Examiners' Report/ Principal Examiner Feedback

January 2011

GCE

GCE Core Mathematics C3 (6665)

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our GCE line on 0844 576 0025, our GCSE team on 0844 576 0027, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Examiners' Report that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

http://www.edexcel.com/Aboutus/contact-us/

January 2011

Publications Code US026237

Core Mathematics Unit C3
Specification 6665

Introduction

This paper was accessible for almost all candidates with no real evidence of students failing to finish.

There was an increase in the number of candidates relying on graphical calculators for calculus/trigonometry type questions. It must be noted that the rubric on the front of the paper states that answers without working may not score full marks. This was applied in questions on this paper.

A lack of bracketing in many questions especially in 2, 5 and 7. This potentially could lead to the loss of many marks

Report on individual questions

Question 1

Question 1 was a familiar one to most candidates. It was generally well done by the majority of candidates although part (b) and finding answers in the range 0 to 2π in part (c) did discriminate.

In part (a) most candidates were able to find R and to make a worthwhile attempt at α usually via the tangent ratio. Degrees were occasionally used despite the range being given in radians. Some candidates were undecided and gave both degrees and radians – sometimes continuing with this throughout the question.

Part (b) was frequently incorrect with +25 as common as the correct answer of -25. Another common answer was -1 and more surprisingly 0. A less common error was to identify the value of *x* for which the maximum/minimum would occur.

The majority of candidates attempted part (c) and realised the need to use the form found in (a). There were therefore some very good solutions, many of which the only error was to omit the second correct answer. Candidates should remember to derive additional values from their principal value before rearranging their equation. Not many gave all three values of 1.16, 5.12 and 7.44 for $(x + 1.287)$. Rounding errors were common with 3.83 and/or 6.15 popular answers.

Question 2

In part (a)there were many fully correct and well-presented answers. Most candidates were able to combine the two fractions, although some used unnecessarily complex denominators. A number of responses included errors made when cancelling the 2 from the numerator and denominator. A number of responses failed to simplify their answer and lost the final mark. A few candidates, having correctly given the fraction with a common denominator on the first line, cancelled one or more of the brackets leaving both numerator and denominator as linear expressions. A common thread running through the paper for numerous candidates, not just the weaker ones, was the lack of/or inconsistent bracketing. Teachers need to be aware that this could lead to the potential loss of many marks.

Part (b), most candidates realised that they could use their answer from part (a) and many were able to successfully demonstrate the proof. A few candidates started from scratch and often went on to gain full marks.

The method used in part (c) was equally split between those deciding to use the chain rule and those using the quotient rule. For the quotient rule, a number differentiated 3 incorrectly, usually as 1. Having found the expression for dy/dx , a number of candidates multiplied out the denominator in terms of x first, before substituting in $x = 2$.
A surprising number reached the correct fractional answer for dy/dx but, on substituting in $x=2$, gave an answer of -6/25 (stating that 2x2-1 = 5). A small number of candidates decided to differentiate their incorrect answer for (b). Candidates should be advised that this should be avoided at all costs, especially where an answer is given.

Question 3

This question was attempted by most candidates but was not answered that well. Only the best candidates produce fully correct solutions. Most understood that $\cos 2x$ should be replaced, although $1 - \sin^2 x$ was sometimes seen instead of $1 - 2\sin^2 x$. The use of brackets was careless in some cases. Many used $\cos^2 x - \sin^2 x$ first, which was acceptable as long as the $\cos^2 x$ was replaced subsequently by $1 - \sin^2 x$. The majority of good candidates did arrive at the correct quadratic equation but solving it was one of the least successful parts of this paper. Many candidates could not believe that it would not factorise! Often several attempts were made before moving on, some just gave up. Those using the quadratic formula did not always quote it correctly. Others made errors in the substitution. A minority used ‘completing the square’ to solve, though with mixed success. A few more successfully used equation solver on their calculators. If they got this far, one or two angles were found, but many didn’t find all four. They either rejected the negative value or only gave one answer for it within the range.

Question 4

The first 4 marks in this question were accessible to almost all candidates. The final 4 marks however were far more demanding and were only gained by the best. In part (a) the majority of candidates gained full marks, some able to write down the correct answer with a minimum of working.

In part (b) most candidates followed the desired route of substituting $t = 5$ and $\theta = 55$ into the equation, then rearranging to make '$-5k$' the subject. Unfortunately the given answer was then just written down without any adequate reason. Candidates needed to recognise that e ^ ($-5k$) could be replaced by 1/e^5k, or show that ln(1/2) = - ln 2 , or even simply state it.

The final Part (c) was poorly done, with a significant number of candidates failing to recognise rate of change as differentiation. Many simply found the temperature when t = 10. Others found the difference between the temperatures at t = 10 and t = 0, subtracted and divided by 10. A number of students realised that they needed to differentiate to find the rate of decrease in temperature but unfortunately put t = 10 into their expression before attempting to differentiate, not appreciating that their expression was now constant. Another common mistake in the derivative was finding expressions of the form A*te*^-*k*t.

