Pearson

Examiners' Report
Principal Examiner Feedback

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Pearson Edexcel International A Level
In Core Mathematics C12 (WMA01)

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General Introduction

Students seemed to have been well prepared for this examination. Some excellent scripts were seen and there were fewer students who scored very low marks. It proved to be an accessible paper with a mean mark of 89 out of 125. Timing did not seem to be an issue either, with most students able to complete the paper. There seemed to be a big improvement in attempting "show that" questions.

Students should be encouraged to set their work out in a logical manner. Points that should be addressed by centres for future examinations are;

- a failure to recognise the need to use earlier parts of questions, especially when prompted to do so in a question. This was evident in questions 5b, 7c and 9c

- an over reliance on graphical calculators when answering questions that state "show your method clearly", "solutions based entirely on graphical or numerical methods are not acceptable" or "Using calculus, ..." This was particularly evident in questions 15d.

Reports on Individual Questions:

Question 1

Overall, this proved to be a suitable question 1 as it was well answered by the majority of students. Common reasons for less than full marks being awarded were: leaving the gradient as $-{}^{8}\!/_{2}$ rather than its simplest form, failing to deal with the negative coordinate correctly resulting in $y = -4x + 19$ rather than $y = -4x + 13$ and, finally, finding the equation of the perpendicular line rather than the parallel line.

Question 2

This was a relatively accessible question on transformations and almost all students scored one or more marks.

Part (a) was well attempted but a few students added 2 to the x co-ordinate to obtain (4,3).

In part (b) a number of students changed the sign of both coordinates giving an answer of (-2,-3)

Part (c) was the least well done with (2,6) being a common incorrect answer, perhaps arising from students reading "2y" on the left hand side of the equation and then thinking that they should double the y value.

Most students reached the correct answer to part (d).

Question 3

This was a relatively familiar question involving algebraic integration . There still seems to be a lack of confidence from some students in dealing with a denominator of Mx^n. Whilst most students knew that they needed to divide by x^2, the 2 sometimes appeared on the numerator causing the loss of at least two marks.

In part (a) full marks were common but there were many incorrect forms including $\frac{1}{2}x + 8x^{-2}, 2x + 2x^2$ etc.

In part (b), perhaps predictably, the most common error was to omit the '+c'. A more worrying error for a small number of students was to go back to the original expression and integrate all three terms to offer the answer $\frac{{}^{1}\!/_{4}x^2 + 4x}{{}^{2}\!/_{3}x^3}$ Another cause of a lost mark was for a small number of students who wrote $+-2x^{-1}$ +-2x^{-1} for the second term.

Question 4

(a) Most students attempted to use the appropriate area formula for a triangle and stated $24\sqrt{3} = \frac{1}{2} \times 3x \times x \times \sin 60$ or equivalent to score the first M. Most students who gained the first M went on to gain the second M for using sin 60 = $\frac{\sqrt{3}}{2}$ directly or by implication to reach $x^2 = k$. Those who failed to score all three marks usually did so due to a lack of working. This was a show that question and it was important to see $x^2 = 32$ or equivalent, or $x = \sqrt{32}$ before the given result $x = 4\sqrt{2}$.

(b) Most students did attempt to use the correct form of the Cosine Rule with $x = 4\sqrt{2}$ A few expressed BC^2 in terms of x to gain the M. Most of these students went on to achieve $BC = 4\sqrt{14}$ and all 3 marks. Reasons for a loss of marks here were: using sin 60˚ and not cos 60˚ in the 'Cosine Rule', giving the answer as 14.97 (not exact) or using Pythagoras' theorem by considering triangle ACB to be right-angled at A despite angle A given as 60˚, and using $BC^2 = AC^2 + AB^2$.

Question 5

Part (a) was well attempted by most students, with the majority of students able to score at least 2 marks out of 3. Loss of marks was usually due to an inability to write $\sqrt{x}$ as an index.

Part (b) proved to be a lot more challenging than part (a), although nearly all students scored the first mark for setting their dy/dx equal to zero. Many students experienced difficulty in working with negative fractional indices. Of those students who reached the stage $x^{3/2}$ =27/8, some were unable to proceed to find the correct value of x. If the value of x was found correctly, then students usually went on reach a correct value for y. A small number of students gave answers in decimal form which was acceptable provided those answers were exact as required by the wording of the question. Students who gave the value of y to be 30.4 lost an accuracy mark.

Question 6

In Q6(a) the majority of students scored full marks. Common errors included using a + nd instead of a + (n-1)d, using 680 as the first term or making simple arithmetical errors. A minority of students attempted the question via repeated addition.

In Q6(b) the majority of students scored full marks. Common errors included using 16 as the number of terms, using 680 as the first term, finding the n th term instead of the sum to n terms and again, making simple arithmetical errors. As with part (a) a minority students attempted the question via repeated addition.

In Q6(c) many students scored full marks but this was the least well answered part of the question. Common errors here included the use of the geometric series formulae, or setting the nth term equal to 17400 instead of the sum to n terms.

