Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel International GCSE

In Mathematics B (4MB1)

Paper 01R

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Paper 01R

Introduction to Paper 01R

While examiners did report many excellent responses to questions, some students did seem under-prepared for this paper with examiners reporting many blank responses to the later questions on the paper.

To enhance performance in future series, centres should focus their students' attention on the following topics:

- Reasons in geometric problems
- Questions that involve the demand to show all working (most notably questions 7, 20 and 21)
- Coordinate geometry
- Histograms
- Unstructured trigonometry questions
- Application of bounds
- Questions requiring algebraic proof

In general, 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. In addition, students 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 students 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

This proved to be a good start for most students with many correctly determining that 540 was the LCM of 60 and 135. The most common (and what turned out to be the most successful) approach was to write these two numbers as a product of their prime factors (i.e. $60 = 2^2 \times 3 \times 5$ and $135 = 3^3 \times 5$) and then conclude that the LCM was given by $2^2 \times 3^3 \times 5$. For those students who attempted to use a factor grid or ladder diagram many either made mistakes in their division or failed to multiply the correct values together at the end.

Question 2

Almost all students started this question correctly by either equating $9n-7$ to 214 or working out terms of the sequence to get them as close to 214 as possible. In many cases, students correctly obtained $n=\frac{221}{9}$ but they did not indicate that this was not an integer (and so therefore couldn't be a term in the sequence) or some students who did write *n* as 24.55... did not give a conclusion that 214 was therefore not a term in the sequence. Of those that did correctly work out the 24th term as 209 and the 25th term as 218 most did score both marks, however, this trial and improvement approach is rather inefficient and time-consuming compared to the algebraic approach discussed earlier.

Question 3

Nearly all students correctly used the given information that the range of the numbers was 18 to calculate the value of *w* as 6. Examiners reported that several students mistook the mean for the median and incorrectly stated that $\frac{w+7+x+24}{4}=10$ instead of the correct $\frac{7+x}{2}=10$. Those that did have a correct equation for *x* nearly all went on to obtain the correct value of *x* as 13.

Question 4

For those students who had learnt that the volume of a cylinder is given by the expression $\pi r^2 h$ nearly all went on to apply this formula correctly. However, examiners did note several incorrect formulae e.g. $\frac{1}{3}\pi r^2 h$ and $\frac{4}{3}\pi r^3$. Even though the question asked for the volume to the nearest cm^3 examiners did not penalise on this occasion answers in the range 2412 to 2413 but an answer of 768π scored only one of the two marks available.

Question 5

This question was answered extremely well with nearly all students solving the equation $\frac{2x-3}{5}=9$ correctly by first re-writing it as $2x=3+45$ and then going on to obtain the correct value for *x* as 24.

Question 6

While the vast majority of students correctly obtained the value of *Q* as 60 there were the usual errors of implying that $(-6)^2=-36$ or that $-4\times-6=-24$. As there were two marks available here students are reminded if they only give an answer which is incorrect (for example, it was common to see –12 but with no indication of where this value had come from) then, in general, no marks can be awarded.

Question 7

Nearly all students made a correct first step in dividing the two given fractions with nearly all re-writing the mixed number as an improper fraction and then multiplying by the reciprocal of the second fraction $\left(\text{e.g.}\frac{11}{4}\times\frac{12}{11}\right)$. However, many did not score the second mark as they did not show all the necessary subsequent working; this could have been done by explicitly showing the cancelling down of these two fractions or by stating $\frac{12}{4}$ before the correct answer of 3.

Question 8

Students were about evenly split on the method employed in this question to work out the size of angle *x*. Many took the approach of using opposite angles in a cyclic quadrilateral to calculate angle *ABC* as 48, followed by using the result that the angle at the centre is twice that at the circumference to obtain the correct answer of *x* = 96. Others used the fact of the angle at the centre being twice that at the circumference immediately to calculate the reflex angle *AOC* as 264 before correctly applying angles at a point to obtain *x*.

Question 9

The vast majority of students differentiated the first term correctly with respect to *x* and obtained $12x^2$. When mistakes were made in this question it was usually due to the second term and a number failed to re write $\frac{7}{x^2}$ as $7x^{-2}$ before attempting to differentiate. It was common to see $\frac{\mathrm{d}}{\mathrm{d}x}\left(4x^3-\frac{7}{x^2}\right)$ being given as either $12x^2-\frac{14}{x^3}$ or $12x^2+\frac{14}{x}$.

Question 10

This question differentiated well with many students scoring at least one mark for a correct first step of re-writing $\sqrt{5a}\left(\sqrt{20a}+a\sqrt{5a}\right)$ as either $\sqrt{100a^2}+a\sqrt{25a^2}$ or as $\sqrt{5a}\left(2\sqrt{5a}+a\sqrt{5a}\right)$ (or for correctly obtaining one of $10a$ or $5a^2$). A number of students, after obtaining a correct answer of either $10a+5a^2$ or $5a\left(2+a\right)$, incorrectly simplified this to $2a+a^2$ and so lost the final accuracy mark.

