates to recognise the symmetry in the shape and assume that all angles were duplicated. They therefore incorrectly identified the missing angle in the polygon as '148' and subtracted this from 360. For candidates who were able to make progress with the question and reach an intermediate value of 138, a small number of candidates subtracted from 180, rather than 360, incorrectly applying their knowledge of exterior angles to this situation. Another common incorrect answer was 212, scoring no marks.

Question 9

Many candidates were successful in this question where they understood that the given value had already been decreased by 20%. The incorrect method of finding 20% of 1080 and then subtracting or adding was seen. Careful reading of the question would help candidates realise that the 20% is a percentage of the original price and not 20% of the given price.

Question 10

Part (a) was fairly well answered. Answers of 3^{37} were quite common. Sometimes the answers that were given were expanded and/or written as a single number.

Part (b) was answered well. Many candidates could write $A \times B$ as a product of its prime factors. Candidates were generally able to multiply *A* and *B*, following the laws of indices. A common problem seen was a failure to write 16 as a power of 2 and produce an answer of 32×3^{80}, which unfortunately scored no marks.

Question 11

There were many successful methods which gained full marks. The majority of these comprised finding 4.6 and working out 13.8. Some candidates had problems rearranging the formula for the area of the trapezium to find *h*. A common error when working out 4.6 was not to divide by 2 but simply assume that *AX* was 9.2 not 4.6. Once the candidates worked out 4.6 and 13.8 they went on to apply trigonometrical ratios such as tan *ABX* = $\frac{'4.6'}{'13.8'}$ **or** tan *BAX* = $\frac{'13.8'}{'4.6'}$. This enabled the candidates to work out the angle as 18.4 or 71.6. Some candidates forgot to add 18.2 to 90 or subtract 71.6 from 180.

Some candidates used a two step method using $AB\sqrt{'4.6'^2+'13.8'^2}$ and then using simple trigonometry or the sine rule or the cosine rule. This ran the risk, inherent in all circuitous methods, of loss of accuracy in the answer due to premature approximation at some stage.

It was not unusual to see the sine rule or cosine rule used, unnecessarily but usually accurately, in right-angled triangles. Working was often easy to follow but some attempts provided a challenge to markers, especially when they covered all the available space. Their task was made more difficult by the ambiguous labelling of sides.

Question 12

This question was generally well attempted. A number of candidates rearranged one equation and then substituted their expression for either x or y into the second equation; a lot of good algebra was seen in this process. Of those candidates who opted to start in the more traditional way by multiplying both equations, many either chose the wrong operation to eliminate or else chose the correct operation but made an arithmetic error (these usually came when attempting to deal with the arithmetic of negative numbers). There were few candidates who wrote down the correct answers without any working but those that did gained no marks.

Question 13

This question differentiated well. Most candidates were able to access the first mark for writing down an equation such as $8000\times\left(1+\frac{x}{100}\right)^6=8877.62$ or equivalent. Many candidates could not rearrange the equation and in particular find the sixth root of $\left(\frac{8877.62}{8000}\right)$. This caused many problems for candidates by using incorrect methods such as writing down, for example, $8000\times\left(1^6+x^6\right)=8877.62$ as they could not deal with the power of 6. Some candidates managed to write down $\frac{8877.62}{8000}-1$ and then find the sixth root of this expression. Some candidates lost the final mark as they left their answer as 1.0175 or 101.75.

Question 14

Candidates' ability to deal with proportionality questions has not really improved over the years. They show little confidence in the setting out of the steps to find the value of the constant and the presentation of their work is often poor and very confused. For the values of F and v to each involve a variable was a step too far for many.

Candidates who used the correct initial formula $F=\frac{k}{v^2}$ generally went on to score full marks in this question. Some candidates misread the question as they wrote down $F=kv^2$ or $F=\frac{1}{v^2}$. Once a student wrote down $F=\frac{k}{v^2}$ then they went on to work out the value of k correctly. Those who failed to gain any credit tended to use direct proportion. Some candidates used $\sqrt{v}$ instead of v^2 in the relationship.

Question 15

In part (a), most candidates were able to complete the first branch but marks were lost by those who assumed the probabilities relating to Spinner A were the same as spinner B. A common error in this part was to only put in one pair rather than two pairs of right hand branches. Some candidates did conditional probability so the second probabilities were $\frac{1}{4}, \frac{3}{4}, \frac{2}{4}, \frac{2}{4}$.

