Examiners' Report
Principal Examiner Feedback

Summer 2025

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

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Introduction

This paper was a little more accessible that previous series, with candidates gaining a higher mean mark than in 2406. Having compared the papers, I had concluded that perhaps two marks extra might be expected, based on the nature of questions, the depth of enquiry and the coverage of the syllabus. As it turned out this was an underestimate, but actual results served to confirm that the paper did provide a fair and robust test. Consideration of answers presented across a range of ability showed that there are a few recurring themes. Students do not always read what is expected of them and set out to achieve an answer when one has been provided that they have been asked to confirm. Setting out to "show" that a certain value is correct is a different skill than finding that result and demands more effort and exactitude in working. Students need to be shown the difference.

Rounding errors tend to creep in where candidates are less sure of themselves. Often handling fractions appears to be difficult, and candidates reach for a calculator. However, exact answers can often then be sacrificed, along with the associated marks. Students need to be able to identify when an exact answer is required. They need to realise that resorting to a decimal value, unless it is of finite length, inevitably loses the exact nature of any result.

They also need to recognise that as soon as they resort to the calculator, they risk losing all further marks, as once exactness is lost it cannot be regained, and their working will necessarily be less exact too.

There were a number of quite outstanding papers produced by students in this cohort, and I had the privilege to mark a few as whole scripts where marks into the high 90s were gained. These students are to be commended.

Question 1

A very accessible start to the paper for three marks, proved a successful start of most candidates. They needed to rationalise the denominator of an expression involving $\sqrt{6}$. Only a few failed to spot the need to multiply by a unit quantity in fraction form that moved the surd from the denominator to the numerator.

We also asked for the answer with a prime number in the denominator, and the largest number of marks lost were from failing to cancel down from 58 to 29.

Question 2

A more substantive second question involved an arithmetic series where we provided the third and fifth terms. Most students could derive the formula for an individual term in the series and gained the first three marks.

We also put a minimum value on the sum of a certain number of terms and asked students to find that number. A good deal of success was found, with the small number not achieving full marks nevertheless attempting the sum correctly. This resulted in a 3TQ to be solved which had one positive and one negative root. Some candidates failed to reject the negative solution as impossible. Others failed to round up the value of 9.8 to a more "sensible" 10 terms in the arithmetic series.

A few not quite getting that far also dropped marks for not implementing an inequality with the given minimum sum value.

Question 3

(a)
This question invcolved a particle, where we wanted to know the times at whichit was at rest, the distance treavelled between these times and the time at which accelleration was zero.

Almost all candidates resolved the zero acceleration part correctly.

(b)
Points where the particle was at rest were also found by a large majority. Solutions to the 3TQ which this required took various forms, probably because the coefficient of the quadratic term was 2, rather than 1. However, the two required times appeared on a pleasing number of scripts.

(c)
Finding the distance travelled required integration of the given expression for velocity. There were few errors here. The resulting expression then needed to be evaluated at the two times found in (b). This worked most neatly for those able to manipulate fractions with confidence, with the final value of $-243/8$ M being found by many. Others resorted to decimals but gained full marks as $-243/8$ could be accurately expressed as -30.375.

Some candidates lost the final mark for not converting the negative value their had calculated into a positive one in order to indicate the distance. Students should be encouraged to consider whether positive or negative answers are required.

Question 4

(a)
Here we presented students with two lenghts of sides of a triangle and one angle. We effectively asked them about the remaining values in the triangle. The first part required use of the sine rule to find two possible values for a second angle.

Most candidates managed to find the first of these, but many did not continue to find the second angle. Such candidates scored 3 out of 4 for this part.

(b)
We then asked for the length of the shortest possible line to join the two for which we had provided values. This required selection of the correct of the two angles found in (a). It also required correct application of either the sine rule or cosine rule with the correct values, one of which was the third angle in the triangle, only achievable by subtracting the given initial angle and the found angle from (a) from 180.

Many candidates worked out the two possible values for this thrid angle, and the lenths of lines associated with each. They then settled on the shortest one, thereby gaining full marks.
More astute candidates used logic to determin ewhich angle to choose and as a result calculated only one length, again the correct one.

However, many candidates used one of the values from (a) in their sine rule or cosine rule equation, and gained only one of the three marks.

<u>Question 5</u>

The majority of students found this a straightforward question and scored the full 7 marks.

For those who dropped marks there was no really prevalent error. Most students understood the question as dealing with a physical shape with length and breadth, but a disappointing number accepted the possibility of a negative value for x.

Many of the marks lost arose from manipulative slips. Most managed the quadratic element correctly, and were able to factorise the 3TQ, but a curious number got the expression for the perimeter wrong or failed to properly manipulate the inequality.

<u>Question 6</u>

(a)
Most candidates began by subtracting the position vectors for A and B although a few added. The majority then understood the need to use Pythagoras' Theorem, reaching a quadratic and attempting to solve. The majority formed a 3TQ=0 although a significant number completed the square. Solving the quadratic was generally well attempted, either by factorising or use of the formula.

Others went straight to the given solutions, thereby losing the last 2 marks, as they had been asked to show that the two values were the correct one.

(b)
Generally well answered. Students understood the need for a value for the magnifute of the vector, in order to divide to reach a unit vector. A few failed to cancel by 2 to reach a simplest expression, losing the A mark while others just divided the given vector by 2, scoring no marks.

(c)
Many candidates scored all 3 marks, with the large majority using the path through O, with only a small number choosing the equally valid route via B.

Students were told which value of p to use. Those who used the incorrect value of p often scored 1 mark.

