Examiner's Report

Principal Examiner Feedback

October 2019

Pearson Edexcel International A level
In Pure Mathematics P2 (WMA12/01)

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General

This paper proved to be a good test of candidates' ability on the WMA12 content and plenty of opportunity was provided for them to demonstrate what they had learnt. There did seem to be a larger number of blank responses on the later questions than usual which may suggest some candidates were pushed for time, having found several parts of earlier questions difficult. Marks were available to candidates of all abilities and the questions that proved to be the most challenging were 3, 7 and 10.

Question 1

This question was generally well answered with about a third of candidates scoring full marks.
In part (a), most candidates manipulated the equation correctly to enable them to differentiate the individual terms. Those candidates often correctly differentiated and proceeded to find the correct x coordinates of the stationary points. There were quite a number of candidates, however, who found the roots of the given equation and scored no marks. Others lost the $x = 0$ solution by cancelling terms rather than factorising.
In part (b), candidates were usually successful in using their answers from part (a). There were some candidates who had done part (a) incorrectly, but their working to complete part (b) showed a restart. In these cases, the candidates were awarded for the skills that were being tested in part (a). Some candidates confused increasing with decreasing, whilst there were other candidates who just stated the same answers as part (a).

Question 2

A very well attempted question giving access to marks to a vast majority of candidates. There were, as always, some candidates who chose to attempt this question by working out each individual term; the majority of these did not score full marks due to inaccuracy.
In part (a) it was pleasing to see that the majority of candidates recognised the geometric progression. Most recognised that r = 1.02 or indicated 102%. The most challenging aspect for candidates appeared to be identifying the correct value of n, with 12 used frequently and 14 less often, in place of the correct $n = 13$. Accuracy cost some candidates the final mark, as they did not leave their answer as an integer due to the context.
Part (b) was generally very well attempted, however similar problems were encountered as for part (a); many candidates incorrectly used 12 or 13 instead of 14, and this seemed to be independent of whether they had counted their n in part (a) correctly or not. A surprising number of candidates also used the sum formula for an arithmetic series, again independent of whether they had correctly used a geometric progression for a term in part (a). Again, accuracy cost some candidates the final mark, failing to give their answer to the nearest thousand.

Question 3

This question was one of the most challenging questions on the paper for candidates. It was extremely rare for full marks to be scored, although nearly all candidates were able to pick up at least half of the marks.
Part (a) was a routine binomial expansion problem and candidates were usually successful in scoring full marks. Some errors when squaring or cubing the $\frac{x}{4}$ term meant that the simplified coefficient was incorrect.
Part (b) was rarely answered correctly with those who did score any marks often achieved it for stating $\frac{55}{16}$. Very few candidates appreciated the need to find the x^5 term of the original expansion and as a result did not score any more marks than the first one in this part. Those who did find the additional term often went on to score full marks. Some candidates did multiply out the expansion but errors in simplifying or not cancelling down did not result in finding a term independent of x.

Question 4

Many candidates scored full marks or nearly full marks on this question. There was a small number of candidates who failed to score, usually due to a lack of experience with the factor theorem.
In part (a), many candidates simply read the -35 from the expression for f(x), demonstrating good understanding. Some candidates showed the substitution, which was nice to see, but took a little longer to get to the result. Occasionally +35 was seen, and there were some poor responses that attempted long division, often resulting in overly complex working and errors.
Candidates generally started part (b) well, working with f(2/3) = 0 [f(-2/3) was rarely seen]. In some cases, algebraic manipulation caused numerical errors and candidates scored M1A0. A minority of candidates attempted to show that $x-3$ was a factor rather than $3x-2$ even though this was stated in the question and was used in part (a) to demonstrate that it gave a remainder and hence was not a factor. There were, however, plenty of excellent responses that scored both marks.
If parts (a) and (b) were done well then candidates generally went on to factorise the cubic fully. Long division was the preferred technique, although some alternatives including the grid method were also generally successful. A reasonable minority of candidates made an expensive slip when expanding the original function, ending with a constant term of -16 instead of +16. This sometimes led to the correct factorisation (usually because a calculator had been used to find the solutions) and candidates scored at most 2 out of 5. Some candidates showed no method other than the expansion and were limited to at most 1 out of 5.

Question 5

This question proved to be a good discriminating question between candidates. A pleasing number scored full marks, however, parts (a) and (c) were often poorly completed.
Candidates struggled to sketch the graph correctly, with many having an exponential growth curve. Most candidates were able to score one of the marks for having a y-intercept of (0,1), however, this was even with graphs that were linear. Those candidates who did draw a correct curve in the first two quadrants picked up both marks in most cases. The occasional candidate did not draw a graph but just stated the y-intercept, which was not acceptable.
In part (b), candidates were highly successful in applying the trapezium rule with many scoring full marks. Some candidates made bracketing errors, or they had an extra term being multiplied by two. Some used an incorrect h of 0.4. There were a number of candidates who tried to just integrate the given expression which scored no marks.
The final part required candidates to use their answer to part (b). This proved to be challenging for most candidates, with only the stronger candidates being able to spot that they just needed to find the integral of $\int_{-2}^{4} 3x \, dx$ and subtract this from their answer in part (b). Some candidates tried to integrate, and others tried to just apply the trapezium rule from the beginning again. Candidates should be reminded to read the question carefully, particularly when there is a requirement to use an early part.

