Examiners' Report
Principal Examiner Feedback

Summer 2024

Pearson Edexcel International Advanced Level
In Pure Mathematics P1 (WMA11)
Paper 01R

Introduction

This WMA11_01R paper was a very good test of the specification. Questions 1 to 7 proved to be the most accessible with questions 8 to 10 providing differentiation at the highest grades. The paper was of appropriate length with little evidence of students 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 equations especially when the question demands that they 'show using algebra' or 'show all steps of their working'. This was true in questions 2, 5 and 10 where some candidates merely wrote down answers.
- Candidates should take care when presenting solutions to questions and should show all steps clearly when solving a multi- step problem. For example, in Question 6(a) and (b) many candidates wrote down an answer following work that was hard to follow.

Question 1

This question was accessible to the majority of students with many gaining full marks. Only a few candidates attempted to differentiate so marks were generally lost for the following reasons:

- Failure to add + c to their solution
- Failure to correctly write $\frac{3}{\sqrt{x}}$ as $3x^{-\frac{1}{2}}$ and so not achieving the integrated answer of $6x^{\frac{1}{2}}$

Question 2

In part (a), almost candidates knew that they needed to expand the brackets before simplifying. The majority then went on to gain the correct answer. Slips were more common than expected with $-35 < -3x$ regularly being simplified (incorrectly) to $x > \frac{35}{3}$

Part (b) (i) was well known, with the majority of candidates simply writing down the solution, which was acceptable here. It is important to note that (b)(ii) started 'Hence' so it was vital for candidates to use the answer to (b)(i) and show some stage(s) of the working. Although the instruction was followed by most, a sizeable number started again using the quadratic formula or else reverted to using their calculators. This resulted in the loss of two marks.

Part (c) was also quite challenging where answers for (a) and (b) having to be combined. This involved the intersection of two sets which was completed easily by more able candidates.

Question 3

Part (a) was a straightforward question on differentiation and almost all candidates scored the 3 marks. Part (b) was more demanding with most scoring only the first of the 3 marks available.

Solving $6x - 24x^{-\frac{3}{2}} = 0$ and writing the answer as 2^k involved accurate index work. The easiest route was undoubtedly via $x^{\frac{5}{2}} = 4 = 2^2$ but many attempted to square, not being comfortable with fractional indices.

Question 4
The proof in part (a) was well done. Errors were rare and generally due to candidates missing out steps as opposed to not understanding how to tackle the problem.

Part (b) was less well attempted. It was very straightforward via the discriminant but many opted to go via differentiation and made little progress after finding $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{-2}{x^2} + 3$

Question 5
The factorisation of $9x^3 - 10x^2 + x$ proved to be more demanding than expected. Amongst many errors seen, resulting in a loss of marks, were

- candidates leaving their answer as $x\left(9x^2 - 10x + 1\right)$
- candidates solving the equation on their calculators and writing $x\left(x - \frac{1}{9}\right)(x-1)$

Part (b) was accessible to candidates who could not fully complete part (a). It involved linking the two parts by setting $x = 3^y$ and hence solving $3^y = "1"$ and $3^y = "\frac{1}{9}"$. Many candidates scored all three marks.

Question 6
This question tested the use of radians, and the formulae for the area and perimeter of a sector. It was attempted by almost all candidates and many were able to achieve all of the marks. A point made by many examiners was the number of scripts where it was hard to decipher the method used. It is important that candidates make their methods clear if they wish to achieve full marks.

In part (a) candidates were required to show that angle *AFB* was 0.433 radians to 3d.p. Whilst many easily achieved this, a few could not due to:

- writing down mathematically incorrect statements such as $\pi - 2.275 \div 2 = 0.433$
- using inappropriate accuracy $\frac{3.142 - 2.275}{2}$ which is not 0.433 to 3 d.p.

