Examiner's Report

Principal Examiner Feedback

Summer 2018

Pearson Edexcel International GCSE

In Mathematics B (4MB0) Paper 02

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Summer 2018
Publications Code 4MB0_02_1806_ER

Introduction

In general, this paper was well answered by the majority of students. Comparing this with last summer's paper the demand of the questions aimed at differentiating amongst the high grade students proved to be greater. Some parts of questions did prove to be quite challenging to students and centres would be well advised to focus some time on these areas when preparing students for future examinations.

Areas were candidates showed particular strengths included most aspects of algebra, differentiation, matrix transformations, calculating means from grouped data and drawing histograms.

In particular, to enhance performance, centres should focus their students' attention on the following topics, ensuring that they read examination questions very carefully and answer the question which is set – not the question that they think is set.

- Applying trigonometry to geometric problems Q1 and 3
- Using Venn diagrams to solve set problems Q2
- Reflecting in oblique lines Q5
- Structuring calculations involving numerous parts Q6
- Solving problems relating surface area and volumes of shapes Q7
- Solving vector problems by comparing coefficients Q9
- Solving probability problems interpolating from grouped frequency data Q10(c)
- Converting units of speed Q11(a)
- Finding instantaneous rates of change from curved graphs Q11(b)
- Solve kinematic problems involving speed/time graphs Q11(c) and (d)
- Manipulate equations to solve equations related to drawn graphs. Q12 (d)

More generally students should be encouraged to identify the number of marks available for each part of a question and allocate a proportionate amount of time to each part of the question. Where answers are given candidates should ensure their working has no gaps but do not need to add an extensive written commentary.

It should be pointed out that the methods identified within this report and on the mark scheme may not be the only legitimate methods for correctly solving the questions. Alternative methods, whilst not explicitly identified, earn the equivalent marks. Some students use methods which are beyond the scope of the syllabus and, where used correctly, the corresponding marks are given.

Question 1

In part (a), a surprising number of candidates failed to find the correct interior angle. Some found the exterior angle correctly (36 degrees) but then assumed that this was the required answer. Part (b) was not handled well at all with many candidates making false assumptions of the diagram. Much wrong working centred on the assumption that either $\angle BAD = 72^\circ$ or 54°. Indeed, the wrong answer of 9.70 cm proved to be as popular as the correct answer. Candidates who started with the cosine rule on triangle *BCD* fared slightly better by achieving a method mark for *BD*. Continuing with their value for BD proved to be more elusive except for the most able of candidates. Overall, a demanding first question with nearly 30% of candidates failing to gain any marks.

Question 2

There were a number of good attempts at this question with many having a clear understanding of what was required. Unfortunately candidates who failed to gain full marks often only gained 1 or 2 marks on this question.

In part (a) in many responses x, y were placed correctly but 20, 15 and 21 seen in diagram without any attempt to adjust for overlaps; as this significantly simplified the overall question this often led to few marks. A small proportion wrote unsimplified expressions such as '$15-x-y-9$' rather than '$6-x-y$' but still gained the mark. These candidates were often less successful in part (b).

In part (b) very few students seemed to understand they had to add the regions and those who did rarely wrote down an explicit sum of their regions. Many students failed to understand that "11 did exactly two of the three activities" meant that $x+y+z=11$: often attempting to find values for x, y and z individually.

Question 3

Quite a few misinterpreted the diagram, thinking triangle PAQ was right angled. A smaller group of students failed to appreciate that triangle APT and APQ were not coplanar and attempted to make use of the angle they found in part (a) in later parts. In both cases this effectively prevented candidates from gaining any marks on parts (b) or (c).

Part (a) was generally well answered. A number of candidates used a more complex method than required but as long as they maintained accuracy they were not penalised for this; beyond the additional time they had devoted to this part of the question. The most common error was in finding the angle ATP rather than APT.

In part (b) most candidates who managed to avoid oversimplifying the question by assuming PAQ was a right angle managed to form a correct equation using the cosine rule which was given. A small number did however state the cosine rule with "sin 65" in place of cos 65; as the equation was given candidates need to be reminded of the importance of using the given equations correctly. The most common issue with those candidates using the cosine rule was failing to adhere to the correct order of operations in evaluating the value of a^2.

In part (c) a number of candidates found the angle AQP or PAQ but then seemed to have no idea how this related to the required bearing.

Question 4

This question on proportionality was accessible to the majority of candidates with 45% achieving full marks. Part (a) had the greatest success, with the correct answer frequently given. The most common technique was to find a constant of proportionality, k=256. Methods using ratios were rarely accurate, as they often simplified the question to a linear relationship which did not gain any marks at all. Part (b) proved less accessible to the candidates. Many identified a different constant k=100 but made no further progress. Most candidates who did manage to get to the end of this question correctly used a cube root, but the occasional square root was seen which was not the correct inverse of r^3.

Question 5

Matrix multiplication to effect a geometric transformation was certainly testing for many candidates. As was reflecting in the line $y=x$. A surprisingly large proportion of candidate simply reflected in either the x or y axis, which was a 3 mark penalty. Following an incorrect R in part (b) however, all marks were available as follow through in part (c) with candidates often polarised into full or zero marks. They should be reminded that matrix transformations are a 'pre-multiplication' process. Part (d) was not well answered at all. Methods using lengthy algebra and defining a matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ were not often successful. The best candidates either stated the answer, or looked at how the vectors $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ were transformed to obtain the correct matrix. Unfortunately, a significant number of candidates described the transformation in words, rather than with a matrix, hence scoring no marks.

