Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International GCSE
In Further Pure Mathematics (4PM1) Paper 01

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Question 1

(a)
This question required candidates to demonstrate that the quadratic equation has no real solutions. This could be achieved through one of several valid methods: evaluating the discriminant and showing it is less than zero, solving using the quadratic formula and identifying imaginary roots, or completing the square and interpreting the graph's behaviour.

Surprisingly, the discriminant approach was not the most common method used. However, candidates who did use this method generally achieved full marks. Those who opted for the quadratic formula often failed to interpret the imaginary roots appropriately, omitting a concluding statement to explain the significance—thereby requiring the examiner to infer understanding. Candidates who completed the square generally performed well, often achieving full marks, although a clear and explicit explanation of the result remains essential in demonstrating secure understanding.

There were a significant number of candidates who substituted $t = 0$ to do this question, which was a misunderstanding of what it meant by the particle never comes to rest.

(b)
This part required candidates to differentiate the given expression for velocity and substitute $t = 4$. Most candidates who used this method correctly secured full marks. This was well-answered.

(c)
Candidates were expected to integrate the velocity function over the interval $t = 0$ to $t = 5$. Most candidates approached the integration correctly. However, a significant number of candidates lost marks during the substitution of limits or failed to evaluate the definite integral accurately, which affected their final answers.

Question 2

Full marks were rarely achieved. There were far more completely blank non-attempts than we would normally expect for a second question on any paper.

Candidates didn't seem to enjoy this question especially its positioning as Q2 on the paper.

(a)
The majority correctly calculated the lengths of AB & AC, but some neglected to mention that AB and AC were the same length (stating '[shown]' instead) and so lost the A mark.

(b)
This part caused some candidates problems. The midpoint was nearly always correct but when finding the gradient of AM, many candidates were seen making arithmetic mistakes. Many had a gradient of -1. Some put the x and y values in back to front and many couldn't sort out positive and negative numbers. The two main incorrect answers were $y = x + 1$ and $y = x + 11$.

(c)

There were many blanks after successful part a and part b. Some gained first two marks, by finding the equation of *AC:* $y = 5x - 13$ and others gained four marks getting as far as $y = -5x + 43$. Surprisingly some never got much further. Very few achieved full marks.

The most successful route through part (c) was the first method shown on the mark scheme—finding and equating the equations of *AC* and *BD*. However, this was not the most common method attempted by candidates.

Most common errors with this method:

- Calculating the gradients incorrectly for either *AC* or *BD* or both.
- Many achieved four marks for correctly finding the equation of the line *BD* but neglected to find *AC* and so could go no further.

The equation of the line *BD* was often found in amongst these methods—so a good number of candidates achieved four marks.

<u>Method 2 – Using only Pythagoras's Theorem</u>

Quite a few candidates found the equation of *AC* and so gained the first two marks, but these were far outweighed by those candidates who didn't.

Many gained one mark by finding an expression for the length of *AD* or *BD*.

Some attempted to link these with *k* and so could proceed no further.

<u>Method 3 – Using Trigonometry & Pythagoras's Theorem</u>

By far the most common method in trying to part (c) was using Trigonometry and Pythagoras.
This involved finding a value of *k* using the cosine rule and then substituting in the equation of the line *AC* into the expression shown above $(|AC| = k\sqrt{26})$. However, there were many different variants.

There were some successful attempts at this method, but there were far too many opportunities for a candidate to slip up, so very few got through to the result of finding a value for *x* and/or *y*.

A good number of candidates were able to find $k = \frac{13}{5}$, gaining 4 marks. Those who had not found the line *AC* usually stopped here.

Question 3

A generally well-answered question with a high proportion of fully correct solutions.

(a)

The majority of candidates were able to find the angle of $\frac{2\pi}{9}$, although there was a common mistake of not halving the perimeter given and ending up with $\frac{\pi}{9}$ and some who thought the perimeter was made of the sum of two terms. Most candidates worked in radians throughout. A small proportion of candidates gave an answer in degrees with no attempt to change back to radians, hence losing all marks in part a.

(b)

Candidates generally understood that they needed to find the difference between two areas, the area of the sector was calculated correctly consistently, however the area of the triangle was often miscalculated. Some using the non-trigonometric formula and some misinterpreting it for a different shape altogether. Many candidates did not progress once they had found the area of the sector, those who did generally correctly subtracted and doubled their results.