Part (b) involved finding the perimeter to the entrance of the tunnel. Whilst most could find the arc length by using the appropriate formula, many struggled to find the lengths *AB* and *DE*. Errors seen here included:

- assuming that angle *FBA* was $90°$ and then using Pythagoras' theorem
- correctly writing down the rhs of the cosine rule $6.4^2 + 6.2^2 - 2 \times 6.4 \times 6.2 \cos(0.433)$ but then failing to square root this

Part (c) involved finding the area to the entrance of the tunnel. Again, there were many excellent and well-presented solutions. Errors seen here included:

- assuming that angle *FBA* was $90°$ and then using the formula $\frac{1}{2}bh$ as opposed to $\frac{1}{2}ab\sin C$

- use of incorrect formulae for the area of a sector with variations of $\frac{1}{2\pi}r^2\theta$, $r^2\theta$ seen as well as use of an incorrect value for *r* including the calculation $\frac{1}{2}\times 6.4^2 \times 2.275$

Question 7
This question involved the coordinate geometry of the straight line. Once again there were many excellent solutions. Candidates do need to ensure that they read questions carefully as some marks were lost due to answers not being in an appropriate form.

In part (a) candidates were asked to find the exact simplified length of line *AB*. Slips in finding the coordinates of *B* were rare and many could then find the answer in the form requested. The correct answer of $2\sqrt{29}$ was sometimes left as $\sqrt{116}$ and occasionally written as 10.77.

In part (b), the equation of a line perpendicular to the original was required. Common errors seen by candidates not scoring full marks were

- not writing the answer in the form $ax+by+c=0$, where *a*, *b* and *c* were integers
- misinterpreting the gradient of $5y=2x+10$ as 2
- stating that the gradient perpendicular to a line with gradient $\frac{2}{5}$ was $\frac{5}{2}$ rather than $-\frac{5}{2}$

Part (c) involved finding the area of a rectangle *ABCD* with *AB* already having been found in (a).
Finding the coordinates for *C* was well done with many going on to multiply *AB* by *CD* to find the area. Many candidates who made slips in (a) or (b) scored 2 of the 3 marks.

Question 8
This question on integration, roots of equations and cubic graphs was discriminating. Able candidates found this accessible with many scoring full marks. Weaker candidates struggled to understand how the different elements in the question could be merged.

Part (a) involved integrating a factorised expression. Most understood that it needed to be expanded before integrating. Common errors seen in this part included

- slips in integration
- a failure to add a constant + *c* and hence no use of (4, 13) in its calculation

Part (b) required the expression to be equated to the form $(x-3)^2(Px+Q)$. This could be written down by able candidates but failing to have the + 45 in (a) meant that the two expressions could not be equal.

In part (c), candidates were required to sketch the graph of $y=\mathrm{f}(2x)$. Most were able to draw a cubic function but marks were lost here for

- omitting the *y* intercept of 45 from the graph
- failing to half the *x* intercepts when the graph of $y=\mathrm{f}(x)=(x-3)^2(2x+5)$ was transformed to the graph of $y=\mathrm{f}(2x)$.

Question 9
Candidates are usually less confident when using the tangent function than when using sine or cosine. This was certainly the case here and many found the question demanding. It gave the more able candidate a chance to show their skills however, and many of these were able to score highly.

In part (a) the number of roots of various equations were required. Most candidates found the correct answer of 3 in (i) but 150 and 3 were common incorrect answers in (ii) and (iii) respectively.

In part (b) many candidates failed to take into account the transformation and merely wrote down $a = \frac{\pi}{2}$. Others misapplied the transformation and found the value to be $a = \frac{\pi}{2} - \frac{\pi}{6} = \frac{\pi}{3}$ rather than $a = \frac{\pi}{2} + \frac{\pi}{6} = \frac{2\pi}{3}$

Part (c) was equally demanding with only the most able making progress. Fully correct answers were common amongst this group of candidates.

Question 10

Part (a) was a very accessible question at all levels but many candidates did not fully understand the demand of part (b).

Part (a) involved showing that the equation of the tangent to a given curve was $y = -3x - 2$. Many candidates scored all 5 marks. Marks were lost when candidates:

- could not differentiate $\frac{56}{x}$
- failed to show necessary steps and working when producing this given answer

Part (b) was challenging. Many candidates failed to start and could not produce the required equation $2x^2 - 25 + \frac{56}{x^2} = -3$. When this was found, marks were lost when candidates:

- resorted to using a calculator in this non calculator question
- failed to multiply through by x^2 thus not reaching a quadratic equation in x^2

There was however some excellent work seen from very able students who could produce concise and accurate solutions.