Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International GCSE
In Further Pure Mathematics (4PM1) Paper 02R

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Question 1

Most candidates were able to successfully state a correct vector path or a correct un-simplified path including ***a*** and ***b*** for one of the required sides, followed by a simplified vector. There were very few working errors seen at this stage other than those who worked out an irrelevant side. Some candidates sketched the shape, but with *ABCD* in the wrong rotation.

The easiest way to draw the conclusion was simply to state that two relevant vectors were equal to each other, but a significant number of candidates then omitted to say that therefore, this was a parallelogram. If only stating that the vectors were parallel or the side lengths were equal, it was necessary to do more work and work with 2 pairs of corresponding sides or vectors.

There were also some scripts with additional working to calculate that the magnitude of the vectors was the same, even though this was already implied by the vector work.
There were occasional issues with poor notation, for example, without vector arrows.

Most students didn't use a diagram, even though it could have helped them understand the problem more clearly.

Question 2

(a)
Many candidates found point *R* correctly with (12, –1) a frequent recurring error. Almost all were able to secure the two marks for the gradients of the two perpendicular lines. The large majority went on to derive an equation for l. Both methods for finding the equation were equally popular. Of those who used $y = mx + c$, a small number lost the method mark through errors in finding c. Centres are encouraged to remind candidates that $y - y_1 = m(x - x_1)$ is a full correct unsimplified equation and is awarded the method mark more quickly. A small number lost the final accuracy mark for not putting the equation in the correct form.

(b)
Very few candidates failed to achieve the method mark for finding point *S* as this was a follow through mark – though there were instances of candidates setting $x = 0$ and also writing the co-ordinates of *S* the wrong way, the former meaning an incorrect method, which could then struggle to gain further marks.

There were a large variety of methods seen for finding the area of *QRS* though many perfectly correct, succinct solutions were seen, often following the drawing of a neat and accurate diagram.
The preferred method was finding *RS* and *QR*, although the determinant method (not on the specification) was frequently seen. Occasionally, if using this method, candidates forgot to include ½, or didn't show the minimum work in calculating their products and made an error.

In a few cases the other alternative methods were used effectively – especially the rectangle and subtraction of three triangles.

Question 3

Most candidates were confident working and using the associated formulae in radians. Work in degrees was possible, but more cumbersome. The formulae needed for this question, arc length, area of a sector and area of a triangle given 2 sides and the included angle were generally well-known, with many candidates achieving full marks.

However, a significant minority of candidates didn't reach $6\theta =$. A few who started with a correct line of $12 + \pi = 6\theta + 12$ managed to make algebraic slips and found an incorrect θ. A surprising number of candidates decided to calculate the length of the line AC using the cosine rule and then used Pythagoras to find the perpendicular to use the formula $\frac{1}{2}b \times h$. This was significantly prone to errors with varying values of θ used.

Although we were able to ignore subsequent working, candidates spent unnecessary time writing their exact final answer as a decimal. Work in degrees was the most likely to lose exactness and therefore forfeit following marks as an exact answer was required.

Question 4

(i)

(Candidates found this generally more difficult than part (ii). Of those successfully answering, the majority used the first ALT from the mark scheme. A significant minority of students didn't seem to recognise the sigma notation, with almost as many incorrectly deducing, this was an arithmetic series and using the formula with the first and last terms.

Many candidates used the incorrect value of n, often using six, if the main scheme were applied, or used a value of eleven, if the ALT scheme were applied. Both gave partial marks. Candidates employing the method awarded marks from the ALT scheme, were either generally very concise in their working and gained full marks or failed to be awarded further marks, once $a = 96$ was stated or implied.

(ii)

There were a significant majority of well-constructed concise solutions here. Where candidates did make errors, they often didn't show sufficient working to find r^6 or r. A very small number of students chose to eliminate r rather than a which was longer and more likely to lead to errors. Other errors seen included finding r^2 instead of r by taking the incorrect root.

Question 5

(a)
Generally answered well by an overwhelming majority of candidates. The remainder theorem, forming an equation, was the most efficient way to answer the question. A slight variation was to form and solve simultaneous equations, which just lengthened the time spent answering this part of the question. A significantly longer, but often well documented solution, was to complete long division. There were occasional instances of students assuming $c = 6$ and then showing that one remainder was four times the size of the other. This was not permitted, as is customary in a "show that" question on this specification.

(b)
This was also generally answered well, with an overwhelming majority of candidates identifying the required quadratic, most frequently using long division rather than inspection. It was pleasing to see candidates were generally showing the required working and not trying to work backwards from calculator work. The second two marks of the question were often where marks were lost, with an incorrect calculation of the determinant or not drawing a sufficient conclusion. Candidates who simply used their calculator to write down two complex roots rarely gained marks as they didn't explain what they'd written down.

Question 6

A large minority of candidates struggled conceptually with this question although the identification of the required angle was often correct. A few incorrectly calculated the angle between the diagonal edge and the base. Many realised that algebraic expressions or values were required for sides to make progress. Some incorrectly wrote, for example, $AB = 3x$ and $AD = x$

Other common errors included incorrect application of Pythagoras (adding when they should be subtracting) or squaring terms incorrectly (missing brackets).

