Examiners' Report
Principal Examiner Feedback

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Pearson Edexcel International GCSE
In Mathematics B (4MB1) Paper 01

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Introduction

The majority of students appeared to be well prepared for this exam and had plenty of success across most of the paper. There were some questions that proved more challenging than others, these included the circle problem in question 13, the HCF and LCM question, the proportion and mean problem in question 17 and the angles problem in question 18. The most challenging questions such as 25 and 27 caused some students problems also.

To further enhance performance centres should focus on the following:
- Remember when a question asks for working, clear method should be shown, and simple use of a calculator would not gain credit. This was evident this year in particular in questions 16 (fractions) and 20 (surds).
- Remember the importance of brackets, especially when manipulating algebra.
- Clearly identifying vectors in the course of working to avoid ambiguity.
- Focus their candidates' attention on the following topics:
  - Representing inequalities on a number line
  - Working with HCF and LCM
  - Reverse mean type questions
  - Angle properties, particularly relating to interior and exterior angles
  - Upper and lower bounds, especially when dealing with various degrees of accuracy
  - Ensure candidates understanding of data and averages in particular is solid.

Report on Individual Questions

Question 1

Generally answered well in both parts, but a significant number of candidates got mixed up between significant figures and decimal places. In part (a) it was common to see candidates correctly round but drop the zeros, giving 74 as a solution and thus lose the magnitude of the answer. In part (b) the common error was to round to two significant figures and give the answer of 0.037.

In both parts we saw a number of candidates giving answers in standard form, which was acceptable, as were answers such as 74×10^2 and 40×10^{-3}.

Question 2

Another question that was answered well by the vast majority of students. Issues only arose when candidates didn't copy the formula correctly when substituting, often dropping the '2' from $2k^2$, or following an incorrect order of operations. It was also quite common to see candidates try to write as a single fraction with a common denominator, and this sometimes led to errors.

Question 3

The most common approach was the expected one, to find the length of *AB* using Pythagoras before finding the area of the trapezium. We did, however, see a number of different approaches using trigonometry, all of which were acceptable. It was perhaps a little surprising to see as many errors in calculating the area as we did. This came in the form of not using the perpendicular length (which had often been found) and using 8.7 instead. It was also common to see 6 and 6.3 used as the parallel lengths. Some split the shape into a triangle and rectangle, and were often successful, but again a disappointing number substituted incorrectly, or forgot to half for the triangle.

Question 4

Part (a) was answered really well, with the majority gaining the one mark for adding the matrices. Part (b) required more thought, but still showed lots of success. Candidates had to form an equation with the matrices, or less commonly, a linear equation taking the correct elements of the matrices. Those who did this often gained the second mark. Some got slightly mixed up and gave an answer of $\begin{pmatrix} 3 & 3 \\ 3 & 3 \end{pmatrix}$ rather than just stating *n* as a scaler value of 3. In this case 1 mark was awarded.

Question 5

Many students were able to gain at least one mark in this question. Most commonly the first mark for a method to find the gradient. Some did substitute incorrectly and lost this mark, but they were in the minority. To gain the second mark candidates had to substitute to find the intercept. This was typically seen in two forms: $y = mx + c$ or $y - y_1 = m(x - x_1)$. Those using the first method would normally go on to get the final mark, provided they managed the arithmetic. Those following the second route also had plenty of success, but some failed to rearrange into the requested form and so did not gain the A mark.

Question 6

This inequality question caused some problems for students. In part (a) most were able to gain at least one mark for manipulating the inequality as far as $-5w \leqslant 15$ but then struggled to get to the correct answer, often giving a final solution of $w \leqslant -3$ rather than $w \geqslant -3$.
Part (b) was answered quite poorly, with those scoring 2 marks being in the minority. Although many were able to place the correct circles on the number line, these were often not joined. We often saw arrows, sometimes going in the wrong directions, but more commonly going past each other. In this case no marks were scored. If it was not fully correct, there needed to be a single line from −4 to 2 (not ending in arrows) to gain 1 mark.

Question 7

Both parts of this question were answered well, but part (a) was answered particularly well, with two marks being awarded regularly. The common incorrect answer seen was $9a^5b^7$ red zero. And this scored zero. We needed to see two aspects of the product to be correct to score 1 mark. Part (b) only offered one mark and a good number were able t gain this. There were a variety of responses

that were able to gain the mark, and all were seen. Of the two elements, candidates struggled most with $2^{-\frac{1}{2}}$.

Question 8
To gain 1 mark on question 8, candidates had to identify 2 correct boundaries, and all 3 to gain both marks. We did condone use of $<$ and $>$ in place of $\leqslant$ and $\geqslant$ but not $=$. Those candidates who struggled with the diagonal line, often gained one as they often got the other two correct. However, the most common error, and one that lost both marks, to get the inequality symbols the wrong way round on the horizontal and vertical boundaries.

