Examiners' Report

Summer 2015

Pearson Edexcel GCE in Core Mathematics C1 (6663/01)

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General introduction

This paper proved a good test of students' knowledge and students' understanding of Core 1 material. There were plenty of easily accessible marks available for students who were competent in topics such as the manipulation of surds, simultaneous equations, differentiation, integration, recurrence relations, arithmetic series and inequalities. 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.

While standards of algebraic manipulation were generally good, some weakness in this area was seen in 2 and 6(a). Work on indices was sometimes problematical and a significant number of students in question 7 incorrectly wrote 4^x as $2y$. There were a surprising number of errors in the arithmetic when calculating the value of the constant in 10(a).

Report on Individual Questions

Question 1

(a) This mark was scored by the majority of students. The most common error was to misinterpret the demand as $(2 + \sqrt{5})^2$ rather than $(2\sqrt{5})^2$.

(b) Most students rationalised the denominator by the correct expression with a few using a multiple of $2\sqrt{5} + 3\sqrt{2}$ such as $-2\sqrt{5} - 3\sqrt{2}$ or $10(2\sqrt{5} + 3\sqrt{2})$. Some students then evaluated the denominator incorrectly and a significant number of students who correctly obtained $(2\sqrt{10} + 6)/2$, simplified incorrectly to $\sqrt{10} + 6$, or $2\sqrt{10} + 3$. A small number of students used a slightly more efficient route of multiplying the top and bottom of the fraction by $\sqrt{2}$, making the rationalisation a little easier.

Question 2

This question was generally well answered, with many students gaining full marks. Most correctly formed the quadratic equation $8x^2 + 36x + 16 = 0$ although there were a significant number of errors in cancelling the coefficients. The most common problem amongst students who were unsuccessful was to square each term in the linear equation to obtain an expression such as $y^2 + 4x^2 + 16 = 0$ and then to subtract one equation from the other. These students made little progress. Those students who were successful in finding both values for x sometimes substituted into an incorrect equation for y or failed to find the y values at all.

Question 3

This question was well answered with the majority of students dealing with the negative index correctly. A very small number of students interchanged differentiation and integration and so scored no marks. Other than these, almost all scored at least 2 marks in each part. In part (a), the first term was almost always differentiated correctly but some obtained a power of -1 instead of -3 for the second term. In part (b), predictably, the omission of “ + c” was seen occasionally and a few students integrated their answer to part (a).

Question 4

Part (i)

In part (a) almost every candidate gained the first mark for $U_3 = 4$. For the sum in (b), although most realised that every term was 4 this seemed to cause difficult in finding the sum of 20 terms and a surprising number stated that 4 x 20 = 100. A few correctly used the sum of arithmetic sequence with a common difference of 0 but common differences of 1 or 4 were also seen. For part (b) a small number of students calculated the 20^{th} term rather than the sum of 20 terms.

Part (ii)

Part (a) was generally well answered although values of 5k and 9k were sometimes seen for V_3 and V_4 respectively. However, these students were still able to progress and gain the last method mark in the question. In part (b), most students calculated or guessed a value for V_5 and proceeded to either sum their 5 terms or apply the sum formula to find the sum of 5 terms. The latter method sometimes enabled those students who had made errors in the value of the terms to gain the next 2 marks, however poor division of 165/15 frequently resulted in an answer of 9 or 13 instead of 11.

Question 5

In part (a) almost all knew they had to consider the discriminant, with the majority scoring the first mark. Some students included x's in their expression or used the discriminant for the quadratic expression given in (a) or began with an incorrect expression for the discriminant.

Having seen the inequality that they had to work towards, many began by setting their discriminant "> 0" and so immediately lost both accuracy marks. Some realised their mistake and changed the direction of their inequality signs to provide a correct solution. Those who began with "< 0" correctly had little difficulty achieving the final inequality, either by dividing both sides by a negative (most commonly) or by changing the terms to the other side of the inequality (less commonly). A few made errors in their simplification of the discriminant, usually sign errors, and so lost the final accuracy mark. Those who began with $b^2 < 4ac$ often reached the required inequality more efficiently.

In part (b) most scored the first method mark often by completing the square, although some only considered the positive square root. Of those who used the quadratic formula, a surprising number made an error in their simplification, eg "36 - 4" becoming "40" a significant number of times. Many students stopped after finding their two roots, without attempting to give a range of values. Relatively few gave the inequalities for the correct "outside" regions and some students, realising that the "outside" regions were required attempted to combine them as a single interval. A few did give the two correct inequalities but used x as their variable.

Question 6

In part (a) almost all students correctly expanded the brackets to obtain a 4 term cubic, but a significant number were unable to divide the expression by $2x$ and frequently multiplied by $2x^{-1}$. The differentiation was generally well done and a few students used the product or quotient rules for differentiation. Some of those using the quotient rule forgot to square the denominator properly so that $(2x)^2$ became $2x^2$. A few students mistakenly thought they could differentiate the numerator and denominator separately.

