Examiners' Report
Principal Examiner Feedback

Summer 2025

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

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Overall

There were three questions on the paper that cause substantial difficulty for the students (7, 9 and 10) particularly those at the lower grade boundaries (though question 9 was found difficult across the board). However, the other questions all provided many good access points with a variety of good solutions seen.

There is, however, still a propensity for students to overly rely on calculators, and thus be caught out when questions are set in which calculator use is not permitted. Learning basic skills such as solving quadratics without a calculator, understanding the role of discrimination, and such are expected and should be showcased by students.

Individual Question Report

Question 1

Many students were successful across all parts of this question, showing a good understanding of indices, though the simplification of the numerical fractions was not always carried out correctly. However, it was quite common to see x terms left in the denominator in parts (b) and (c), giving an answer which was not in the required form. A careful heed to the demand of the question is advised.

Almost all students scored the mark in part (a) for finding $p^{\frac{1}{2}}$, with the most common error being to square instead of square root, but that was only rarely seen. A lack of simplification was occasionally also noted.

In part (b) the majority were able to complete the manipulation of the coefficients and indices correctly. However, several students gave the answer $\frac{2}{5x}$ without showing the x^{-1}, losing the second mark for not achieving the form required. There were also numerous cases of incorrect working, failing to combine correctly or mistakes with the powers, $\frac{2}{5}x$ also not being an uncommon incorrect answer.

Although there were also many correct responses to part (c), this was probably marginally less well done than part (b). It highlighted the weak algebraic skills of some students, with pq^2 often interpreted as $(pq)^2$, leading to an incorrect answer of $\frac{25}{4}x^2$. Others failed to square 40 in the numerator of q, while there were also many errors with indices. As in part (b), the final answer was often given in the form $\frac{100}{x^2}$, losing the A mark.

Question 2

The differentiation skills on display were very strong with nearly all students able to successfully differentiate in part (a). In the very rare instances where error was made, it was generally a minor slip, but still scoring the method mark for at least one power reduced by 1.

Part (b) proved more challenging but most students were able to score the first two marks by correctly setting their part (a) solution equal to 16 and rearranging to one of the given forms. Solving the resulting equation was more variable in performance, and one place where resorting to solving on a calculator was often seen.

While the astute students were able to spot the most direct method of matching the powers of 2, some students used log work to find *k*. These often worked in decimals, and some lost the final mark due to giving *k* as a rounded decimal. A significant number of students tried to work with powers of 2, substituting in 2^k as well as equating to 16, but their indices work was sometimes poor, a frequent error being to write $5\left(2^k\right)=10^k$ and hence lose all three marks in this part.

Some students who had correctly arrived at $x^{\frac{3}{2}}=4$ and attempt solutions via taking logarithms went awry in the working, resulting in incorrect values of *k*. Few of these students checked their *k* values in the equation to see if it was correct. There was also a portion of students who did not pick up on the premise of the question and attempted instead to find the second derivative or even try integrating to get back to *y* and find a constant of integrations, though these were in the minority.

Question 3

A fairly routine question for most with majority of students scoring full marks. The majority recognised the need to simplify the expression by expanding and sorting out the powers, and were able to proceed to a correct answer A few students lost the final mark by omitting the "+*c*" from their final solution or for a minor slip in working. Single errors usually involved an incorrect term of the quadratic, usually $9x$ or $12x$ instead of the correct $6x$, though a few many a slip in just one power, with two terms in $x^{\frac{1}{2}}$ being the most common such mistake. A few lost track of the factor $\frac{1}{3}$, losing it completely or multiplying on the first term of the expansion by it, while others managed to successfully integrate initially only to make errors simplifying the nested fractions. Only a small number of students attempted to falsely "simplify" at the end by multiplying through to remove the fractions, but these were not penalised.

