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Principal Examiner Feedback

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Paper 2F

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Principal Examiner's Report
4MA0-2F

Introduction to paper 2F

Many correct responses were seen throughout the paper (with the exception of the final question), but there were a significant number of blank responses to questions. This was the case with some of the earlier questions, for example question 4e, as well as some of the later questions. Working was generally given in questions but the level of arithmetic was disappointing, particularly when negative numbers were involved.

Report on Individual Questions

Question 1

Part (a) was invariably correct; only very occasionally was 'Amazon' given as an answer rather than the correct 'Nile'.

In part (b) the most common error was to either omit the 'hundreds' or give two hundred rather than four hundred.

Part (c) was well done. Part (d) was slightly less well done with 5464 and 4425 being common incorrect answers.

There were a surprising number of blank responses in part (e); 3440 was a commonly seen incorrect answer, occurring when candidates subtracted rather than added.

Question 2

Part (ai) was usually correct; when it wasn't, 'impossible' and 'unlikely' were the common answers given. Part (aii) was also generally correct with the most common incorrect answer being 'likely'.

Part (b) was well answered in both parts.

Question 3

Naming shape (a) was more problematic for students than naming shape (b); common incorrect answers were 'cylinder' and 'ball'. The most frequently given answer in (bi) was 'cube'; 'cuboid' also appeared a significant number of times and was an allowable answer. It was rare to see an incorrect answer in part (bii). However, in part (biii) there was confusion between vertices and edges with "12" being a common incorrect answer.

4 It was rare to see an incorrect answer in parts (a), (b) and (c). All but a handful of students were able to draw a bar at an acceptable height. Bars that were clearly below half way between 9 and 10 were not awarded the mark. The ratio question gave many students the opportunity to score the full two marks but a surprising number were only able to gain one mark or no marks. Ratios that were correct but not fully simplified occurred often for one mark; less frequent but also worth one mark was a fully simplified ratio but with the order reversed. Ratio notation failed to appear in a significant number of responses, denying candidates any marks. Addition or subtraction of the number of barrels of oil was a commonly seen incorrect method, as was the answering of the question as a fraction.

5 In part (a) some candidates forgot to take place value into consideration and therefore had 4.6 as the smallest number rather than 4.56.

In part (b) the incorrect answer of 3.5, from candidates presumably working out half of seven, was seen almost as often as the correct answer of 7.5.

Part (c) was well answered, as was part (d) although 0.04 and 4.0 were seen occasionally.

When an incorrect answer was seen in part (e), which was rare, it usually had 87 rather than 100 as the denominator of the fraction. The same conceptual error was seen in part (f) with the responses 9.16 and 0.916 seen – this occurred more often than the incorrect answer in part (e) did. Students should be reminded that, when asked to convert a fraction into a decimal if the result is a terminating decimal all figures should be given. Some students clearly rounded their answer without writing down the full answer; in such circumstances the mark could not be awarded as, for example, 0.6 or 0.56 is not the decimal equivalent of $\frac{9}{16}$.

6 In part (a) candidates were more successful in writing down coordinates for the point in the first quadrant than for the point in the third quadrant. Part (ai) was almost always correct but the coordinates in part (aii) were frequently given as $(-1, -3)$ rather than the correct $(-3, -1)$.

Popular incorrect answers in (b) included parallelogram, rhombus and rectangle.

Whilst many students were able to provide the correct name for the angle in (ci), the most popular incorrect answer was 'obtuse' followed by 'right angle'.

There was strong evidence in (cii) of students struggling to use a protractor correctly. A significant number of answers were in the region of either 85^o or 105^o.

7 It was rare to see an incorrect answer in part (a). The majority of students also gave the correct answer in (b) but there were a significant minority who gave the incorrect answer of k^5.