Question 11

This question on the intersecting chord theorem was a good source of marks to most students with many correctly stating that $5 \times 7 = 4 \times CP$ followed by the correct value of 8.75 for *CP*. When errors occurred, it was usually down to an incorrect application of the theorem with several students stating that either $(5+7) \times 5 = (CP+4) \times 4$ or that $(5+7) \times 7 = (CP+4) \times CP$ so possibly getting confused with the corresponding formula for two intersecting secants.

Question 12

This was another question that was a good source of marks to most students with many correctly writing down the three inequalities that defined the shaded region. Students are reminded that one way of deciding which way round the inequality sign should point is to test a point that lies inside the shaded region, for example, if we take the point (2, 2) then considering the line $y = \frac{1}{2}x$ then clearly $2 \geq \frac{1}{2}(2) \Rightarrow y \geq \frac{1}{2}x.$

Question 13

It was clear to examiners that students did not read the question carefully and instead of calculating the depreciation for one year at 20% followed by two subsequent years at 15%, many calculated just one year (at 20%) or all three years at the same rate (or in some cases more than three years). It was also important to note that many students also believed that a rate of depreciation for one year at 20% followed by two years at 15% was equivalent to a depreciation of 50% overall. Finally, students are reminded when working with percentages that statement such as $8600 \times (1-20\%) \times (1-15\%)^2$ are not mathematically correct and if the answer is then stated incorrectly no marks will be awarded. The most efficient way to tackle this problem was to write $8600 \times 0.8 \times 0.85^2$ which examiners noted many students did in fact do.

Question 14

Many students correctly started this problem by first calculating $5\mathbf{A} + n\mathbf{B}$ as $\begin{pmatrix} 20+4n & 15+nx \\ 10+2yn & -5+7n \end{pmatrix}$ and then setting up one of the two equations $20+4n = 8$ or $-5+7n = -26$ in an attempt to find the value of *n*. When errors occurred, it was usually down to slips in arithmetic rather than a misunderstanding of what was involved in finding the three required values. Several students began by re-arranging

$5\mathbf{A}+n\mathbf{B}=\begin{pmatrix}8 & 27\\ 1 & -26\end{pmatrix}$ to $n\mathbf{B}=\begin{pmatrix}-12 & 12\\ -9 & -21\end{pmatrix}$, however, due to the number of negative signs involved this method was not as successful.

Question 15

Both parts of this question were accessible to the vast majority with many students scoring both marks in each part of the question. In part (a) nearly all correctly divided the left-hand side by 10^5 and it was only in the simplification that some students made errors. While it should be noted that there were quite a number of acceptable answers (e.g. $x+\frac{y}{100}$, $\frac{10^2x+y}{10^2}$, etc.) it was worrying that a number of students gave an answer of $x+0.0y$ instead of the correct equivalent $x+0.01y$. In part (b) nearly all students made a correct start of obtaining 34×10^{132} but significantly fewer realised that this was not in the required standard form and even less could correctly re-write this as 3.4×10^{133}.

Question 16

This question proved to be one of the most demanding questions on the paper and many students scored no marks. Most students did not realise that this question was testing the topic of bounds and instead thought the question was simply asking them to work out the area of triangle *ACE* using the values given, therefore, an answer of $\left(\frac{9.3}{7.2}\right)^2\times15.4=25.7$ was all too common. Those that did correctly state the bounds for one or more of the given values did not use the correct bounds which should have been $\left(\frac{UB(AE)}{LB(BD)}\right)^2\times UB\left(BCD\right)$ leading to an answer of 26.4. Students are once again reminded that if a value is given correct to say 2 significant figures e.g. 7.2 then the upper bound is 7.25 and not 7.24, 7.249, 7.2499, etc.

Question 17

The part of the question that asked students to calculate the size of angle *x* was done extremely well with many correctly obtaining the value of 124. However, many did not read the question carefully and did not give reasons for each stage of their working. Of those that did most gave enough detail with the most common approach being to use angles on a straight line twice, together with vertically opposite angles and angles in a triangle. Examiners did note that several students wrote about ‘alternate angles on a straight line’ which was incorrect.

Question 18

Many students in part (a) not only wrote down an equation in *x* but also solved it too – although this did not cause any great issue with the marking it must be noted that students are advised to read the question carefully and only answer the question that has been set in that part of the question. In part (b) many students correctly calculated *x* as 9 but many failed to answer the question which was to work out the number of crayons that Suzy had.

Question 19

This question was received extremely well with most students correctly calculating the number of sides of the polygon as 17 using the formula $180(n-2) =$ sum of interior angles. Again, it must be noted that many students did not read the question carefully and instead of calculating the size of each angle (correct to one decimal place) just gave 17 as their final answer.