Question 7

(a)
Genarally correct for both marks with just occasional slips usually on the values at 3 or 3.5

(b)
Most candidates attempted to plat the correct points they had calculated in (a). Most did so correctly. However, were mistakes were made a recurring issue was placement in the x-direction, rather than the y-direction. I am convinced that this was because the values on the x-axis were printed on top of the squates of the graph paper. More care needs to be taken with design, as this was a factor impacting those with any sight impairment. Our papers must be accessible.

(c)
This part proved a real challenge for many students. Weaker candidates often began by taking logs to base 3, scoring the 2nd M mark and then little more. Others tried various approaches, sometimes gaining 1 or 2 of the M marks. Good candidates usually succeeded in reaching the linear form as $y = mx + c$, going on to draw the correct line and reading off from the graph. A number then lost the final mark through failing to correct to 1 decimal place.

Others, despite finding a value for the vertical intercept, proceeded to draw a line with the correct gradient, but through the origin rather than through (0, -2).

A small number of candidates did not attempt the linear equation in the normal form but used an exponential form to plot y values and and achieved the required straight line.

Question 8

(a)
While many students tackled this part well, a surprising number failed to differentiate to find the gradient function for the curve, usually scoring just the 2 B marks.

Students should be encouraged to consider the nature of any function presented in a question. Usually, with a straightforward polynomial, we will want them to differentiate, or to integrate, or to do both. The bility to demonstrate these skills is central to success in the qualification.

(b)
Good candidates achieved both expressions with just a few lines of working while others could spend half a page making little headway. Those who fully expanded the quartic rarely made any progress. Marks lost for bracketing errors were frequent, here and elsewhere in the paper.

(c)
Many candidates made a reasonable attempt at this part, scoring most of the marks. The lack of brackets, particularly when finding the product of roots, led to lost marks for a number of candidates.

Most candidates understood how to form the final quadratic although some omitted the final "=0".

Question 9

The last three questions on the paper were, as expected, the most challenging. Almost one third of candidates got full marks here, but almost one quarter achieved two marks or fewer.

(a)
Genarally this exercise in demonstrating differentiation of a complex term was well attempted. Terms were written in various orders, but the majority of students managed to regroup these into the required form.

(b)
This part called for a sophisticated derivative of a quatient containing polynomical and trigonomtric terms. Most attempted it with a clear demonstration of the quotient rule. A small number recast the given term as a product with a negative exponent and then used the product rule. Success rates were similar, as either approach showed an understanding of what was required.

Students then had to show the value of the normal to the given curve at a particular value. It was possible to substitute the given value for the point on the curve immediately after differentiating, but more success was achieved by students who took the time to simply the derivative first. Some who found the substitution too difficult to resolve simply aborted the question.

Those who managed to complete the substitution then demonstrated the understanding of the need to find the negative reciprocal of the tangent in order to reach a value for the normal.

Question 10

This was one of the two highest tariff questions on the paper, and proved very challenging.

(a)
Five marks were available here for accurate rearrangement of trig terms to demonstrate two identities. Students were advised to consult the formula sheet in the exam paper, and both identities involved a double-angle term.

We were expecting them to use the given formula $\cos(A+B)=\cos A\cos B-\sin A\sin B$ having substuted a second A for the B.

Too many of them went directly to $\cos 2A=\cos^2 A-\sin^2 A$ without establishing the equivalence of this expression, and without realising that this form does not appear on the formula sheet. Marks were lost as a result.

Those who achieved the first identity almost all achieved the second as well.

(b)

Almost all candidatesrealised that since were needed the intersection of $y=\sin x$ and $y=\cos 2x$ the first step was to equate the two terms. Not many then seemed to realise that substituing a rearranged version of one of the identities in (a) would yield a quadratic in $\sin x$. Those who did, could then solve the resulting 3TQ and identify which of the possible roots was the correct one.

Some failed to find the full co-ordinates required. Others lost marks by working in degrees rather than radians.

(c)

The final part required students to find a volume of revolution involving the given curves. This also required manipulation of the double-angles.

Some students insisted on continuing with their work in degrees. Whilst not strictly incorrect, this added a complication that meant many answers ended in grief.

Those able to spot that the identifies in (a) still had a role to play here tended to emerge with a correct solution, although only 9% of candidates managed full marks.

Students should be encourage to pay careful attention to given expressions in a question. Very often, these expressions, or a simple rearrangement of them, will occur again in later parts of the question. We are attempting to provide some support for the later parts by providing the initial expressions. They are there for a reason.

Question 11

This question was designed as the least accessible on the paper, and so it proved.

Just over 40% of candidates failed to achieve a mark, with many not attempting the question at all. A further 31% gained just one mark, most because they had realised that a chain rule for differentiation was required, and they had written an expression that would have formed the basis for a fuller answer.

Having said that, over 16$ of students achieved full marks on the quesiton.

We had presented a hollow right circular cone, resting on its point, and filling with water. We showed the dimensions of the cone in terms of its horizontal hight and its radius.

The key to solving the question lay in realising that whilst the full size of the cone had height 4m and radius 3m, this ratio of 3 : 4 held true at all levels of filling of the cone, and that therefore the radius, *r*, could be substituted for the height, *h*, with scaling in the expression for the volume of the cone and its contents.

Many students replaced the value for *r* and then differentiated with respect to *h*, or vice versa, but those who realised that a substitute expression would work better went on to find the nicely rounded final value of 4 metres per second.

So, the workings were relatively simple, the demand in the question lying in working out how to relate the various given parameters.

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