Question 6

This question tested the candidate's ability to extract information, create a complete method using clear steps of working. 38% of candidates obtained a fully correct answer and were awarded full marks. It was common, however to miss part of the information, particularly the interest calculation. Candidates who cannot find a percentage of a number found themselves completely out of their depth and did not gain any marks at all. Some candidates calculated 2 year's worth of interest at 8% (either simple or compound interest) which was incorrect, as the interest was not a 'per annum' value.

Methods that attempted to use 'profit per year' were generally less successful, as the watches were purchased in $ but sold in £ and candidates regularly ignored this point, obtaining a mixed-currency calculation which prevented them from earning the 3rd Method mark which was for converting an amount in pound to an amount in dollars.

Question 7

Overall in part (a), this was well answered with clarity on separate cylinder and hemisphere surface areas. However, there were a surprising number who tried to use $4\pi r^2 - \pi r^2 + 2\pi rh.$

Although there were a number of correct answers to part (b), a significant minority of candidates, whilst correctly finding an expression for h, a correct formula for the volume proved to be more elusive with $\frac{2}{3}\pi r^3$ being added to the volume of the cylinder, rather than subtracted. Many valid attempts were seen to differentiate in part (c) and in some cases despite an error in one term, the method was earned. Frequently π had 'disappeared' from the term $\frac{13}{2}\pi r^2$ and a common incorrect answer of 17.7 was seen as a result. Although some candidates tried to substitute their found r into the differentiated expression, the majority successfully substituted into the correct expression to earn method, even if they did not earn the accuracy mark.

Question 8

The overwhelming majority of candidates scored the mark in part (a). Part (b) had errors where candidates created an incorrect composition of functions. For those candidates who did manage a correct composition, many typically went on to collect all marks for that section as most of the time they rejected the negative solution. In part (c), the inverse function was generally very well done. However, many went on to find λ in terms of x rather than x in terms of λ. There were a small number of candidates who, having correctly found the required answer, went on to 'cancel' the numerator λ with the denominator λ giving an answer of 15/3. A correct answer to part (d) proved to be more elusive than one would have expected, with many equating the numerator to zero rather than the denominator. As a consequence, a frequently seen incorrect value of λ was -0.5. Sometimes this was seen alongside the correct answer but, given a choice, the candidate did not score this last mark.

Question 9

This question proved particularly difficult for all but the most able candidates to access the full range of marks available. Part (a) did provide a way for most candidates to show some basic ability to manipulate vectors with many scoring well on this part of the question. Part (b) was a little more demanding with a few candidates clearly not understanding that simply restating the result given would gain no marks. Most candidates however did show sufficient working to secure the marks in this section. Part (c) was considerably more demanding but a number of candidates did realise that the key to answering this part of the question was equating the coefficient of **a** found in the previous part to zero. Only the most able candidates were able to score any marks on this section of the question. Very few realised that they would need to find an expression for OH in a similar way to the expression they had already proved for OG.

Question 10

This question proved very accessible to the majority of candidates.

In part (a) 59% of candidates gained full marks. Common errors included using frequency multiplied by class width which scored no marks. Also commonly seen was use of the upper value in the range rather than the mid-point although this still allowed candidates to gain two of the three method marks.

In part (b) 61% of candidates gained full marks. Many drew correct histograms but a number of these candidates did not show the frequency densities they used. This did limit the marks available to some candidates who failed to show their working.

Part (c) proved less accessible with only 28% of candidates gaining any marks. A small number of candidates failed to consider an appropriate fraction of the 30-50 group but most candidates left this section unanswered.

Question 11

This question proved to be very demanding with 46% of candidates failing to gain any marks on this question.

In part (a) only 30% of candidates were able to convert from m/s to km/h. Common erroneous values of 900000000km/h or 0.00000694km/h should be instantly recognisable as nonsense speeds for a car.

In part (b) only 13% of candidate realised that they would need to draw a tangent to use the graph to identify an instantaneous acceleration. Instead the incorrect method of 'average acceleration – calculated using two values on the graph (commonly (0,0) and (4,16)) was applied. Candidates who did draw a tangent line on the graph at t=4 were largely successful in obtaining full marks on this section.

In part (c) 33% of candidates gained marks. Those who did not draw a straight line graph in (c) for the van's journey essentially prevented themselves from gaining any marks in part (d). Candidates should be aware that constant acceleration corresponds to a line with constant gradient on a speed-time graph.

In part (d) 18% of candidates gained method marks. Calculation of areas using triangles or trapezia were largely successful, however failure to recognise that the van started when t=2 meant that a large number of candidates did not have a fully correct method for their area, and hence did not gain any of the marks in this part of the question.

Question 12

In part (a), most candidates scored three marks here, although a few produced rounding errors (5.6 instead of 5.7 being a typical error). In part (b), the most common mistake was a misplot for x=2.5. This was commonly plotted at (2.5 - 0.3). There were also some instances of the curve missing past x=3.5. Generally, however, the quality of curve sketching was of a very good standard. The candidates were expected to give the minimum value of the function for part (c), but many simply quoted $x = 1.5$ or gave both the x and y value, thus failing to clearly identify the minimum value of the function.

In part (d), many candidates had difficulty in finding the linear expression equal to $x^2 - 8 + \frac{5}{x}$ and a significant number of candidates simply 'reverse engineered' their solution by solving the cubic on their calculator, identifying the two points on their graph which matched up with their found positive solutions, drew the line and wrote down the answer. This method, whilst commendable, was not the method required in the question and the non-appearance of $(y =)2x - 2$ meant that such candidates earned no marks for this last part of the question. Candidates should be aware that whilst calculators with more advanced features are allowed these features should be used with caution and should not expect to gain marks simply from solving equations using these features.