Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International Advanced Level
In Pure Mathematics P3 (WMA13) Paper 01A

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This WMA13_01 paper was a suitable test of the specifications for a prepared candidate. The paper was of appropriate length with little evidence of students rushing to complete the paper.

There were no questions that proved too demanding for the majority of students.

Points to note for future exams mainly revolve around these two sentences.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

For <u>ALL</u> questions, candidates should make their methods clear. Where questions start with the two bold sentences shown above, it should be a warning that using calculators to solve complex equations will result in the loss of marks. It is also vital to show the necessary steps on the way to solving the problem.

<u>Question 1</u>

This represented an appropriate start to the paper with a straightforward question on transformations. Almost all candidates scored 3 or more marks here with parts (b) and (c) proving the most difficult.

<u>Question 2</u>

This question on roots and iterative methods was also very accessible.

Full marks were common with reasons for losing marks being;

- In part (a) for failing to mention 'continuity' as a reason for the root lying in the interval $[1,2]$
- In part (b) for omitting necessary lines in the proof
- In part (c) for failing to round correctly

Question 3

This question, on the link between $\frac{dx}{dy}$ and $\frac{dy}{dx}$ was generally well received and produced many fully correct solutions. Most candidates knew the quotient rule and applied it correctly to the expression in y. Other methods were seen in part (a) including attempts at implicit differentiation or via division and the chain rule. Once a correct result in part (a) was established, many candidates were able to use the given information to find the coordinates of P. Common reasons for the loss of marks in this question were;

- mixing up $\frac{dx}{dy}$ and $\frac{dy}{dx}$ thus forming incorrect equations in y
- giving two different possible positions for P (not realising that only one was possible as it lay above the x-axis)

Question 4

This question on algebraic division and integration was generally very well done.

In part (a) most candidates attempted to find the values of the constants via division rather than via the identity $3x^3 - 5x^2 + 7x - 5 \equiv (Ax + B)\left(x^2 + 1\right) + Cx + D$. Proving that $D = 0$ was straightforward via division but much more demanding via the identity.

Attempts at the integration in part (b) were more mixed with many candidates failing to score any marks at all as they struggled to establish a correct form for $\int \frac{D}{x^2 + 1}\, dx$

Common reasons for a loss of marks in this question were;

- slips in division leading to incorrect constants, commonly $C = -4$ rather than $C = 4$
- poor attempts at integration with $\int \frac{D}{x^2 + 1}\, dx \to 2x\ln(x^2 + 1)$ or $k\left(x^2 + 1\right)^{-2}$ commonly seen
- failing to write the answer in the required form with $\frac{5}{2} + 2\ln 2$ seen rather than $\frac{5}{2} + \ln 4$

Question 5

Parts (a) and (b) were expected and candidates generally showed good skills in manipulating and differentiating trigonometric expressions. Part (c) was unfamiliar and proved to be very discriminating.

In part (a) most candidates used a correct method of differentiation and scored all 3 marks. Similarly in part (b), writing an expression in the form $R\cos(2x+\alpha)$ was performed quickly and accurately.

Common reasons why marks were dropped in the first two parts were;

- slips in differentiation where terms like $5\cos 2x$ were differentiated to $5\sin 2x$ or $10\cos 2x$ instead of a correct $-10\cos 2x$
- setting $\tan\alpha = \frac{5}{12}$ rather than $\tan\alpha = \frac{12}{5}$ in (b), thus reaching an incorrect result.

There were two main methods seen in part (c). The easiest and most direct route was via part (b). Differentiating the form reached in part (b) produced an easily solvable equation. Most candidates proceeding via this route scored 3 of the 4 marks, often failing to produce the larger value of 2.44, instead giving the smaller value of 1.10. Around 50% of the candidates chose the more difficult route via the derivative in part (a). The equation produced, $6=-10\sin 2x-24\cos 2x$, required manipulation before a solvable version could be found. Many gave up at this stage whilst other decided that it must be the same identity as part (b). Completely correct solutions via this route were rare.