In cases where the integration was not successfully completed there were a number of reasons for this. Some managed to expand and simplify the expression removing the denominator but then stopped not completing the integration of their expression, thinking the job was done. Other students made an error in dividing their terms initially, failing to gain a correct power – for instance simply adding in $+3x^{-\frac{1}{2}}$ as a fourth term was a common such mistake. There were also many who integrated the numerator and denominator before division. Very few attempts with decreases instead of increases in powers were seen.

Question 4

There was a more mixed performance on this question than the preceding ones, with parts (a) and (b) generally being answer well, but students being much less confident in part (c), working out the numbers of solutions.

Part (a) was mostly successfully answered, though occasionally students would either give a non-zero y coordinate or answer in radians rather than degrees. A few had interchanged x and y coordinates. Cases of a completely incorrect x co-ordinate were rare but $90°$ and $180°$ were both seen as answers.

In part (b), many students were able to correctly spot that the graph stretched by a factor 4 to achieve $(x,-4)$, but some students multiplied the "x" coordinate by 4 instead usually obtaining $(-4\times\text{"their }x\text{"}, y)$ or even getting -4 but writing as $(-4, y)$, which was allowed for the method mark. A frequent error was the use of 4 or -1 instead of -4 for the y coordinate. It was also common to see the error of a sign slip on $-180°$ and coordinates were given the wrong way round, again condoned for the method. There were a small number of approaches that continued to use radians to obtain $(-\pi, -4)$, which could gain both marks if use of radians had already been penalised in (a).

As noted above, part (c) proved much more of a challenge for students, often being left blank by those who seemed unsure what was being asked of them. A considerable number tried to find solutions to the equations with no reference to the number of such solutions they could find, despite the key word "number" being in bold in the question. Those who did attempt the state the number of solutions had a plethora of response. Most successful was the 100 for (i), although answers of 200 or 50 (forgetting to double) were often seen. The other two parts were only rarely answers correctly. In (c)(ii) the most common incorrect answer was 8 where they did not realise there was originally only one solution, while 5 or 7 were also common, as well as various other numbers to a lesser extent. For (c)(iii) answers of 12, 6 and 9 tended to be common.

Question 5

This was generally another well attempted question with many fully correct responses seen, sign errors in finding the coordinates in part (b) being the most common cause of loss of marks, while part (c) was a challenge for some.

Part (a) was usually successfully completed with most able to rearrange the given equation and state the perpendicular gradient. Not all picked up on c being 0 straight away, as it went through the origin, but often arrived there after some work. Common errors in this part, included not making y the subject and just taking the coefficient of x as the gradient, or finding the correct gradient and then finding an incorrect value for c.

As long as a correct form for the equation was found in part (a), then the method in part (b) was accessed by most for solving the equation. They understood that they need to find the intersection point of the given line and the line they found in (a). The most common method was to make y the subject of the given equation and set it equal to their equation from part (a). Students using this method usually found the correct coordinates. A small but significant number of students who substituted their equation from part (a) into the given equation in the given form made errors in the rearrangement and found incorrect values. There were a few errors with negative signs, when solving the equations leading to $(5, -10)$ with other incorrect solutions being uncommon.

Part (c) was the part most students found most challenging. Those who realised the shortest distance is the perpendicular distance and had the correct coordinates usually scored full marks but many students did not appear to appreciate that the shortest distance was the perpendicular one and attempted longer winded method (and unsuccessful) methods Many of these students found the distance between where the given equation crossed the axes instead, or similar other incorrect approaches. Also, those who had the incorrect signs in (b) could not score the accuracy here even with the correct answer found, though many did score the method.

Question 6

Although there was a ramping in difficulty from this point in the paper, this question still produced many good responses, with most students generally appearing confident in using radians and the radian measure techniques. However, there were also many responses of a more mixed performance, for instance there were some attempts by students to convert the angle of 0.6 radians into degrees and later converted their answer in degrees back into radians rather than work in radians directly. Most students recalled the correct formulae to calculate areas and perimeters, but not all used the correct values in the formulae. Only a very few attempted right-angled trigonometry or Pythagoras.