Question 4

(a)

This question was done well overall, with many candidates drawing all three lines correctly.
In some cases, one line was drawn incorrectly, resulting in either a smaller triangle or a four-sided shape.

A few candidates drew the lines for $3x+2y=18$ and $x+3y-6=0$, but failed to draw the third line. In such cases, they appeared to treat the ***y*-axis** as the third boundary, which led to an incorrect triangle.

Candidates were most likely to draw $3x+2y=18$ correctly, while getting the other lines wrong or omitting them altogether.

(b)

The majority of candidates either got this part correct or answered it correctly based on the lines they had drawn.

Some candidates drew a **quadrilateral** instead of a triangle. Although their reasoning may have been sound, they could not receive the mark because the required region had to be bounded by three lines, not four.

Others answered part (a) correctly but shaded the quadrilateral to the left of the shape—bounded by all three lines and the ***y*-axis**—instead of the correct triangular region.

A surprising number of candidates completed all the correct working for the final part, but then stated that the lowest value of P was $-\frac{3}{5}$, which was incorrect.

Question 5

(a)
A number of candidates simply rewrote the expression they were supposed to prove and then rearranged it, mistakenly believing this was a valid approach.

On the whole, many did expand the brackets correctly and earned the first mark. However, some candidates incorrectly expanded $-3\alpha\beta\left(\alpha+\beta\right)$ as $-3\alpha^2\beta+3\alpha\beta^2$, which meant they did not gain the final mark.

In these cases, almost none of the candidates identified their mistake and instead incorrectly concluded that they had completed the proof.

(b)
Overall, this part of the question was attempted well. Most candidates understood what they needed to do—find the sum and product of the roots and substitute them into the required quadratic equation. However, implementation often broke down when candidates attempted to compute the sum and product. A common mistake was using 3^2 instead of 3^3, and some divided by 3 rather than multiplying or dividing by the correct constant, such as $\frac{7}{2}$.

The final step of forming the quadratic in the format $x^2 - \text{sum}\, x + \text{product} = 0$ was usually done correctly. If a fully correct method still failed to achieve full marks, it was typically because the candidate omitted writing "= 0" at the end—though this error was rare.

Question 6

The responses to this question were very varied.

(a)
Many candidates correctly identified the value of B as 4 but did not recognise that they needed to take the square root of 4 to obtain $A = 2$. As a result, they often left their answer as $A = 4$.

Occasionally, candidates would correctly find the value of A, but then incorrectly state that $B = 2$. A small number made the mistake of treating $\frac{x}{4}$ as simply x, which affected their overall accuracy.

(b)
Many candidates began their response well, correctly identifying (or following through from earlier errors) the x-term and applying the correct method to find the coefficients.

However, some mistakes arose when candidates failed to recognise that the coefficient of $\frac{x}{4}$ was negative, leading to incorrect signs in their final algebraic expressions.

It was also common for candidates to forget to multiply their found expression by the value of A, which was essential to completing the method.

(c)
Overall, candidates were not very successful with this part of the question.

Very few reached the correct final answer using the required method. A few simply entered the expression into their calculator and wrote down the result. Some candidates managed to find the value of x but were unsure how to proceed with it. A noticeable number substituted $\frac{\sqrt{305}}{10}$ directly into their expansion, indicating a misunderstanding of the method being assessed.

Question 7

There were very few fully correct solutions to this question. It is still proving to be a difficult topic for all but the very best candidates. Many had no sign of k at all, leading to a maximum of 2 marks. Of those that did, very few realised $\frac{dV}{dt}$ was $-k$ and that $\frac{dh}{dt}$ was $-\frac{1}{60}$, which cost them two marks. The integration was done well, but a quite a few changed π to 3 during the process. The chain rule was stated by most and the substitution attempted but the lack of k was costly. The most common answer was $\frac{28\pi}{5}$ but with no negatives during their working at all and so 4/6 marks achieved.

Question 8

Most candidates attempted some or all parts of this question.

A small number misinterpreted the angle between plane VAB and the base $ABCD$, which led to limited progress.

Many candidates would have benefited from drawing separate diagrams for each part of the question, rather than relying solely on the one provided.

