Examiners' Report
Principal Examiner Feedback

January 2020

Pearson Edexcel International GCSE
In Mathematics B (4MB1) Paper 1

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Introduction

In general, this paper was well answered by the majority of candidates. Some questions did prove to be particularly challenging to most candidates particularly Q12, 18, 19, 22 and 24. Centres would be well advised to focus some time on these areas when preparing for a future examination.

In particular, to enhance performance, centres should focus their student’s attention on the following topics:

- Reasons in geometric problems, particularly in relation to the appropriate details required.
- Probability in unstructured questions
- Simplifying Algebraic Fractions
- Problems involving Upper and Lower Bounds
- Scale factors involving area
- Vectors
- Problems involving sectors of circles
- Linking stationary points to zeros of derivatives
- Unstructured problem questions involving linking multiple topics

In general, candidates 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. In addition, candidates should also be advised to read the demands of the question very carefully before attempting to answer. 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 candidates use methods which are beyond the scope of the syllabus and, where used correctly, the corresponding marks are given.

Report on individual questions.

Question 1

Approximately two third of the responses to this questions were correct. Common errors included rounding to 1 or 2 sf along with writing in standard form, giving the mantissa correctly but the exponent given as 4 and the complete expression would equate to the required value but resulting answer was not in standard form. Many otherwise good papers lost marks on this question.

Question 2

Approximately half of the responses to this question were correct. The most popular incorrect answer being 236°. This was as a result of $(360-124)$. A simple diagram should have highlighted this answer being incorrect and many candidates would have benefitted from this. Very few candidates scored only one mark as very few who showed a correct method failed to gain the correct answer.

Question 3

The majority of responses to this question were correct. The most common incorrect answer given as 135°. Candidates failing to obtain the required answer for two marks were sometimes able to pick up an M mark for either giving (correctly) another angle usually shown on the diagram.

Question 4

The majority of candidates knew how to convert both fractions to top-heavy form for the method mark but approximately half of those were unable to turn their result back to a mixed number in its simplest form gaining only 1 of the 2 marks. Common answers seen in the wrong format were $\frac{39}{8}$ and 4.875.

Question 5

A significant number of candidates did not correctly use the given universal set, often listing odd numbers in both parts. This essentially prevented them from gaining any marks in this question. Another commonly seen error included failing to identify 24 as a factor of 24. Also a surprising number of blank responses seen for a question so early on in the paper.

Question 6

A significant minority of candidates simply found the middle item of the given list and $\left(\frac{18+78}{2}\right)=48$ proved to be a common, but incorrect, answer. Those candidates who started by writing down the numbers in order fared better as the method mark was earned. Approximately 25% of these candidates then wrote down either 23 or 26 as their final answer, in some cases after finding the correct answer of 24.5. A little under half the responses to this question were fully correct.

Question 7

The majority of responses to this question were fully correct. Most that did contain errors either contained one numeric slip allowing these candidates to still gain one mark or showed a complete lack of understanding of the demand, many giving answers involving algebraic expressions.

Question 8

The majority of candidates were aware that they needed to convert either 42 mins or 5 hours to be able to answer the question. However, this was done to varying degrees of success. About two thirds of the candidates did achieve full marks for the question. Those who failed to gain full marks often picked up one mark for either $\frac{42}{a}\times100$ or $\frac{b}{5}\times100$.

Question 9

Drawing a singular straight line between -3 and 4 earned method but the correct endpoint symbols proved to be elusive to a significant number of candidates. This standard convention needs to be learned by candidates. In part (b) approximately half the candidates scored the mark. Commonly seen errors included excluding 0 from the list and including the number 4 in the list.

Question 10

Both parts generally well answered with the majority of candidates gaining full marks. Where candidates lost marks on the second part it was often for giving an answer in the form $\begin{pmatrix} -16 & -6 \\ -8 & x \end{pmatrix}$ where $x \neq 10$ often giving –6. Another common response seen gaining 1 mark was that the diagonal entries were correct, but the off diagonal were incorrect, namely in the form $\begin{pmatrix} -16 & a \\ b & 10 \end{pmatrix}$ or $\begin{pmatrix} a & -6 \\ -8 & b \end{pmatrix}$. There was the occasional answer given as in a 2 x 1 matrix form but this was very much an exception.

Question 11

Generally a well answered question with most candidates gaining 2 or 3 marks. The most common error with this question was the inability to simplify their numerator once a single fraction was formed. The most common error being writing $-4x$ for the final term after expanding. Some candidates also tried to simplify further by expanding and re-factorising the denominator or cancelling terms once writing as a single fraction, essentially undoing their previous work. A significant number lost marks through incorrect expansion of the denominator this was not required but where it was attempted needed to be followed through correctly to gain the final mark.

