Examiners' Report
Principal Examiner Feedback

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International GCSE Mathematics
4MA1 2F Principal Examiner's Report

This was an unusual examination series and we had a very varied group of responses with some of an excellent standard but others leaving out vast quantities of the questions on the examination paper.

On the whole, working was shown, but it is still the case that many students would do well to show us all the stages in their work, especially when a calculator is used.

Problem solving questions often cause students problems and the best advice for them is to try to do what you can even if you cannot finish the question as valuable method marks can often be gained.

In some cases students misread numbers in questions, especially the numbers of zeros, and more care is needed. In some cases it appeared that students misread the numbers from their calculators giving a number very similar to the one required.

Question 1

Almost all students were able to select an even number and a multiple of 3 from the given list of numbers. Well over half were also able to select a prime number in part (c) and a cube number in part (d). Common errors were to include 1 as a prime number and to give 25 as a cube number.

Question 2

While a majority could correctly change 3 litres into 3000 millilitres, somewhat fewer gave the correct answer for changing 6500 grams into kilograms, where division by 100 and sometimes 10 was common.

Question 3

Most answers were correct for giving the frequencies for two marks and, where a candidate did make a mistake, most gained one mark for at least two correct tallies or frequencies. While many students clearly understood that 'mode means most' and gave the correct answer of 1 pet in part (b), a good number lost the mark by giving the frequency. In part (c), there were few correct answers for the range of the number of pets, as most students didn't realise that the lowest value for the number of pets was zero; so they subtracted 1 from the maximum value instead of zero.

Question 4

Working with directed numbers in the context of temperatures was well done by the majority, who in part (a) could identify the city with the lowest temperature from a list with five cities. Most could find the difference between two temperatures for part (b), the most common error being to subtract 10^o from 15^o instead of -10^o. In part (c), students were given an initial temperature of 22^o and asked to find the temperature when it dropped by 50^o; this produced many correct responses, although there were a noticeable number of students who incorrectly subtracted 22 from 50 to give a positive answer.

Question 5

In part (a), there were about as many students who could write a list of five decimal values in order as those who made an error. Most could write 0.6 as a percentage in part (b), with 6% rather than 60% being the most frequently seen incorrect answer. Writing 60/7 as a mixed number for part (c) was straightforward for many, but commonly seen was a decimal answer. In part (d), mostly correct answers were seen for the award of the two marks for subtracting a decimal value from a given fraction, nearly all by changing the fraction to a decimal before subtracting. Of those who worked in fractions, some lost one of the marks by giving the answer as a fraction.

Question 6

It was rare to see a wrong answer when giving the next term in a number sequence and likewise for an ‘explanation’ as to how they worked out the answer, which required ‘adding 4’. A few were able to give the nth term by way of explanation. The majority could also find the first number in the sequence greater than 70, most commonly by extending the list of terms. Part (d) asked if 96 could be a term in the sequence, and for a supporting reason, and there were many correct and straightforward responses; these usually referred to the sequence only having odd numbers and/or 96 being an even number, or that 95 was a term in the sequence so 96 could not be.

Question 7

Responses here were variable, from all parts correct to all parts incorrect, but the majority scored at least some marks for giving and plotting coordinates in parts (a) and (b). Where marks could not be awarded, this was usually for interchanging the x and y coordinates. Many attempts to find the midpoint in part (c) were correct. The least well done part was (d), where students were asked to draw the line with equation $x = 4$. While many correctly drew this, many responses showed the line $y = 4$

Question 8

It was pleasing that most students were able to attempt to add four lengths of time onto a starting time of day and find the correct finishing time. A noticeable number of these did not appreciate that the starting time was given in 24 hour clock format and so did not indicate in their answer that the finishing time was in the afternoon; thus answers of 13:50 and 1.50 pm gained all 3 marks, while 1:50 was awarded 2 marks. Of the remaining students, some gained at least one mark either for adding the four lengths of time or for adding only two or three of the lengths of time to the starting time. A common error in adding times was to convert 1 hour 15 minutes into 115 minutes.

Question 9

A surprisingly high number of students were not able to read a sufficiently accurate figure from a conversion graph to give a value for 10 metres in feet. Some even ignored the graph and attempted to use a power of ten with multiplication or division. Interestingly, more gained the mark for reading a value in metres for 50 feet. Part (b) required the conversion of either 820 metres to feet or 2850 feet to metres, but this was set in a problem context which had to be interpreted. While there were students who understood this and could use sufficiently accurate figures to draw a valid conclusion, a variety of inaccurate and incorrect calculations were seen, as well as further work with powers of ten. An alternative method of comparing ‘multipliers’ (e.g. 820/10=82 compared with 2850/33=86.4) was sometimes used. Blank responses appeared regularly.

Question 10

Around half of responses showed all three correct values in their table. Where only one was correct, this was most usually 120^o, where students understood that the sum of the angles was 360^o and could subtract the three given angles to find the missing one. A good number could then work from 30^o to 12 pairs of trainers and from 165^o to 66 pairs, but this latter calculation was the least well done part of the question, where some students seemed unable to apply a similar method to that they had already used. Where no marks were awarded, this was mostly for the appearance of seemingly random numbers in the table or for blank responses.

