Examiners' Report

January 2015

Pearson Edexcel International Advanced Level in Core Mathematics C12 (WMA01/01)

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Overall the candidates seemed to be well prepared for the paper and working was usually comprehensive and easy to follow. There was however a large minority who gained very few marks on most questions and left out several other questions, perhaps gaining most of their marks on questions 8 and 10.

A number of responses were poorly presented, some verging on illegible. In these cases there seemed to be little intent to make the work structured, readable and easy to follow. Other candidates, usually able ones, insisted on forcing their response into as small a space as possible, occasionally making two columns of work on the page thus making the work harder to read.

It is possible that some candidates found the paper rather long, judging by the number of blank and incomplete responses seen for the later questions, but it is also possible that such candidates lack practice at working through longer papers and dividing their time appropriately.

Question 1

Most candidates (95%) gained the mark in part (a), but part (b) caused considerable difficulty, with many candidates (48%) gaining no marks or just one mark. This question should have been a straightforward start to the paper but caused some confusion and generally was not very well answered. 95% gained the mark in part (a). Some did not simplify and left the power as 6/3. The main errors were adding indices or simply replacing the 1/3 with a cube root sign.

Part (b) was very poorly done with many candidates (48%) gaining no marks or just one mark. Many candidates were unable to evaluate the coefficient correctly as they could not manipulate the surds efficiently even though this could have been done using their calculator. There was poor manipulation of fractions leading to an incorrect power of x. Some candidates managed to do a lot of work in this part, usually with an unsuccessful outcome.

Question 2

19% of the candidates achieved full marks and another 19% gained one or two of the marks on part (b). Surprisingly 13.6% gained no marks on this question.

In part (a), the majority of candidates were able to apply the Trapezium Rule accurately with a correct value for h. The value of h was occasionally incorrect, the most common wrong value being 9/4. The common bracketing mistake, mentioned on the mark scheme, was seen in a few cases.

In part (b) quite a number of abortive attempts to use calculus to find the required integral were seen. Those candidates who did use half their answer to part (a) often added this to 1 instead of 9. Some restarted with a new table and the trapezium rule though this was quite often not to the required accuracy.

Question 3
About 50% of candidates got full marks on this question and about 10% scored no marks at all.

In part (a) most candidates recognised that a stretch in the y-direction was required (although a translation in the x-direction was quite common, and a few attempted the graph of $f|x|$), and found the 3 correct coordinates for the transformed graph. It was less common for candidates to realise that the asymptote also changed; many left it as $y = 3$, and some changed the asymptote to $y = 6$, despite finding the new coordinates correctly.

In part (b) the vast majority of candidates who transformed the graph performed a reflection, but often it was in the x-axis rather than in the y-axis. Those who attempted the correct reflection usually achieved full marks, if all points and the asymptote were labelled.
However, in each part it was common to see candidates losing at least one mark for omitting to label all relevant points, or failing to give the equation of the asymptote.

Question 4
43.7% gained full marks on this binomial theorem question and a further 14.6% made some attempt at part (b).

Applying the Binomial expansion has become a successful skill in recent years and many excellent responses to part (a) were seen. There were very few cases where components of each term were added rather than multiplied, or $\frac{10}{2}$ used for ${}^{10}C_2$, for example. The method mark was gained by almost all the candidates. Some started with $2^{10}(1 + \frac{x}{8})^{10}$ but a common mistake was to use $2(1 + \frac{x}{8})^{10}$ A few arithmetical errors were seen in the powers of 2 or in the Binomial coefficients, leading to loss of marks.
Some candidates had no idea how to start part (b) and some did not use their expansion to evaluate the required value, but worked out 2.025^{10} by calculator. Laborious methods were seen in attempts to find $x = 0.1$ and work quite often stopped after 0.1 had been found. In other cases 0.025 or 2.025 was used for x for which no credit was available.

Question 5
This question was not well answered with 26% of candidates scoring no marks and only 16% gaining full credit.

In part (a), candidates who had learnt the proof for the sum of the first n terms of an arithmetic series often gained full marks. It was, however, surprisingly unusual to see a well set out, fully correct proof of what is not a difficult proof to learn. On the whole many candidates had a vague knowledge of how the proof started and where they wanted to get to, but there was a fair amount of creative work in between. A surprising proportion of candidates struggled to write a correct expression for S_n at the start of their proof, often having the last term incorrect, or they did not display a sufficient number of terms to make subsequent steps in their proof complete. Some candidates separated the a's and terms in d and used the sum of integers but some either started with, or used something that they were trying to prove, e.g starting with $S_n = \frac{1}{2}n(a + L)$. It was also quite common to see an argument which was effectively only valid for even n.