Question 12

A very demanding question which led to a large number of completely blank responses. A significant amount of students had no idea about what $Q(x)$ stood for. Many considered Q as an unknown on its own and expanded brackets on the right hand side of the equation leading to the form $2xQ + kQ + 11$. Eliminating 11 from both sides proved to be the only mark achieved by some candidates, this credited those students who made some attempt at this question. Once this had been done, most of the successful candidates simply factorized the left hand side of the equation and a very few arrived at the required answer.

Question 13

Most candidates successfully answered this question or at least picked up both method marks. Marks were lost due to misconceptions such as not cubing 3 when simplifying the numerator or leaving their numerator as $27x^5y^6$ by adding their powers rather than multiplying.

Questions 14

This question was well answered by the majority of candidates. Candidates seemed clear on the method to be able to answer this question, with elimination the most popular approach for candidates. Again, lost marks were mostly due to arithmetic errors such as failing to subtract terms, involving negatives, when using the elimination method or failing to expand and simplify correctly if using substitution. In general those using substitution methods more often made numeric slips. Once one variable was found candidates knew to substitute their solution into an equation to find the second variable. A small number of candidates had working which was clearly incorrect leading to incorrect solutions and then gave the correct solutions on the answer line. Candidates need to be aware that using allowed calculators to gain the correct solutions will gain them no marks if this is not backed up by correct working.

Question 15

Very few candidates recognised the need to find the line $x = 3$ when stating their solutions. This led to most candidates scoring either 2 or 0 marks. 2 marks if they were able to correctly interpret the inequalities of the two equations given. However often, no attempt to find the third equation was made. Those who did recognise the need for the third inequality were evenly split between those who set up an equation of $0 = 6 - 2x$ and those who set up an equation of $6 - 2x = 5 + x$, unable to recognise that this is the point of intersection of the two oblique lines.

Question 16

Generally poorly attempted with the majority of candidates scoring 0 marks. Two main misconceptions were seen with similar frequency. Firstly candidates failed to recognise the need to square their scale factor, setting up an equation of the form $\frac{7200}{x} = \frac{3}{400}$ with a result of 960000. The second misconception was that candidates failed to correctly convert units to m^2, often dividing by 100 rather than 100^2. The mark scheme was designed to allow candidates to gain marks if they managed to avoid either of these errors irrespective of the order they attempted to deal with these separate processes.

Question 17

A good source of marks for many with just under half of candidates scoring full marks. Those who were able to find the length *BD* were often able to follow this up with full marks for the question. Incorrect responses seen were an incorrect use of Pythagoras' Theorem to find *BD* often leading to 6.96, using $\frac{6.5 \times 2.5}{2}$ to find the area of *ABD* and attempts to find the area of the quadrilateral using a single formula, often incorrectly attempting to use the area of a trapezium formula. Many candidates failed to round their answer but, in this instance, this was not penalised.

Question 18

Generally poorly answered, a significant number of blank responses were seen and a little over half the responses gained no marks. Often these involved equating the coefficients of the vectors in various ways. Those who recognised the need to use Pythagoras to find $|\mathbf{p}|$ or $|\mathbf{q}|$ were split evenly into 3 groups. Those who scored no more marks, often making no further progress or square rooting the sum of two square terms by removing the squares. Those scoring 3 marks occasionally because of minor errors in their working but more often by rejecting the wrong final solution, a significant number clearly not taking note of the given condition $x < 0$. Those scoring full marks. A small number of candidates solved their quadratic without showing any working. They would only gain credit for that if they gave both solutions or only gave the required solution of –4.2, candidates should be wary of providing results without working as these will only be credited if fully correct.

Question 19

This was a challenging question with a significant number of blank responses with over half the responses awarded 0 marks. Candidates often failed to organise their work or provide sufficient annotation as to what they were finding making awarding any marks in some cases very difficult. In a question like this using a variable x or r without defining them in term of the problem made some responses ambiguous, marking was generous in regards to this but the working indicated that many candidates were themselves unsure what they had found. This was often exacerbated by poor formation of symbols such as x, r and π. In a number of responses, even the candidates themselves became confused over their previous expressions. In addition, there was a variety of misconceptions in evidence, including; using area of a sector formula rather than length of an arc, creating an expression for the perimeter of *OCB* rather than *ABCD*, subtracting a length, usually *AD* and failing to simplify their expression correctly to gain the third method mark. This final issue was far more commonplace in those candidates who had not defined there variables and whose symbols were difficult to distinguish between.

Question 20

Answers to part (a) were generally split between a correct answer or an answer of 12 due to simply finding the mode of the numbers in the table. For part (b) some candidates found the range of each class rather than the midpoint. As this is a fundamental error they gained no marks for this. Others found the sum of the midpoints and then divided by 6 or 50. Of those who did calculate the correct mean a number lost the final mark due to not following the demand to calculate to the nearest °C.