A wide range of trigonometrical equations were used in the final step to find the angle, with all three right-angled triangle options used. Also popular was the use of cosine rule. Candidates who made the least progress or made most errors generally tended to not make use of the diagram.

Question 7

(a)
Many candidates wrote excellent concise solutions to this part of the question and work was of a greater quality than in recent years. If marks were lost it was often due to not stating "$A =$ " as required. Some candidates wrote " SA = " or "surface area = ".

Where candidates made errors in working, they were generally able to successfully recover these by making use of the given answer. Candidates should be encouraged to rewrite solutions when this occurs, so that their work is clear to read.

(b)
This part of the question was also generally well completed. Candidates generally differentiated successfully (it was required to differentiate $4x^2$ correctly with some latitude for the negative power term) and almost all candidates set this to zero and solved for x. Occasionally there were errors, including taking a square rather than cube root.

Unfortunately, a minority of candidates failed to substitute this value back into the correct expression for A to obtain the correct minimum value, even though this was explicitly stated at the start of the question.

Candidates who missed this part of the question tended to focus on the final stage, which was justifying the value as a minimum. Most knew to calculate the second derivative (and did so successfully) but final conclusions were occasionally insufficient to award the final mark. A calculation was not required (but had to be correct if completed), if arguing effectively that the second derivative had to be positive. However, as a minimum, candidates needed to state that their second derivative was greater than zero, or positive.

Question 8

Many candidates correctly used the product rule, but a surprising number (given that only a numerical value was required), completed incorrect simplifications or factorisations, which meant the final accuracy mark couldn't be awarded.

Those who failed to differentiate correctly did so through a variety of errors – incorrect use of product or chain rule, errors with powers or subtracting the terms being the most common.

Most candidates substituted $x = 1$ and for those who had made errors in differentiation or simplification, so long as there was some attempt to differentiate, this was the only mark that could be awarded.

Question 9

(i)
A significant number of candidates found it harder to attain marks, particularly all three marks, in part (i) compared to part (ii). Where this happened most frequently was in not presenting the final answer in the requested form, which was delivered most efficiently by using the method detailed in the main scheme.

The ALT approach frequently delivered an incomplete answer of 243^3 or another equivalent. The method used was split relatively evenly between the main and alternatives in the MS. A not insignificant number of candidates chose a very circuitous route, the most common of which was to employ a change in base of logs.

(ii)
Mainly students used the obvious change of base of logs, but occasionally we saw $\log_2 a$ or $\log_a 2$, which required greater work, but could lead to full or partial marks.

The solving of the resulting quadratics was generally good, but centres could remind candidates that, they should show their method here, as method can only be implied by a correct solution. A small number factorised incorrectly and still attained $\frac{1}{16}$, which could not be awarded credit, as the method was incorrect.

Generally, work on this question was stronger than in recent years.

Question 10

(a)
Almost all candidates were able to find the given constant b, showing sufficient working and continue on to find the constant a.

(b)
Generally candidates were able to list the required equation and gain this mark. Occasionally candidates lost the mark by simply listed the value $\frac{5}{6}$.

(c)
Most candidates were also able to gain this mark. The question demand was to list a coordinate, listing $x = \frac{2}{5}$ with $y = 0$ was condoned, but this was the minimum accepted.

(d)
Part d was generally done well by candidates using the formula for quotient rule. Candidates using the product rule had less success as the algebraic manipulation required was significantly more challenging. A minority of candidates who expanded the denomiator, were then unable to offer the justification required and of those who kept the denomiator as $(6x + 8)^2$, a few failed to describe sufficiently why the overall fraction was positive.

(e)
The success of candidates in this part of the equaation was much greater than in recent years. Where errors were made, this was either a lack of labelling or only one branch of a negative reciprocal curve drawn. And in curves not approaching asymptotes.

(f)
Completed well by many candidates, although, some restarted their differentiation in this part, invariably losing time they could've spent on other questions.

Question 11

Nearly all candidates managed to gain the first mark, with many adding the decimal unnecessarily. A small number of candidates unfortunately failed to write down the exact value first, choosing to write down a rounded decimal, which cost marks significantly in work throughout the rest of the question.

For the candidates who found the demand of this question difficult, this and the next B mark for stating the integral with the correct limits from 0 to 2 for the area under the curve were often the only marks gained.

A significantly differentiated set of responses was seen across part (b), with a pleasing minority of fully correct and well documented solutions. Candidates could be reminded that the area under a line is usually most easily calculated using the formula for the area of a triangle (in this case or sometimes the area of a trapezium). The equation of the line integrated along with the substitution was significantly harder in this question than doing so, though a minority of candidates were impressive in accomplishing this correctly.

The differentiation of $3e^{x/3}$ provided a challenge for many, with many incorrect versions. Candidates sometimes left the gradient in terms of x for the gradient of the normal at $x = 2$, but a value was required here (exact not decimal), to find the equation of the line and hence the x-intercept.

Those candidates who successfully differentiated $3e^{x/3}$ often also integrated correctly overall, and it was pleasing to see the correct answer, after explicit substitution appearing much more regularly than in recent years. This allowed marks to be awarded, even if the integration was not quite correct.

It often helped candidates knowing what they were aiming for as the format was given in the question with the same coefficient W on all 3 terms. This unfortunately led some candidates to produce a correct answer from incorrect work.

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