Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel International A Level
In Pure Mathematics P1 (WMA11/01)

June 2019 Examiner's report

This was the second WMA11 paper under the new specification. The paper was found to be a little more accessible than the one in January, perhaps due to the fact that the new topics were now more familiar and better known to candidates and teachers. The paper was of an appropriate length with little evidence of candidates rushing to complete the paper.

Points to note for future exams are

- Candidates should take care when using a calculator to find the solutions of equation especially when the questions demands that they 'show using algebra' or 'show all steps of their working'. This was true in Q2 and Q5 where a sizeable majority of candidates merely wrote down answers.
- Errors when using radians were common. This seems to be an area of weakness for a great many candidates.
- Candidates need to care when sketching graphs. There were many occurrence's when a sketch of sin *x* in Q9 (b) looked linear and the one for tan *x* appeared in the wrong regions.
- 'Show that' questions are always found to be more difficult. In this paper Q9(b) was poorly attempted with many candidates failing to satisfy the demand of the question.

<u>Question 1 (Mean Mark 5.0 out of 6)</u>

This question was accessible to the majority of candidates with many gaining full marks.
In part (a) the method mark was generous and achieved by almost all candidates. Most candidates also earned the first A mark for the correct differentiation of $\frac{1}{8}x^3$ but then the final mark was sometimes lost due to a variety of errors on the $\frac{-24}{\sqrt{x}}$ term.
Part (b) was also well done with very few finding the equation of the normal. The first method mark for substitution of 4 into their $\frac{dy}{dx}$ was earned by almost all candidates. Using this value to form the equation of the tangent was done well by the vast majority with most going on to find the equation in the correct form.

<u>Question 2 (Mean Mark 3.1 out of 5)</u>

In part (a), knowledge of the method of rationalising the denominator was demonstrated by almost all candidates. Many marks were lost for poor manipulation of fractions and for leaving a numerically correct answer with a single denominator, rather than in the form required. Candidates using their calculator to derive the result were not awarded marks.

In part (b) the majority of responses took the 'otherwise 2' approach rather than the 'hence' approach suggested in the question. After collecting the terms in *x* on one side of the equation and dividing, the connection to part (a) was generally not recognised and the denominator was again rationalised. For full marks, candidates taking this approach to the question were required to show intermediate work before stating the given answer which many did not.

<u>Question 3 (Mean Mark 6.3 out of 9)</u>

Only a minority of candidates succeeded in gaining full marks for this question, though almost all candidates gained method marks.
In part (a), almost all candidates understood what was required of them and earned both method marks. However, too many candidates made errors in calculating the perimeter of the compound shape. The most common error was in simplifying (6*x*-2) – (2*x*-1). Other common errors were in omitting at least one of the un-labelled edges.
In part (b) candidates were more successful at finding the area then the perimeter of the garden, and in most cases went on to solve the quadratic correctly to reach critical values of $\frac{-18}{11}$ and 2. This part asked them to form and solve the quadratic inequality in *x*, so the required answer was $-\frac{18}{11} < x <$

2. Many candidates failed to appreciate this demand and wrote down the answer to part (c) or, due to the context of the question, $0 < x < 2$.
As a result, completely correct solutions were rare. The mark scheme allowed candidates to score the mark for part (c) in part (b). This involved linking the solutions to parts (a) and (b) resulting in the range $1.5 < x < 2$.

<u>Question 4 (Mean Mark 3.7 out of 5)</u>
It was pleasing to note that most candidates knew that the given expression had to be written as a sum of terms before the integration was attempted. There is still a misconception, however, about how this should be carried out with many getting one of terms wrong.
Common errors included:

- $\frac{4x^2+1}{2\sqrt{x}} = 4x^2 + \frac{1}{2}x^{-\frac{1}{2}}$
- $\frac{4x^2+1}{2\sqrt{x}} = \left(4x^2+1\right)2x^{-\frac{1}{2}} = 8x^{\frac{3}{2}} + 2x^{-\frac{1}{2}}$

Once the correct sum was formed candidates generally performed the integration correctly with only a few making fractional or sign errors. The failure to add the constant of integration + c was also seen.

<u>Question 5 (Mean Mark 3.9 out of 7)</u>
In part (a), the majority of candidates scored full marks. Some candidates made errors when factorising or using the quadratic formula and as a result did not derive the correct roots. Some candidates divided by x, rather than factorising it out, and therefore missed the zero root. As stated earlier, a sizeable number of candidates merely stated the answers, showing no working at all, thus scoring 0 marks in (a).

In part (b), candidates struggled to understand the link with part (a). Some candidates attempted to multiply out and solve the resulting equation or else made an incorrect connection with part (a). Others set $(y-5)$ or $(y-5)^2$ equal to u, then recalculating the answers for part (a). Candidates who omitted the zero root of the equation in x usually did not identify 5 as a root of the equation in y. Some candidates used the correct approach but did not obtain both solutions from the positive root of part (a), neglecting the ± in the quadratic formula.