Question 6

This question demanded a solid knowledge of differentiation. If candidates could not use the product rule of differentiation and know that $(2x-3)^3$ and e^{4x-2} differentiated to $a(2x-3)^2$ and $b\mathrm{e}^{4x-2}$ respectively, they were unlikely to score any marks in this question. Having differentiated correctly, they needed to possess good algebraic skills to produce the form $2(4x-3)(2x-3)^2\,\mathrm{e}^{4x-2}$. This skill was lacking in a significant number of candidates. In part (b), many candidates knew the process but mistakes were common and completely correct solutions were rare.

Common reasons for losing marks in this question were;

- incorrectly differentiating $(2x-3)^3$ to $3(2x-3)^2$ or e^{4x-2} to $(4x-2)e^{4x-2}$
- not finding exact values in (b), resorting to decimal equivalents instead
- giving the final answer as $g(x) \geq -27e$ rather than $-27e \leq g(x) \leq 0$

Question 7

Part (a) required candidates to show that $\sin 4\theta$ could be written in the form $\sin\theta\cos\theta\left(P+Q\sin^2\theta\right)$. This was answered well by the majority of candidates with many achieving all three marks. By writing $\sin 4\theta$ as $2\sin 2\theta\cos 2\theta$ and subsequent use of the double angle identities led the well - prepared candidate to the correct form of the answer. Of those candidates who did not achieve all 3 marks, marks were generally lost for;

- Incorrect identities being used for $\cos 2x$
- Slips in notation and/or bracketing errors

Part (b) was more demanding with one out of three marks a common score. As this was a proof, many candidates achieved the given result but made huge and sometimes incorrect jumps in trying to achieve it. Completely correct and concise solutions were rare and pointed to a high achieving candidate.

By contrast, correct solutions in part (c) were common. Marks were generally lost in this part for;

- using an incorrect identity with $\sec^2 x = \tan^2 x - 1$ regularly seen
- achieving only one of the two valid solutions
- incorrect use of a calculator with some candidates solving $4\tan^2 x + 5\tan x - 4 = 0$ without sight of any intermediate work

Question 8

This question based around functions and modulus was well done.

In part (a), candidates were asked to find $\mathrm{fg}(2a)$. Most found g $(2a)$ first and then applied f to the result. There were very few incorrect solutions to this part, with finding $\frac{3\times 2a-2a}{2a-a}$ sometimes written as $4a$ rather than 4.

Part (b) required candidates to find f^{-1}, the inverse function to f. Most candidates knew they were required to change the subject of the formula $y=\ln(2x-3)$ with the majority of these attempts being successful. To fully define a function (or in this case an inverse function) you require both an equation and a domain. In keeping with previous examination series, the mark for finding the domain was not scored by many, with lots of candidates unaware that it was required to be found.

In part (c) candidates were asked to sketch a graph of $y=|\mathrm{g}(x)|$. This proved to be more demanding than anticipated with many omitting the equation of the horizontal asymptote.

By contrast, there were many excellent solutions at part (d). Given that the larger solution was 8, candidates should have been able to solve $\frac{3x-2a}{x-a}=10$ with $x=8$ to find the value of a. Then using this value for a, the smaller solution could be found by solving $\frac{3x-2a}{x-a}=-10$. Errors were introduced when candidates were unaware which equation to solve and how to use the given information.

Question 9

This question, on exponentials, was set within the context of administering doses of antibiotics to a horse. Scores of 2 and 3 out of 7 were common with part (c) very demanding and requiring good problem-solving skills.

Part (a), however. was straightforward with many candidates scoring the two marks available. When marks were lost, it was usually for incorrectly substituting D = 30 and t = 8 into $x=D\mathrm{e}^{-0.2t}$

Despite part (b) being a proof with a given answer, 0 marks were common. Whilst most found a calculation that resulted in the answer of 17.5 mg, most of these were via an incorrect method. For example, whilst $20e^{-0.2\times8}+20e^{-0.2\times2}$ looked a plausible calculation, it was in fact incorrect.

Part (c) was probably the most demanding aspect of the whole paper. Dealing with the fact that the two doses were given at different times posed the biggest problem. There were many eloquent solutions to this however, for example via the solution of $30e^{-0.2\times(T+8)}+20e^{-0.2\times T}=10$ or $6.06e^{-0.2\times T}+20e^{-0.2\times T}=10$, showing a real appreciation of the problem. As a result, completely correct solutions in part (c) were relatively rare and an indication of higher- level skills.

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