Question 9
Angles of elevation, and in particular, depression, do cause students some problems, and that was the case here. However, it was pleasing to see so many students correctly placing the $10°$ on the diagram, which then often led to at least 2 if not all three marks. Those who placed the $10°$ incorrectly at ATB were able to gain some credit if they gave a correct trigonometric statement to find BT for their incorrect diagram.

Question 10
Proof of congruence is always a difficult question for a number of reasons. Firstly, candidates need to be able to see the corresponding sides and angles, but they also need to be able to provide reasoning, which is something that many struggle with.

BC being a common side was probably spotted most often, closely followed by $MC = NB$. However, the reasoning for this was sometimes lacking in clarity. The third property of $\angle MCB = \angle NBC$ was often seen, but so were other angle properties that were irrelevant to this proof. It was a real shame to see some candidates find all three correct properties and provide reasons, and then fail to state which of the congruence relationships they had used, or to state this wrongly, often given as AAS rather than SAS.

Question 11
Finding an inverse of a matrix is a common topic for students, and one where many scored marks. The majority were able to score at least one either for a correct method to find the determinant or more commonly for finding the correct matrix. Those who found both did normally combine them correctly, and markers were able to ISW failed attempts at multiplying through the matrix by $-\dfrac{1}{7}$ if a correct answer was given in working.

Question 12
The first mark in this rearrangement question was normally awarded for multiplying through by y and expanding the bracket on the right of the equation. Very few went the route of separating the RHS into 2 fractions, and those attempted this often failed. To gain the second mark candidates had

to correctly isolate the terms in x on one side and the terms without x on the other. This step was often done correctly, and could be awarded even if the first wasn't, providing their equation had exactly 4 terms and exactly 2 of these were terms in x.

The final mark required students to factorise and divide to give a correct equation with x as the subject.

Question 13
Many students simply did not know where to start with this problem. Thos who had success typically formed a right-angled triangle *OAD* and wrote a correct statement using Pythagoras and the radii of the two circles. From here a significant proportion were unable to get further. The second step required them to write an expression for the area and use their previous statement to eliminate one of the variables. The few that got this far were then normally able to complete the algebra to the given solution. This was certainly one of the most challenging questions on the paper.

Question 14
It is clear that although many had success on this question, a significant proportion of students struggle when it comes to HCF and LCM questions. Part (a) definitely performed better with students most commonly using a table and dividing all values by primes as a method. There was some evidence of factor trees being used to find the prime factor form, but this was less common. In part (b) however, many didn't really know how to tackle the problem. Some listed both 28 and 35 in prime factor form and were able to score 1 mark. Those who had most success started by listing multiples of 28. Those who took this route often gained the second mark, but they were in the minority.

Question 15
The familiar skill of factorising expressions was tested in this question and almost all students gained some credit. In part (a) it was rare to see the award of zero marks. The correct answer was seen regularly, and when it wasn't the expression given was typically worthy of one for a correct partial factorisation. Part (b) was done equally as well, if not better. Award of 2 marks was very common, and the main time it wasn't was when, after factorising correctly, students went on to solve $x^2 - 7x + 12 = 0$, which is obviously not part of the question. In this case B1 only was scored.

Question 16
The main issue here that stopped marks being awarded was students not showing enough evidence of their method. Obviously, this is a question that a calculator can do and as a result, clear evidence of each step of the method was needed to award the marks.

The first mark was the most commonly awarded for converting both mixed numbers into improper fractions, and very few skipped this step. The second mark was the one most commonly not awarded. Many jumped straight from $\dfrac{15}{8} \times \dfrac{14}{5}$ to $\dfrac{21}{4}$ without showing how they got there. To gain the mark there needed to be evidence of a method to multiply. This was commonly awarded for

$\dfrac{210}{40}$ or for seeing $\dfrac{15}{8} \times \dfrac{14}{5}$ being simplified to $\dfrac{3}{4} \times \dfrac{7}{1}$. The third mark was for a correct method to add $\dfrac{1}{6}$ to another fraction. This meant that if an earlier error led to the second element being an integer, this mark could not be awarded. Much like the previous mark, many didn't gain this as they did not show sufficient evidence of their method to add. Candidates often jumped from $\dfrac{1}{6} + \dfrac{21}{4}$ to $\dfrac{65}{12}$ or even $5\dfrac{5}{12}$ and they were not awarded the 3rd M1. To gain the mark students needed to show how they were going to add the fraction. This could be by writing them with a common denominator either as two fractions or a single fraction, such as: $\dfrac{1 \times 2}{6 \times 2} + \dfrac{21 \times 3}{4 \times 3}$ or $\dfrac{1 \times 20 + 210 \times 3}{120}$.
The final mark could only then be awarded if the candidate had scored all three method marks and showed a correct improper fraction leading to $5\dfrac{5}{12}$. Unfortunately, some candidates did not fully rea the question and missed the instruction to give their answer as a mixed number and gave $\dfrac{65}{12}$ as their final answer and they did not score the final mark.

