Principal Examiner Feedback

Summer 2018

Pearson Edexcel GCE Mathematics

Core Mathematics C2 (6664/01)

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Introduction

The standard of work seen was, on the whole, higher than in previous years. Presentation was good and a range of methods were used to answer questions. A general comment, made regularly, related to the number of students who lost marks due to not quoting the correct formula before substitution. Explaining methods is essential and writing down numerical answers without clear methods is not helpful.

Comments on individual questions

Question 1

(a) Almost everyone got correct values, and correct approximations to $4\sqrt{2}$ of 5.7, 5.66, 5.657 were common.

(b) Most scored the first 3 marks, but a sizeable minority failed to score the final mark, usually due to using their rounded decimal value from (a). Common incorrect answers were 51.413 and 51.425, but some gave the answer 51.4 using 3sf rather than 3dp. The most common incorrect value for h was $12/4 = 3$, confusing the number of strips with the number of ordinates. The bracketing error was only seen occasionally.

Question 2

This question was generally answered very well with a very high percentage of students gaining full marks.

(a) Almost all scored the B mark for the constant term 128 and only a very few failed to gain the method mark for using the correct binomial coefficients. It was pleasing to see that nearly all of the students recognised the correct structure for the expansion and that there were hardly any numerical errors. Use of notation seems to have improved although there were the usual errors made due to poor bracketing, resulting in not squaring and cubing the constant 'k' in the third and fourth terms respectively. These usually scored 3 out of the 7 marks available. Some of those who factorised out the 2^7 before expanding then made mistakes with the fractions work and ended up with incorrect coefficients.

(b) This was generally well answered by most students and they realised that they had to set their coefficient of x^3 equal to 1890. Some who obtained the correct expansion in (a) failed to gain any marks because they never had an equation which did not include a power of x. A few used their term in x^2, gaining no marks. Some of those who had an incorrect expansion in (a) did however manage to recover in part (b) and go on to obtain full marks. A few students took the square root of 1890/560 instead of the cube root so lost the A mark, and those who did this without showing the intermediate line of working lost both an M mark and the A mark. A few students also gave a negative answer for the cube root and so lost the A mark.

Question 3

Predominately there were very good solutions which scored full marks.

(a) Use of the remainder theorem was by far the most popular choice of method. A few attempts at long division struggled to manipulate the algebra correctly with the A and B involved. There was some variation between arriving at $0.25A + B = 28.5$ then multiplying by 4 or multiplying by 4 first before manipulating the equation to the given one. There was a common slip on the final line, with a number of students writing $A + 4B = 144$ instead of 114.

(b) There were occasional errors here due to $(-1)^3 = +1$ and/or $(-1)^2 = -1$ leading to $A + B = -21$.

If the "= 0" was not seen at first, it was soon recovered in order to arrive at an equation.

(c) As the second equation was quite a simple one, using this to substitute for A or B in the given equation, was the most common method leading to correct values for the variables.

(d) Algebraic long division usually produced the quadratic factor successfully, with occasional mistakes in the subtraction causing problems. A mistake in the first subtraction usually resulted in $14x$ in the factor and a remainder. There was not much evidence of a 'check for error' in these cases. Arriving at the factor by equating coefficients or trial and improvement was also seen but not so often. Some students seemed confused by the term "quadratic factor". A few continued to try factorising or even used the formula to arrive at 'solutions' but most were happy to stop and quote the correct factors.

Question 4

(a) This was completed well by the majority of students. A few lost the accuracy mark due to premature rounding. Working in degrees was generally less successful.

(b) The most common error was correctly finding the area of the triangle but failing to add on the area of the sector afterwards.

(c) Most students recognised the need for the cosine rule and substituted in the correct values but here calculator work and early rounding played a part in reducing their scores. The arc length was usually calculated correctly and the perimeter was usually made up of the correct parts.

Question 5

(a) and (b) were generally answered well to form the circle equation and thus find the centre and radius correctly. Errors in completing the square and arithmetic were the main causes of loss of marks on these parts. Common errors that arose were usually due to the $2x$ term and resulted in '$(x - 2)^2 + \ldots$' rather than $(x - 1)^2$. There were a few students who completed the square correctly but were then unable to interpret this and some wrote down the incorrect centre of the circle as (1, 7) or (-1, 7). Errors with completing the square occasionally led to a negative value for r^2. It was rare to see $r = 50$ rather than $\sqrt{50}$ and the exact surd or equivalent was almost always seen following a fully correct method.

(c) Most students recognised the need to substitute $x = 0$ but some attempted $y = 0$. Common errors were to compute $(0 - 1)^2$ as 0 or to fail to give the zero solution after factorising. Those who solved by square rooting $(y + 7)^2 = 49$ occasionally only gave one solution as they reached just $y + 7 = 7$ rather than $y + 7 = \pm 7$.

(d) By far the most popular approach was to find the gradient of the line between (2, 0) and the centre. Slips applying the formula or using an incorrect formula such as $m = \frac{x_2 - x_1}{y_2 - y_1}$ were fairly common. Students would benefit from stating their method clearly before calculation as there were a number of sign errors made and credit could not be given when a formula or method was not shown clearly. Most students realised that they needed to proceed by finding the negative reciprocal, although some took the positive reciprocal or just the negative. Errors with using the straight line method via either $y - y_1 = m(x - x_1)$ or $y = mx + c$ were not common and a substantial number of students obtained the correct equation with integer coefficients, although the "= 0" was occasionally missing.