In part (b), most responses scored 0 or 3 marks. Errors included adding their probabilities along a branch rather multiplying. Provided that each fraction was less than one, these fractions obtained in (a) were followed through for the method in part (b). In this way, two of the three available marks could be gained. Many candidates scored at least one mark for stating correctly the calculation for one of the available paths. The most common mistake was for candidates to not identify all three possibilities, often missing off the option of both spinners showing green. Some candidates worked with decimals throughout; this did not markedly affect the spread of results, with fully correct and fully incorrect answers seen in (b).

Question 16

Part (a) was answered well and a correct reason was clearly stated. A common incorrect answer given was ‘the angle at the centre is twice the angle at the circumference, and a numerical answer of 116 generally accompanied this. This was not the reason to gain the second mark in part (a). Candidates who did recognise the correct approach and reason, sometimes lacked familiarity with the terminology needed. Reference to ‘cyclic’ was sometimes omitted and occasionally ‘trapezium’ or ‘parallelogram’ replaced ‘quadrilateral’.

Part (b) was not answered well. Many candidates left this blank, or followed incorrect methods, scoring 0 marks. Dividing 58 by 2 was a common error, as was subtracting from 180. Most candidates restarted their calculations, rather than using their answer in (a). A common answer was 116^{o}, found by doubling the angle at *N* and failing to realise that this is not the reflex angle *MOP*. Many of the answers given were not reflex angles, including the common 116.

Question 17

The correct reasoning process needed to answer this question was $\frac{m_{UB}}{v_{LB}}$. Responses tended to fall into three groups (i) candidates who followed the processes shown above (generally gained full marks), (ii) candidates who knew something about lower bounds and upper bounds but could not apply the reasoning correctly (1 or 2 marks) and (iii) candidates who had little or no idea of bounds (those who worked out an answer using exact values and then took the upper bound of this exact value).

For many candidates the 5 kg caused problems as it was given to the nearest 50 grams. candidates were unsure on converting mass into kg or g and then finding the upper bound. 5.050 was a common seen. When finding the bounds of the volume, some candidates worked only with the 1.84, not including 10^{-3} in their answer. Others changed to decimal form but made errors, so that e.g. 0.01835 was sometimes seen. Most candidates scored a maximum of 1 mark, for the varied reasons stated above; it was relatively rare for candidates to correctly deal with rounding to the nearest 50 grams, change kilograms into grams, correctly round a number in standard form to 1 significant figure *and* correctly identify the bounds to use. The density formula was generally stated correctly however.

Question 18

Part (a) was answered well by many candidates. This was a standard histogram question set on the paper. Some did lose a mark by drawing bar heights in the correct ratio to the ones given in the mark scheme. Unless they labelled the frequency density axis or provided a key, these candidates were limited to 2 marks. Some candidates decided to divide each frequency by the corresponding midpoint value in the class interval, or by the upper limit. Another common error was to divide by the midpoint or end points of the table to find their 'frequency density'. A common error was not to label the *y*-axis. Some candidates were awarded 2 marks for the correct frequency densities given by the table. Many candidates were not familiar with histograms and instead drew frequency diagrams, line graphs and cumulative frequency diagrams, all of which scored 0 marks.

Part (b) proved a challenge for many candidates. Many candidates did not know how to work out the number of plants with a height greater than 40cm. Some simply wrote down 40 + 8 and another common error was to write 500 + 400 + 80. candidates who drew a correct histogram often scored both marks in (b). A few candidates who scored 0 in (a) were able to gain full marks in (b) from correct numerical reasoning using the table of values.

Question 19

Marks on this question were well spread with less able candidates struggling to start. Many candidates did write down a correct expression to multiply both numerator and denominator by the same correct expression. $3+\sqrt{7}$ was the expected choice but some used $-3-\sqrt{7}$ instead. The more able candidates were able to expand the numerator to obtain 2 correct terms. Some candidates did not correctly simplify the numerator and denominator so lost the final accuracy mark. This was a challenging question. Many candidates used an incorrect expression to multiply numerator and denominator by, with $3-\sqrt{7}$ often seen, as well as $\sqrt{7}$.

A significant number of candidates used their calculator to reach the answer straight away, and if they did not show the steps of the working, as requested in the question, they scored no marks.

