Examiners' Report
Principal Examiner Feedback

November 2024

Pearson Edexcel International GCSE
In Mathematics B (4MB1) Paper 02

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November 2024
Publications Code 4MB1_02_2411_ER

Introduction
In general, this paper was well answered by the majority of candidates. Some parts of the paper did prove to be quite challenging to some candidates, such as the final part of question 7 on vectors, solving the inequality on question 10c and the combination of transformations using matrices on question 11e.

In particular, to enhance performance, centres should focus their candidate's attention on the following areas:

- Showing clear working by drawing a straight line, when it is requested in the question e.g. question 10
- Carefully read each question to ensure that ratios are not misread or misunderstood e.g. question 6
- Make sure they have appropriate equipment for a Mathematics examination
- Focus their candidates' attention on the following topics
  - Using tangents to find the gradient of a curve
  - Solving inequalities as well as equations by drawing a straight line on the same grid as a curve
  - Combinations of transformations using matrices
  - Problem solving style questions on Shape and Space

Report on Individual Questions

Question 1
On the whole, this question was answered well, with the majority of candidates able to obtain some if not all four marks. Elimination and substitution methods were equally likely to be used, although elimination tended to offer the greater simplicity in obtaining the answer, with a number of candidates failing to navigate the algebra required to deal with substitution. Sign errors were the most common cause of lost marks, but it is of note that almost none of the candidates performed a check on their answer - a step that would be sure to catch out most of the common errors.

Question 2
Part (a) was the most successfully drawn line, very few candidates wrote out points/table for this with nearly all gaining at least one mark, for a gradient of 1 or a positive gradient through (0, -4). Part (b) was less successful and those that did use a table or calculate points often used x = –4 producing a decimal value. There was a large proportion who couldn't draw this line. Consequently, very few earned 1 mark for listing two points correctly. Too often marks were withheld in parts (a) and (b) due to the line not being extended across the required range. Those that were able to sketch both lines correctly generally were able to get the mark for the correct region in part (c) (as it is often the region enclosed by all the lines). The most common error in identifying the region was to assume that the required area was below $x - y \leq 4$. Part (d) was challenging for most. Very few identified both correct values with –3 often omitted due to not recognising the inclusive inequality. Other candidates either misunderstood the question or overlooked the requirement that y is an integer.

Question 3
There were very few fully correct answers for this question, with errors often seen in part (b) and part (d). Part (a)i was well answered in the main. Part (a)ii and (a)iii were answered less successfully than (a)i with answers quite often having one element missing suggesting that the reason for not gaining these marks was due to knowledge on number properties rather than set notation. In part (b) the main issues were populating

V only with 13 rather than 23 and not labelling C intersection S with a zero. Usually, candidates scored some credit on this item. Those that scored 2 out of 3 often did so because they left the C intersection S blank. In part (c)i candidates with a blank in their Venn diagram often scored this mark for a correct answer of 23. The follow through mark was rarely awarded. In part (c)ii lots of candidates did not identify the required region correctly, the most common follow through answer was 11. Part (d) showed a poor understanding of conditional probability by many candidates. There were many answers with a denominator of 70, 11/70 being a common incorrect answer.

Question 4

Part (a) involved finding the arc length of a sector. Some changed the angle to radians and used $0.5r^2\theta$ instead of $r\theta$ and some calculated $r\theta$ without changing the angle from degrees to radians; both of which gained no credit. Among those who clearly set out to find the arc length, there were some careless errors e.g. omitting π, getting the radius wrong, omitting the 2 in "$2\pi r$". A few tried to use Pythagoras, thinking the sector was a triangle. In part (b), a few candidates correctly calculated the area of sector *OCD* but failed to multiply by 5/12. Again, similarly to part (a), there were a few who used the formula for arc length instead of the area of a sector, scoring 0 marks. Those that used the correct area formula in degrees or radians usually went on to gain full marks on this part of the question. There were some instances of misreading or misinterpreting the given statement or treating area ABEF as a sector of the circle. Part (c) was not answered as well as the previous parts, with weaker candidates struggling to find an effective strategy. Some assumed that *BC* was equal to 1.1 cm. Most solutions that gained credit involved either seeing sectors *OAF* and *OCD* as similar shapes and using the ratio of their areas and sides, or for finding the sum of their area from part (b) and the area of sector *OAF* and then equating this to the area of *OBE* to find the radius of that sector. Strategy rather than accuracy was the biggest issue on this part of the question.

Question 5

The majority achieved the first mark here with only a few incorrectly assuming replacement. It was nice to see a large number of the candidates understanding the need to add two products together here, but a minority of candidates really did not understand which products were required. The use of a tree diagram to aid understanding was rarely seen. Part (b) was less well answered than part (a), with only a small minority able to get full marks here. Most were able to get the two method marks. The correct starting equation was seen frequently. Candidates were less successful in rearranging this to achieve the correct three term quadratic. It was nice to see that most candidates were able to confidently solve their quadratic equation using the formula and showing all the necessary values substituted to get this mark. Some candidates offered both 25 and –4 as final solutions and so could only be credited with four of the five marks.

Question 6

In part (a) many candidates struggled to interpret the ratio correctly. The most common error being to use $\frac{8}{33}$ instead of $\frac{8}{25}$. Having this error could be credited with two of the four marks, even if $\frac{4}{3}\pi r^3$ was used instead of $\frac{2}{3}\pi r^3$. Those that totally ignored the ratio and proceeded as if the hemisphere volume ratio was 1660 could be credited with one of the marks. Candidates would benefit from taking time to re-read questions where there is a lot of information to be absorbed in order to understand the question more fully. Of those that were credited with the three method marks for formulating a correct equation in *r*, there were a few who took the square root instead of the cube root to determine the radius. In part (b) a good number of candidates obtained one mark for substituting their r from part (a) into the correct given volume of a cone formula. To gain further marks on part (b) candidates needed to have understood the ratio correctly.