Using implicit differentiation was more common than usual. The differentiation was confidently handled by many, although some differentiated the terms in y with respect to y, often setting $\frac{dy}{dx}$ equal to the result. A few who obtained the gradient using implicit differentiation showed a lack of understanding, as they then proceeded to take the negative reciprocal of their value. Students who unwisely attempted explicit differentiation almost always ran into difficulties.

Question 6

This question was a good source of marks for most students.

Part (a) was straightforward for many and almost all students were able to quote and use the formula for the sum to infinity correctly. A common incorrect answer of 'a = 1000' did occur fairly regularly, due to use of r = 0.9.

In part (b), students were asked to find the 5th term of the sequence and many did so confidently. Some had errors carrying through from part (a) but most did use either the correct or their calculated value of a together with n = 4. The most common loss of marks here was due to either a sign error i.e. -12465.9 rather than 12465.9 or rounding errors where students stated 12465 as their answer.

Part (c) was the most challenging part of the question and most students knew what was being asked of them, but a significant number of students lost marks here due to the negative common ratio. Many omitted to quote the formula for the sum and it was also common to see sign errors within a correct formula. Students should be strongly encouraged to quote the formula they are using before substituting values. The powers of negative numbers were problematic for some students and quite a number of students believed that 1 – (-0.9)12 = 1 + 0.912. Or due to lack of rigour when substituting into the formula, some obtained 1 - -0.912 which sometimes was calculated correctly and but often gave rise to 12824. An additional, fairly common loss of 1 mark was due to stating the answer as 7175.7 rather than stating the answer correct to the nearest integer as requested in the question. Other, more serious but less common errors arose from use of 'n = 11' or 'a = 10 000'

Question 7

(i) The most common method used by students involved the power law for logs. It was rare for marks to be dropped here but errors were made when students failed/forgot to add 1 to their RHS (or subtracted 1 instead).

(ii) (a) On the whole students did much better with this question than with similar logarithm questions in the past. It was rare to see responses that gained no marks at all as most did show knowledge of the 3 rules for manipulating logs and students were usually able to apply at least one of the rules correctly. The key to the question was how well students dealt with the constant term 1 in the equation. Often any problems with reaching an equation that did not involve logarithms were caused by the constant term. It was disappointing to see a number of able students show minimal working (sometimes with no explicit logarithm work) on a "show that" question.

(ii) (b) Most students did reach both correct answers for x but there were some errors, more often from students who had used factorising rather than the quadratic formula. It was pleasing to see that a good proportion of students considered the domain given after solving the quadratic and went on to consider whether each solution was valid.

Question 8

Generally this question was well attempted by many students, although some were more successful in part (ii) than part (i). There seemed to be quite a few who were not able to interpret the answers given on their calculators or use the answer given on their calculator to obtain the remaining solutions. In (ii), a few seemed to work everything in degrees and then convert to radians rather than just setting their calculator into radian mode.

(i) It was unusual for a student not to gain the first two marks here by applying the inverse cosine to reach $x + 70 = 41.4$ or $x = -28.6$, but they often discarded this for not being within the range, rather than interpreting it as the angle of 331.4°. Most however did use their answer to find the other solutions in the range given, but often only one (usually 331.4) was given. A few students attempted to expand the bracket to find what $\cos x$ was equal to, before trying to find other solutions. Not all students found alternative solutions for $x + 70$ before subtracting 70. The method for finding the alternative angles was often not very clear, but a large proportion of students did succeed in finding at least one, if not both, of the solutions.

(ii) Nearly every student used and applied the correct trigonometric identity $\cos^2\theta = 1 - \sin^2\theta$ to obtain the three term quadratic in $\sin\theta$. Some sign errors resulted in -11, instead of -1 at the end of the quadratic equation. Most went on to use a valid method to solve the quadratic equation and obtained the correct values for $\sin\theta$. Some used their calculators to just write down the values, also gaining the marks. A few students decided that there were no solutions to $\sin\Theta = -1/3$, stating that it was outside the range, but these could still go on to gain all but the last accuracy mark for giving two correct angles in the range. A common error following the correct value of 3.48 was to calculate $2\pi - 3.48$ to get 2.80. There continues to be a problem with marks being lost owing to truncation or premature rounding and unfortunately many students lost the last accuracy mark as they gave one of the angles as 0.25 instead of 0.253. A minority of students chose to work in degrees and changed their answers back to radians. Those who gave all four angles correct, but in degrees, were able to gain all but the last accuracy mark.

Question 9

This was answered well with many completely correct solutions, although some needed two or more attempts and extra paper to achieve this.

(a) The main reason for errors in this part was in multiplying out the brackets and dealing with the second term incorrectly. Most common were $14x^{3/2}$ and $14x^1$ leading to $x^{1/2} = 0.3$ and $x = 0.2$ if then differentiated and rearranged with no further errors. Even those who correctly reached $x^{1/2} = 2$ sometimes followed this with $x = \sqrt{2}$. Sometimes the correct $x = 4$, $y = 112$ appeared with no working, or following incorrect working, so credit was not given. A few found the second derivative and put that equal to 0 to attempt to find x.

(b) This part had more correct answers than part (a) since some of those who had incorrectly multiplied out before reverted to the factorised form and achieved the correct answer. Again $x^{1/2} = 5/2$ was sometimes followed by $x = \sqrt{(5/2)}$.

(c) Most had a correct attempt at integration, with many using their x values from both previous parts and correctly using them as the limits. A few used 0 as the lower limit however. A significant number just found the area under the curve and didn't consider the rectangle at all. Most of those who used a rectangle used the correct width and height for their values, though common errors were to use the rectangle from 0 to 25/4, or to find the area of a triangle instead. Very few used way 2 on the scheme.

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