The proof in part (a) was generally well attempted. Most students used the sine rule to calculate the angle *CAO* before finding the required angle by subtracting their angle *CAO* and 0.6 from π. The most common errors here were failing to take the inverse sine of 0.6399… to obtain angle *CAO*, before attempting the subtraction, working to too few decimal places throughout the working and when applying the sine rule, using $OC = 15$cm (instead of 17cm).

A few attempted to use the cosine rule to calculate *AC* first. This led to more errors, either through using the cosine rule incorrectly or by finding the correct quadratic equation but not justifying the selection of the positive root. In this method most went on to use the sin rule correctly to find *COA*, securing the method mark. Again, though most worked with a good level of accuracy keeping values to at least 3 decimal places throughout, a few only used two and so lost the accuracy. Also, some students used the cosine rule with the given answer $COA = 1.847$ to find *AC* and then used this in the sine rule to establish $COA = 1.847$. This type of circular argument scored no marks.

Failure to make any significant progress with part (a) did not prevent students making further progress with many such going on to answer both part (b) and part (c) with some degree of success.

In part (b) most students identified that they had to find the area of a triangle and a sector but not all were correct with the angle and side lengths used. A few approach it via the sum of the triangle, semicircle and sector, usually correctly. In general, the $\frac{1}{2}ab\sin C$ formula was used correctly, though a common error was to use both sides as 15. For the sector, most found the area of the major sector correctly, though some instead attempted the area of the minor sector and a few subtracted 1.847 from π rather than 2π and so could access at best one mark. Early rounding errors and lack of units meant some students failed to gain the final mark even with correct formulae used.

Again, part (c) was generally approached well. The length AC was found accurately in most cases, with the majority using the correct formula for the cosine rule, but some using the sine rule correctly with the given angle. Almost all students recognised the need to find an arc length, though again here a few found the minor arc or mistakenly used $(\pi - 1.847)$ for the angle. Another very common error in this part was that a significant number failed to add the extra 2, while omitting units on their answer was also relatively common though in most cases had already been penalised in part (b) so was not further penalised here.

Occasionally a misunderstanding of the word "perimeter" seemed to occur in responses which included the radii OA and OB in their answer.

Question 7

This question proved challenging for many, with the ability to set up an equation of the correct form at the outset the biggest stumbling block. Those who did recognise the correct form would often go on to successfully complete the question, but many were unable to make much progress due to the incorrect forms being set up in part (a)

In part (a), less than half of students scored full marks, indeed were even able to set up a correct equation. Only a few students understood that when a graph touches the x-axis, there would be a repeated root and correctly formed the expression $f(x) = kx^2(x-4)$, then used the given point (10, 120) to determine the value of k. Even in such responses variations on the form including $(x-0)$ brackets were often used. One common error was to omit the constant k and just give a function $f(x) = x^2(x-4)$. Another common incorrect solution was $f(x) = kx(x-4)^2$ (with or without the k). Others thought that $(x - 10)$ was a key factor in the form of $f(x)$ giving expressions such as $f(x) = kx(x-4)(x-10)$ (with or without the k).

Those who began with a general cubic form $ax^3 + bx^2 + cx + d$ rarely achieved a fully correct solution with most not getting beyond finding "d" as they did not consider f'(x).

Many did not even succeed in setting up a cubic equation but used a quadratic instead – unable then to make progress in part (c) as well. It was not uncommon to see, for example, $x(x - 4)$ as the final result.

Some incorrect solutions centred on finding a gradient and completing to a linear function, misunderstanding what was being asked for in the question. Occasionally these would revert to finding a cubic for part (c), but usually such attempts made little progress beyond possibly part (b).

Part (b) was the best answered part of the question overall, yet even here many did not give a fully accurate sketch, with about half of the students drawing a fully correct graph. Most students could get correct shape, an "Upside down" parabola, but the positioning was less well accomplished despite having attempted to work out some coordinates in many cases. There were numerous cases of U shaped parabola and many drew a second cubic function passing through points (0,0) and (8,0) on the Figure. Other errors at this stage were to have the graph passing through (4,0) again or failing to extend the parabola into the lower quadrants.