Question 11

The majority of students could readily find 23% of 450. Errors were very varied, including division by 450 with multiplication by 100, and simply multiplying 450 by 23.

Question 12

Part (a) asked for the factors of 9 and although the number 3 appeared in most answers, about half the students omitted either 1 or 9 or both. There were also a concerning number of blanks.
Part (b) asked for the LCM of 15 and 70 but more students gave the common factor 5 as their answer than the correct multiple of 210. A good number were at least able to gain one of the two marks for showing the prime factors of both 15 and 70, most commonly on a ‘factor tree’.

Question 13

Finding the area of a floor in the shape of parallelogram and working out how much paint would be needed to paint it and the cost of this paint were the stages in this multi-step problem. Some students were able to produce clear and succinct working to arrive at the correct answer, gaining 5 marks. However, many were not and some attempts could not gain any marks, although most students seemed to display some understanding of the problem. The highest number of errors occurred for trying to find the area of the parallelogram. Students simply multiplied together the three given dimensions, or added them, sometimes using Pythagoras’ theorem to find the length of the unlabelled side. Confusion between perimeter and area continues to be an issue seen on candidate responses on Foundation tier papers. Those who did work with area often split the shape into a rectangle and triangle but added the area of the triangle instead of subtracting or forgot to divide by 2 when finding the area of the triangle. Partially correct attempts were able to gain one of the first two method marks. Provided that there had been some attempt at finding the area using dimensions from the diagram, division of their ‘area’ by 20 to work out the number of tins of paint was awarded a method mark. When a candidate continued from here to work correctly to find the cost of their tins of paint another method mark could be gained. Of those students who had managed to work accurately to this point, some did not realise that the paint could be bought in a combination of packs of 4 and single tins and lost the final accuracy mark, as the total cost they gave was not the least cost.

Question 14

Around half of the students could correctly take out a single common factor, while the remainder seemed not to understand what was required. The most common incorrect answer was 15f from attempting to subtract 10 from 25f. In part (b) for changing the subject only around a quarter of the responses were fully correct, with a smaller number of students gaining one mark for a correct first step. Students need to be aware that writing a fraction over a diagonal line is not good notation, as in an example like this where both c and h are divided by 5, the use of a diagonal line shows only the second letter divided by 5 and thus is not a fully correct answer. A regularly seen error was simply for the y and c to be swapped over. Other incorrect responses were variable and came from seemingly random algebraic manipulation. That was also true for part (c) where well over half the students were not able to gain a mark for solving an inequality. Blank responses were regularly seen, as were answers where the question was just re-written, sometimes in words. In a good number of instances this was because they did not know what was being asked. Some were able to benefit from the award of one mark for either a correct first step or by finding the minimum value of x but unable to write this into an inequality for their answer.

Question 15

Showing how to divide given two simple fractions was clearly set out by a little under half of the students. However, many lost one of the two marks for not showing all the steps; students would benefit in general by providing more method than not enough. Most of the rest had little idea and those who tried to work with decimals were not successful in gaining any marks.

Question 16

Only a little over half of the students could identify the modal class from a grouped frequency table, which is quite concerning. However, in part (b) where an estimation for the mean was asked for, just under half were able to gain either full or part marks. Part marks came either from using a consistent value within each time interval which was not the midpoint or from division of the sum of products by a value other than the total frequency. The usual variety of incorrect approaches was seen, for example, adding the midpoints or the frequencies and dividing by 5, and adding the lower and/or upper bounds of the time intervals, usually followed again by division by 5 Here, and in general, students could gain more marks if they were to reflect on their answer in the context of the question to consider if it makes practical sense. 5760/5 = 1152 is an obviously incorrect answer when the question information is read carefully.

Question 17

Given a list of ingredients for 6 people, the requirement was to work out the quantity of one ingredient needed for a larger group and then to find how many people could be served using a given amount of another ingredient. Part (c) was a standard ratio question where 162 had to be shared in the ratio 2 : 7 In all three parts about twice as many students gained full marks than those who scored no marks. The success rate in part (c) was a little lower than in (a) and (b), with marks lost for forgetting to multiply by 2 once 'one part' had been found, or for division into 162 by each separate ratio number.

Question 18

Students here needed to use their knowledge of angle facts in a parallelogram and triangle to find the size of a missing angle, and give full reasons for their working. A handful managed to do just that and were rewarded with 5 marks. A slightly larger number gained 4 marks, for finding the correct size of the angle but not writing down *all* their reasons. There were a noticeable number of students who could correctly find the size of the angle but gave no reasons, for 3 marks only. Not all students understand that giving reasons is not the same as showing full working and they should be encouraged to learn how reasons should be stated using mathematical terminology. They also need to understand the 'angle DEF' notation, as there are students who think this means the sum of angles D, E and F and give 180^o as their answer. A correct first step was made by some students, giving them one mark, but a large number were unable to move beyond some random working, usually incorporating values from the diagram with 180 and 90 but in ways that were not relevant. There were also those who began by subtracting 58^o from 180^o to give 122^o but there was no indication from their working or by a label on the diagram which angle they were calculating, so the method mark could not be given. Of those who mistakenly thought that angle EDF was 58^o, many clearly knew the properties of isosceles triangles, as they gave 61^o as the size of the other angles.