Question 17
A significant number of students found this question surprising challenging. There were method marks on offer, each dependent on the previous, and an accuracy mark. The first mark was most commonly awarded for a method to find the total weight of the other 9, or all 10 apples. Many used the wrong weight here and multiplied by 148 instead of 154 and scored zero. A decent proportion completed this first step and went on to correctly find the total weight of the red apples but went no further and only scored 2. The final step was to find the mean weight of the red apples by dividing by 8. Almost all who gained this mark also gained the final one. The only time they didn't was if they rounded incorrectly to 107.

Question 18
There were two main methods for this question. One provided much more straight forward algebra and as a result, students who took that path were often more successful. This more straightforward route was to add the two expressions given in the question and set them equal to $180°$. This led to a fairly straightforward linear equation to solve to obtain the value of x. This could then be used with either the expression for the interior or exterior angle to find the number of sides.

The second method required candidates to form a pair of simultaneous equations using the two expressions given in the equation and the angle properties that link interior and exterior angles to the number of sides, e.g. $2x = \dfrac{90(2n-4)}{n}$ and $\dfrac{x-54}{2} = \dfrac{360}{n}$. From here they had to rearrange one into the form '$x =$' or '$n =$' and substitute into the other to eliminate. It was this step that commonly

proved too challenging for many. It also provided a much more complex linear equation to solve to find n.

Both methods were equally as valid, but the first provided more marks due to the simpler algebra.

Question 19

This proportionality question was answered generally quite well with many gaining at least some credit. The biggest errors were to work with $y \propto k\sqrt[3]{x}$ or $y \propto \dfrac{k}{x^3}$. Candidate who did this could still possibly gain the special case if they completed the rest of the question without any further errors. Those who scored zero typically worked with $\sqrt{x}$ and not $\sqrt[3]{x}$.

The first mark was for setting up a correct statement of proportionality or a correct equation with k. From here they had to substitute and rearrange to find k for the second mark. The final mark was for putting the formula together and substituting the given value of x to find $y = 2.25$

Question 20

A bit like question 16 this is a question that could be answered entirely on a calculator and so clear method was required if candidates were to gain marks.

This question had 3 method marks, and they were often seen in different orders. The first was for a method to square out the bracket on the numerator. Evidence did need to be seen for this, such as $27 + 3 + 2 \times \sqrt{81}$. Simply going straight to 48 was not sufficient to gain the mark.

The second method mark was for a correct method to rationalise the denominator. What the candidate multiplied by to gain this mark depended on when in their method they did this. It could be any one of 6 possibles, but the most common were $\sqrt{45} - 3$, $3\sqrt{5} - 3$ or $\sqrt{5} - 1$. The third mark was possibly the easiest to gain and could be awarded for simplifying $\sqrt{45}$ to $3\sqrt{5}$ or for those that rationalised before simplifying it was for simplifying the denominator to an integer. Only if all three of these method marks had been awarded, and the candidate correctly then simplified to $4\sqrt{5} - 4$ could the A mark be awarded. We saw all possible combinations of marks awarded on this question.

Question 21

Although most candidates scored at least one or two marks, the number going on to get three or four was disappointing. The most common bound found correctly was the bound for a, with most really struggling with the bound for y in particular. Any one correct bound however, would gain one mark. To get the second mark a correct method for time travelled by one car was needed. The values used her had to be between the two correct bounds. This mark was often awarded for the first car and for

something like $\dfrac{115}{90.5}$, and it also meant those who found no bounds but knew how to calculate time correctly could gain 1 mark.

The third mark was for a correct difference in time calculated using figure between the given figure and the correct bound. It was this that many struggled with, and the example above would lose this mark regardless of the method for car two as 90.5 was not acceptable. Although you could gain the 3rd mark and not have the exact right bounds, you couldn't gain the A mark. To get this, candidates needed to have used the correct bounds and lead to an answer of 0.822

Question 22
This question had 3 method marks, which again could be awarded in any order. The first was for a factorising the denominator of the divisor. Like is typical with factorising of quadratics it could be awarded if not fully right providing it would expand to give 2 correct terms. It was quite common to see $(4x-5)(3x+2)$ in place of $(4x+5)(3x-2)$. This example could gain this first mark but would not lead to a correct answer.