Question 7

Part (a) Many students were able to score both marks on this part of the question. However students need to be reminded that when a question says 'show' then they must write down sufficient steps to fully explain their method. In this particular example students were expected to have at least one intermediate line of working between $2(-2)^3 + a(-2)^2 + 18(-2) - 8 = 0$ and the statement $a = -3$.

Part (b) Most students were successful in finding the quadratic factor $2x^2-7x-4$ either by long division or by comparing coefficients, and of these a high proportion went on to factorise the quadratic correctly and achieve the correct fully factorised form for g(x). Some students found the roots of the quadratic (by graphical calculator) giving the factors as (x+1/2) and (x-4), and as a result, they lost both the method mark and accuracy mark. The question required students to 'use algebra' and therefore students could not score the four marks by simply using a calculator to find the three routes of g(x) = 0 and then producing the form $(x + 2)(2x + 1)(x - 4)$.

Part (c) Most, but not all, students recognised the link between parts (b) and (c) and were then able to achieve some success on part (c). Most students identified $\sin\theta = -1/2$ as the only relevant value for $\sin\theta$ and, having done so, were able to proceed to achieve at least one of the two correct answers for θ. Only a very few students lost marks for failing to give their answers as multiples of π. Overall, a pleasing number of completely correct solutions were seen for this question.

Question 8

(a) This part was correct in most cases. Incorrect formulae seen included $\frac{1}{2}r\theta = 6$ and $r^2\theta = 20$

The angle θ was stated to be in radians so whilst $\frac{\theta}{2\pi}\times 2\pi r = 6$ was correct, $\frac{\theta}{360}\times 2\pi r = 6$ was not.

(b) The simplest method here was to divide the equations or substitute in order to eliminate θ and in most instances this easily led to the correct values for r and θ. A number of concise and accurate answers were seen. However in many cases the application of simultaneous equations involving substitution was poor; some students attempted to subtract the equations and some poor algebra was seen resulting in equations in θ^3 or r^3.

Question 9

(a) Most students were able to either sketch an appropriate shape for the curve or were able to sketch a curve passing through $(0,1)$. The second mark was harder to score and many failed to achieve this. Amongst reasons for this were; incorrect curvature, intercept given as $(1,0)$ and most common of all, a curve that was not asymptotic to the x - axis.

There were many fully correct answers for part (b). Errors were rare and mostly due to an incorrect strip width, with $\frac{8}{5}$, $\frac{8}{2}$ or $\frac{2}{5}$ commonly used incorrect values.

Part (c)(i) proved to be demanding. It revolved around recognising that $2^{x+2} = 2^x \times 2^2$ and hence an approximation to the integral could be found by multiplying the answer to (b) by 4. Common errors seen included squaring the answer to (b), adding or multiplying by 32 and multiplying (b) by $[4x]_{-4}^{4}$

Part (c) (ii) was more familiar and a number of students realised the answer was 24 + their answer to part (b). A number of students re-started the question with various levels of success. and applied the trapezium rule on their new function. This was given credit this time, even though (technically) they were not using their answer to part (b).

Question 10

Part (a) Whilst most students achieved the correct answers, there were a significant number who made numerical errors in their calculations. Indeed a few students attempted to use Pythagoras to obtain the values of p and q.

Part (b) This part of the questions was well done by many. Most students knew how to get the gradient of AC and then went on to get the gradient of the normal. The majority the used a correct method to find the equation of the line with the $y = mx + c$ method seen only occasionally. It was possible to score full marks on parts (b) and (c) without having achieved correct answers in part (a). Unfortunately, those students who used incorrect values of p and q from part (a), were then destined to drop a further three accuracy marks in parts (b) and (c). A disappointing number of able students dropped the final mark in part (b) for failing to write their line equation in the form specified in the question.

Part (c) A number of students failed to recognise that the coordinates for E satisfied both $x = 7$ andtheir equation for l .However a pleasing number of students understood what they had to do and worked carefully to achieve exact coordinates for E, as required by the question

Question 11

Part (a) This part of the question offered students an opportunity to gain marks for a standard application of a learned method, and a very high proportion were able to score all four marks. Students who opted to extract a factor of 3 from $(3 + ax)^5$ before expanding were more inclined to make errors and lose marks. A few students dropped a mark by having $270ax^2$ for their third term.

Part (b) was very much more discriminating with many weaker students writing 405a = 0 or 405a = 1. However high calibre students were able to proceed using a correct method to achieve an exact value for a.

Question 12

Part (i) was generally well done with many students picking up at least 3 marks. Even students who made a "false start" such as $\frac{3\sin(\theta+30)}{2\cos(\theta+30)}=0$ generally recovered to obtain at least one correct angle. Errors were rare and included students replacing $\frac{\cos(\theta+30)}{\sin(\theta+30)}$ with $\tan(\theta+30)$, the failure to find a second angle as well as the inability to cope with the $(\theta+30)$ aspect of the question.

