Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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In Mathematics B (4MB1) Paper 01

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Introduction

In general, this paper was well answered by the majority of students. Some parts of the paper did prove to be quite challenging to some students, such as the Highest Common Factor on question 7, the total surface area on question 19 and the more challenging questions 24 and 26.

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

- Showing clear working, particularly when it is requested in the question eg question 5, question 21b, question 27b and question 28b

- Annotate diagrams as these are often marked eg question 23

- Make sure they have appropriate equipment for a Mathematics examination eg for question 4

- Focus their candidates' attention on the following topics

    - Calculations to find the average speed when given information about the two or three parts of a journey
    - Shapes with similar area and volume where there is a percentage increase or decrease
    - Circle theorems (including reasoning)
    - Probability in particular unstructured questions

Report on Individual Questions

Question 1

Candidates fared better on part (b) than on part (a) as the phrase 'order of rotational symmetry' proved to be quite problematic. Indeed, as well as the occasional correct value of 2, there were many integer values of 1, 4, 8 and even 24 (including several scripts which showed 8 out of 25 as the answer [identifying that there are 8 black squares and 25 squares altogether]). On part (b) whilst most of the answers were correct, the most common errors were to only shade 4 squares (omitting the central one) or to draw four lines of symmetry on the diagram without shading any squares.

Question 2

Like the previous question, candidates fared better on part (b) than on part (a) where the demand of the question proved to be challenging. Indeed, 'both a rational number and a natural number' suggested to a significant number of candidates that they needed to list at least two values for part (a) and 4 and 3/2 proved to be popular but erroneous answer. Indeed, looking at many responses, it seemed that candidates wanted to share out all four numbers across the two answers rather than giving the required singular answer for each part.

Question 3
There were many fully correct answers to this question but there were still a significant number of candidates who simply wrote down 28 and 55 scoring only one mark. One calculation which seemed to appear on a significant number of scripts was $(3\times5^2-20)[=55]$ and $(3\times4^2-20)[=20]$ giving a difference of 35. This clearly scored the method but, for some strange reason, the second calculation proved to be incorrect resulting in the loss of the final mark. Some candidates found the 3rd and 4th terms, resulting in 0 marks being awarded, or formed algebraic equations and solve them.

Question 4
Fortunately, the mark scheme overlay allowed for a level of tolerance on candidate's bisector (a significant number of candidates' bisectors proved to be very close to the edge of the tolerance allowed.) Indeed, for a more accurate bisector in the future, candidates should be encouraged to use compass arcs in excess of 5 cm. As usual, with this type of problem, there were candidates who simply joined *F* to *H* and/or produced the perpendicular bisectors of each of the two or three lines. Such candidates were in the minority, and it was pleasing to see so many candidates correctly using their pair of compasses to draw a (reasonably) accurate bisector.

Question 5
It was obvious by the positive responses to this question that the vast majority of candidates were well drilled in advance with fraction manipulations. The main issue seemed to be giving a final answer as a mixed number, with a minority of candidates giving their final answer as 35/18; provided a required previous step was seen this resulted in only being awarded one mark.

Question 6
The majority of candidates scored full marks on this algebra question. Those who did not gain the 2 marks invariably were awarded 1 mark for a partial factorisation or an answer in the form $5p(\ldots-\ldots)$

Question 7
The vast majority of candidates did not realise that they needed to find the Highest Common Factor of the three numerical expressions and many incorrect answers included a factor of 3 (which lost all marks immediately). A significant number of candidates simply evaluated each of the three numbers and chose either the largest or smallest of these. Few candidates picked up one mark by giving both the HCF and the LCM and a few others picked up one mark for $2^2\times5^n\times7$ or $2^m\times5^3\times7$ where *m* and *n* must be non-zero integers. For the rest, it was either full marks or nothing.

Question 8
A very generous method mark was awarded for any Pythagorean statement involving 7^2 and 3^2, with, or without, a square root sign. As a consequence, many scored a method mark even if they found the difference of their numbers squared and then square rooted

for an erroneous answer of $2\sqrt{10}$. Such answers only scored one mark whilst about half the candidates were able to give the required answer of $\sqrt{58}$ for both marks. Some candidates went on to give the decimal equivalent, but this working was ignored unless, of course, we had not seen the required exact answer.

