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Examiners' Report
Principal Examiner Feedback

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Mathematics A (4MA1) Paper 2F

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Students were, on the whole, well prepared for this paper and were able to make a good attempt at all questions. It was encouraging to see good attempts at multi-step problem solving questions such as question 17

On the whole, working was shown and enabled students to benefit from method marks, even when an arithmetic error had occurred. The minority of students still need to be reminded that they need to do this.

There were some instances where students failed to read the question properly. For example, in question 8b a significant number of students gave the fraction of animals that are not cows rather than the fraction that are cows.

Metric unit conversion continues to be a weakness e.g. question 22, as does the recall of the correct circle formulae, e.g. question 12a

Question 1
All parts of this question, testing basic understanding of simple decimals, fractions and percentages and conversions between them, were successfully answered by almost all candidates. The error that was seen most often, but by only a small number, was giving 0.7 as 7% rather than 70%

Question 2
This question also had a very high success rate. Candidates showed a ready understanding of simple probability and most gained full marks. A few incorrectly chose certain rather than likely for an event with actual probability 5/6 and the occasional probability line was seen marked at 2 or 4 instead of at 3

Question 3
It was encouraging to see so many fully correct responses to this simple problem-solving question. Most candidates understood to divide the 150 (burger rolls) by 6, as the rolls come in packets of 6, and then to multiply this by £1.03, the cost of each packet. A very small number of candidates wrongly multiplied the total number of burger rolls by £1.03

Question 4
It was unusual to see errors in any parts of this basic algebra question. When collecting like terms, a few candidates, who were fine with 4m and 2m, were unsure about what to do with the single m When asked to multiply two terms, the occasional candidate added the numbers.

Question 5
When asked to represent some temperature date for two cities, a high number of candidates scored full marks, producing a statistical diagram (various types of bars graphs and time series graphs) that had a correct scale, accurately plotted values,

some means of distinguishing between the two cities and labelled axes. The most common way that a mark was lost, was by failing to include a label on the temperature axis; such responses were seen about as often as fully correct diagrams. For a few, finding an appropriate scale was an issue, as was accurate plotting of all the values.

Question 6
Giving the 12 possible combinations when a 6-sided dice and a coin are thrown proved very straightforward for almost all candidates. The occasional pairing was missed and a few candidates simply stated the number of combinations but such responses were rare.

Question 7
Many candidates were able to reflect a triangle in the line y = 1 and gain the two marks. However, the original triangle was often seen reflected in the y axis, which gained no marks Candidates were able to gain one mark, if they reflected the triangle in a line parallel to y = 1 or in the line x = 1 and such responses were common.

Question 8
In part (a), many candidates could write 19/5 as a mixed number but it was not uncommon to see 3.8 and there were even some non-responses.
In part (b), given a total of 84 animals, almost all candidates could subtract the number of other animals to find the number of cows and give this as a fraction out of 84 They were awarded 2 marks. A noticeable number of candidates were able to benefit from the award of 1 mark for either finding the number of cows but not expressing it as a fraction or for giving the number of 'non-cows' as a fraction of 84
Ordering 4 fractions in part (c) produced many correct responses; where working was shown this was usually the conversion of the 4 given fractions into decimals, with the rare occurrence of attempts to convert to fractions with a common denominator.
In part (d), candidates were asked to show that the subtraction of one given fraction from another led to a given fraction. The success rate in this style of question seems to have improved, with a pleasing number of candidates showing fractions with a common denominator, the result of that subtraction and concluding with the given answer. One mark was regularly lost by missing out either the interim fraction or by not showing the concluding step. However, conversion to decimals, ambiguous statements and random working (usually multiplication) with the numbers in the question were often seen.

Question 9
This multi-step problem needed candidates to calculate the volume of water in a cuboid shaped tank, convert the volume to litres and, given the requirement of 4 litres of water per fish, find the maximum number of fish for the tank. While correct answers appeared regularly, errors were more frequent. The water level in the tank, 3cm below the top of the tank, proved an initial stumbling block, as

candidates were not sure at what point to subtract the 3. So the first method mark could be given for finding the volume of water or the volume of the tank. Where the wrong volume was then used, method marks could still be gained for division by 1000 and division by 4 and these steps were regularly credited. A surprising number of candidates attempted to find the volume by multiplying two of the dimensions and dividing by the third, and adding the three dimensions was also a fairly popular starting point.

