Examiners' Report

Summer 2014

Pearson Edexcel GCE in Core Mathematics C2R (6664/01R)

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General Introduction

This paper proved a good test of students' knowledge and students' understanding of Core 2 material. There were plenty of accessible marks available for students who were competent in topics such as binomial expansions, integration, geometric series, trigonometric equations and differentiation. Therefore, a typical E grade student had enough opportunity to gain marks across the majority of questions. At the other end of the scale, there was sufficient material, particularly in later questions to stretch and challenge the most able students.

Trigonometry in general proved to be an area of weakness for a significant number of students. Some responses showed that students were either unfamiliar or uncomfortable when working in radians and often converted to degrees e.g. Q05 and Q07(ii). Q10(d) involving the trigonometry of a right angled triangle also caused significant problems, possibly due to not using a suitable diagram.

Report on Individual Questions

Question 1

This question was generally well answered and responses showed that students could work confidently with binomial expansions. Although the majority of responses gained full marks the error of not squaring the denominator in the x term when expanding the bracket was seen occasionally, leading to an incorrect expansion of,

$$1+12x+126x^2+756x^3$$

Since the bracket did not contain a negative term, sign errors were all but eliminated, increasing the likelihood of maximum marks.

Question 2

Q02(a) was well answered by the majority, though a few seemed unaware of the sum to infinity formula. Those with a correct solution used appropriate algebra rather than verification.

Students had few difficulties with Q02(b) with only a handful using $\left(\frac{5}{6}\right)^4$ instead of the correct $\left(\frac{5}{6}\right)^3$.

Q02(c) was well done by most although premature rounding cost a significant number the final accuracy mark, with "3" given as the final answer. A small number found S_{29} instead of S_{30}.

Question 3

This question was well done by most students. Most errors seen were either bracketing problems or issues finding the value of h. Many who did use an incorrect h often divided by 5 not 4 in finding the width of the strips. As the trapezia were of width two, the multiplying factor outside the bracket was 1. This meant that it was not realistically possible to identify genuine bracketing errors so that expressions such as

$$\left(\frac{1}{2}\times 2\right)\times\left(\sqrt{3}+\sqrt{19}\right)+2\left(\sqrt{7}+\sqrt{11}+\sqrt{15}\right) \text{ or } \left(\frac{1}{2}\times 2\right)\times\sqrt{3}+\sqrt{19}+2\left(\sqrt{7}+\sqrt{11}+\sqrt{15}\right)$$

were condoned and it was assumed that students were interpreting the trapezium rule correctly.

Question 4

For Q04(a) the majority could obtain the correct value for a by solving $f(2) = 0$. There were very few students who chose long division or comparison of coefficients.

Many students could at least make a start in Q04(b) and used inspection or long division to establish the quadratic factor $-4x^2 + 9$. Interestingly, many students stopped at $(x-2)(-4x^2+9)$ for the factorised form of $f(x)$, presumably not spotting the difference of two squares. Of those who did attempt to factorise $-4x^2 + 9$, a significant number of students chose to change the sign and obtained $(2x+3)(2x-3)$ without subsequently compensating for the change of sign.

The method in Q04(c) was well known and most chose to evaluate $f\left(\frac{1}{2}\right)$, with a few students opting for long division. The scheme allowed for a follow through accuracy mark for those with an incorrect value for a in Q04(a).

Question 5

Q05(a) was extremely well done. Most problems occurred because students were not comfortable using radians and changed 2.1 radians to degrees before making an attempt at the arc length DEA.

In Q05(b), to find the width and height of triangle BCD many students resorted to using the sine rule instead of basic trigonometry. This then caused problems for some who wrote down equations such as $\frac{7}{\sin 90} = \frac{DC}{\sin(\pi - 2.1)}$ and then proceeded to work in radians, including using 90 degrees as a radian measure. There were some cases where students did not appreciate what was meant by the perimeter and included BD in their total. There were also a significant number of cases where students rounded prematurely which meant that the final A mark was lost.

Question 6

The most common error in this question occurred when students integrated the given expression, substituted the limits 2 and -4 to give 10.5 and then stopped. The most popular correct strategy was to find the area of the enclosing rectangle and then to subtract their 10.5. With this approach, some students found different values after substituting $x = -4$ and $x = 2$ into the curve and so did not have a rectangle, although it was treated as one. Others had difficulty evaluating their integrated expression with the required limits.

