Examiners' Report

Summer 2014

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

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General Introduction

Within this paper the level of algebra was pleasing. A point that could be addressed in future exams is the lack of explanation given by some students in questions involving proof. It is also useful to quote a formula before using it. Examples of this are when using the sine rule, cosine rule and quadratic formula.

Report on Individual Questions

Question 1

This was an accessible question on the application of the sine and cosine rules. In Q01(a) the majority of students used the cosine rule, made a correct substitution and calculated AC as 9.8... Many, however, lost the 2nd accuracy mark as they did not round correctly to the nearest 10 metres or they had incorrect units.

In Q01(b) most students used the sine rule correctly to calculate angle A but a few used the cosine rule. However accuracy was lost following truncation of the answer from Q01(a).

Question 2

This was a question testing the student's ability to manipulate surds. Whilst a good proportion of students scored full marks, a number had difficulty starting apart from simplifying $\sqrt{27}$ to $3\sqrt{3}$. Quite a number of students failed to realise that $6x\sqrt{\frac{3}{3}} = 2\sqrt{3}x$ and a few were unable to simplify $3\sqrt{3} - 2\sqrt{3}$.

Those students who multiplied through by $\sqrt{3}$ tended to be far more successful as it produced an equation with integer coefficients of x.

Question 3

Q03(a) was answered correctly by the majority of students by either writing $a = \log_4 20$ and using the appropriate log-of-any-base button on the calculator or by taking logs of both sides and rearranging to make a the subject. Errors included incorrect rearrangement after taking logs of both sides and incorrectly converting into logs.

Q03(b) was answered extremely well by most students. The most common approach was to put $2\log_2 b = \log_2 b^2$ and add or subtract logs to reach $\log_2\left(\frac{b^2}{30b}\right) = -3$ or use $\log_2\left(\frac{30b}{b^2}\right) = 3$ with some students cancelling down the fraction. Many students with a correct solution also incorrectly included $b = 0$ as a solution. Some wrote $3 = \log_2 8$ and then used laws of logs in order to find the correct solution. A common misconception was to rewrite the original equation with the logs removed. Some students used numerical values for logs rather than use laws of logs to simplify. Some assigned $\log_2 b$ a letter such as x and then attempted to write an equation in terms of x but these equations tended to be incorrect. Some used the laws of logs incorrectly to get $\frac{(\log_2 30b)}{\left(\log_2 b^2\right)}$.

Question 4

The majority of students completed Q04(a) successfully and scored full marks. Occasional errors were made on the $\frac{16}{x}$ term with some students converting this to a power of $\frac{1}{2}$ and some resorting to using logs..

Q04(b) was also a good source of marks with many completely correct solutions. The most common mistakes included putting $x = 2$ into $f'(x)$ to find y, or putting $x = 8$ into $f(x)$ resulting in (8, 66) as the coordinates for the turning point. There were a few students who thought that $\sqrt[3]{8} = \pm 2$ but in almost all cases they then ignored the negative solution to successfully find the turning point as (2,12). A number of students however struggled to multiply through by x^2 to reach the required cubic and were reduced to acquiring $x = 2$ by trial and error. Some tried to solve the equation by factorising.

Most of the students who completed Q04(b) successfully were then able to attempt Q04(c), getting at least one of the parts correct, usually Q04(c)(i). The students who had incorrect coordinates for the turning point in Q04(b) also were able to access both marks following through on their solution. Common errors included adding one to the *x* coordinate for $f(x+1)$ and doubling the *y* coordinate for $\frac{1}{2}f(x)$. A few students also doubled or halved the *x* coordinate for this part of the question.

Question 5

Q05 was an accessible question to find the equation of a line given two points. A large proportion of students correctly calculated the gradient of the line and proceeded to find the equation. A significant number of students failed to put their answer into the required format thus forfeiting the final mark in Q05(a).

Q05(b) required the ability to use their skills in coordinate geometry to solve a problem. Of those who approached this part of the question using the perpendicular gradient most were successful. Indeed it was the simplest way to tackle the problem. On the other hand those who attempted using Pythagoras did not do so well often failing to cope with the algebraic demands that were required under this method.