Question 5

Question 5 proved to be a useful source of marks for all candidates. Grade A students scored almost all marks and E grade students picked up at least 5. Part (a) proved a positive start to the question for nearly all candidates with most writing down both correct x coordinates although a few did struggle in solving ln x= 1.
Write down should have been a hint that no real calculation was required.

In part (b) apart from a few who confused the notation with the inverse function most realised the need to use the product rule and proceeded correctly. The majority of good candidates scored full marks in this part. Candidates should still be advised to quote formulae before they are used.

While some candidates in part (c) mistakenly used $f(x)$ instead of $f'(x)$, most successfully substituted both 3.5 and 3.6 into their derivative and knew to look for a sign change. There were a multitude of wordings applied to the significance of this – "hence root" being the most common - and candidates would be advised to read the text of the question in order to set their conclusion in the right context. There were however some excellent answers where candidate clearly understood the question and in some cases added diagrams to illustrate their point.

A significant number of candidates omitted part (d) altogether or tried a variation on (c). Those who realised that they had to equate the derivative to zero usually gained full marks. Trying to work backwards from the answer rarely proved a good idea with candidates unsure of how far they needed to go with their solution. The neatest solutions often resulted in continuing from a simplified version of the derivative they had found earlier.

Part (e), this as with (a) proved a good source of marks even where there was little gained in other parts of the question. Often just the correct values appeared and it was good to note that virtually all complied with the question and gave all 3 answers to 3 decimal places.

Question 6

In part (a) it is worth noting that a number of students were weak on notation with a significant number finding the derivative $f'(x)$ rather than the inverse function $f^{-1}(x)$. The ones that tried to find the inverse were generally successful although a worryingly large minority found the algebraic manipulation beyond them.

Many candidates gave the correct answer in part (b) which could be easily found from the graph. A few used domain notation rather than the range.

Parts (c) and (d) were often not attempted. Of those that did, many failed to see that g(2) and g(8) could be read from the graph, and instead worked out the two linear equations for the function g. This could lead to the correct solution but rarely did they were not always correctly applied. A popular incorrect solution involved finding g(2) correctly, but then simply squaring to get gg(2)=g(2)×g(2)=0. Part (d) was generally more successful as the function $f(x)$ was given.

Part (e) accurate sketch graphs were usually seen in (e)(i), with candidates generally familiar with the idea of a modulus. Incorrect or missing co-ordinates lead to the loss of some marks. There was less success in (e)(ii) with the sketch of the inverse function. Many were able to remember to reflect in the line $y = x$ but there were many incorrect attempts, again with missing or incorrect co-ordinates

In part (f) a substantial majority realised that the domain of the inverse was the same as the range of the original function, but there was again some confusion about which variable 'x' or 'y' should be used.

Question 7

In part (a) most candidates knew that the quotient rule should be used. It would again be wise to quote this formula. Only high achieving students produced full solutions to part a, with common mistakes including differentiating $(3 + \sin 2x)$ to give either $(2\cos x)$ or $(\cos 2x)$, and similarly with $(2 + \cos 2x)$. Predictably, the final A mark was frequently lost through candidates not being explicit enough in their working to demonstrate the given result – jumping from $(2\cos^2(2x) + 2\sin^2(2x))$ to 2 was common. This was a given solution and hence there was an expectation that the result should be shown. This could be achieved by writing $(2\cos^2(2x) + 2\sin^2(2x))$ as $2(\cos^2(2x) + \sin^2(2x)) = 2 \times 1 = 2$

Some candidates struggled in part (b) to give a correct value for either y or m. A very common incorrect result was obtained by using the calculator set in degrees to work out these values. Occasionally, a "perpendicular method" was used to replace a gradient of -2 with 0.5. Most candidates arriving at an answer understood that exact answers for 'a' and 'b' were required.

Question 8

Part (a) question has been set before and most attempts proceeded in the correct manner by either using the chain rule or quotient rule. Again this was a ‘show that’ question and candidates are expected to demonstrate that the answer is true and not simply write it down.

The successful candidates in part (b) used the result in part (a) to simply write down the answer. Some unfortunately went back to first principles wasting valuable time. Marks were lost by candidates who wrote the solution as $\sec(2y)\tan(2y)$, $\sec(2x)\tan(2x)$ or indeed the LHS as dy/dx.

In part (c) most candidates recognised the need to invert their answer for (b) reaching $dy/dx = 1/(dx/dy)$. Many also replaced $\sec 2y$ by x often stopping at that point. The students who continued to find an expression for $\tan 2y$ in terms of x generally obtained the correct final result. This could be described as a grade A type question and it certainly did discriminate between very good students.

Grade Boundary Statistics

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481

Email publications@linneydirect.com

Order Code US026237 January 2011

For more information on Edexcel qualifications, please visit www.edexcel.com/quals

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH