Examiners' Report/
Principal Examiner Feedback

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Pearson Edexcel International GCSE
in Further Pure Mathematics (4PM0)
Paper 01

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Question 1

Part (a)

This was generally well answered with most candidates opting to use the more obvious formula $A = \frac{1}{2}ab\sin C$, though too many went straight from $A = \frac{1}{2} \times x \times x \times \sin 60$ to the given result, losing a mark as it was essential to show where $\frac{\sqrt{3}}{2}$ came from. A smaller number of candidates chose to find the height of the triangle in terms of *x* using Pythagoras theorem, and then used $A = \frac{1}{2} \times \text{base} \times \text{height}$. Candidates should note the word ‘show’ very carefully and make sure that every step towards a given result is clear and seen.

Part (b)

This was, as in past similar questions, not as well answered with many candidates not knowing where to start. Those that had a grasp of connected rates of change and use of the chain rule usually went on to score full marks. Some candidates confused themselves by introducing *l* for the side of the triangle so they then had to contend with a fourth variable, which inevitably led to a lack of success.

Question 2

Quite a few candidates answered parts of the question in the wrong places, and credit cannot be given when work is not given in the correct part of the question, as it is not clear to the examiner that the candidate knows what they are seeking to find. Most commonly, candidates were differentiating the expression for *s* almost in automatic pilot throughout parts of the question regardless of whether it was required or not.

Part (a)

Approximately half of the candidates realised that the height from which the stone was thrown was when $t = 0$. Candidates should be looking at the allocation of marks for a hint of the amount of work involved in any particular section. In part (a), the answer was worth one mark so that is an indication that the answer can be written down virtually without working.

Part (b)

Many candidates differentiated the given expression for *s* correctly, but then failed to write down the initial velocity (from using $t = 0$), thus losing the A mark. Because this problem had constant acceleration it was perfectly possible to answer this question fully without calculus and there were several attempts to do this using *UVAST* equations (which is beyond the specification, but perfectly acceptable). However, unless a candidate left their solution for *t* from putting $s = 0$ and finding the total time in their calculators as an exact answer, they ended up with an inexact value for the maximum height which also lost the A mark.

Part(c)

This was again a single mark answer and some candidates did indeed derive the acceleration from their $\frac{\mathrm{d}s}{\mathrm{d}t}$ as was intended, but many just wrote down 9.8 m/s^2 because they knew this was the acceleration due to gravity. This was acceptable for the B mark in this part of the question

Part (d)
Those candidates who had interpreted the question correctly were able to answer this part within three lines of working. There was some incorrect calculus with some candidates integrating and some finding the second derivative of *s*. This part was also answered by a good number of candidates using $v^2 = u^2 + 2as$. The solution is slightly more involved than using calculus, but it is a valid method, though they had to carry forward their value for *u* here from part (b).

Question 3
There were many completely correct responses. A generally well answered question, though once again many would be well advised to show every step in their methods clearly in 'show that' questions.
Parts (a) and (b) were very well answered with very few incorrect vectors.

Part (c)
Most candidates opted to go the slightly longer way around as the vectors $\overrightarrow{OS}$ and $\overrightarrow{BR}$ were easier to define that the vectors $\overrightarrow{SC}$ and $\overrightarrow{RC}$. It was clear from the responses that either a candidate could manipulate and understand vectors or they could not, in which case they achieved no marks in this section. Otherwise, the number of fully correct responses was in the large majority. Credit was given for the last mark for those candidates who referred to the vectors as parallel, or as minimally acceptable just the word 'shown'. A conclusion however minimal was nonetheless required for the final mark in part (c).

Part (d)
Virtually every candidate who got as far as part (c) correctly also achieved both available marks here. The method mark was allowed for follow through from parts (b) and (c).

Question 4
Approximately half of all candidates gained all 3 marks in this question. The majority of those who did not, converted the given angle in radians into degrees, making the question much more complicated. Part (a) was worth one mark, and even if candidates used the correct formula in degrees with the correct angle in degrees (which was not exact – 103.132..°), they often failed to achieve an exact answer. Credit was however, given for answers which rounded to 9.0.
Some candidates confused the formulae of the arc length and the area, and the most common error in part (b) came from using the incorrect formula $A = r^2\theta$. In order to achieve the M mark in this part candidates who opted to use degrees had to use the formula $A = \dfrac{\theta}{360}\pi r^2$ with a correct *r*.
Some candidates were uncomfortable using radians, despite that fact that this question could easily have been answered by writing down the length of arc and area of the sector almost without working.

Question 5
This was the lowest number of full marks achieved among all 10 questions; very few correct responses were seen, although many managed to draw the three lines accurately and identify the region given by the inequalities.

Part (a)
A few candidates were unable to draw the 3 straight lines, a major problem being reliance on the sole strategy of seeking intersections with the axes, which for only $y = -x - 1$ gave both points; the other two lines giving only one intersection on either the *y* axis or the *x* axis. Given that most candidates are using graphic calculators, it was surprising how many failed to draw the correct lines.