Question 10

This question showed an accurate pie chart with the number of degrees for each type of animal given. For part (a) the majority of candidates were able to find the ratio of number of elephants to number of giraffes; where this was simplified and given as 2:1 the accuracy mark was also awarded. A single mark could be gained by leaving the correct ratio not fully simplified or for an answer of 1:2

Part (b) told candidates that 8 lions had been seen and asked for the number of giraffes. This was well done, although with quite random attempts making an appearance from some candidates. Part (c) showed a second pie chart (same size), with the same types of animal seen. The sector for elephants was larger on the second pie chart than the first. The subtlety, that this does not necessarily mean a greater number of elephants, was lost on nearly all candidates, who simply stated that more elephants were seen because 190^o is bigger than 150^o A few were able to recognise that the total number of animals might have been different and expressed this in a variety of ways to gain the mark.

Question 11

In part (a) most could solve a two-step equation and an encouraging number of candidates showed algebraic working. Trial and improvement was seen and noticeably some candidates who added the 5 from 5*m* to the 7 to get 12*m* and attempted to solve from there.

Finding the subject of the equation in part (b) had a lower success rate, with much confusion over the order of working and a good number of candidates who simply swapped the two letters over.

Part (c), subtracting indices when dividing two terms with the same base, produced many correct answers, but addition of the indices and division of the indices were also seen regularly.

Simplifying n^o in part (d) was straightforward for those who ‘knew the rule’ but answers of 0 and n were probably seen more than the correct answer.

In part (d), candidates needed to cube an expression with a number and two letters, both with an index number. While many could deal with the letters, far fewer recognised that the 3 also had to be cubed, leaving it in their answer as 3, with others squaring it. Many incorrectly added the indices and some wrongly simplified x^6y^{15} to give xy^{21} on the answer line, thereby losing them one of the two marks.

Question 12

In part (a), where a candidate knew the formula for the circumference of a circle and used it, they tended to gain full marks. However, other formulae were used at least equally often, the most popular being pi r^2, pi r, (pi d)/2 and (pi r)/2; candidates who took one of these routes achieved no marks.

Part (b) gave the area of a square and candidates needed to start by square rooting 169 to find the length of a side of the square. This concept appeared unfamiliar to most candidates, who variously halved and quartered the 169 or made seemingly random attempts, even including the use of 90° and 60°, and were unable to gain any of the three marks available. Of those who got as far as 13 for the first method mark, somewhat surprisingly a good number could not proceed to use this length to find the perimeter of the composite shape, comprising a square with equilateral triangle attached on one side. For those with some understanding but who didn't recognise that the shape only had 5 sides, we saw 13 multiplied by 6 which included one internal line or by 7 which was the perimeter of the square and the triangle separately. Thus the accuracy mark was lost.

Question 13

Working out the size of angle *y* required several calculations and a high number of candidates were able to proceed step by step to the right answer for three method marks. Where they were able to give at least one 'angle fact' to support their working, they gained another mark and for including full reasons the final mark could also be awarded. While only some gave all the necessary reasons, many were able to give several, although some candidates were too minimal in the wording of some reasons to gain credit for them. Almost everyone was able to access this question to find the size of some angles, mostly from knowing that angles on a straight line sum to 180° or that angles at a point sum to 360° For some, there was confusion about which were the equal angles in the isosceles triangle, while others 'invented' parallel lines in the assumption that the 'alternate angles' would be equal.

Question 14

This multi-step question enabled most candidates to gain at least the first two method marks, usually for multiplying 300 by 9½ to find the number of cars made each day and working out 8% of this to find the number of faulty cars. Unfortunately some gave this as their final answer, having not read the question, (which asked for the number that are **not** faulty), sufficiently carefully. For those who did, the final two marks were relatively easy to gain and correct answers were mostly seen. One interesting point to note was the number of candidates who got an answer of 1350 from multiplying 300 by 9½ hours – this came from a misread of 9½ hours as 9 ½hours! Method marks could at least be awarded to those who showed working.

Question 15

More correct perpendicular bisector constructions were seen than has often been the case but there were a noticeable number of non-responses, perpendicular bisectors drawn in but not constructed (these gained one mark) and arcs drawn which did not intersect, together with the usual assorted 'doodles'.

Question 16

There were mostly correct answers for writing down the modal class in part (a). As usual for such a question, there were also candidates who wrote the number of birds in the modal class and a few who attempted to work out the median.