Question 9

Many candidates did not fully appreciate that they were required to work out (TOTAL distance)/(TOTAL time). In many cases where no marks were earned, candidates simply added the two average speeds together (80 + 50) and divided by 2. In some cases, the distance was halved to 12.5, whilst others divided 80 by 2.5 rather than multiplying them. Of those candidates who correctly determined the distance travelled for the first part of the journey (200 km), picking up a method mark for doing so, a significant number added this to 12.5 instead of 25 and so no further marks were awarded. A few attempted to work in minutes, or even seconds but did not convert all numbers to the relevant units in order to combine them correctly. Candidates should be reminded to check the reasonableness of their answers as some gave totally unrealistic values for the average speed, having multiplied their distances together, rather than adding them.

Question 10

A significant number of candidates seemed to feel that the missing value in $H \cap G'$ was $5x - 1$ and this led many to change the value in $H' \cap G$ to $2x - 5$. This not only lost the mark in part (a) but the equation $2x - 5 + x$….. was immediately deemed incorrect and both marks were lost in part (b). Providing the candidate had written $x - 5 + x$ + their answer to part (a) + 2 = 32 then method was earned. Indeed, if the value 2 ($(H \cup G)'$) was missing, the method mark could still be earned.

Question 11

Finding the mean of the two given numbers proved to be the most accessible mark on this question, although a significant number of candidates were multiplying rather than adding the two given numbers. Converting one of the numbers so that it is written as the same power of ten as the other number proved to be more problematic with many incorrect answers of 7.8×10^n seen. Athough M1M0 was occasionally scored it was found that if candidates were able to correctly convert one of the numbers, they then proceeded to the correct answer, although some did not gain the accuracy mark as they had a final answer of 20×10^{100}

Question 12

In part (a), the most common (incorrect) value given for the gradient, *m*, was 2 and whilst many candidates gave the correct intercept on the y axis as their value of c, many incorrect answers of 10 $[4 = -2 \times (3) + c]$ and -2 $[4 = 2 \times (3) + c]$ were seen. It was surprising how the majority of candidates tried to calculate c, too often unsuccessfully, rather than just read it off from the graph. Most candidates were unable to give the correct answer for part (b) with the most popular, but erroneous, answer being defined as $x \le 3,\ y \le 4, y \ge mx + c$.

Question 13
Many candidates scored the first method mark, either for being able to factorise only the numerator or only the denominator. 2 marks was an uncommon mark, as where correct factorisations were obtained, almost all candidates successfully cancelled appropriate factors. A common error working with the numerator was to equate it to x^5. The denominator was sometimes incorrectly factorised to $(x–1)(x+2)$ or $(x+2)(x–2)$. Some candidates had the correct answer $\frac{x^2}{x+2}$, but then tried to cancel by x and gave their final answer as $\frac{x}{2}$. A few candidates took a factor of x out of the numerator, whilst some 'cancelled' x^2 from the numerator and the denominator. A small number attempted to form an equation and solve it.

Question 14
Whilst the majority of candidates scored the mark for part (a), a common mistake seen was for candidates solving part (b) using $x = 0.14$ and then working backwards in part (a) (using their value of y) to show that $x = 0.14$. Quite a circular argument! What was noticeable here was that there were a significant number of blank responses to this part of the question. Part (b) was attempted well with most candidates achieving all three marks.

