Examiners' Report/
Principal Examiner Feedback

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International GCSE
Mathematics B (4MB0) Paper 02

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International GCSE Mathematics B
Specification 4MB0
Paper 02

Introduction

This was the first paper for this new specification and what was pleasing was how well prepared candidates were in algebraic techniques and trigonometry. There is still work to be done with candidates where the responses are clearly wrong but there are ways within the question of re-checking previous work and starting again.

This was particularly noticeable in Q4 (where the answer was given), Q5(c) (where a fractional answer for *x* or *y* would suggest a previous wrong calculation), Q7(b) (where the answers determined are decimals; no formula given suggests either integer or simple fractional values for the answers) and Q8 (where probability answers greater than one should suggest something is going wrong).

Candidates should also be reminded that if they are continuing a question on a page which does not relate to the question that they are answering, they must say...'continuing on page xxx'.

Report on individual questions

Question 1

Candidates generally coped well with part (a) by correctly dividing 2500 by 625. Only a very few candidates seemed to be unsure how speed, distance and time were connected and two marks were obtained by the majority of candidates. As good as the answers were for part (a), part (b) proved to be very disappointing. Many candidates simply found the average for the second leg and then found the average of two averages arriving at an incorrect, but popular answer of 670 km/h. Very few correct fractions of the form $\dfrac{2500+2500}{4+3\frac{1}{2}}$ were seen and sometimes candidates who got this far lost the final mark because they failed to correct to the nearest whole number.

Question 2

Part (a) was reasonably well attempted with many candidates identifying the common factor of x and then making a good effort to factorise the remaining quadratic. This resulted in two of the three marks available. The last mark was often lost however either because the three required terms were not drawn together in the form $x(x-2)(x-3)$ or the attempt at factorisation of the quadratic earned method but the resultant quadratic was incorrect (often seen as $(x-6)(x+1)$).
Some candidates saw three terms and assumed that it was enough to show $(x-3)(x^2-2x)$ for the complete factorisation. Such answers earned one mark only.

In part (b), many picked up a method mark for either attempting to factorise $2x^2+2x-24$ or x^2+x-12. The second method mark was only possible if there was, as a result, a common factor in the numerator and the denominator which was cancelled correctly. A common incorrect final answer (which earned two marks) was $\frac{x^2-2x}{x+4}$.

Question 3

This question was badly attempted. Many simply saw a quadrilateral inside a circle and assumed, incorrectly, that the quadrilateral was cyclic. This was often compounded by assuming that *BC* was parallel to *AO* and, as a consequence, an incorrect answer of 56° proved to be far more popular than the correct answer of 62°. A further factor, which reduced a candidate's score on this question was the inability of many to give two valid reasons.

Question 4

This question was usually well answered by candidates who recognised that the height, *h*, of the cone was in fact $\sqrt{39^2-15^2}$ and not 39 cm and many scores of 5/5 were seen in this question. Of those who did not achieve full marks, many simply used 39 cm or used the volume of a sphere instead of a hemisphere or simply converted π to decimals and tried to convert back on the final line. In the case of converting to decimals, only one mark was lost (provided the working was correct). In the case of using 39 cm, a maximum of one mark was obtainable. This was a *show that* question and candidates who did not arrive at the required answer had a clear opportunity to start again.

Question 5

Many candidates were able to see that the number of elements in $(A \cup B)'$ = 35 – 27 and full marks were seen on many scripts for part (a). However, the number of elements in $(A \cap B')$ proved to be more elusive as incorrect attempts such as 35 – 17 and 27 – 17 proved to be quite common.

Fortunately for a significant number of candidates, starting again from the given data and writing down the equation $x + y = 35 - 17$ enabled many to pick up the three marks in part (c) despite errors in part (b).

Question 6

Although the majority of candidates were successful in part (a), a few reflected trapezium *A* in the *y*-axis and therefore lost both marks here. Part (b) proved to be more successful as despite an incorrect trapezium *B*, follow through marks were allowed here. A rotation of 90° anticlockwise was often seen but not necessarily about the correct point. (M1) was allowed for the rotation but the accuracy was lost if the resultant trapezium (*D*) was in the wrong place. Indeed, only the correct trapezium enabled the final two marks to be achieved. Some very competent candidates went a step further with their answer to the final part of this question by giving the corresponding 2 x 2 matrix for the transformation.

In tackling this type of question, candidates should be made aware that the final **single** transformation should be one that they would recognise from their standard work on transformation geometry. In this question, reflection $\rightarrow$ translation $\rightarrow$ rotation leads back to a reflection.

Question 7

Although many correct expressions were seen to part (a)(i), there were still a significant number of candidates who believed that $(x + 2)^2 = x^2 + 4$ thus losing the A mark. Pleasingly, $\frac{1}{x^2-9} \times (x+2)$ was rarely seen.