Question 6

In Q06(a) most students obtained at least one mark for using the identity $\cos^2 x + \sin^2 x = 1$ in the denominator. However many did not show sufficient working to obtain both marks for a 'show that' question. Some students only used the identity in the numerator and therefore did not earn any marks.

Most students did not gain full marks for Q06(b) with the most common error being a failure to consider $\tan x = -\sqrt{3}$ or a failure to find the equivalent angle to $\frac{-\pi}{3}$ in the given range and so only finding three of the four solutions. Some students found the correct answers in degrees and converted to radians. A common error was to miss the +2 in the equation and obtain $\tan^2 x = 1$ instead. Some students restarted the question and found the solutions correctly but lost marks as the question required the use of Q06(a).

Question 7

In Q07(i) most students managed the integration and dealt with the negative power correctly but many ignored the given point which would have enabled them to find the constant of integration and instead went straight on to evaluate f(1) so that they could only earn 2 out of 5 marks. This usually occurred when they had omitted to add "+ *C*".

Some students appeared not to understand that $\mathrm{f}'(x)$ means the derivative of f(x) and hence differentiated instead of integrating. In a few cases they integrated one term and differentiated the others.

The majority of the students who did remember to add a constant went on to achieve full marks.

Q07(ii) was found to be more challenging. The integration of the first term, however, was surprisingly successful, with only a few students failing to realise that $\sqrt{x}$ was $x^{\frac{1}{2}}$ but many were unable to divide by $\frac{3}{2}$.

Many students did not realise that *A* needed to be integrated and either ignored it or "integrated" *A* to $\frac{A^2}{2}$.

Several students simply substituted the limits of 4 and 1 into $3\sqrt{x} + A$ and set this equal to 21. Another frequently seen error was to substitute the limits and equate each part to 21 thus finding two values for *A*.

A common mistake at the end was a sign error, writing $16 + 4A - 2 + A$ after removing the bracket, leading to $A = \frac{5}{7}$.

Question 8

Q08(a) was designed to give students a hint for the whole question by providing one of the equations. There was insufficient evidence for a 'show that' answer with many students just re-writing the statement with $nbx = 12x$ hence $nb = 12$. When an answer is given it is essential that the student shows that they understand the problem and shows all steps to the given answer.

In Q08(b) many students could not simplify ${}^{n}C_{2}$ to get $\frac{n(n-1)}{2}$ and left it as $\frac{n!}{2!(n-2)!}$

Perhaps the most common error was in failing to square the b. However, those students who reached $\frac{n(n-1)b^2}{2} = 70$ usually went on to substitute n or b from Q08(a) and many successful answers of $n = 36$ and $b = \frac{1}{3}$ were seen.

Question 9

Q09(i) was done well by most students, who realised that they had to sum an arithmetic sequence. Generally they were able to use the correct formula with the correct initial term and difference. Only a few obtained the answer by listing and adding all the terms.

A few students did not understand what the sigma notation meant. It appeared that some students were unable to distinguish between AP's and GP's and tried to use the formula for Geometric series instead of Arithmetic.

Another common error was to find the twentieth term instead of the sum of twenty terms.

Q09(ii) was done less well and caused considerable problems, with many students failing to score any marks. Again this may have been due to the notation. Those students who worked out the first few terms quickly realised that the common ratio was $\frac{1}{4}$ and went on to find the correct answer. Many students did not seem to understand the meaning of the notation or to realise that $r = \frac{1}{4}$.

Frequently *r* in the formula was replaced by 0, leading to $a = 16$. The answer 48 was obtained by students with the correct *r* value but who thought the first term was $\frac{a}{4}$ and the answer -48 was obtained by those students who thought that $r = 4$. Some students simply set the first term of the series equal to 16, giving an answer of $a = 16$. There were a few solutions where students tried to use logs to solve this question.

Question 10

Only a small number of students failed to rearrange the expression to the form ...= 0 The vast majority therefore managed to get the zero on the right hand side and were able to calculate then discriminant. Again most set the discriminant >0 reaching the given solution in a couple of lines.