Candidates who used $S_n = a + (a + d) + (a + 2d) + \dots\dots + (L - d) + L$, rather than $S_n = a + (a + d) + (a + 2d) + \dots\dots + \{a + (n - 1)d\}$ were able to gain full credit providing they showed or stated that $L = a + (n - 1)d$.

In (b), although there were many correct answers it was very common to see, in particular $n = 500$, but also $n = 70$ and 72, used, which invariably meant that a maximum of one mark was available, if a correct formula and $d = 7$ were used. Candidates who used $\frac{n}{2}(a + L)$ gained no marks unless $L = 497$ was used. Fortunately few candidates listed and added the terms, as invariably they omitted at least one term in reaching their total.

Question 6
Full marks were gained by 43% of the candidates with a further 19% losing just one mark.

In part (a) the majority of candidates scored at least two of the method marks (usually those relating to the power and the use of the addition rule) and many were able to derive the equation correctly and often very succinctly. There were many rather minimalist solutions, in the extreme case starting with a non-log equation, and candidates should realise that it is in their own interests, in "show that" questions, to show all the steps. Those who combined $\log_4 x$ and $\log_4 (2x - 1)$ on the RHS were generally more successful than those who worked with $2\log_4(2x + 3) - \log_4 x - \log_4(2x - 1) = 1$, sometimes followed by $\log_4\left[\dfrac{\frac{(2x+3)^2}{x}}{2x-1}\right]$, which often lead to an incorrect equation.

A small minority of candidates displayed no knowledge of the laws of logs, exemplified by such statements as $\log_4(4x+6) = 1 + \log_4(x + 2x - 1)$ and
$2\log_4 2x + 2\log_4 3 = 1+\log_4 x + \log_4 2x + \log_4 -1$.

In part (b) most managed to use a correct method to solve the given quadratic but many did not discard the value of $x = -1/2$, thus losing the final mark here. Many of those who failed to produce the required equation in (a) did not attempt this part. A few did not act upon the word "hence" and attempted this part from scratch without reference to part (a).

Question 7
Almost half the candidates (49.7%) obtained full marks on this circle question, but 12.9% gained no marks at all.
Parts (a) and (b) were generally well answered. Those candidates who completed the square were usually successful although there were some sign errors when dealing with the constant terms, which were penalised in part (b). Those that used $x^2 + y^2 + 2gx + 2fx + c = 0$ made more mistakes, the most common one being to fail to divide by 2. The majority of candidates knew they had found r^2 from the circle equation and correctly took the square root of 16. Often the centre contained a sign error but full marks for part (b) were available for a fully correct method leading to the correct radius.

Part (c) was very well answered with candidates substituting $x = -3$ into the equation of the circle and reaching a 3 term quadratic in y. Some candidates then used their calculators and gave the two answers in simplified surd form with no indication of method. Those who completed the square, or used the formula, generally did so correctly but some left their answers in decimal form or did not fully simplify the surds, leaving $\sqrt{12}$ or $\sqrt{48}$ in their answer. Errors also occurred when candidates substituted -3 into their incorrect equation from part (a) rather than using the correct version given in the question.

Question 8
54% of candidates gained full marks and very few (5.4%) made no progress.
In part (a), finding u_2, u_3 and u_4 was generally completed quite well with many excellent solutions seen, although weaker candidates made such errors as $u_3 = 3(3k - 12)$ instead of $3(3k - 12) - 12$.

Some candidates saw the common factor of 3 in u_2, u_3 and u_4 and thought that they could divide by 3, to make the terms simpler. The distinction between taking a factor out of an expression, and dividing both sides of an equation, is one that is often not clear to weaker candidates.

In part (b) candidates usually put their u_4 equal to 15 and went on to solve for k. Many gave an exact value but then rounded this, which usually led to the loss of the final accuracy mark in part (c). A small number found u_5 and equated this to 15.
In part (c) most candidates knew what was required but errors in (a) led to loss of marks. A small number attempted to use a formula for the sum of an AP.

Question 9
While 27.9% of candidates gained full marks, 18.5% gained no credit. In this question there was often a reluctance to work in radians, which led to a lost mark in part (a) . Others changed to radians after the angle was found in degrees which could lead to a loss of accuracy by premature approximation.