Question 6

This question was generally answered well by the majority of candidates, with the modal score being full marks.
Part (a) was usually answered perfectly, with $y = -2x + 7$ given by the vast majority. Some candidates attempted to use the gradient of 1/2, while others seemed to attempt a coordinate approach to the gradient. Arithmetical slips were occasionally costly here, with candidates sometimes arriving at $y = -2x + 9$.
Part (b) was more challenging, however, it was still well attempted by the majority. The most efficient strategy [finding the point of intersection between the original line and their answer to (a)] was chosen most frequently and generally led to the correct answer, although some were not sure what to do after they had found the point of intersection. There were those that attempted to solve the problem using a discriminant approach. Those that used the given line were able to score full marks but generally did not. Those that attempted to use their answer to (a) scored no marks as it was not a viable strategy. For the candidates who got as far as finding the radius, there were instances were candidates did not simplify their equation, leaving r^2 as $(6\sqrt{5} / 5)^2$, losing the final accuracy mark. There were unusual occasions when equations of the form $(x - a)^2 + (x - b)^2 = r^2$ were given.

Question 7

Candidates made good progress with this question, although a significant number struggled with applying the laws of logarithms correctly.
Part (a) was usually answered correctly with full marks being achieved by the vast majority. Those who made errors in this part often scored nothing in all parts.
Part (b) was much more challenging for candidates. Most were able to score the method mark for some evidence of applying the laws of logarithms correctly, however, there were a significant number who incorrectly thought that $\frac{\log\ldots}{\log\ldots} = \log\ldots - \log\ldots$. There were a pleasing number who did score full marks, although some made errors with simplifying their expression and lost the accuracy mark.
In part (c), most candidates understood the $\sum$ notation and were able to write out the first few terms. The combination of logarithms with the sum of an arithmetic sequence proved challenging for a number of candidates who were unable to split up summation appropriately. A good number of candidates did proceed to achieve the correct final answer, although some omitted the k in their expression which lost both accuracy marks.

Question 8

Question 8 proved to be accessible to the vast majority of the candidates and allowed the most able to differentiate themselves through accuracy in part (i).

The modal score in part (i) was 4 out of 5, with those that were generally successful unable to score the final mark due to an overreliance on calculators and premature rounding. They ignored the requirement to give their answer in exact form and generally arrived at awrt1.03. There was a significant minority of candidates who were unable to process the original fraction to an integrable form, either choosing to integrate immediately or bringing the $2x^2$ up as an extra term. These candidates scored no marks. Arithmetical slips were common in manipulating the fractional term, particularly in the coefficients of the two terms involved. Some differentiation was seen but this was rare.

Part (ii) was very well answered in general, with the majority scoring full marks for $k = 29/18$. Occasionally candidates failed to integrate the initial expression correctly, usually on the k term going to k^2 rather than kx. The first term was sometimes incorrectly simplified (usually with a coefficient of 3/2 as opposed to 1/6), although this only cost these candidates the final accuracy mark. There were some candidates who did not follow up with the usual F(b) – F(a) and instead set F(b) = 55 and F(a) = 55 separately. Finally, some candidates were unable to score the final accuracy mark as a result of leaving their answer as a rounded decimal, as opposed to in exact form.

Question 9

This was one of the most challenging questions on the paper, which was probably due to the number of marks and parts. Most candidates were able to pick up half of the marks, although very few scored full marks.

In part (a), most candidates were able to proceed to finding at least one of the correct angles. There were a significant number, however, who rounded their earlier values which resulted in 14.8 degrees being seen often.

Part (b) combined trigonometry with arithmetic sequences which most candidates struggled to score any marks on. Those candidates who did attempt this part were usually able to set up the equation and proceed to the given answer. Some candidates lost the final mark for poor notation such as $\sin\alpha^2$ or because they did not show enough working; in particular, candidates should be starting with the given terms including $\tan\alpha$ and showing that $\tan\alpha = \dfrac{\sin\alpha}{\cos\alpha}$ by substituting appropriately.

Most candidates were able to score the majority of marks in part (c). Nearly all candidates used the identity $\sin^2\alpha + \cos^2\alpha = 1$ correctly and proceeded to the required quadratic equation. Candidates solved their quadratic by a variety of methods, with some using their calculator which is acceptable. Candidates should still show their working, where possible, so that method marks can be awarded if they make errors. Most scored the first four marks, but the final mark proved to be difficult to gain, with only a small number finding the required value for α in the given range.

Question 10

Some candidates may have run out of time at this stage as there were more blank or partly answered scripts to this question than others.

Part (a) was very well done with just some errors in manipulation of equations having an effect on the correct solutions of $a = 4/3$ and $b = 1/3$. Frequently candidates found the first equation $8a + b = 11$ but made no further progress. As above, this may be due to a lack of time, or potentially as a result of the more challenging equation involving finding dy/dx, substituting dy/dx = 7 and $x = 2$. A common error in differentiating was to see the $+b$ term remains in their expression for dy/dx.
In part (b), many candidates knew the process they were required to carry out but failed to complete it for full marks. Commonly candidates substituted their a and set dy/dx = 0 and scored the first mark. However, many did not know what to do next. Many candidates simply stated there were no solutions, without showing how they knew this (presumably due to an overreliance on calculators). Those that continued and used the discriminant or quadratic formula were able to score the second mark, with the former being more successful in scoring the final mark due to a simpler requirement in their conclusion. Some candidates who generally had a good strategy here were unable to be awarded the final mark because they had not set their dy/dx = 0 prior to using the discriminant. Exposure to the rigour required in proofs and "show that" questions would be of assistance to these candidates.

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