In part (b) the correct value for the y coordinate was usually achieved when the original equation was used but some students used their processed expression and made mistakes either with the evaluation or because their expression was incorrect. Students should be aware that is always the best policy to use an original version wherever possible. Most attempted to determine the numerical value of the gradient by the substitution of $x = -1$ into their derivative but many did not deal well with the negative number such as squaring -1.

The method for finding the equation of a line was usually correct and the majority of students gained the last method mark. A correct final answer to this question was relatively rare given the frequency of earlier errors. A small number of students neglected to write the final answer in the form required by the question with integer values.

Question 7

In part (a) many students gave $4^x = 2y$ and then proceeded to use this in (b), thus gaining no marks for this question. Others probably realised that this was incorrect but were unable to find an alternative and so left the question blank. In a number of instances there was valid working but no explicit y^2, so no mark in (a) but often the y^2 was then used correctly in (b).

In part (b) students who had been successful in (a) almost invariably made a good start to (b). A few did not appear to make the connection between the parts and started afresh in (b), with varying degrees of success. Those that were able to produce a quadratic usually gave the correct one and solved it correctly for y. However, several left their answers in terms of y and then neglected to find the values for x, thus losing the final two marks. Of those who did go on to find values for x, errors included $x = 1$ from $y = 1$ and $x = 1/3$ rather than $x = -3$. Logs were seen infrequently.

Question 8

In part (a) most students found the factor of x, usually $+x$, correctly, although a surprising number switched the terms inside the bracket without making the necessary corresponding change to the sign outside. Quite a lot of students proceeded no further in this part, but those who did would usually gain at least 1 mark. Errors were usually sign errors. It appeared that many students did not recognise the difference of two squares and needed to try out different possible solutions before reaching the right one. A few took out x as a common factor then went on find the solutions for $9-4x^2 = 0$ which helped them to sketch the graph for part (b), but then they didn't complete part (a) by finding the factors.

In part (b) most students were able to gain two marks by knowing the shape of a cubic graph and sketching it passing through the origin. The third mark tended to be lost because they drew a positive cubic graph rather than recognising that this one was negative, or not labelling their key points or getting the points where $y = 0$ incorrect eg ±2/3 instead of ±3/2. Quite common for 1 mark was seeing a cubic with a maximum or minimum at the origin and passing through 3/2 only. Very occasionally there was a sketch of a quadratic graph.

In part (c) students were able to gain marks even if they had found parts (a) and (b) difficult. Generally students found points A and B successfully. When using Pythagoras theorem, some students got confused with signs or which values to put together, which often resulted in an answer that did not match up with $k\sqrt{10}$. The students who used a sketched diagram of a triangle and worked with the co-ordinate points to calculate lengths tended to gain full marks. It was quite common to see however students who found that 9+81 = 100.

Question 9

The majority of students successfully found the correct value for k in part (a). Common errors included solving their equation in k incorrectly due to an arithmetic slip (usually subtracting 1500 instead of adding) or using an incorrect formula, with k instead of $k - 1$. Some students did not use an equation at all, but simply subtracted 17000 then divided by 1500 arriving at an incorrect answer of $k = 10$. Listing was seen occasionally but more often than not gained no marks as attempts were incomplete. Also a few obtained an answer which was not an integer.

Full marks were fairly common in part (b) but a score of 1 out 5 was also common for those students who misinterpreted the question and found S_{20} with $d = 1500$. In general, those students gaining the first two method marks went on to gain the third by finding the sum of the 20 terms in total. Poor arithmetical skills let down some students losing them the final accuracy mark. Many students struggled to multiply by 11/2 and a surprising number of numerical errors made when adding the two numbers found for first 10 or 11 terms and final 10 or 9 terms. There were few instances of listing - these seemed to be mainly used as a check on the answer obtained from the algebraic approach.

Question 10

On the whole, part (a) was well done, although some good students lost the final accuracy mark because they failed to simplify fully. A very common error was to leave the coefficient of $x^{\frac{1}{2}}$ as 18/4 rather than 9/2. A few weaker students differentiated, but this was rare. The fractional powers were usually well managed, but the 2 sometimes disappeared instead of becoming $2x$. Almost all students made the correct substitutions and attempted to find c. Incorrect values were usually the result of incorrect integration or poor rearrangement.

Success in part (b) was varied. Many students had difficulties finding the gradient of the tangent. Many could find the gradient of the normal by rearranging the equation but a large number of students just then used $-\frac{1}{2}$ rather than finding the tangent gradient. The majority of students who correctly identified the gradient of the tangent as 2 could manipulate the resulting equation to successfully find $x = 1.5$. If they had not identified the gradient correctly, students were faced with a quadratic in $\sqrt{x}$ that they could not process and scored no marks in this part. This was also the case when occasionally -2 was used as the gradient. A few students used $-\frac{1}{2}x$ or $2x$ as the gradient and a few used the integrated $f(x)$ from part (a) instead of $f'(x)$.

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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