In part (a), although most were familiar with the cosine rule, sometimes the wrong angle was found, though a few candidates then went on to solve parts (b) and (c) correctly. A sizeable minority wrongly assumed that triangle AXB was right-angled, with the right angle at X. A mark was sometimes lost when angle AXB was given to only 2 significant figures.

In part (b) a fairly small, but surprising, number thought that the area of a sector of a circle was either $r^2\theta$ or $r\theta$. Some found the area of the minor sector and went no further. Many realised that the area of the major sector was necessary, but then used "0.421" instead of double this angle, obtaining the frequently seen incorrect answer of 293.
Most candidates used 'Way 1' (on the scheme) here, often working in degrees, and achieved the correct answer with no difficulty. Those using 'Way 2' or 'Way 3' often made errors because they had already made assumptions about right-angled triangles, but a few confidently found the length XY and achieved the required result. Areas of sectors were sometimes seen in attempts at (c). A common incorrect solution was $2\ (\frac{1}{2} \times 5 \times 10)$.

Question 10

This question was generally well done and 48% of the candidates gained full marks. In part (a) the vast majority of candidates were familiar with the Remainder Theorem and very few attempted long division. The majority were able to translate the first piece of information into the equation $a - b = 11$ although a few made errors with the negative numbers and reached $a - b = 1$ (or –1). Only a small number of candidates attempted f(+1) rather than f(–1).

Most also attempted f(1/2) but a fairly common error was to equate this expression to 0 (or occasionally 15) rather than –15. Most used a correct method to solve their simultaneous equations.

In part (b) those with correct values for a and b usually managed to divide the cubic by $(x+1)$ correctly and went on to gain full marks. Those with incorrect values for a and b often struggled with division by $(x+1)$ and seldom attempted factorisation of their quadratic. Some solved a quadratic equation before stating the factors and lost a factor of 6 in the process.

Question 11

This question discriminated effectively and while 18.5% of candidates achieved full marks, 19.6% achieved no marks. Throughout the question candidates worked in degrees as required and it was very rare to see answers given in radians. In general candidates appeared to be more familiar with part (b) than with part (a).

In part (a) many candidates either omitted the y intercept altogether or gave a decimal value and then only gave 2 of the 4 possible x intercepts. Sometimes, having found (60,0) and (240, 0) the other two intersections were given as (-60, 0) and (-240, 0), ignoring the fact that the y-axis was not a line of symmetry, and some only gave one or two solutions; in fact many candidates appeared to not use the printed graph to help them.

In part (b) most candidates began to solve the equation by dividing by 4 and finding the inverse sine and these usually went on to score at least 4 marks, losing the final mark by giving only 2 correct angles.

Question 12

19.5% achieved full marks on the Geometric Series question, set in context, while 16% achieved no marks.Candidates experienced some difficulties with this question, generally because they were unsure of the appropriate power to use when matching their ideas of the geometric sequence with the year.

In part (a) most gained at least one mark when finding an appropriate expression and many were able to find the correct difference, but did not always show enough detail to satisfy the requirements of a 'show that' question. Some became confused by the 'similarity' of the result for 2020 (£402,627.50) and the required value for the difference (£40,300).

Some good responses were seen in part (b), with correct initial inequalities and good work with division and logs. The most common error was to stop at $n = 15$ or $n > 14.5$ and not give the year. A fair number used n as a power, rather than n - 1, but knew which year they were referring to. Most used the appropriate inequality or worked with equality. Inequality errors were rare. Some candidates used the sum formula rather than the term formula, scoring only 1 or (occasionally) 2 marks out of 4. The mistake 275000 x $1.1^{(n-1)} = 302500^{(n-1)}$ was seen a few times. Candidates who used trial and improvement needed to show the values for $n = 14$ and $n = 15$, not just one of them.
In part (c) the majority used a valid formula for the sum of a geometric series, but quite often $n = 10$ was used instead of $n = 11$.

A very small number attempted to sum individual terms. Many candidates did not give their answers to the required accuracy (to the nearest £100) but were not penalised as more accurate answers were accepted here. A minority of candidates miscopied numbers, particularly using 27500 instead of 275000.

Question 13

There were some good answers with 19.6% of candidates scoring full marks. There were 13.3% who scored no marks however.

