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Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel GCE Mathematics

In Core Mathematics C3 (6665/01)

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Introduction

There were a number of scripts that were extremely difficult to read and candidates should be aware of writing so that the examiner can read. Also crossing out or changing a sign needs to be done clearly.

Candidates need to make connections to the parts of the questions, often part (a) will help them answer part (b) etc.

There were many show questions in this paper and candidates need to take care with their notation, bracketing and need to show all the stages of their working.

Question 1

This question was generally very well attempted. Nearly all candidates at some stage factorised

$x^2 - 4$. Common mistakes included errors when dividing by $x - 2$ or $x + 2$ or $x^2 - 4$. This meant candidates could often gain method marks, as they had usually found a correct quotient. Their remainder, however, was sometimes incorrect.

Another common error followed successfully dividing by $x^2 - 4$ but then writing an incorrect form, often writing the remainder as a fraction with $x + 2$ or $x - 2$ as the denominator. It was rare to see any candidate starting off with division by $x - 2$ and those who did were often unsuccessful. Some candidates who started dividing by $x + 2$ forgot to divide by $x - 2$ as well. The method of comparing coefficients was seen less often. Common errors with this method were expanding brackets incorrectly, missing terms when comparing coefficients or incorrect signs.

Question 2

All felt that this was a good question which tested various different methods - differentiation, trig identities, algebraic manipulation.

Part (i) (a) was generally answered well. A large majority of candidates used the quotient rule accurately to find the correct derivative for M1A1. Many candidates realise that they had to factorise out $(2x - 1)^2$ to simplify. Those candidates who did realise what was required did so successfully. A reasonable minority of candidates decided that 'simplest form' implied expanding brackets, ending up with quite unpleasant expressions that cost them marks in part (b).

Part (i) (b) was much more challenging, however; whilst a large majority of candidates found a correct critical value for their numerator, it was a very small proportion who achieved both marks. A majority of those who had both critical values did not realise that $x = \frac{1}{2}$ was all that was needed for this value (i.e. no inequality).

Part (ii) was one of the best-answered questions on the paper. A large proportion of candidates found this accessible, and achieved full marks by reaching C = –2. Candidates who tried to simplify the argument using the identity $\cos 2x = 2\cos^2 x - 1$ prior to differentiation were generally less successful, however a reasonable number of candidates reached the required form correctly even through this method.

Question 3

Part (a) The majority of candidates achieved full marks in this part of the question. It was rare to see the solution explained in full and the working clearly documented. Most often the working was minimal but most quoted $\tan\alpha = 1/8$ or $\tan\alpha = 8$. Few candidate used $\sin\alpha$ or $\cos\alpha$ alone to find α. A small number of candidates gave their angle in radians or the value of *R* as a decimal.

Part (b) A significant number of candidates did not answer this part correctly. Usually a correct method of 13 + R/10 resulted in the correct answer, as most had given a correct value for R in part (a). The main problems arose when the relationship to part (a) was not recognised and candidates were still working with cos(15t) – 8sin(15t). Sometimes graphs were drawn to explain their reasoning. Many who realised that the maximum value occurred when $\cos(15t + \alpha) = 1$ then missed out 'R' from their calculation. A small number thought that the maximum would occur when $t = 0$ or 24.

Part (c) Most candidates were quite successful in this part of the question. A few did not use the 'simplified function' from part (a) and so did not find the correct solution at any stage. The correct RHS of $-5/\sqrt{65}$ (or equivalent) was found with relative ease and this usually resulted in a correct angle (128.33) from that stage, and the correct 3.03. Occasionally a second solution was not sought or an incorrect 180 - ... or 360 + ... was used. A handful of candidates did not seek out a secondary solution until the 82.87 had already been subtracted. Of those who arrived at the two correct value for *t*, most did not convert these to 'times of the day', and the final mark was lost.

Question 4

This question seemed to challenge the candidate's ability to accurately manipulate algebraic expressions. Those with poor notation or scruffy workings suffered most.

Part (a) The first step was generally done well, but there were many algebraic slips in the processing needed to arrive at a single fraction. Some candidates made a slip with a double negative therefore not cancelling the numerical values on the numerator. A few candidates found the inverse function instead. A few candidates did not simplify their answer and left it as $9x/9$.