While many were able to work out an estimate for the mean number of birds from the grouped frequency table, the kind of errors that were made were those that might be expected. Candidates used an incorrect point within the class interval, some divided their total by 4 instead of 40 and some gave the total number of birds rather than the mean; each of these nevertheless gained some credit. Completely incorrect approaches also appeared, for example, dividing the sum of midpoints by the frequency or the frequency by 4

Question 17

It was pleasing to see how candidates could share 90 counters in the ration 2:13 even though the question did not explicitly give them this as a starting point. The most obvious error from that point was not understanding that for the probability of taking a red counter rather than a blue counter to be 1/3, the ratio red:blue needed to be 1:2 rather than 1:3 So finding 1/3 of 78 blue counters, or finding 1/3 of the 90 counters originally in the bag, followed in almost all cases. The final step was then usually to subtract the original number of red counters. A small minority did work their way successfully to the correct answer.

Question 18

Writing the numbers 1 – 12 in the correct regions of a Venn diagram from information that required an understanding of intersection and union was fairly well done. We saw fully and partially correct answers, with few candidates unable to gain any marks at all. Where only one region was correct, this was usually the intersection. For full marks, the sets needed to be labelled with A and B; failing to do so meant that otherwise correct diagrams failed to score full marks.

Question 19

This was the question that candidates found the most challenging on this paper. While there was no expectation that they would formally use algebra, it was hoped that candidates would see that if the length of 4 tiles plus the width of 1 tile was 123cm and the length of 2 tiles plus the width of 1 tile was 67cm then the length of 2 tiles must be
123 – 67 However, they almost unanimously did not! Knowing the length of a tile made finding the width and the area of the shaded area quite straightforward and a handful of candidates were awarded all 5 marks. Most however, started by working out the area of the whole rectangle but had little idea how to proceed from there. There were then three main approaches seen; stop at that point, divide that area by 12 or try random mathematical operations on the area and the numbers in the question.

Question 20a

There were surprisingly few correct answers in part (a) for finding the HCF of 96 and 120 especially given how many candidates were able to gain one mark for finding at least two factors of each number, either by listing or by showing them on a factor tree. These methods, or writing one number as a product of prime factors, at least enabled many candidates to gain one mark.

Even fewer candidates gained marks in part (b) where they were asked for the LCM of three numbers given as a product of prime factors. The majority of candidates multiplied these out to give the 'real' number but then did not know how to move forward. There were those who then tried to work out these numbers as a product of prime factors, often wrongly! The occasional Venn diagram made an appearance and sometimes this enabled a candidate to provide the correct answer.

Question 21

The most efficient method of multiplying the initial investment by 1.023^3 was used by some candidates, as was the longer method of calculating the interest and adding it to the investment year by year. Correctly worked out, these methods gained all three marks. However, the award of one mark was far more frequent for those candidates who worked out the interest for the first year, often but not always multiplying this by 3 and adding it to the original investment. Clearly many do not appreciate the difference between simple and compound interest.

Question 22
In general, one of three methods were used in part (a). The correct one of 3.5/0.65 (for 3 marks) and the incorrect one of 3.5 x 0.65 were offered in about equal measure and the incorrect one of 0.65/3.5 somewhat less frequently. Candidates often tried to use a triangle with density, mass and volume but with varying success as many did not know where to place the D, M and V
In part (b), changing a speed from kilometres per hour to a speed in metres per second gave some candidates the opportunity to gain three straightforward marks. However, for many, even the conversion of kilometres to metres proved problematical. The conversion factors for metric units is something candidates need to learn. The award of only one mark was common, either for conversion of kilometres to metres or for division by 60 at least once or for working out the number of seconds in one hour.

Question 23
While some candidates clearly know how to solve simultaneous linear equations and can use algebra to do so, for far more at this tier the topic remains a mystery. For those with some understanding who could make a promising start, the difficulty of the directed number aspect when they tried to add or subtract equations, having equated the coefficients of one term, denied them further success. Where there was an appropriate method with only one arithmetic error the first method mark could be awarded and a second mark could sometimes be gained by correctly substituting their found value of one term into an equation, in an attempt to find the other term. Many times, we saw responses where the given two equations were added, leaving terms in both x and y, which candidates then did not know what to do with.

Question 24
Very few candidates were able to give the equation of a straight line which was drawn on a grid but a number of correct responses was seen. Some, but not many, could work out the gradient of the line but could not necessarily incorporate this into an appropriate equation. Others had some understanding that the form of the equation was $y = mx + c$ but did not always know how to select and substitute values that could be found from the diagram. Seen quite often was a table of values for x and y taken from the given line but rarely did such an approach help the candidate answer the question.

Summary

Based on their performance on this paper, students should:

- learn and be able to recall metric conversions, e.g. 1 km = 1000 m
- Know the formulae for area and circumference of a circle
- Understand that the length of the side of a square is the square root of the area
- Read questions carefully and check that they have answered what was asked
- Show careful working

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