Examiners' Report/
Principal Examiner Feedback

January 2016

Pearson Edexcel International GCSE
Mathematics (4PM0)
Paper 02

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January 2016
Publications Code UG043227

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Paper 2:

Question 1:

Overall this question was very accessible and usually resulted in full marks being awarded. The majority of candidates understood how to attempt the question and most chose to re-write the equation in terms of powers of 2. A correct equation usually followed and soon afterwards most arrived at $x = -1/7$. Despite an otherwise correct method, there were several examples of sign errors in the candidates' algebra and most commonly this lead to $x = 1/7$.

Approaches using logarithms (ALT1 and ALT2 in the mark scheme) were next in popularity and these were generally successful although there were more errors seen than with the main scheme approach. Approaches similar to ALT 3 were rarely seen, if at all.

Question 2:

This was a well attempted question on the whole with the majority of candidates gaining full marks. The most common weakness occurred when the formulae for sector area and arc length were not known. Some candidates opted to find theta first and occasionally forgot to then work out the radius. Errors in rounding were not common. A few candidates were seen working in degrees instead of radians, and managed to eliminate the theta, then produced a correct solution for $r = 12$ However, very few of them worked out the correct solution for theta in radians via this approach.

Question 3:

Forming and substituting an equation with y as the subject was the most popular choice and this usually resulted in candidates earning at least the first three marks. A variety of algebraic errors were seen including failing to divide both terms by 3 (or 4) when making y (or x) the subject, errors on substitution such as the +1 or -2 being omitted, poor expansion of the bracketed terms and careless collection of like terms after expansion. Each of these errors meant the A mark for a correct 3-term quadratic was lost along with the final two A marks for the correct values of x and y.

Any prior algebraic errors resulted an incorrect quadratic which was usually dealt with by using the quadratic formula. This meant that candidates still had a chance to earn the final M mark for solving their quadratic with an appropriate method. However, there were some incorrect expressions for the quadratic formula or errors on substitution without a correct formula which mean the M mark was also lost.

Candidates who got to a correct 3-term quadratic usually went on to get full marks although there were a few careless attempts at factorising and a handful of candidates who failed to work out a value for the second variable. Typically either 4 marks (due to at least one algebraic error) or the full 7 marks were awarded.

Question 4:
There were a good number of candidates gaining full marks here. The majority were able to apply the product rule for differentiation accurately although subsequent algebraic simplification did lead to mistakes being made. As always with a "show that" question some candidates failed to show sufficient working to be awarded full marks and others reached the required result from incorrect working.

Question 5:
Candidates were clearly familiar with this type of question and in part (a) the vast majority recalled how to link $\alpha\beta$ to $\alpha + \beta$ and $\alpha^2 + \beta^2$ and scored both marks. It was rare to see an attempt to solve for the values of α and β but a few managed it. However, most who tried lost at least one mark which was usually due to working with decimals.

In part (b) the majority of candidates knew to use the sum and product of roots but not all of them remembered about the minus sign in the formula x^2 **–** (sum of roots)x + (product of roots) or that without being set equal to zero, they only have an expression rather than an equation. There were plenty of fully correct responses and a significant number with at least one of these errors. As with part (a), the required algebra was usually produced and was often fully correct although there were also incorrect substitutions such as using $\alpha\beta = 5$ instead of 3 or determining that the product of the roots was 0. Correct sums and products usually lead to full marks overall although any sign errors or omissions of '= 0' in part b) were usually repeated here and a few didn't achieve integer coefficients.

Question 6:
Parts (a) and (b) were generally attempted very well leading the majority of candidates to changing from $2x$ to x in the last part accurately. For some candidates this was as far as they were able to go with the final substitution and simplification proving troublesome. Many did not supply sufficient evidence of using $\cos^2 x + \sin^2 x = 1$ rather than changing the denominator to fit the required result.

Question 7:
Part (a) was often answered correctly although it was also apparent that a significant number of candidates had very little understanding of asymptotes or how their equations could be determined.