Question 20

This question was answered well by some candidates. Many candidates worked out the linear factor to be $\sqrt{\frac{300}{108}}$ or $\frac{5}{3}$. The candidates went on to cube the linear factor and then multiply it by 135. Some candidates attempted the question by writing down a correct equation such as $\left(\frac{A_1}{A_2}\right)^3 = \left(\frac{V_1}{V_2}\right)^2$ and then substituting the correct values for *A* and *V*. Many candidates did not correctly identify the type of scale factor they were working with at each stage of the question. It was common to see candidates multiply 135 by $\frac{300}{108}$ or the linear scale factor only. Some candidates dropped into decimals immediately and rounded their scale factors, losing the final mark.

Question 21

The combination of skills needed to complete this question made it difficult so fully correct answers were sparse. Many candidates could not factorise $9x^2 - 4$ and/or $3x^2 - 13x - 10$. As they could not factorise the rest of the question was out of reach for the majority of candidates. Many candidates who did get to the stage $\frac{1}{x-5} - \frac{7}{x-1}$ could not find the common denominator and then lost the next three marks. Some candidates did gain only the third mark as it was independent of the other marks. Many candidates did not recognise the need to factorise, a fundamental approach to working with algebraic fractions; instead they chose to multiply out the various expressions, often being left with unwieldy numerators and denominators that prevented further progress. Candidates who did factorise correctly, did not always cancel fully and again encountered problems with further manipulation as a result. There were a significant number of candidates who were penalised for not recognising that they had to multiply the first two fractions before subtracting the third.

Question 22

The majority of candidates could not answer this question. Many candidates failed to rearrange the equation to find the gradient of $-\frac{7}{2}$ and then could not recall that the perpendicular gradient can be worked out using $m_1 \times m_2 = -1$. Some candidates lost the final A mark as they did not clearly write down the coordinates as required. A common error was not to write the answer as $\left(0, -\frac{89}{7}\right)$ but to write it as $(0, -12.7)$, The question clearly states to find the **exact** coordinates. Some candidates also did not recognise that the *x*-coordinate would be 0, offering different values for the *x*-coordinate.

Question 23

This was a poorly answered question with many candidates not engaging with it at all. Most candidates who were able to differentiate correctly equated their answer to zero. They lost the second mark as they had to clearly show the formation of an inequality, $3px^2 - m < 0$. Many candidates wrote down $3px^2 - m = 0$ and worked out the *x* values to be $\pm\sqrt{\frac{m}{3p}}$. Some candidates wrote down their *x* value as $\sqrt{\frac{m}{3p}}$ thus losing the B mark in the question. Only the most able candidates gave the correct range of values for *x*. Many candidates did not recognise the need to differentiate at all. Some introduced the equation of a straight line, while others factorised the expression for y.

Question 24

This was answered well by the more able candidates. The candidates wrote down the first term and the common difference and worked out the sum of the first 100 terms to gain two marks. A common error was to subtract the sum of the first 50 terms (8975) from the sum of the first 100 terms (35 450). The candidates should have worked out the sum of the first 49 terms (8624) and then subtracted this value from 35 450 to obtain the correct answer. There ought to be classroom discussion about the use of the word inclusive

Some candidates listed all the numbers from 351 up to 701 but had no idea what to do next so only gaining two marks.

Question 25

Part (a) was answered well by only the most able candidates. Candidates were not generally confident in using the correct terminology. Reflections were often described as 'flips' or 'inversions'. Those who did state 'reflection' often incorrectly stated descriptions for the x-axis, or failed to identify a mirror line at all.

Part (b) was answered well by a minority of the candidates. Candidates are encouraged to use sharp pencils when drawing graphs and to try to get their curves to go through the key points. Success with this topic tends to be limited to the higher grade candidates. They showed a reasonable understanding that a stretch and a translation were involved but struggled to get the combination correct. It might have helped them to consider it in two steps, first looking at the result of the translation and then stretching that curve. Details such as translating and stretching in the right direction were often wrong. Those who had the correct idea of what to do were sometimes let down by poor accuracy. Attempts at one part of the transformation were able to score a mark, but all five key points had to be correct and this was rarely achieved. Some candidates did gain one mark by plotting 3 key points correctly for the required curve.

Summary

Based on their performance in this paper, candidates should:

- Be able to work out the sum of the interior angles of a polygon
- be able to interpret inverse proportion
- be able to interpret set notation
- read the question carefully and review their answer to ensure that the question set is the one that has been answered

- make sure that their working is to a sufficient degree of accuracy that does not affect the required accuracy of the answer.

- Candidates must, when asked, show their working or risk gaining no marks for correct answers

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