<u>Question 6 (Mean Mark 4.0 out of 7)</u>
In part (a) a large proportion of candidates gained the first method mark having realised that they needed to equate the two equations and proceed to a quadratic. However, the correct quadratic was not always achieved, with incorrect signs appearing after the manipulation of the terms. The most straightforward way to solve this part involved the use of the discriminant. The fact that 'c' in the discriminant was '- c' in the equation caused much confusion, and, as a result, candidates calculated $c = +12.25$ rather than -12.25. A smaller number of candidates approached this by differentiation producing elegant solutions. This is a more demanding method however, and many did not proceed further than finding $\frac{dy}{dx} = 2x - 3$.
Almost all candidates who gained full marks on part a) went on to score full marks here which ever approach they took to solve part a). Even those who scored poorly in a) managed to gain at least one if not both of the method marks here by using their value of c and then attempting to solve their 3TQ.

<u>Question 7 (Mean Mark 5.6 out of 10)</u>
This question tested the use of radians and the formulae of the area and perimeter of a sector. It was attempted by almost all candidates but few were able to achieve all of the marks.

Part (a): This part demonstrated that a large majority of candidates know the formula for the area of a sector, but choosing the correct angle in radians was only done by a minority. Very few candidates tried to work in degrees. After correct work, a significant number of candidates failed to earn the final mark due simply to providing an answer with insufficient accuracy.
Part (b): Candidates knew to apply the sine rule to find angle *ADO* but even though the question specifically stated "angle *ADO* is obtuse", this was not carried through successfully. The majority of candidates gave angle *ADO* as the acute angle 0.884^c, rather than the obtuse angle 2.258^c.
Part (c): Almost all candidates found the length of arc *ABC* directly using $6\times(2\pi-0.7)$ rather than subtracting the minor arc from the circumference. The difficulty in this part was in finding the length *OD*. Candidates who followed through from part (b) with an acute angle for *ADO* found *OD* to be greater than 6. At this stage, candidates often abandoned the question or repeated their calculations hoping for a different result. A few decided to subtract 6 from *OD* instead! Candidates who used the cosine rule to form a quadratic in *OD* were equally successful as those using the sine rule. A few candidates mistakenly used the length of the minor arc *AC* as the length *AC*.
This part of the question was often poorly presented with very little clarity as to what the candidates were actually calculating. Candidates would be well advised to perhaps draw their own diagrams and set out their work with for example *CD* = … rather than labelling all unknowns as x =..

<u>Question 8 (Mean Mark 6.3 out of 9)</u>
Able candidates found this a very accessible question with many scoring full marks. Slips were relatively common, especially in part (b), with the term $-\frac{8}{3x^2}$ causing the most concern.
However, this question did highlight many areas of misunderstanding. Weaker candidates did not spot the difference in technique between part (a) and part (b) and treated it as one long question. Misunderstandings seen that caused a loss in marks were:

- Integrating in part (a)
- Differentiating again in part (a) and finding $f''(4)$ as opposed to $f'(4)$
- Finding the equation of the tangent rather than normal in part (a)
- Failing to add a constant in part (b)
- Making a sign slip when integrating $-\frac{8}{3x^2}$

<u>Question 9 (Mean Mark 3.5 out of 7)</u>
This is one of the newer aspects of the specification and candidates and centres are still getting used to its demands. It was tackled much more fluently than the equivalent question in January.
Part (a) of the question proved, perhaps surprisingly, challenging for many candidates. Correct answers were rare, with many only writing the y coordinate, or minimum = - 4, or providing several answers with no clear indication of which one was the correct answer, hence gaining no marks.
The curve sketching for the sine function in part (b) was successfully tackled by most. Marks were generally lost when candidates drew curves that were linear. The tangent curve was less successful, and was often drawn in the wrong place, with asymptotes at 0, 180 & 360. Other candidates drew tan graphs that were 'reflections' of the true curve and had versions of a cot graph. A surprising number omitted the 0-90 section altogether while the 90-360 section was correct.

Candidates who were successful on parts a) and b) were generally able to gain full marks in (c). Many others also managed to score all 3 marks despite slipping in the earlier parts of the question. It was not uncommon to see the 6, 12 and 11 derived with ease and even when the graphs had been drawn incorrectly.

<u>Question 10 (Mean Mark 6.1 out of 10)</u>
This was a very accessible question at all levels but many candidates did not fully understand the demand of part (c).

Correct solutions in part (a) were common although a sizeable majority wrote down $P = -\frac{1}{2}$ or else gave both points where the curve intersected or met the *x*- axis.
All candidates understood what to do in part (b) and there were many completely correct and well-formed solutions. Errors did creep in on some solutions, where the multiplication of $(x-4)(2x+1)^2$ was spoiled by an incorrect attempt to expand $(2x+1)^2$. It was rare to see errors on the differentiation.
Part (c) was far more challenging with very few correct responses. Many candidates merely found the *y* coordinate when $x = \frac{5}{2}$ without ever considering proving that the tangent at this point was parallel to the *x*- axis. Many who did consider the gradient did not prove that it was zero at $x = \frac{5}{2}$ or else took long winded routes in an attempt to find the tangent.
Part (d) however, was well done with many gaining marks even when they had not done so in part (c).