In part (a)(ii), many correct attempts were started with $y(x+23)=1$ seen. Unfortunately, some poor algebra did not enable all these attempts to arrive at the correct expression for h^{-1}.
Whilst some candidates attempted to solve fg = h^{-1} rather than fg = h, the majority solved the correct equation and earned full marks for part (b). Candidates should be reminded that if the formula for the solution to a quadratic equation is **NOT** given on Paper 2 then the resultant quadratic will **always** factorise.

Question 8

Part (a) required a probability to be written down. It was not sufficient, for the mark, to simply place this value on the diagram, even if correct.

In part (b), whilst there were many completely correct diagrams earning the three marks, a significant number of diagrams had 0.75 and 0.25 missing from the first pair of branches or had a pair of probabilities which bore no relationship to their answer for part (a) – typically 0.8 and 0.9 were incorrect values seen.

Despite any incorrect values written on their diagram, candidates were able to pick up the majority of the marks in part (c) if they could show method. Using the incorrect values of 0,8 and 0,9 identified on the first pair of branches would, however, give a probability greater than one. This should have then been an indicator that something was not quite right in the candidate's previous working.

Part (d) was a discriminator and as such it was expected that only those candidates who were most competent at probability would be able to attempt a solution. In order to tackle this type of problem, candidates would be expected to approach it from first principles*: probability* = $\dfrac{\textit{number of favourable outcomes}}{\textit{total number of outcomes}}$

in this question, the proportion of people who passed the test (*total number of outcomes*) was the answer to part (a)(ii) and the proportion of people who are left-handed (*number of favourable outcomes*) was the answer to part (a)(i). Dividing one answer by the other gave the required result. Unfortunately, most solutions seen were as a result of multiplying their two answers together rather than dividing and, as a consequence, no marks were earned.

Question 9

Candidates were generally well prepared for this topic with many achieving the majority of the first nine marks (parts (a) $\rightarrow$ (e)). Where marks tended to be lost were:

(i) (a)(ii) where **a** – **b** was written down rather than the required answer of **b** – **a**,

(ii) using fractions involving 1/2 rather than 1/3 in the remainder of the parts to the question,

(iii) not adding $\frac{1}{2}\mathbf{a}$ to their $\mu(\frac{2}{3}\mathbf{b} - \frac{1}{6}\mathbf{a})$ in part (e).

Many candidates simply gave up on the last part of the question. Of those who did continue, many correctly equated their two vector expressions but then this good work was sometimes spoiled by poor algebra as simultaneous equations, involving fractions, generated arithmetically incorrect answers. Candidates should be advised that answers for this type of question are invariably simple fractions often directly linked to the ratios given in the earlier parts of the question.

Question 10

Part (a) was generally well done with only a minority of candidates missing off one side (x^2) or incorrectly finding a volume. Parts (b) and (c) were dependent on (a) and were generally well done. Part (d) highlighted some deficiency in understanding the process of differentiation. Indeed, some candidates attempted the process by using the product rule rather than multiplying out the expression in *x*. Candidates should be reminded that the product rule is not on this syllabus (and therefore is not expected). Whilst it is not penalised as a method, there was clear evidence on the scripts seen that this method tended to lead to errors and therefore lost marks. Candidates should also be reminded that they do not need to find a second derivative to prove a maximum or minimum. There are no marks for this process and it only leads to lost time in tackling the paper. The identification of the turning point was meant to help candidates in drawing the graph. Conversely, having drawn the graph, candidates could have re-checked their working for part (d) by reading the value of *x*, which gave a maximum, from their graph.

Part (e) asked for values of *V* to one decimal place where necessary. This should have indicated to the candidate that table values (involving *x*) should have been determined to at least two decimal places. Those that only gave one decimal place for $x = 2.5$ lost a B mark for *V* by giving a value of 24.4 instead of 23.4.

Except for those candidates who misused the vertical scale, many good attempts at the graph were seen with all points plotted and curved (not straight) lines passing through these plotted points. There were mixed results however for part (g) where some candidates did not either draw the line V=20 or incorrectly read values from their correctly drawn line. Expressions indicating a range (i.e. $1.9 < x < 3.8$) were penalised one mark.

Question 11

Whilst a minority of candidates assumed that all work involved right angled triangles, there was much correct use of the cosine and sine rule evident in parts (a) and (b) from the majority. Part (c) was generally well done although some candidates lost a lot of marks, from this point onwards, by thinking that *BD* bisected the angle *ABC*, leading to the use 50^{o}.

Part (d) caused the greatest number of problems for candidates. Whilst a number of candidates showed good methodology, a significant number either misinterpreted the question, stopping at *DC*, or had become confused by this point and used some completely incorrect methods to find *DC*. It was common to see that even the weakest candidates knew that they should use *BD*/2 somehow. There were a variety of methods attempted, some more successful than others. A neat method seen was using the cosine rule on triangle *BMC* which tended to earn full marks. Using Pythagoras though on triangle *BMC* earned, at most, one mark.

In part (e), the candidates' responses showed that the angle of elevation is not a well understood concept and there were more incorrect trigonometrical expressions seen than correct ones involving tangent of 40°.

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