Question 7
This question differentiated well, with many candidates able to pick up marks in part (a) and only the most able picking up the marks in part (b)ii.

Part (a) was found to be the most accessible part of the question. Of those who lost marks on this part, it was usually due to sign errors and not showing clear working when trying to find AD. The full range of marks was awarded in part (b)i with many clearly understanding the need to find two expressions for the same vector route to allow coefficients to be compared. The majority found expressions for *CE* and scored two marks for *CE* = *k*(1.5a + b). Finding the second expression for *CE* proved to be more challenging, with errors in manipulation or for failing to incorporate the vector *AD* in their second expression. Of those who correctly found two appropriate expressions, many struggled with the algebraic manipulation to find *k*, although some very concise and correct solutions were also seen. Unsurprisingly part (b)ii was found to be challenging with only the most able candidates picking up both of these marks. The method mark, alone, was awarded to some for correctly finding the value of the second parameter (provided it was useful for answering this part of the question) or for a correct expression for AE or DE with no obvious preference between them.

Question 8
This question also differentiated well with the full array of marks being awarded across the question.

Parts (a) and (b) were generally very well attempted. The most common mistake in part (a) was to divide by 518 rather than the required 560. In part (b) it was common to divide by 360 rather than 720 but also to calculate all three angles, which was unnecessary (unless used as a check) and may have wasted valuable time. Part (c) was less well answered with a number choosing the group 10 – 15 perhaps because it was the middle group in the table or the group 0 – 5 which was the modal class. Part (d) was also very well attempted, with again a significant majority able to gain marks. A large number of those who did not gain full marks were able to make some attempt at multiplying the frequency with the midpoint. From those with sensible attempts at this point, the most common error was to divide by 5 rather than the sum of the frequencies.

Question 9
This was a challenging question for many with a total score of 1 mark seen regularly, usually for correctly finding the value of f(2).

Part (a) was not well answered, with only a few appearing to understand the concept of the range of a function. Many candidates tried to solve an equation to find a value for *x* and of those that identified that the answer had something to do with –8 many failed to form the correct inequality. In contrast, part (b) was almost universally well answered, almost none of the candidates showed any problems in interpreting the question and making the substitution. In part (c) when candidates realised that completing the square was an appropriate method, there was a reasonable level of success but it wasn't uncommon to see candidates start by trying the use hg(*x*)=6.1 for which no credit was given. When $g^{-1}(x)$ was found it was usually successfully substituted into h(*x*) and equated to 6.1, with the 4th and 5th method marks almost always awarded together. There was a correlation here with those candidates who understood they could proceed by completing the square (and understood the notation of what the question was asking) and those candidates that had the algebraic manipulation skills required to gain full marks. Those who were able to think more laterally about the nature of the inverse function (as described in the alternate mark schemes) were rewarded with a significantly easier path to the correct answer - although these candidates were very much a minority of those attempting the question.

Question 10

Part (a) was almost universally correctly answered, and many of those were able to convert that into a graph worthy of gaining at least 2 of the 3 marks for part (b). Part (c) and (d) often gained 0 marks due to not following the instruction to draw a line onto their graph. These questions are a common feature of this paper, and almost universally give marks dependent on the drawing of a line on their graph. From those who did draw a tangent for part (c), many were able to gain the mark for finding the gradient. Part (d) was more challenging, even from those able to draw the relevant line at $y = 1$. It was common for candidates to find correct critical values but fail to interpret those numbers in light of the question to give the required inequalities.

Question 11

In general, part (a), (b) and (c) were done fairly well by the majority of candidates, whereas part (d) and (e) were more challenging.

In relation to part (b) and (c) there were more candidates than expected that did not pick up both marks in part (a). The image often appeared in the wrong quadrant or with the wrong orientation. Some candidates did not read the question carefully and rotated triangle A about the origin and some reflected in $x = a$. Part (b) was answered more successfully than part (a) with significantly more candidates securing both marks here. Almost all candidates who drew a reflection did so in the correct position, however there were some who reflected A in the wrong horizontal line. Most candidates in part (c) were able to multiply a correctly formed coordinate matrix by the given transformation matrix and in the correct order, with only a minority multiplying the wrong way round. There were a few calculation errors within the multiplication that candidates did not spot and resulted in a triangle E that was not an enlargement. In part (d) most candidates recognised the enlargement but then a minority went on to state another transformation in their description and lost the mark. The scale factor was spotted correctly by the majority. Finding the centre was the aspect that most candidates struggled with. The more successful solutions used construction lines on their diagram to find the centre but some inaccuracy in lines sometimes led to an incorrect coordinate eg (0, 10.5) and some candidates incorrectly wrote their coordinate as a vector. Part (e) required good organisation and skill to solve with matrices with only a small minority earning full marks. Most partially correct solutions found at least one coordinate of F and then some of these found at least one coordinate of G in terms of k. Very often candidates then stopped or got stuck trying to find the numerical values of the coordinates of G, or incorrectly finding the matrix N. Among stronger candidates, the majority went with one of two strategies - either finding the coordinates of A in terms of k or correctly finding the matrix N, when this was successfully carried out, it was common to see a final correct answer.

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