There were a pleasing number of fully correct responses, with students able to deal with collecting terms including one with a minus sign. However, there was a noticeable number who incorrectly attributed the minus sign to the terms in m, giving $13p + 3m$ as a final answer, which gained no marks. Others simply ignored the minus sign; their answer of $13p + 5m$ gave them one mark. A few attempted to join all terms, giving expressions such as $8pm$ as their final answer. Without working this gained them no marks but where accompanied by correct working in the body of the script, they were usually able to gain one mark.

The majority of students were able to deal with substituting a positive and a negative value into an algebraic expression and correctly evaluating it. However, a large number could not cope with -5 and arrived at 20 instead of the correct -20, producing a final answer of 47. If their working had shown an initially correct substitution or the correct evaluation of one of the products, this gained them one mark, but with no working shown 47 gained them no marks.

It was pleasing to see a good number of correctly factorised expressions but there were a higher number of responses not indicating an understanding of factorising. Thus there were many scripts that showed different ways of incorporating c with 5 and with 2 (from the index number), with $7c$, $3c$, 25 and $4c^2$ seen regularly. Incorrect factorising that produced two terms when multiplied out, one of which was correct, gained one mark. There was a noticeable number of blank responses.

Common incorrect answers in part (f) were d^{35}, 12*d* and 35*d*.

8 Although this question involved working with a negative value for one of the temperatures, the success rate was very high. However, 27°C was a frequently seen incorrect answer, either coming from incorrectly combining – 12 and + 15 or from a misinterpretation of the question.

Despite having a calculator, many students struggled with (bi). It was clear that a number of students thought that the presence of brackets meant that multiplication was involved; this was confirmed by the fact that 63 was a common incorrect answer along with 2 and −16. Conversely it was rare in see an incorrect answer in part (bii).

Students had more success in (ci) than in (cii). The most common incorrect answer in part (d) was 25. In part (e) 64 was occasionally seen.

9 Responses to drawing lines of symmetry on a rectangle were fairly equally divided between those who correctly drew a vertical line and a horizontal line to gain a mark and those who wrongly included the two diagonals. Many responses were drawn free-hand but sufficiently accurate to be awarded the mark.

When there was an incorrect answer given in (bi) then it tended to be shape B, the trapezium. There were more incorrect answers in part (bii) than in part (bi). The most common incorrect answer here was D (rhombus) although B (trapezium) was also seen frequently.

10 Part (a) was well done although some candidates still write 17:45pm rather than 17:45

While fully correct answers were often seen, finding the length of time between 5 45 pm and 8 10 pm proved difficult for a large number of students. Counting from 5 to 8, to give 3 or 4 hours, occurred regularly, sometimes with the correct 25 minutes, which allowed the award of one mark, as did other numbers of hours with 25 minutes. Using a calculator to subtract to give 2.65, with an answer of either 2 hours 65 minutes or 3 hours 5 minutes, gained no marks. Often 45 and 10 were added instead of 15 and 10. Where full marks could not be given, methods that clearly showed counting up between the two given times with an understanding of 60 minutes in an hour were often sufficient to get one mark.

11 The majority of students were able to identify the mode in part (a).

Most students understood that the range involves the highest and the lowest values. While many correctly selected 45 matches and 50 matches and subtracted to give 5 as their answer, the highest and lowest frequency values were equally often selected, which was not rewarded with any marks. 45 and 50 clearly selected but without the subtraction gave some students one of the two marks. Other responses showed attempts to find either the median or the mean.

Many students understood the mean requiring the addition of values and division by how many there are. However, some of these students found in unclear, from the table, which values to use. Thus this question elicited the usual variations, as well as a fair number of correct responses. The most common errors were to add the six numbers from the number of matches column to give 285 and to divide this by 6 or by 50, or to add the numbers in the frequency column to give 50 and to divide this by 6. Some students benefitted from the award of one mark for a correct method to find the total number of matches but failed to gain more as they divided this total by 6 instead of 50. A few students showed correct working for this question by the table but then gave a different answer on the answer line for part (c) – in these circumstances, no marks could be awarded.

12 Two main approaches to this question were seen; either the calculation of the volumes of the two cuboids and then division of the larger volume by the smaller, or the working out how many small cartons would fit along each of the dimensions of the box (for example, 40 ÷ 8 = 5). The latter approach was less successful, as many students who started well went on either to add the 3 resulting values instead of multiplying them or to select one of these values, usually 4, as their answer, in both cases gaining only one mark. A few worked out how many cartons would fit across one complete face of the box but almost invariably failed to proceed to use the third dimension. Also seen regularly but worth no marks was summing the three dimensions of the carton and the box and dividing the resulting numbers or attempting to work with the total surface areas.

13 Calculating $\frac{5}{9}$ of 72 kg was a straightforward question for many students, who were able to gain two marks. However, there were also many who took $\frac{5}{9}$ as equal to 0.5 and simply halved 72 kg. Only where this approach was evident from clear and full working, were students usually able to gain one method mark.

In part (b) most responses to adding fractions produced either fully correct or completely incorrect answers. Showing two relevant fractions with a common denominator and the resulting (non-simplified) fraction when the fractions were added achieved full marks. Occasionally a candidate simply showed two relevant fractions, which allowed the award of one mark. Converting to decimals was not an appropriate method here and so gained no marks. The use of the “box method” for adding fractions gained no marks for a “Show that” question. A significant number of students had no idea of the concept of adding fractions, preferring to subtract the numerators and divide the denominators in order to achieve the final fraction.

14 The majority of answers to the probability question were both correct and written using accepted notation. Some students gained only one mark by working as far as the probability of not taking a yellow counter but failed to divide by 2 to find the probability of taking a red counter. Some realised the need to divide 0.7 by 2 and scored the second method mark but lost the final mark with an answer of either 3.5 or 0.45

15 Calculating the area of a rectangle was achieved by most students but there was less success with calculating the area of the circle. 8^2, $\pi \times 8$, $\pi \times 16$, $\pi^2 \times 8$, $\pi + 8$ were all seen as incorrect attempts. There were also those students who did not work out the area of the rectangle but instead found its perimeter or ventured into the 4^{th} dimension by multiplying together the dimensions of all four sides. Where correct methods were seen for finding both areas, the second method mark was awarded for the subtraction of the two values found. From correct values, the majority of students went on to give a sufficiently accurate final answer to gain full marks. The question was beyond some at this tier, who combined the numbers on the diagram in a variety of creative ways.

16 This question produced a complete range of responses and a noticeable number of blanks. Many fully correct straight line graphs were seen, often with a clear table of values. Where this was not the case, students were able to gain 3 marks for plotting all

the integer points but forgetting to join them or for a straight line segment joining at least 3 correct points. For those unable to do this, two marks were available for those who could plot at least 2 of the points and one mark for those able to state the co-ordinates of 2 points. Those who drew a line through (0, 4) with a clear intention to use a gradient of 3 were rewarded with two marks. A line through (0,4) with a positive gradient or a line elsewhere on the grid with a gradient of 3 provided some with one mark. However, there were many variations on using −2, 3 and 4 (from $y = 3x - 4$ and values of x from −2 to 3 as stated in the question) to plot points, for example, (−2, 3) or (3, −4) or (3, 0), sometimes joining their points to produce triangles or quadrilaterals. Students need practice in producing their own tables when required to draw straight line graphs from the equation.

17 In part (a), many students recognised enlargement and of these most appreciated that the scale factor was 2 but few made any reference to the centre of enlargement. The award of two marks was more common than the full three marks. Some gave somewhat ambiguous answers about the shape doubling in size, which was insufficient to allow the award of either a mark for the type of transformation or the scale factor. Too often, enlargement was combined with another transformation denying the candidate any marks, which could only be given for a **single** transformation. Most commonly the additional information related to the 'moves' of a translation. There were several blank responses.
The majority correctly translated the required triangle in part (b). Where an error was made, it was usually with the positioning, although some different sized triangles were also seen. Again, there were more non-responses than might have been expected.

