Examiners' Report/
Principal Examiner Feedback

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Pearson Edexcel International GCSE
Further Pure Mathematics (4PM0)

Paper 01

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There was plenty of work in this paper for all but the weakest candidates. Most managed to produce attempts at all questions, with the possible exception of question 8, and most seemed to complete all they could do without running out of time.

Question 1

Most candidates seemed to score either all four marks or no marks at all on this question. Of those who scored no marks, nearly all stemmed from applying incorrect limits despite using the correct formula for an arithmetic series. There were a wide variety of approaches to this question, most of which led to a correct solution if executed accurately. Alternatives to the methods given in the mark scheme included listing many or all of the 37 terms, and using addition and multiple rules to decompose the sum into S_n = $7\sum r - \sum 2$ Some candidates seemed to account for this at the beginning of their attempt and then forget it again in the course of their working.

Question 2

There were many fully correct answers to this question. Most did part (a) by completing the square and usually got the correct values for *a* and *b* but often had the wrong value for *c* as they often changed the 5 to $\frac{5}{2}$ when they took out the factor of 2 and then made arithmetic mistakes. It was very rare to see the method of equating the expression to $a(x-b)^2 + c$. Most simply wrote down the answers to part (b) but a few did differentiate the expression to find the minimum value. Several candidates confused the minimum value of f(x) and the minimum value of x at which it occurred.

Question 3

Candidates generally had a good idea of how to tackle this question and most errors occurred in the differentiation of the individual components rather than in the application of the product and quotient rules. There was the occasional attempt to reduce the power of e^{3x} by one in part (a) and a more frequent failure to multiply by the coefficient of x in when differentiating e^{3x} and $(5x-7)^2$ in part (a) as well as $\cos 2x$ in part (b). Incorrect order in the numerator of their quotient rule frequently lost candidates both accuracy marks in part (b).
In both parts, candidates spent many lines of working simplifying their answers when the question did not ask $\frac{1}{\beta^2\alpha^2} = \frac{1}{16}$ for simplified expressions..

Question 4

Virtually every candidate found the correct a as 8.

The usual error in part (b) was to use the expression $2n(n+3)$ as the *n*th term which gave answers of 12 for part (b) and 296 for part (c). Some got part (b) correct but then gave part (c) as the sum of the first 25 terms and an answer of 1400. A few compared coefficients of $2n(n+3)$ and $\frac{n}{2}(2a+(n-1)d)$ leading to parts (a) and (b) being completed together.

Question 5

The first part of this question was answered very well, with only a small proportion of candidates making conceptual errors such as raising 2 to the power 7 or attempting to change the left hand side into $\frac{\log_7 2x}{\log_7 3}$.

In the second part of the question, there were many different yet successful approaches to factorising the given expression, some even invoking rules of logs. One unfortunate method which cropped up more than once was substituting x for $\ln 3x$. Because of the structure of the expression, this actually gave a correct factorisation in some cases, but would not be successful in cases where the factors did not have the same form. Correct factorisation tended to lead directly to full marks in the final part, although a few candidates mishandled the natural log, attempting to divide by $\ln 3$ or to use common logs instead, despite having answered part (a) correctly.

Question 6

This question was very well indeed with many scoring full marks. The usual loss of the final A mark resulted from a failure to not give the two answers to the required accuracy. A few misquoted the cosine rule, or did not draw their triangles correctly.

Most candidates used sine rule correctly in part (b), even if they followed through incorrect values from (a), which earned the first two marks. Some attempted to use the cosine rule again but this led to arithmetical errors in many cases as it was more complicated.

Question 7

The first part of this question was answered reasonably well, with almost all candidates achieving at least half the marks available. Incorrect rounding was the most common error in completion of the table, with final 2.55… being truncated rather than rounded. Most points were plotted correctly, with notable exceptions being the first point where 0.8 was clearly difficult to read from the x-axis and the three points around the bottom of the graph, where their relative heights were often muddled.
Many candidates skipped parts (c) and (d), either with or without some failed attempts at rearranging. Several ignored the requirement to use their graph and instead attempted to rearrange the given equations and solve them with a graphic calculator which earned no marks. For those who followed the instructions, a number still failed to give their answers to the required number of decimal places either from not reading their graphs with sufficient accuracy or as a consequence of inaccurate drawing of the graph in part (b).