Success in part (c) generally depended on the answer to part (a). Those without a cubic equation were unable to make any progress at all, but those who did have a cubic were often able to score the first three marks of this part. Strong algebraic skills were evident, with most students successfully solving the system of equations (their cubic and the quadratic) to find coordinates of intersection points. Where the answer in part (a) was correct, they would often successfully achieve the correct non-origin coordinates, though a few students missed the (0,0) solution, suggesting minor oversights in factoring or root identification. Others discarded the negative solution, $x = -8$, or did not find values of y that would correspond to their x's. Occasionally the expression for C_2 was incorrectly multiplied out at the start of the solution and the B1 was lost. But if a quadratic was identified from the attempt at cubic = quadratic this was in the main correctly solved (most often by calculator, but many students did write out the formula for solving quadratic correctly).

Question 8

There were many completely successful attempts at this question, this kind of topic being favoured by students in preference to the work of question 7. However, there were a number or students who seemed confused about whether to differentiate or integrate at various points, meaning that working appeared in the wrong part of the question. Credit was given for correct work.

Most students were able to progress well in part (a), though a few set out from the start to trying and find an expression for f(x) before then differentiating again and trying to find k. Such attempts usually went wrong and often didn't continue into (ii) but skipped instead to (b) or (c). Those who could see what to do in (i) usually correctly showed $k = 4$, setting f'(4) = 10 with substitution shown and proceeding to simplify before reaching the answer. Occasionally insufficient simplification was shown before stating the given answer, while a common error was for f'(x) to be confused with f(x) and (4, 12) substituted after an attempt to integrate. Another noted error was to substitute 12, rather than 10, for the value of $\mathrm{f}'(4)$.

Part (a)(ii) was generally very well done with few errors, mostly arithmetical after setting up the correct equation. Incorrect approaches here tended to be from those attempting to find f(x) first. Example eroors include solving the equation $12 = 40 + c$ to give $c = 28$ or $c = \frac{12}{40}$ or similar.

For part (b) almost all students attempted to differentiate f'(x), usually correctly, albeit sometimes giving the answer still in terms of k. However, many did not proceed to substitute of $x = 4$, thinking finding the derivative was all that was needed and thus losing the final mark.

Again part (c) saw most students attempt to integrate f'(x) and gain at least one mark, with only a few errors in manipulating fractions, so usually scoring the first two marks, but not all proceeded to find c. A few again left their answer in terms of k, but were still able to access these first 2 marks. A few assumed c was the answer from (a)(ii), while others omitted it or just left it as + c. But the majority did realise the constant needed to be found and attempted to do so, though there were more algebraic errors in carrying this out than might have been expected, though most were able to deduce the correct value for the constant and to write down a correct expression for $\mathrm{f}(x)$.

Examples of errors made in this part include mistakes with the fractions, for example giving $\frac{1}{4}/3$ as $\frac{3}{4}$, miscopying, having integrated correctly, the term $\frac{x^3}{12}$ as $\frac{x^3}{2}$, and obtaining an incorrect value for the constant of integration, or carried out the same miscopy in their final line of working, after calculating the constant correctly.

Question 9

This question proved to be the most challenging question on the entire paper with many making little or no progress with it. The requirement to describe transformations has not often been tested on this specification and student seemed uncertain about them, while the algebra for part (b) proved beyond even some of the better students. There were more blank responses than in question 10, which may indicate timing issues with students intending to return to this question later but failing to find time to do so, or may simply be because students opted not to answer it as they could not see what to do.

In part (a) there was a plethora of answers given with students both seeming unsure about what the transformations were and with how to describe them. Many did not offer any answer at all, and for those who did correct mathematical language was seldom used, though for the method marks some tolerance was allowed with this. However, it did mean very few accessed the accuracy marks.