(a)
This was a 'show that' question, so clarity of method was essential.

Most candidates correctly started from $\tan 30° = \frac{VP}{6}$ and demonstrated the necessary rearrangement to obtain the required result.

A small number used longer, more involved methods, which were often valid, while others lost the accuracy mark by failing to show any intermediate steps in their working.

(b)
Many candidates successfully obtained the answer $2\sqrt{21}$, either by using
$VA^2 = \left(4\sqrt{3}\right)^2 + 6^2$ or $VA^2 = \left(6\sqrt{2}\right)^2 + \left(2\sqrt{3}\right)^2$

(c)
This part was generally answered well by those who had succeeded in part (b).

(d)
This part of the question proved more challenging, and many candidates failed to score any marks. A common misconception was the belief that the perpendicular from point D to line VA would bisect VA. Some candidates who found a correct method to calculate the length lost the final mark by expressing their answer as a decimal instead of in exact form.

(e)
Only the strongest candidates were able to reach the final part of the question successfully.

Many did not recognise which angle they were required to calculate. Even among those who identified the correct angle, some used incorrect values from part (d). Candidates with a valid method often lost marks by giving their answer as a decimal rather than in exact form.

<u>Question 9</u>
Most candidates attempted some or all parts of this question. Some made no attempt at this section, but those who did usually began with a correct differentiation of $f(x)$. Many were able to use the given coordinates of the maximum and minimum points to produce correct equations for finding a and b. However, a few candidates failed to substitute into $f(x)$ to find c, which resulted in the loss of the final accuracy mark. Candidates who failed to gain any marks typically substituted the coordinates of the maximum and minimum points directly into $f(x)$, which led to two equations in three unknowns. Others who only gained the first mark for correct differentiation often failed to use $f'(x)=0$ to form the necessary simultaneous equations. There was also a possible alternative method using integration, but this was not seen in any of the scripts.

(b)
(i) Many candidates successfully used the factor theorem to show that $(x + 1)$ is a factor of $f(x)$. A small number of candidates used algebraic long division in this part of the question instead, which was also acceptable.

(ii) Algebraic long division was used by most candidates to factorise the cubic expression, with few errors. Some used inspection effectively. It was rare to see the incorrect factorisation $(x+1)(x-3)\left(x+\frac{1}{2}\right)$.

(c)
Many candidates attempted to calculate the required area, although others left this part blank—possibly due to time constraints.

A common issue was failing to recognise that the area below the x-axis would be negative and should therefore be treated using the modulus to find the total area. Most candidates recognised that integration was required and used the correct limits, but errors frequently occurred in substitution and sign handling. Only the strongest candidates reached the correct final answer.

A very small number used incorrect limits or attempted a single integration between -1 and 3 without considering the sign change.

Question 10

Most prepared candidates scored all available marks in part (i) However there were some arithmetical errors leading to $\frac{59}{6}$ for a few candidates.

In part (ii), there were many fully correct solutions showing how the log work has improved in recent years. Most knew the power rule and change of base, but there was less success with the subtraction rule. A few ended up with a quartic and of those that did, few knew how to proceed. Some of the candidates committed simplification errors when forming the quadratic equation. Nearly all the applicants solve quadratic equations using the formula and are now showing working for this, so gaining method marks. Most of the candidates were unable to state the single correct value after solving the quadratic equation, and as a result, they lost the final A1 mark for that.

Question 11

Most of the candidates were able to solve for x by equating y to 0. However, some candidates were not equating the equation to 0 and had a difficult time solving for x.

For the volume of rotation, most candidates were able to use the correct equation and proceed to integrate as required using the correct limits. In a few cases 0 was used as the lower limit instead of 2. A common mistake was switching the limits, where 2 was used as the upper limit and b as the lower limit. Very few candidates made an integration error. Some attempted to solve the volume of revolution about the y axis and could only score at most 1 mark.

A few candidates did not square y, hence had a difficult time integrating the function.

There were a few blanks too. This might be due to it being the last question, implying a lack of time. A few errors were made, which deterred candidates from reaching the correct 3TQ equation. This included the wrong sign of 8, a plus instead of a minus, which led to a constant term in 3TQ of -58 instead of -42. Other errors included forgetting to include π on both sides. This led to a 3TQ in b and π.

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