The quotient rule was the most popular approach for the differentiation in part (b) although there were a handful of product rule attempts which were rarely successful. It is likely that many of these were actually the result of candidates recalling an incorrect formula for the quotient rule rather than intentional attempts at using the product rule. When used, the quotient rule was generally well-understood and a valid attempt was usually seen which was often enough for all three marks. Although it had no effect on the marks for this part of the question problems usually then began as candidates attempted (often unnecessarily and incorrectly) to simplify their derivative.

In part (c) almost everyone understood the requirement to set their derivative to equal zero and in some cases the M mark for doing this was the only mark scored. Candidates who got full marks for part b) and resisted unnecessary and incorrect simplifications were usually able to proceed correctly to both correct stationary points and then score either full marks for the whole question or 8/9 due to an incorrect asymptote equation in part (a). Any poor attempts at simplifying the derivative either here or in part b) often meant a correct quadratic numerator could not be obtained and in some cases, the quadratic terms had disappeared entirely. A few candidates made no further progress beyond finding their x values while others made careless errors when substituting to find the corresponding y values.

Question 8:
Where the values for the first term and common difference were correctly identified, part (a) was generally answered correctly. The rest of the problem highlighted many issues related to algebraic simplification. Some candidates were unable to use the given information at all and many who did start with the correct algebraic terms went astray working towards the correct quadratic equation. A few who arrived at two correct solutions to the quadratic did not then identify 10 as the only viable answer.

Question 9:
Most candidates were able to score the first two marks in part (a) but then lost marks due to poor use of notation or by failing to provide an adequate conclusion.

Part (b) was the most challenging part of the paper and it was often poorly attempted with no clearly identifiable method or it was missed out entirely. Those who made a reasonable attempt usually followed the method from the main scheme although significant numbers of ALT 1 and ALT 2 were also seen. As with previous sessions, there were many examples of candidates trying to use vectors in place of lengths.

Despite the problems many candidates experienced with this question, it was pleasing to see several concise solutions which demonstrated an excellent understanding of the techniques involved.

Question 10
Part (a) proved to be quite accessible to the majority of candidates with a good number gaining full marks for finding the values of p and q. The algebraic division in part (b) was less well attempted but those who did mostly factorised the cubic accurately. Some candidates did not finish the problem fully from here, failing to give any solutions to the equation at all or omitting to write down one of the solutions (usually this was $x = 3$).

Question 11:
Both part (a) and part (b) were accessible even to the weakest candidates and the vast majority earned at least the first 4 marks in this question. Surprisingly many candidates seemed unable to follow rounding instructions which usually lead to values of 2.13 and 2.36 appearing in the table. Careless plotting was the principal cause of lost marks in part (b) as it often meant that a smooth curve could not be drawn. It would appear that several candidates misread the scale and this was also an issue for parts (c) and (d).

Although some candidates used $y = 4$ in part (c), there were many who correctly connected the equation to the graph and drew in the line $y = 6$ or read off the point of intersection using the grid line at $y = 6$. Although their algebra was fully correct, some candidate's poor graph sketching and earlier errors meant that the correct value could not be obtained from their graph so they could only get the M mark. A few candidates were unable to connect their graph to the equation and lost both marks by clearly using their calculators to obtain a solution instead. This was also evident at times in part (d).

The algebraic manipulation required in part (d) was too much for many and while there were several correct attempts, it was more common to see little or no identifiable method or work being abandoned part-way through which may also be an indication of candidates running out of time. Those who were able to rewrite the equation without logarithms usually went on to score at least 3/5 for this part and their errors were often omitting the + 2 or failing to sketch a graph that represented the equation in their working. A few candidates were unable to connect their graph to the equation and lost all of the marks for this part by clearly using their calculators to obtain a solution instead. There were also examples of candidates producing fully correct working and then misreading the scale or losing the final mark due to a poorly plotted graph.

Question 12
Parts (a) and (b) were accessible to the majority of candidates. In part (c) failing to identify the correct angle was the most common error with a good number working out the length of AE prior to calculating angle BEA instead of angle BEM. The last part saw candidates working out a variety of incorrect angles the most common one being angle CEH.

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