Question 8

Most candidates knew how to do part (a) but the usual errors were to show insufficient working or try to work back from the answer. There was some ‘fudging’ by writing the required $3\tan x = 11\tan\alpha$ preceded by some erroneous working.

Some candidates did not use part (a) to do part (b) (despite it being given), and most of these candidates scored no marks as their algebra became very complicated. Those who used part (a) usually scored at least 4 marks as some only gave the first solution of 24.9°.

Question 9

Most candidates understood the requirement of the first part of the question to set s equal to zero, but several proceeded to cancel out the factor of t, ignoring the possibility of $t = 0$, which lost them all marks in part (a). Again, most understood the requirements of part (b), but errors arose from incorrect substitution of their values from part (a) or the tendency to make $\frac{d}{dt}(5t) = 0$. Only the best candidates recognised the need to write speed as 4 when the velocity turned out to be -4.

Very few candidates demonstrated a full understanding of the situation in the final part of the question. Of those who differentiated again to find a stationary point, few seemed to realise this point was a minimum, but those attempts still gained the majority of the marks. Other candidates answered on the basis of the speeds calculated in part (b) without any further working or made a list of all speeds for integral values of t within the given range, neither approach gaining any marks. A few candidates drew a sketch of the graph of v against t, which enabled them to appreciate what was actually happening and score full marks.

Question 10

Many candidates did parts (a) and (c) correctly but part (b) was found to be much more difficult. In part (a) some missed out the minus sign in the sum of the roots. The common error in part (b) was not to use the given expression $(\alpha^2 + \beta^2) = 7\alpha^2\beta^2$ and then fail to give the quadratic equation with the coefficients given in terms of k. Nearly all managed to rearrange $\frac{1}{\beta^2} + \frac{1}{\alpha^2} = \frac{\beta^2 + \alpha^2}{\beta^2\alpha^2}$ for the first method mark and find the product to be $\frac{1}{\beta^2\alpha^2} = \frac{1}{16}$ for the B mark.

Part (c) was answered much better than the rest of the question although a common error was to solve the quadratic they found in part (a) of the question. Many did part (c) before they did part (b) which was allowed.

Question 11

Considering how simple the expected method of substituting p and 8 into the equation of C, it was surprising to see the number of candidates who used a different approach to show that $p = 3$ in the first part of the question. Some differentiated and compared the gradient at $(p,8)$ with the gradient given by l. Others went the whole way, and wrote an equation for the tangent in terms of p and set up simultaneous equations in p and q. Some made mistakes in arithmetic which led to a value of p between 3 and 4, but then attempted to dismiss this by writing $p = 3$ in any case as it was a show question.. On the whole, the value of q was found much more straightforwardly and accurately despite not being given in the question.

Many candidates were able to recycle their working from part (a) or extract the gradient of the tangent from the given equation rather than differentiating in part (b) and the equation of the normal tended to be given accurately or at the very least to follow from their own values. The most common mistakes were in arithmetic or the failure to give integer coefficients.

Those candidates who drew sketches of the triangle in question in part (c) were more likely to
display correct working even if they made slips in arithmetic. The "cross-product" method of finding the area tended to be most successful in obtaining a correct, exact answer. Some candidates successfully split the triangle into two right-angled triangles. The most common errors were rounding of the x-intercepts before calculating the area or failing to choose an appropriate base and height. A few even tried to integrate to find the area of the triangle but this was never successful.

A complete correct solution of the final part of the question was very rare indeed, and only a handful were seen. Many candidates did not attempt this at all or made serious mistakes in determining which two volumes would need to be calculated and subtracting them. Many only calculated one volume (either a cone or a solid of revolution) and often then with incorrect limits. Others tried to combine the two calculations unsuccessfully. Mistakes in working with the complicated exact fractions required were rife, few candidates having the acumen to factorise out a constant from their integrals in order to simplify the working. The few reasonable attempts generally began with a sketch of the area to be rotated.

A good sketch was important in this question and centres should encourage students to have a visual appreciation in order to apply a correct method.

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