Question 20

It was pleasing to note that most students correctly stated that the length of *AB* would be given by the expression $\frac{3(5\sqrt{2}-2)}{2-\sqrt{2}}$ (and so scored at least one mark in this question) but many then simply wrote down the correct answer of $9+12\sqrt{2}$ without showing where this came from even though the question asked students to show their working. Of those that correctly multiplied the numerator and denominator by $2+\sqrt{2}$ most then went on to obtain the correct answer.

Question 21

This question proved to be a good source of marks for nearly all students with the majority favouring elimination over the substitution method for solving the pair of simultaneous equations. When errors did occur, these were mainly due to sign slips or basic arithmetic errors rather than any conceptual errors.

Question 22

Most students found this question on proof rather demanding with most attempting to prove the congruency of the two triangles by SAS with the majority only scoring one mark for stating that *BC* was common to both. While some students did state the correct reason for why angles *DBC* and *ECB* were equal most could not give a fully correct reason for why *EC* = *DB*; for this reason, examiners expected to see an answer involving the fact that *D* and *E* were the midpoints of equal sides. Finally, students are reminded that at the end of the proof they must state SAS (or equivalent).

Question 23

On the whole the responses to this question were mixed with many students incorrectly starting their solution by stating that $\frac{27^{3x}}{9^y}$ was equal to 3^{3x-y}. However, most did manage to pick up at least one mark for re-writing the right-hand side as 3^{3x+1}. Of those students who correctly re-wrote the equation using a base of 3 (by re-writing the terms

27^{3x} as 3^{9x} and 9^{y} as 3^{2y}) most correctly went on to obtain the linear equation $9x-2y=3x+1$ and hence the correct answer of $y=\frac{1}{2}(6x-1)$.

Question 24

It was pleasing to note that in part (a) nearly all students correctly used a ruler and a pair of compasses to construct the locus of points that were equidistant from *A* and *B* and showed all their construction lines. Part (b) surprisingly was not done as well with many students struggling to have *C* correctly positioned on a bearing of $250°$. Most students who had completed parts (a) and (b) correctly usually went on to obtain the mark in part (c).

Question 25

This question discriminated well with many students assuming that points *A* and *B* were both on line $\mathbf{L}_1$. Many who did realise that the key to solving this problem was to calculate the gradient of the given line did so incorrectly by assuming that the gradient of line $\mathbf{L}_2$ was either 5 or –5, and even though those who did calculate the gradient correctly as $-\frac{5}{4}$ many did not know how to use this result to find *A* and *B*. It was pleasing to note that those who did obtain coordinates for *A* and *B* many continued and applied the correct distance formula to find the length of their *AB*.

Question 26

In part (a) almost all students used the factor theorem correctly and showed that $(2x-1)$ was a factor by substituting $x=\frac{1}{2}$ into the given cubic and obtaining a value of 0. The two most common errors made by students were substituting $x=-\frac{1}{2}$ or not using the factor theorem at all (for example many used long division).

The responses to part (b) were mixed and it was clear that many students did not understand the link between the two parts. While many could factorise the cubic as $(2x-1)(3x+1)(x+4)$ many then went on to either give the factors and not the roots as their final answer or incorrectly stated that $x=\frac{1}{2}$ was a root too.

Question 27

Almost all students had the correct method in mind to find the area of the quadrilateral *ABCD* (by splitting it up into two triangles *ABC* and *ACD*) but some were more successful than others. Most could apply the cosine rule correctly to find the length of *AC* (although there were the usual incorrect forms of the rule seen) and also the formula $\frac{1}{2}ab\sin C$ to find the area of triangle *ABC*, many struggled with finding the area of the other triangle with only the most able being able to work this out and maintain the required degree of accuracy in obtaining the correct answer of 69.1. Students are reminded that they must use the most accurate values possible in questions such as this as many obtained an incorrect value of 69.2 by using earlier rounded values.

Question 28

Part (a) was done extremely well with nearly all students who attempted it realising that the estimate for the mean came from using the mid-values in each interval. When errors occurred these usually came from incorrectly stating one (or more) of these mid-values.

Apart from the common error of drawing a bar chart, part (b) was answered well with many students correctly drawing the required three bars to complete the histogram and completing the two lines of the given table. Students are once again reminded that in order to score full marks the frequency density axis must be given a correct scale.

Question 29

Part (a) was answered extremely well with many students setting up a correct equation of the form $P = \frac{k}{w^2}$ and then using the given values to obtain *k* as 400, and hence a final answer in this part of 2.56.

Part (b) was more of a struggle with many students getting confused between their two relationships for *P* in terms of *w* and *y*. The most successful students were those who obtained the separate results that $P = \frac{400}{w^2}$ and $P = \frac{300}{y}$. Those that did use this approach usually went on to correctly eliminate *P* before substituting *w* = 2 to obtain the correct answer of *y* = 3.

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