Part (b) Again, started well setting fg(a) = g(a) but many were not all were able to reach the correct quadratic formula as they incorrectly simplified (lna)^2 as 2lna which then meant they did not achieve a quadratic equation.

Having a achieved a quadratic it was common to replace lna with another variable in order to factorise or use the quadratic equation. Many did not use the domain for x given in the question and gave two answers, a = e^{-1} was not rejected, for a so could not gain the final A mark (or used *x* throughout).

Question 5

Part (a) was a standard modulus function question, which a great majority of candidates found part (a) to be very easy and straight forward. Almost all candidates managed to sketch the graph correctly with only a few drawing a v graph which did not fall in the correct position. The identification of the intersection coordinates was correctly made with many candidates giving them in the correct format, whilst a minority just stated the values on the axes.

Part (b) was started correctly, with most candidates dealing with the modulus to get at least one correct solution. Where both values were not found, it was usually due to sign errors in the work that followed.

Part (c) presented itself as the most challenging part of the question and left many candidates with no idea - probably due to misinterpreting the phrasing of the question. Some went on to test both values of a on both cases to figure out which one gives the larger solution, and many who did this neglected to identify their chosen answer.

Question 6

Part (a) many candidates differentiated correctly and even factorised the quadratic to reach the expression required at the start of (b). A few were let down by poor notation e.g. ln x + 3 missing brackets

Part (b) The errors seen in the proof section were often due to poor notation again, predominantly due to the absence of brackets. i.e. ln(x+3) as ln x + 3

Candidates who did not score the 2nd M mark did not attempt to form an equation with the *x* on one side or moved too quickly to the required form without the interim step. It is important that candidates show every stage of their working for proof questions and this was often an error that occurred throughout the paper.

Part (c) generally successful, even for those who couldn't do (a) and (b).

Part (d) common errors were forgetting to double or leaving the answer as a negative. Many did not know where to start. In many cases, this substitution was made into f '(*x*) and thus lost the marks.

Question 7

Part (a) was done very well, since the compound angle formulae are given in the formula book. Careless bracketing cost marks, when multiplying by secA. Those who wrote as a fraction were more successful.

Part (b) was poorly attempted – only a select few spotted the connection between this and part (a). Those candidates who did not make the connection generally scored no marks and those who did generally scored most of the marks.

Candidates do need to make the connections between parts of the questions, especially with solving trig equations

Question 8

Part (a) was answered well with most able to complete the routine solution to achieve the correct answer of 16.22. Almost all used the accuracy required by the question. A small number of candidates started with the wrong value of 6000 but were able to pick up the three marks for the SC. In this part of the question. Most candidates were able to deal with logs successfully.

Part (b) A significant number of candidates lost at least the A mark and sometimes the previous M mark before as well. Most could differentiate correctly but many made no attempt to show the required form. Of those who continued and found p and q correctly, many did not achieve the marks because of failing to write the final answer in the form that was asked for in the question.

Part (c) Most candidates started by forming two equations correctly but weaker candidates did not always write both of them in the exponential form. There were many clear and concise solutions to find k = ln(5/2), usually by dividing one equation by the other. Other correct methods involved substitution but often took a circuitous route to the answer. There were a significant number of examples of incorrect manipulation of logs to give the answer required and these lost 2 marks. The majority of candidates gained the last B mark by substituting ln(5/2) into one of their earlier equations to find the value of C. A small number of candidates calculated C first, and they were usually successful.

<u>Question 9</u>

Part (a) The first 2 marks were often achieved for differentiating to find dx/dy correctly. A correct expression for cot *y* in terms of *x* was also seen. However, the algebraic manipulation that followed to achieve the printed answer was beyond the capabilities of many candidates. Some were quite happy to plough on through very complicated algebraic processes in the hope that they might arrive at a quadratic instead of realising they were going off track, stopping and starting again. The manipulation of an algebraic fraction divided by another with addition or subtraction involved was poorly demonstrated. The layout of this proof was poor becoming disjointed and therefore difficult to achieve final A mark.

(b) and (c) Majority answered this correctly. Those who found the x coordinate of A were able to substitute this into the expression for dx/dy although some forgot to invert to find dy/dx. Occasionally candidates used arctan(1/3) as arccot(1/3) thus generating 3/4 as their answer.

(c) generally, this was correctly answered if 1/4 was obtained in (b).

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