Question 21

This question discriminated between the candidates well with marks at all levels being commonly seen. Few candidates picked up the mark for part (a) some responses clearly failed to appreciate that $g(x)\geq 1$ a small number realising the significance of 1 but using a strict inequality. At this level it is important to use correct notation and while $y\geq 1$ was condoned $x\geq 1$ gained candidates who gave this answer no marks. For part (b) candidates were more successful. The most successful method was substituting 2 into $f(x)$ and then substituting 1 into $g(x)$ separately. Candidates who lost marks tended to do so because they tried to find an expression for $gf(x)$ before substituting in a numerical value. This meant that many candidates picked up the first method mark due to correct order but then issues with expanding and simplifying their expression led to no further marks. A significant minority attempted to solve $f(x)=gf(x)$. Given the complexity of this it is hoped that candidates would realise this was inappropriate for a 4 mark question.

Question 22

This is a new topic on this specification. However this has now appeared on a number of past papers and seeing a significant number of candidates leave this question blank and approximately three quarters score no marks for their response is disappointing. A lot of candidates simply substituted the values in the question into the equation without finding any bounds scoring no marks. Those who started by finding the upper and lower bounds of each value were able to gain 2 marks without a lot of work, even allowing for one error in each case. Calculating the upper bound or lower bound of the required expression gained one mark each, this was somewhat more challenging with the requirement that both upper and lower bound were required to be used correctly to gain this mark in either case. In order to gain full marks candidates had to calculate both the upper and lower bounds and give their answers to a level of accuracy that showed agreement to 2 dp and a difference in the 3rd dp. Given that only a few candidates successfully made it to this stage we did not insist on seeing a written explanation in this case but candidates should be taught that when a question states “give a reason for your final answer.” We would usually expect a comment to justify their final answer.

Question 23

Very good algebraic work saw the majority of candidates scoring well particularly on parts (a) and (b). Common errors seen included an answer of $5a(2a - 5b)$ seen in part (a), an attempt to solve the "equation" in part (b), those who proceeded by factorising at least gained 1 mark but were penalised as they clearly had not understood the demand to "factorise". Part (c) was more demanding and saw significantly less candidates gain marks. Many candidates spotted a common factor of 2 gaining 1 mark. A number however interpreted $50x^2$ as $(50x)^2$ and $72y^2$ as $(72y)^2$ giving answers of $(50x - 72y)(50x + 72y)$. Candidates should have been able to spot this was in error by attempting to expand their result to obtain the original expression.

Question 24

Another demanding question with a significant number of blank responses and approximately two thirds of candidates failing to gain any marks. Common misconceptions seen included; substituting $x = \frac{1}{2}$ into y without any attempt at differentiating, expanding the numerator correctly but then not dividing through by x, this did score marks for those who used the product or quotient rules successfully but since these are beyond the scope of the specification they must be used completely correctly to gain any credit and often candidates made errors when attempting these. Candidates who attempted to expanded the numerator in their working often scored one mark for this.

Question 25

A significant number of candidates scored no mark for this often leaving blank responses. The question was generally well answered by those attempting it with a large proportion of students making some effort at the explanation. However, more attention needs to be paid to minimum wording for these explanations - it appears that some are under the impression that some code words such as simply writing "cyclic quadrilateral" is enough whereas they also need to refer to "opposite angles" in this case as well. Minimum explanation in bold on the mark scheme should be used as a guidance of what is expected in future examinations. In addition, explanations regarding equality of lengths does not relate to equality of angles. Finally, when "reasons" is stated in the question at least 2 distinct reasons (or possibly the same reason in relation to 2 separate structures) will be required. Mathematical misconceptions were often due to failing to spot that *ABCD* was a cyclic quadrilateral or assuming that *ADC* was a right angle. Part (a) was generally answered better than part (b). In Part (a) there was some confusion over three-letter angle notation and some students did not understand which angle was being asked for. In part (b) a few students confused BCDO with a cyclic quadrilateral. Generally, those who identified angle BOD being twice BCD on the circumference went on to a successful conclusion. Once again, a logical step-by-step approach and good presentation helped here.

Question 26

Another demanding question with nearly three quarters of all responses scoring no marks including a significant number of blank responses. The main misconceptions seen were; not recognising the need to find n($T \cap B$) and writing $\frac{15}{30} \times \frac{9}{30}$, finding $x = 6$ but then using 30 as their initial denominator, using 30 or 9 as all denominators rather than reducing the value by 1 for each new selection. Most candidates who gained any marks realised the need to calculate n($T \cap B$) but few candidates then successfully developed this further.

Question 27

A significant number of blank responses, since many of those who did attempt this question gained some marks this possibly indicates some candidates need to review their timings. Most candidates were able to pick up the first method mark but from then on there were several misconceptions which meant that relatively few candidtaes were awarded full marks; using $CB = \frac{1}{3}(AB)$ as their fraction rather than $\frac{1}{4}$, being unable to create an expression for $\overrightarrow{OD}$ or $\overrightarrow{CD}$ and using $\overrightarrow{CB}$ rather than $\overrightarrow{BC}$ to find $\overrightarrow{OC}$ when following the path OB $\rightarrow$ BC.

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