Q10(b) proved to be a little more demanding due to the fact that the quadratic did not factorise. A variety of responses was seen in producing the answers including the use of the formula, completing the square and use of a graphical calculator. Students who produced a numerical solution lost the final mark as an exact answer was required.

Question 11

For Q11(a) the most common method seen was completing the square. Many students obtained the correct coordinates of the centre but lost marks when calculating the radius. A common error was stating the radius as 5 instead of $\sqrt{5}$.

In Q11(b) most students scored marks for calculating the distance *TQ*. Some also calculated *TM* (*TN*) at this stage. The majority used cosine correctly to calculate the half angle (some used sine). Some used degrees and then converted back to radians.

In Q11(c) the area of the sector was well done with only a few students using the formula for a circle in degrees rather than radians or calculating arc length. Using ‘ $\text{Area} = \frac{bh}{2}$ ’ was a common method of calculating the area of triangle *TQN* (*TQM*), but a frequently seen mistake was to take *TQ* as the perpendicular height. Those who used the $\frac{1}{2}ab\sin C$ formula tended to make fewer errors.

Question 12

Q12(a) was simply showing that (3,0) lay on the curve. Most students completed this part of the question by substituting $y = 0$ into the cubic and then either factorised or made $x^2 = \frac{1}{3}x^3$ on the way to reaching $x = 3$.

Of those who took the route of substituting $x = 3$ to show $y = 0$ some failed to show sufficient working to gain the mark. In a show that question all necessary steps must be given.

Q12(b) was an accessible question on tangents. Most of the students who attempted this part of the question completed it well and a large number scored all five marks. However there were a number who failed to differentiate and just wrote down $m = -3$ from the tangent equation already given. They did not score any of the marks on this 'show' question.

In Q12(c) students needed to find a point of intersection of two lines using algebra. Most started by equating the two equations but then struggled to do anything else. Better students rearranged the equation to $x^3 - 3x^2 - 9x + 27 = 0$ and used the fact that $(x - 3)$ had to be one of the factors.

Q12(d) involved students understanding what area is found when you integrate a function between two limits. It was obvious that some had little experience in this field. Common mistakes included multiplying by 4 when integrating $\frac{1}{3}x^3$ instead of dividing by 4 and trying to integrate $x^3 - 3x^2 - 9x + 27.$ This resulted in an area that was 3 times as big as the area required. In most cases students were aware that they needed to subtract one area from another, although it was not always completed the correct way around. The comparatively few students who found the area of the triangle separately tended to be far more successful.

Question 13

This question was found to be challening, with many students scoring no marks at all.

Many made no effective progress in Q13(a), but those who realised that $\cos x$ takes a maximum value of 1 when x is a multiple of 360 degrees usually scored at least 2 marks. Only the best students achieved the final mark by converting their value of t into a time and providing the exact time of day.

Students seemed to find Q13(b) easier to begin than Q13(a). Almost all who attempted this part realised they needed to set up an inequality and solve for t. This was done quite well. The most common mistake made by students was failing to convert their t values into times. Marks were frequently lost through inaccuracy due to premature approximation. A common mistake, seen in both parts of the question, was to expand $\cos(30t - 40)$ incorrectly as $\cos(30t) - \cos(40)$.

Question 14

This was a challenging question on optimisation and as such, the first part contained many 'show that' parts.

In Q14(a) the two ways in which to find the area of the triangle were via the formula $\frac{1}{2}ab\sin C$ or Pythagoras' Theorem.

In Q14(b) most students equating the given surface area to 960 and making l the subject before substituting in their formula for volume of a prism. However a number of students lost marks for having the area of cross section incorrect.

Q14(c) was a starting point in this question for less able students, although the $\sqrt{3}$ did cause some problems. A high proportion of students differentiated correctly to reach the value of x for a turning point. Marks were then lost, either because the student failed to proceed to the value of V, or because they mistakenly used a rounded value of x (often 10) in proceeding to a value for V.

In Q14(d) most students attempted to find the second derivative and the majority had a correct algebraic answer. Most then used the value of x found in Q14(c) to ascertain that it was negative and hence a maximum value of V. However some failed to provide a convincing reason for the maximum value of V.

Grade Boundaries

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

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