Question 15
The key to this question was to determine the triplet ratios for the three colours of counters. The vast majority of those who did arrive at the correct ratios of 15 : 6 : 8 went on to score full marks on this question. The most common error was to simply write down the ratios 5 : 2 : 3 : 4 and used these figures to generate incorrect numbers for the different counters, whilst a surprisingly large number of candidates misinterpreted the question and proceeded as though the total number of blue and yellow counters was 56

Question 16
Whilst there was much good work here, a significant number of candidates scored two or fewer marks as a consequence of determining the length of *CD* as $3x + 1$ or missing out one length of the perimeter, usually the length of *BC*. A significant number of candidates tried to find the area by having two overlapping rectangles and in this case could only score a maximum of two marks if they had correctly obtained a value of $x = 2$. Surprisingly, hardly any candidates had the perimeter as $2(3x+4+5x)=40$ when using this method would have eliminated the common error of *CD* being $3x + 1$

Question 17
In part (a), the vast majority of candidates scored marks here. Occasionally spoilt by poor arithmetic, though still gaining one mark if two or three elements were correct, the

required correct matrix was often seen for both marks. This was repeated in part (b) where a small minority of candidates failed to obtain the correct value of *p* but were able to obtain one mark by having a correct equation or showing the resultant product of **BC** = $\begin{pmatrix} -3p-4 \\ 2p+28 \end{pmatrix}$

Question 18

A number of candidates used the area of a sector instead of the arc length and vice versa, getting both of these the wrong way round resulted in no marks being awarded. Curiously, a significant minority of candidates worked in radians instead of degrees but the majority of these did not fare well and most scored no marks at all. There were some problems with rounding, for example 1113 rounding to 11; provided an answer that rounded to 1100 was seen first then the subsequent working was ignored, and full marks were awarded. For those candidates that were awarded 3 of the 4 marks available it was generally the rearranging of $\frac{75}{360}\times 2\pi r = 54$ to find *r* or πr where the mark was lost

Question 19

This problem on similar figures proved to be quite challenging and there were many blank scripts and confused jumbles of calculations which suggested that the methods had been poorly learnt or understood. Candidates who worked with a volume scale factor of 0.43 fared little better and, despite some work and availability of marks, such candidates tended to score no marks. The recognition that the volume scale factor was 0.57 enabled a minority of candidates to score at least one mark. Finding the linear scale factor and then squaring to get the surface area scale factor ($\sqrt[3]{0.57^2}$) led a small, but confident, minority of candidates to the required answer.

Question 20

A common mistake here was to write down an incorrect version of the chord theorem, for example calculating 5×2 instead of 5×7. For those candidates who used a correctly substituted formula, the majority went on to gain full marks. What was helpful to candidates was the follow through marks for correctly using the sine rule with their *PB* + 4, provided clear working was shown. This enabled such candidates to pick up at most two marks from an erroneous beginning.

Question 21

Despite the demand of part (a), a small minority of candidates simply factorised the given quadratic and therefore scored no marks. However, there were some good attempts by a significant number of candidates and many answers of the form $3(x+1)^2 - r$ were seen earning such candidates three marks for a correct value of 12 or two marks otherwise. In part (b) despite some poor attempts at factorisation by a minority of candidates ($(x+1)(x-3)$ proving to be a popular but erroneous expression), many correct answers were seen for this part of the question. Although some opted to solve using the Quadratic Formula, errors using this method were quite common. Occasionally, candidates did not show working and this resulted in no marks as the question clearly stated ‘show your working clearly’ A small number found both values but rejected -3.

Question 22
There were a worrying number of blank scripts here as a significant number of candidates were unable to connect displacement with velocity. Of those that did appreciate that the cubic function needed to be differentiated, much good work followed. But then candidates who were confident with part (a), seemed to not understand the requirement of part (b) and there were many blank responses. Of those that did make an attempt, some erroneously set their answer to part (a) to zero rather than differentiating and equating to zero. Even those candidates who solved the correct linear equation to find $t = 4/3$ seemed to stop there without appreciating that they needed to find a value for v. Such candidates then lost the last mark.

Question 23
All three methods in the scheme were used quite frequently. Assuming *COB* and *COA* were congruent triangles was a common error, leading to dividing either 51 or (360-102) by 2. Many candidates failed to realise that *OBC* and *OCB* were the base angles in an isosceles triangle and therefore equal, which prevented them finding a complete solution. Labelling of angles was often incomplete, incorrect or completely lacking, as was the reasons for their calculations, in particular a phrase using the word tangent but without the word radius (or diameter). There was also confusion over which angle was 54, indicating a poor understanding of the alternate segment theorem.