For part (i) many thought it was a translation rather than a stretch, while others described as a reflection. Those who did realise it was a stretch often did not use this work, or scaling or compression, which were also acceptable. But words such as “contraction”, “enlargement”, “magnify”, “squish”, “shrink” or “elongate” were all seen and accepted as conveying the right idea. Obtaining the scale factor was also not well attempted with many not giving a scale factor at all, and the factor often being given as 2 instead of $\frac{1}{2}$ for the x direction. Giving the scaling in the y direction was less common, but the factor was usually correct if done so (and given). Many students failed to give a description of the transformation at all and focused on the equations and the numbers within them alone. Responses such as “y halved” or “multiply x by 2” were common. Some simply stated “Transform in the x direction” or similar.

Part (a)(ii) was marginally more successful, though students showed a similar focus on the equations and the numbers within them again. Comments such as “Adding 12 to the function” or “Transformation by 12” were common but mention of “shift” or “move” were sometimes included to give access to the method. A few did give a translation vector, but these were rare, language such as “move up by 12” was much more common. Some students identified the translation but gave the wrong direction of the movement whilst others thought that it was a reflection in the x-axis.

Part (b) was the more successfully attempted part of the question but was still more challenging that other parts of the paper. Most were able to access some marks, though few scored full marks. The best progress was made in (i) where, as long as they could get started, students usually showed the process of rationalising, and the correct result then followed. But many could not see how to take out the common factor $\sqrt{x}$, while others did but then attempted to produce the required result without rationalising the denominator. A few attempted to square the equation and solve the resulting quadratic in $\sqrt{x}$, but these rarely justified the choice of root.

In part (b)(ii) many students simply produced decimal values for x and y. Some attempted to square the given expression for $\sqrt{x}$ but made errors with the expansion often not resulting in a surd answer. Having found x the majority of students substituted their found x value into $y = \sqrt{2}x$ which gave compounded roots. The simpler and more successful method of substituting $\sqrt{x}$, that was given, was taken by only a few and many either found just the x coordinate correctly before going wrong with y or obtained the correct y value correctly from the given information but failed to square the expression to get a correct x coordinate. Fully correct solutions were rare and a good indicator of high-grade students.

Question 10

After the challenge of question 9, this final question provided a bit of stability at the end of the paper for the better students, though was still very challenging for lower grades and discriminated well.

In part (a) the majority of students realised that the given equation was a quadratic in x^3 and attempted to solve it. However, some did not spot the hidden quadratic and were unable to make progress in the question. Those who substituted $"y" = x^3$ (or equivalent alternative variable) were often able to solve the resulting quadratic for "y" and gain at least 2 of the 3 marks. Most were then able to solve for x, giving exact answers, but there were occasional sign errors and decimal answers given. Some common errors made when students realised this was a hidden quadratic include: poor algebra using the substitution $x = x^3$ and subsequently forgetting to return to x^3 after solving; getting $x^3 = -\frac{1}{7}$ and then leaving x as a rounded decimal answer; concluding as the roots were negative there were no solutions. Examples of answers where a hidden quadratic was not recognised include incorrect attempts to solve the equation $7x^6 + 8x^3 + 1 = 0$ by trying to factor out an x^3 term, such as $x^3\left(7x^3 + 8\right) + 1 = 0$ or $x^3\left(7x^3 + 8x + 1\right) = 0$ or some other attempt at factoring x^3 which led to gaining no marks here.

Part (b) saw good starts but few good finishes, with many realising the discriminant was needed but few able to pick out the correct region for the solution. The majority recognised that this was a question requiring use of the discriminant, and the vast majority started out with the correct unsimplified form. Slips in expanding and simplifying were common, and the correct simplified discriminant was seen less often than expected. Even with a correct expansion of $b^2 - 4ac$, a significant number failed to deal with the negative coefficient of k^2 appropriately and so chose the inside rather than the outside region. The drawing of a quick sketch should be encouraged to determine if the inside or outside region is required.

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