Part (ii)(a) The response to this part of the question was relatively disappointing. For the first method mark the identity $\sin^2 x + \cos^2 x = 1$ was well known and used by almost every candidate however it was quite common to see it used to change every term, and many students lost sight of the fact that they were required to work towards $\tan^2 x = k$. Poor algebra was again apparent so that in many cases the correct equation $\frac{\cos^2 x}{\cos^2 x}+\frac{2\sin^2 x}{\cos^2 x}=5$ led to $2\tan^2 x=5$

In part (ii)(b) it was possible to gain the two method marks even where there had been mistakes in (a).
In spite of clearly writing $\text{Tan}^2\, x = k$ some students failed to take the square root, and a few conveniently ignored the fact that they had a negative value for k rather than checking their work to look for their mistake.
Most of the students who found $k = 2$ found all four correct solutions but a few only considered the positive square root.

Question 13

This question differentiated well across the ability range with only the more able students demonstrating an ability to both to handle inequalities and to give the level of detail necessary with regard to the 'show' requirement in part (b).

Part (a). The vast majority of students correctly identified the centre and radius of the circle. Just occasionally the radius was not given in an exact form which cost the candidate a mark.

Part (b). This part of the question was not well answered. Although most students were successful in finding an expression for the square of the distance from *P* to the centre of *C*, only a minority then set this as less than the value of the radius ^{2}. Attempts which did not start with this inequality statement were highly unlikely to result in a convincing response to the 'show' requirement and consequently only scored the first of the three marks available.

Part (c). Most students were able to solve the quadratic equation to achieve two exact roots. A small number gave decimal approximations and therefore forfeited accuracy marks. Surprisingly a few students then went on to select/guess the 'outside region' showing no real appreciation on the solution of inequalities. Occasionally a good solution was spoiled by using *x* rather than *k* in the final answer statement thus losing the fourth mark.

Question 14

This question gave an opportunity for more able students to demonstrate their greater understanding of the concepts and processes involved, particularly in parts (b) and (d).

Part (a) The majority of students were able to score both marks with almost all using an expression of the form $8000\times r^5$. Occasionally, students wrote down the amounts of mineral year on year and were able to score both of the marks provided they showed full accuracy throughout the process. The inclusion of the answer in this part allowed students to check that their value of $r = 0.85$ was correct.

Part (b) Only a minority of students scored the mark in part (b). The key was to show correct understanding that the sum to infinity exists only when $|r|<1$.

Part (c) Students who knew the value of *r* generally did well on this part of the question, with many scoring both marks.

Part (d) Most students who attempted this part did start with a statement involving Sn. It was from this point onwards that some poor working was seen with some students attempting logs of negative numbers. Nonetheless, many students did go on to solve correctly and achieve N = 8.5… It was regrettable that some able students got this far but then failed to make the statement N = 9.

It was clear that the method of taking logs to solve equations had been well rehearsed but the actual setting out of working did, at times, reveal a less than a full understanding of the processes involved, especially where inequalities were used.

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Question 15

(a)(i) the vast majority of students scored the mark. The most common incorrect answer was 36
(ii) the vast majority of students scored the mark although many responses took over a page of working to get there. The use of the word 'State' and the fact that it was only worth one mark should have been enough clue to suggest that it could be written down

Part (b) was demanding and most students did not achieve the 3 marks . Common errors included putting the function equal to 0 instead of 18, attempting part (c) instead, missing brackets and other notation errors. There was significant non response to this part.

In part (c) the majority of students scored full marks. The most common error was to fail to calculate or derive the 18. There were also some arithmetical slips.

Questions like 15 (d) always present problems for students, especially those who are uncertain about which area a definite integral actually calculates. Most students attempted to integrate but many used the incorrect function, many used the limits from just 0 to 3 and others failed to recognise that the area required was above the line. There were however some excellent, concise, well written and accurate solutions. As in the summer, there are a sizeable minority of students using their graphical calculators to find the answers to their integrals. The phrase "Use calculus " at the start of part (d) was designed to deter this, and there is a minimum expectation of seeing $\int_0^5 \left(\frac{1}{2}x^3 - x^2 - \frac{15}{2}x + 18\right)\mathrm{d}x = \left[\left(\frac{1}{8}x^4 - \frac{1}{3}x^3 - \frac{15}{4}x^2 + 18x\right)\right]_0^5$ before we see the area under the curve calculated as $32\frac{17}{24}$

Question 16

This question proved to be more problematic than might first have been hoped. Perhaps there was a lack of familiarity with this sort of problem, with students having to select and use only relevant pieces of information. Most did recognise the need to put (1,4) into $\mathrm{f}(x) = ax^3 + bx^2 + 2x - 5$ to obtain one equation in *a* and *b*. Only better students knew how to find the second equation. This involved recognising the link between $\mathrm{f}'(1)$ and the 12 in $y = 12x - 8$. When this was used students had a relatively easy task of finding values of a and b.
Many set $\mathrm{f}(x) = 12x - 8$ or $\mathrm{f}'(x) = 12x - 8$ and failed to score anything other than the one mark

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