Question 24
This probability question proved very challenging to many candidates with a significant number of blank scripts and for those candidates who did provide a response, the most they achieved was one mark for the probability of a red or the probability of a blue button. Indeed, when it came to combining two events eg. the probability of 2 reds, many erroneously wrote $\frac{3}{8}n \times \frac{2}{7}n$. Other erroneous expressions such as $\frac{3n}{8n} \times \frac{3/8(n-1)}{n-1}$ and $\frac{3}{8}n \times \frac{3n-1}{7}$ were prevalent and only a very small minority of candidates achieved a correct expression for two buttons of the same colour and equating to $\frac{10}{19}$.
The final hurdle was to manipulate their correct equation into either a correct linear or quadratic form to arrive at the required solution.

Question 25
Much correct algebra was seen with a majority of scripts showing the required answer. Removing the denominator from the right-hand side was as far as some weaker candidates were able to go, but more confident candidates correctly moved the $2h$ to the left-hand side as well for the first method mark. Provided that the factorisation of h was done correctly, the final answer followed. Although, it was at this stage that other errors

crept in such as $ph = 2h + 5;\ h = \frac{2h+5}{p}$ or $ph - 2h = 5;\ h - 2h = \frac{5}{p};\ h = -\frac{5}{p}$. The question was completely accessible to many but, as shown, there were glaring algebraic mistakes made. Most of those who failed to write '*h*=' on the answer line were saved by having written it in their working.

Question 26
An exercise in the algebraic manipulation of the cosine formula followed by the use of the sine formula for the area of a triangle proved challenging to many candidates. Indeed, some only scored a mark for a correctly quoted area formula with sides substituted whilst others went further and correctly quoted the cosine formula. The next 'hurdle' was to expand correctly (with allowable errors in, at most, two terms). Such candidates had now earned, at most, 3 marks. Two of the three remaining marks were available for completely correct working as successful candidates arrived at the correct quadratic equation $11x^2 - 12x - 20[= 0]$. For candidates who arrived at this quadratic, the vast majority continued to achieve full marks.

Question 27
Much correct working was seen in part (a) but whilst it wasn't essential to use this answer in part (b), few candidates simplified the given expression $\frac{6+2\sqrt{3}}{3\sqrt{2}-\sqrt{8}} = \frac{6+2\sqrt{3}}{3\sqrt{2}-2\sqrt{2}} = \frac{6+2\sqrt{3}}{\sqrt{2}}$. By multiplying both the numerator and denominator by $\sqrt{2}$ led candidates who used this approach to the expression $3\sqrt{2}+\sqrt{6}$. A significant number of candidates instead correctly rationalised the denominator by multiplying by $\frac{3\sqrt{2}+\sqrt{8}}{3\sqrt{2}+\sqrt{8}}$ although errors were common in multiplying two brackets containing surds. Some had different signs in their numerator and denominator indicating an incomplete understanding of the correct method. A significant number of candidates who gained the method mark and obtained the expression $3\sqrt{2}+\sqrt{6}$ unfortunately did not earn the final mark as they did not have an answer in the required format.

Question 28
In part (a), the majority of candidates were able to correctly substitute $x = \frac{4}{3}$ into the cubic (although some candidates did use 1.3) and many arrived at $f\left(\frac{4}{3}\right) = 2$. The substitution earned the method mark, and many candidates simply gave the correct result and stated that $(4x - 3)$ is a factor, which alone was not sufficient for the accuracy mark.

In part (b), a significant number of candidates, with minimum preamble, wrote down the required answer. The question required working and so such candidates (who probably used their calculator) earned no marks. Indeed, whilst a small minority attempted to factorise correctly, a larger proportion were able to show long division (or a synthetic division method) and, if dividing by ($4x – 3$), successfully arrived at $4x^2 + 4x - 3$ which was enough to earn the first two marks. These candidates, who had now shown some method and then wrote down the required answer, earned the remaining two marks. Some candidates used one of the other two factors instead of ($4x – 3$) and this was perfectly acceptable. A minority of candidates spoilt their good work by showing the factorisation and then solving the equation by giving values of x. These candidates lost the last mark.

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