Part (b)
When it came to finding values of P, only a minority realised that they needed to consider the vertices, and of those, very few knew that for a full solution they needed to test all three. Of the minority of candidates who had interpreted the question correctly, most achieved either the greatest or least, but only a very few found both, and even less found all three values. However, full marks were given to those who correctly identified the maximum and the minimum values of *P* only.

Question 6
This question was very successful in discriminating the middle to high ability candidates.

Part(a)
Most candidates were able to manipulate the logarithms successfully mainly by using logs, usually in the base 3.

Part (b)
Those students who managed to convert $9^y = (3^2)^y = (3^y)^2$ also found the correct 3TQ and were able to proceed to the correct final solution, finding both roots in virtually every case.

Part (c)
This part of the paper discriminated between candidates very well. The first method mark was available for converting 6^x into $3^x \times 2^x$. Only a few candidates achieved this, but of those the small minority who were able to factorise the expression completely found a completely correct final solution.

Question 7
A good number of candidates gave completely correct answers to both parts of the question, with abundant evidence of proficiency in integration and algebraic manipulation.
Part (a)
The focus of this part of the question was knowledge of calculating volumes of revolution by using calculus. Therefore, only a limited number of marks were available in part (a) for just for demonstrating integration. It was necessary for candidates to use a correct formula and to interpret the problem correctly. A few candidates confused parts (a) and (b) and subtracted their volume from that of a cylinder or cone. On the whole, this was answered well.

Part (b)
The focus in part (b) was the area between a curve and a line. As before, this was a well answered question, but there were candidates, possessing state of the art calculators who just wrote correct answers down (for both parts of the question) without showing any working.

Question 8
Part (a)
There were many completely correct responses in this part of the question. Most candidates were able to apply the given identity for $\tan\theta$ and also remember and apply the identity $\sin^2\theta + \cos^2\theta = 1$. Full credit was given for both applied correctly, although it is worth reminding candidates that a full method must in evidence for a 'show' question.

Part (b)
This was a little more demanding so there was slightly less numbers of candidates successful here. Candidates starting from the LHS or RHS were in equal measure, either method being completely acceptable. There were some excursions into trigonometry using needless identities such as $\cos 2\theta = \cos^2\theta - \sin^2\theta$. In general, those candidates who realised that the result in part (a) should have been used in part (b), were successful.

Part (c)
This was the least well answered part of the question and it discriminated well between middle and high ability candidates. There was an obvious link in this part from the two earlier parts and unsuccessful candidates employed some very inventive trigonometry (to no avail) when they should have looked at the given results for the earlier parts, particularly part (b).
Those candidates who successfully formed the 3TQ then went on in nearly every case to give two correct angles in the given range.

Question 9
The remainder and factor theorems were clearly very well known to the vast majority of candidates, many scoring full or nearly full marks.
Part (a)
Almost every candidate scored full marks in this section. The only occasional errors were in sign slip ups when solving the simultaneous equations.

Part (b)
Again, virtually every candidate was able to divide polynomials correctly and accurately, achieving the correct quotient without a remainder.
The only regular error that was seen was the failure to factorise f(x) correctly by missing out the factor of 2, either separately or embedded in one of the algebraic factors. This did not affect the solution of f(x) = 0 and in the final part of the question virtually every candidate achieved all three roots correctly.

Question 10
This question was probably more accessible, and more successfully answered, than most recent long questions in coordinate geometry.
Parts (a) (b) and (c) were answered easily and accurately by the majority of candidates who had reached this far in the paper.

Part (d)

This was sometimes omitted completely and some candidates clearly lacked the understanding that a right angle triangle sits in a semi-circle, mainly because they had not drawn a diagram. Here, as in later parts of the question, a simple diagram would have made it obvious which length was required, as unsuccessful candidates were looking for *AB* or *BC* again.

Parts (e) and (f)

Many candidates attempted to remember and use the formula for the proportional division of a line, where the use of a sketch and simple counting, or the use of vectors would have found the coordinates of *P* and *Q* quicker and easier, though finding point *P* was far more successful than point *Q*. A simple sketch would have made it obvious that the *y* coordinate of *Q* could not be anything other than 3.

Part (g)

The most usual way for candidates to verify that point *Q* lay on the line *BC* was by finding the equation of the line segment *BC* and testing the coordinates they found for point *Q*. Many candidates scored two marks here for the line alone. However, point *Q* was only found correctly by a few candidates, so the final mark in this question was lost.

Other methods included finding the midpoint of *BC*, comparing the gradients of *BQ* and *QC* or indeed verifying that the lengths of line segments *BQ* and *QC* were equal.

Centres should encourage their candidates to draw a clear labelled diagram, which is essential in any question on coordinate geometry.

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