The second was for dealing correctly with the difference. This meant writing the two fractions with a common denominator or as a single fraction with a common denominator. There was an allowance for a single sign error if the brackets were expanded, and this normally came in the expansion of $-3(3x-2)$. Again, this was condoned here for the method mark but would not lead to the A mark.

The third method mark was for a correct method to divide. To gain this, candidates needed to show multiplication by the reciprocal.

Students performed quite well with many picking up one, two or even three of these method marks. A significant number however struggled with the simplification, especially dealing with $14-7x$ and not realising that can be written as $-(7x-14)$. This often led to a factor not been cancelled or a sign error in the final answer.

Question 23
This multipart question about grouped data was relatively low grade compared to some others at this point in the paper but was not answered as well as possibly would be expected. Most gained some credit, but often answered the questions in the wrong part suggesting that their understanding is not as solid as it could be.

Part (a) asked for the modal class, and was normally answered correctly for 1 mark, although we did see some sloppy notation often giving the interval as incorrectly such as $0 < d \leqslant 5$. Candidates found part (b) much harder, and it was significantly less common to see the correct answer here. Many candidates lost some or all the marks in part (c) as they didn't use the correct values in their

products. It was possible to gain 2 marks using values other than the midpoints, but not if the lower bounds were used (as these are not actually in the intervals). It was very common to see students use the values of 1 and 3 for the first two intervals, both which could gain some credit, but then use 5, 10 and 20 for the remaining three products. To give credit we needed at least 3 suitable products with intention to add, and, in this case, there would only be 2. To gain both marks for the products we needed at least 3 correct midpoints along with clear intention to add. Providing at least one of these marks was awarded, the third was then awarded for dividing the sum of their products by 60. Those who had the correct products did normally go on to score all 4 marks.

Part (d) was answered well like part (a) with students giving a correct probability more often than not.

Question 24
Students did find this similar shape problem hard. Many gained at least one mark for their work with the scale factor. Normally cube rooting to get $\frac{5}{3}$ or $\frac{3}{5}$ but many failed to square this to get an area scale factor. Providing at least one mark had been awarded for the scale factor work the third mark could then be awarded for a suitable equation. Unfortunately, many students were unable to form this equation correctly and so no further credit was gained. The fourth mark was for rearranging their equation to make the surface area of *B* the subject. Again, the nature of the equations formed meant that even those who gained the third mark, often then struggled with the manipulation. Those who did gain the fourth mark were often able to gain the A mark for carrying out the calculation. Some then calculated the surface area of *A* and gave this as their answer and therefore lost this last mark.

Question 25
Lots of students were able to make a start on this question, which showed that even at this late stage of the paper they were still showing resilience. The first mark for a method to find the angle EOC was awarded fairly regularly, and this was followed by the second mark for a method to find EC in a good number of cases. When EC was found correctly it was normally through use of the cosine rule rather than any other method. A significant number of students knew they had to use the intersecting chord theorem, but often didn't remember it correctly. Some also attempted to use this without first finding EC, in this case normally using the '10' from the question in its place. If candidates did gain the first 3 marks many went on to then score some or all the remaining marks. Mark 4 was for rearranging their equation into a quadratic ready for solving and the 5th was for solving their quadratic. These marks were both dependent upon the previous mark being scored. In a few cases the accuracy mark was withheld as the student gave both solutions to the quadratic, rather than just the positive solution.

Question 26

This question offered 2 marks that were accessible to many in the form of parts (a)(i) and (a)(ii). Lots of students were able to give suitable vector expression to gain the marks. Part (b) however, was a challenging vector problem and one that was too hard for many. Candidates had to find two different and correct versions of a number of possible vectors to gain the first mark. It was here that most fell down. Either only finding a single expression or using correct vectors with wrong signs. The second mark was for equating coefficients to form a pair of simultaneous equations. This mark was dependent upon the previous one and was typically quite well done if M1 had been scored. The third mark was for taking their solution of the simultaneous equations and using this to find a correct expression for $\overrightarrow{MP}$ and the final mark was for simplifying it into the correct form. This type of vector problem where forming simultaneous equations is required is an area that centres would do well to practice.

Question 27

The final question had three processes involved for the five marks. The first two were for differentiation of the given function. A single mark could be awarded if the index of one term was correctly reduced by one, or two marks providing the constant terms was differentiated to zero and at least one other term was fully correct. The third mark was for equating $\dfrac{dy}{dx}$ equal to zero and correctly substituting $x = 3$. Many struggled here, either not setting to zero and using the 4.4 that was needed later, or quite often differentiating again before completing this step. The final method mark was for then substituting $x = 3$, $y = 4.4$ and their value of b back into the original function. Students could gain this mark even if b had been found incorrectly and was in a number of cases. There was then an accuracy mark for the correct answer. This is a challenging topic, and it was pleasing to see the stronger candidates tackling it well.