In part (a) the vast majority of candidates knew that they should differentiate and almost all did that successfully, and many went on to get full marks; those who did not manage this start to the question rarely scored anything. A fairly common error seen was to put $dy/dx = 0$ and use the resulting x value as the gradient of the tangent, and a few, having stated that $dy/dx = 6x – 4$,and perhaps realising it was a linear expression, used 6 as the gradient of the tangent, rather than substituting $x = 1$.

The rule for perpendicular gradients was very familiar to candidates and nearly all used a "changed" gradient in their equation of the normal, and algebraic manipulation was usually good. Some students, having done correct work throughout, left their answer as $x + 2y – 3$ (omitting = 0), or failed to give the equation in the form required, and so failed to score the final mark.

Part (b) was done well with most appreciating the need to solve the equations simultaneously. The students who eliminated y from the equations were more successful, as this led to an easier quadratic equation to solve. A common error for students trying to eliminate x was to write the equation as $3(3–2y)^2 – 4(3–2y) + 2 = 0$ rather than having y on the right hand side.

Part (c) differentiated well between the candidates. Despite its similarity to part (b) this part was more demanding and it was common for candidates not to attempt this or to stop part way through the solution. Those who followed the approach used in part (b) were able to form a quadratic in x but sign slips were common. Those who started by eliminating x to form an equation in y were usually defeated by the more difficult algebra encountered in this approach. Although good candidates were able to set up their equation correctly and apply the $b^2 = 4ac$ condition successfully and were able to score full marks, it was very common to see scores of 0, 1 or 2 marks here. Very few tried to use the alternative gradient method given in the scheme. Of those who began by solving the given equation in k, it was the exceptional candidate who went on to give a complete solution, showing that their line l_2, for each value of k, was a tangent to the curve.

Part (d) was a good source of marks for those students who persisted to this part of the question, even if they had not attempted part (c). However, some lost the accuracy mark because they did not give exact answers. A few candidates wrote down decimal answers with no method shown.

Question 14

26% of the candidates achieved full marks but 20% achieved no marks on this trigonometric question. Many candidates found part (i) very demanding and a large number made no attempt at all at this part of the question. Common errors were to use $\cos\theta = 1 - \sin\theta$ or $\cos\theta/\sin\theta = \tan\theta$. Some difficulty in manipulating the equation led to answers of 7/3 and -3/7. Candidates were happy to work in degrees and most who reached -7/3 continued to complete the question successfully, finding both angles in the given range. There was little evidence of extra solutions within the required interval and rounding was done well in most cases. Candidates who tried to square the expression were generally unsuccessful, usually because they ignored the negative root or they ended up with extra solutions in the given interval.

In part (ii) candidates generally achieved at least the M marks and clearly understood what they had to do, with many going on to get full marks. Most of them substituted $1 - \cos^2 x$ for $\sin^2 x$ but the occasional candidate found it difficult to multiply by 11 leading to an incorrect quadratic in $\cos x$. Most candidates solved their quadratic to reach 2/7 and -1/3. There was reluctance by some candidates to work directly in radians with many calculating answers in degrees and then converting to radians, often with rounding errors. Most attempted to find all four solutions although some had difficulty finding solutions to $\cos x = -1/3$ and lost the final mark. Answers were occasionally given as 'multiples of π'.

Question 15
This question was answered well with 34.9% achieving full marks and 73% achieving 7 or more of the 11 marks available.

Part (a) was extremely well answered with candidates displaying an excellent knowledge of differentiation and the majority gaining full marks.
In part (b) the majority of candidates recognised the need to substitute $x = 4$. Often the general layout of work here was poor with many candidates failing to set their derivative explicitly equal to zero and attempting to reach $k = -78$ (given) from an expression rather than from an equation. Many however gained full marks. A few candidates unnecessarily found the second derivative in order to show that the point was a minimum.

Part (c) distinguished between candidates, with the better candidates producing accurate concise solutions. It was pleasing to see that most candidates were able to integrate $10x^{\frac{3}{2}}$. Whilst most knew that they were required to integrate the equation of the curve and take the limits between 0 and 4 to find an area, some candidates found it hard to identify the actual region required and left their answer at this point, obtaining only 3 out of the 7 marks available. A great number of candidates failed to find the area of the rectangle, even if they had found $y = -168$ and just gave their answer as 432. Others struggled with the negative signs and ended up adding, rather than subtracting, their integral from the rectangle. An occasional candidate attempted to use a triangle rather than a rectangle to find the area. Some integrated their expression for dy/dx instead of integrating y. Overall, this was a good question for the candidates to demonstrate their understanding of areas on graphs.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
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