Question 19

Given ratios of 3 : 2 : 5 and told that the 2 : 5 'shares' were together £76 more than the 3 'shares', students had to recognise that £76 was the difference between 7 shares and 3 'shares' and divide £76 by 4 to find 1 'share'. The small number of students who grasped this almost always went on to complete the problem successfully, finding three 'shares' and subtracting the cost of a game to find how much money was left. However, by far the majority of students found this multi-step problem challenging to interpret and so never got beyond some tentative working with ratios, often based on adding 3,2 and 5 and trying to use 10 in various ways, which gained them no marks. There were many working spaces left blank. The incorrect answer that was seen most regularly was £27.50 from subtraction of £48.50 from £76, values which were given in the question.

Question 20

In part (a), being asked to increase a given salary by 4% enabled a high number of students to be awarded all 3 marks, with others gaining one for simply finding 4% but forgetting to add it on. A regularly seen error was to increase by or find 40% instead of

4% There were also attempts to find 10%, 5% and 1% of the original salary and use these to find 4% but invariably there were mistakes and working was not shown, so no credit could be given. Instances were seen of division by 4 and even subtraction of 4. In part (b), students needed to appreciate how compound interest works; some did and used (rarely but efficiently) multiplication by 0.85^3 or more commonly worked one year at a time remembering to find 15% of a reduced amount each time. Around the same number of students could find 15% of the salary, often subtracting it from 750 000 either just once or three times or they calculated 45% of the salary or decreased it by 55%; any of this working gained them one mark.

Question 21

A majority of students gained a mark in part (a) for multiplying 2 terms, correctly using the 'addition rule' for indices. However, in part (b), around the same number were unable to square the term $3cd^4$ correctly, with often only the *d* term squared or the 3 doubled to give 6 or d^6 instead of d^8. As well as a small number who gave the correct answer, about the same number gained one mark for writing two of the three terms correctly. In part (c), only about a quarter of the students were able to solve a pair of simultaneous equations correctly. A few others gained one or two marks for a correct initial step for finding each of x and/or y From responses, it was clear that many students knew they should multiply one or both equations but often this did not result in equating coefficients so that adding or subtracting resulted in still having both x and y in their new equation. Some students were hindered in their progress towards a correct solution by having their working in assorted places, rather than a more methodical approach, which might have eliminated some of the many errors seen.

Question 22

This was a straightforward question, not set in any context, to find the size of an angle in a right-angled triangle using trigonometry. Only a minority of students managed to do this, with a further few able to gain one mark for recognising that it was a question that could most easily be done using tan x and that 3.4 should be divided by 4.7 A high number of responses with Pythagoras' theorem were seen but mostly students did not move on from that so scored no marks. Had they used the value of the hypotenuse within a correct trig ratio they could have gained further marks. Although there were often indications from sight of the words sin, cos and tan that students recognised the need for trigonometry, working that followed suggested guesswork, and simple multiplication of the dimensions from the diagram was a regularly seen approach.

Question 23

This question did require the use of Pythagoras' theorem but here most responses failed to use it! A small number of students recognised that it was needed to find the height of the triangle, which they did, and then used the height to work out the area of the triangle, gaining all four marks. By far the majority of students did not appreciate that there was a dimension to be found and simply worked with the numbers given. Some used the 8.5 cm length of side as the height; thus the most common wrong answer seen was 34, with frequent appearance of 68 when a candidate had forgotten to divide by 2. Others added the length of the three sides and found the perimeter. Frustratingly, there were a noticeable number of students who successfully found the height for 2 marks but did not then recall that it was the area of the triangle that was asked for in the question.

Question 24

It was encouraging but a rarity to see a fully correct response to finding the total surface area of a cylinder, where the height had first to be worked out from information given about the volume, and to award all 5 marks. Some other students also found the height and used it to work out the curved surface area of the cylinder but omitted to include the two circular areas. This was worthy of 3 marks and a good number of students benefitted from this. The area of the two circles could be found from the dimensions given in the question and where this was calculated an independent mark could be awarded. Again, frustratingly, there were students who found that the height of the cylinder was 8 cm but failed to progress from there to substitute values into the relevant formulae to find the surface area. This question was another where confusion between perimeter (circumference) and area was apparent.

Summary

Based on their performance in this paper, students should:

- learn and be able to recall metric conversions such as 1 kg = 1000 g
- learn how to convert minutes to hours
- know that factors of a number include 1 and the number itself
- know the difference between LCM and HCF
- learn angle reasons using correct terminology eg isosceles triangle
- note that a perpendicular height is needed to find the area of a triangle when using

  Area = $\frac{1}{2} \times \text{base} \times \text{height}$
- show clear working when answering problem solving questions
- read the question carefully and review their answer to ensure that the question set is the one that has been answered

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