A significant number of students chose a different strategy and attempted the area by subtracting the curve from the line first and then integrating. This approach was met with varying degrees of success. Those who worked this method carefully often produced the correct answer but there were a surprising number of sign errors and it was not uncommon to see $4 - \left(\frac{1}{8}x^3 + \frac{3}{4}x^2\right)$ interpreted as $4 - \frac{1}{8}x^3 + \frac{3}{4}x^2$.

Question 7

Responses to Q07(i) were varied. The majority of students could at least reach $\sin 2\theta = \frac{1}{3}$ following a fairly straightforward rearrangement. Occasionally just one value was found for theta but the most common mistake came from premature rounding with 9.8 and 80.3 seen often. Some students obtained the first value correctly (9.7) but then subtracted this value from 180 degrees with 9.7 and 170.3 resulting.

In Q07(ii) the majority of students recognised the need to apply the appropriate trigonometric identity, $\sin^2 x = 1 - \cos^2 x$, although some incorrect identities were seen including $\cos x = 1 - \sin x$. Those who did obtain a quadratic in $\cos x$ sometimes made errors when rearranging or made mistakes when solving the quadratic. Commonly students dealt with the constant but then 'lost' the negative to give $5\cos^2 x - 2\cos x$ leading incorrectly to $\cos x = 0.4$.

A large number of students chose to work in degrees and although some converted back into radians at the end, most lost the first A1 mark by leaving their answer in degrees. The final B1 mark was also occasionally lost when students gave only one value from $\cos x = 0$ or cancelled their quadratic, losing one factor altogether.

Question 8

Very few errors were seen in Q08(i). The majority took logs base 10 and divided but some took logs base 5 to give the correct answer directly.

Success in Q08 (ii) was very varied. Those with a clear understanding of the properties of logs could make significant progress although the resulting quadratic in $\sqrt{x}$ confused many.

The most common error was from those whose understanding of logs was weak, wrote $\log(x+15)$ as $\log x + \log 15$. Some credit was given for any evidence of understanding of either the power law or addition/subtraction laws and some students could gain at least one or two marks. Solving the quadratic involving $\sqrt{x}$ was challenging for many and of those who chose to square $x+15$, sometimes produced x^2+225. More successful students substituted $y=\sqrt{x}$ to help with the factorising and solving of the equation.

Question 9

In Q09(a) most students were able to attempt an equation with three areas and these were often correct in the un-simplified form. Students regularly used Pythagoras to find the height of the triangle in finding the area and this led to a complicated expression that was sometimes simplified incorrectly. Students chose this approach more regularly than the area formula in terms of sine. For the semi-circle, not squaring the denominator when removing the bracket led to an incorrect simplified expression. Some students gave a final answer with a subtraction inside the bracket instead of an addition.

Q09(b) saw the first B1 lost with an incorrect term for the perimeter of the semi-circle for some. Students were using $2\pi r$ for the circumference but then often they used x as the radius. Most gained the M1 for the substitution. There were errors in the manipulation of the expression to reach the given equation but the most common was in expanding the bracket to reach a positive $\frac{\sqrt{3}}{2}x$ term.

In Q09(c) most students made a good attempt at differentiation and gained the M1 for at least one term correct. (Usually the x term). Many students found solving the equation difficult and errors in manipulation often led to an incorrect value for x. A large proportion of students failed to use their value of x to find the minimum value for P.

Many correct responses were seen in Q09(d) and students usually differentiated again successfully. Almost all substituted their value for x from Q09(c) but then some failed to consider the sign and/or give a conclusion.

Question 10

Q10(a) was generally well done although there were some errors seen.

In Q10(b) many students were familiar with the equation for a circle but difficulties often occurred with finding the radius. Methods were often muddled and students did not make it clear if they were finding the radius or the diameter.

For Q10(c) and Q10(d) a clear labelled diagram was of great benefit, but seen only rarely. A fair proportion of students were successful in Q10(c) but far fewer scored well in Q10(d). It was here in particular that the clear diagram came into its own. As it was, many students found the wrong angle with $\angle RAQ$ a common substitute for $\angle ARQ$.

Grade Boundaries

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

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