18 For those candidates who understood the meaning of the intersection and union signs in (ai) and (aii) respectively, common errors were to include additional numbers in (ai) such as 25, 35 etc and, in part (aii), to leave out a number; most frequently 10 or 15.

In part (b) a good number of students were able to recognise that the given statement is untrue because 5 is both prime and a multiple of 5 and is therefore in both sets. In fact a number of candidates gained a mark for the minimal response of '5 is in both sets'. Others had some understanding but did not appreciate which box to tick. Many appeared to have no knowledge of the symbols or the concept and so this question had a high number of guesses or non-responses.

19 It was pleasing to see many fully correct responses from students who could both divide £240 in the given ratios and go on to find the required difference. Others dealt with the ratio but stopped at that point, gaining the first method mark. Common errors were to divide £240 by the numbers from the ratios or to add the ratio numbers (to get 15) and then multiply the ratio numbers by 15. A variety of other irrelevant and somewhat confused attempts made regular appearances.

20 Looking at clear and succinct algebraic working leading to a correct solution was much appreciated and such responses were seen. However, more often scripts were covered with numerous attempts of trial and improvement. Between these extremes were those who showed an algebraic expression for the perimeter, sometimes equated to 62 and sometimes simplified, but who could not progress further with algebra. Some credit was given to students who used only a numerical approach. In this session, clear working showing substitution into a correct expression was awarded one mark and where the correct value of 6.5 was used a second mark could be gained. However, centres should note that when a question specifies 'clear algebraic working' students who do not follow this instruction are in danger of gaining no marks.

21 Most students made an attempt at this question, often successfully. Others were able to find three numbers that had either a mean of 6 or a median of 8 and gained one of the two marks. Some overlooked the demand that the three numbers should all be different and that they should be positive (and included zero as one of their chosen numbers).

22 Some students showed an understanding of solving an inequality in part (a) and were able to progress to a solution incorporating the inequality sign. Others gained one mark by treating the inequality as an equation and giving $x = 9$ or just 9 as their final answer. Others presented their solution as an embedded answer, which denied them the mark unless they had clearly shown 9 as the solution in the body of the script. The more imaginative used the 3, 8 and 35 that appeared in the question in a variety of ways in combination with assorted mathematical operations, for example $35 - 11 = 24$, or $11x = 35$. Many non-responses were seen.

In part (b), writing correctly an inequality shown on a number line was accessible only to a minority of students at this tier but some fully correct responses were seen. Where one part of the inequality was correct, students picked up one of the two marks. Many understood that -2 and 4 along with $<$ or $>$ needed to appear in their answer but failed to include a variable and produced answers such as $-2 < 4$ Others attempted to list possible integers and blank responses were not uncommon.

23 It was rare to come across a candidate who knew that the angle between the tangent and the radius is 90^{o} but there were a few. Most took the opportunity here to draw on any fact they remembered about angles and both inventive word descriptions and angle calculations appeared in explanation. A number of students simply write “It is 90 because it is a right angle” and so did not gain the mark.

Part (b) of the question was answered a little more successfully than part (a) but only by a minority of students. A good number were able to arrive at 44^{o} but often without reference to which angle they were finding – where either notation was used or the angle was clearly marked on the diagram in the correct position students scored one mark. In the majority of cases where 44^{o} was seen the students assumed they had found the required angle and no further calculations were made. The tautology ‘It’s 90 degrees because it’s a right angle’ was a response that occurred a few times. Non-responses were numerous.

Summary

Based on their performance on this paper, students should:

- check arithmetic carefully, especially when working with negative numbers.
- use correct notation when working with ratio and then working with probability
- ensure that they explicitly name any found angles or mark these on the diagram and link any calculations to angles when answer geometry questions.
- give just a single transformation when asked to describe a transformation.
- show clear algebraic working when this requirement is included in the demand for a question; this presence of this statement is likely to indicate that an equation will need solving (and possibly forming).

- Construct a table of values when asked to draw the graph of a given equation.

Grade Boundaries

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