Pearson

Examiners' Report

Principal Examiner Feedback

Summer 2017

Pearson Edexcel International GCSE
In Mathematics B (4MP0) Paper 02

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The two papers here were fairly well matched in difficulty. Candidates scored slightly better on paper 2 compared with paper 1. However, it is impossible to know whether this was due to paper 2 being slightly more accessible or due to there being an extra week available for revision, specifically targeted at topics not tested on paper 1. Perhaps the inclusion of log equations on paper 1 caused candidates to omit log theory from their final revision and hence find the final question to be harder than it really was. Candidates should be reminded that any part of the specification can be tested on either paper, or sometimes even both.

Candidates must also remember that, as stated on the front of the paper, "without sufficient working, correct answers may be awarded no marks". This is always true in a "show" question but can also happen in other questions, particularly if the word "hence" appears where a link to a previously obtained result must be shown to justify the "hence" demand.

There were fewer cases of incorrect rounding or use of incorrect angle units than are often seen. However, far too often candidates were seen to be using a previously rounded answer in further working, thus losing accuracy

Question 1

Most candidates were able to accurately draw the three lines required often using tables of values of coordinates. However a number of candidates failed to draw one of the lines correctly, usually either $y = 2x$ or $2y = x - 2$.

There was less success in identifying the required region *R* with a number of candidates over-extended their shading to include the complete area enclosed by the three lines.

Maximising the objective function *P* proved to be a mystery for a great number of candidates, suggesting there had not been much practice in this type of exercise. Many assumed that the required point would have integer coordinates, leading to the wrong answer, with *P* = 8 or 10 being common incorrect answers. Almost half read the values from the grid and gave various results for $10.5 \le x \le 10.8$. Only a few candidates were able to work out the greatest value of *P* by solving the correct two simultaneous equations.

There were, however, a number of completely correct solutions.

Question 2

Most candidates realised that the equations had to be solved simultaneously and very many candidates obtained full marks in this question. Solutions usually took the simpler option of eliminating *y*. Solving the resulting quadratic equation was well understood though the formula method was commonly seen.

A number of candidates chose to eliminate *x* and obtain an equation in *y*. This resulted in greater algebraic manipulation and accordingly this approach was generally less successful. Some stopped at $y = y^2 - 16y + 60$ and then solved just the right hand side = 0.

Question 3

Most candidates were able to use the discriminant to form an inequality in part (a). A significant number of candidates, however, showed a lack of understanding of how to solve a quadratic inequality. It was very common to see a correct solution obtained from incorrect working.

In part (b), many candidates, having formed an inequality correctly, simply took the square root of both sides without including $\pm$ and lost part of their solution. Some candidates did not switch the inequality sign while trying to divide by -4. However, they gave correct integer answers from incorrect working and hence only lost the final A mark. A small number of candidates omitted zero from their list of integer values and also lost the final mark. Many did not give any integers at all.

Question 4

This was generally a well answered question, with most candidates able to at least score some marks, and a significant number able to get full marks.

In part (a) most candidates knew that they had to differentiate to find acceleration and very few errors in differentiation were seen. Some candidates just substituted 2 into the given expression for velocity but this was rare. All but the very weakest candidates gained full marks.

There were more candidates who did not know that integration was required in part (b) than understood part (a). Only a few candidates used the initial conditions to determine the constant. Many candidates either ignored the existence of the constant by substituting $t = 3$ directly or used the definite integral approach.

Question 5

The majority of candidates were able to start this question with a correct application of the cosine rule in one form or another, but more often than might be expected were not able to simplify it accurately, with marks lost for basic errors with the subtraction of negative numbers. There were some cases of candidates attempting to use the sine rule.

Candidates who obtained the correct solutions for their quadratic equation generally identified a single, valid value for *x*, either explicitly in part(a) or by implication in part (b). Most candidates who had achieved a value for *x* were able to obtain the area of the triangle by a valid method. The majority of candidates gave their answer to part (a) to the required degree of accuracy. The most common error, however, was to substitute the rounded figures obtained in part (a) into their equation for finding the area of the triangle. This frequently led to the loss of the final mark for accuracy in part (b).

Question 6

In part(a) many candidates started their expansion with a ‘1’, missed out the binomial coefficients 6,15,20, or gave an expansion in terms of powers of $\frac{qx}{p}$ or with no terms in *p*.

Some did not simplify their expansion, leaving the brackets around $(qx)^2$ and other powers. Part(b) was found to be one of the hardest parts of the paper with few fully correct solutions and most not getting the solution $p=-10,\ q=15$. Most scored the first mark but quite often their equation simplified to an equation in *p* or *q* and not one using both letters. Most obtained the equation $p+q=5$ and got the solution $p=2,\ q=3$ even if their first equation was incorrect. Some substituted their first equation into their binomial expansion from part(a) and then tried to add 5 terms in p^6 or q^6 usually making algebraic mistakes. When taking the square root or sixth root most only gave the positive root and not the negative root. Many needed a supplementary sheet to complete the question.

Question 7

A well answered question with most candidates able to score at least some marks.

In part (a) almost all candidates could produce a dimensionally correct expression for the surface area and most got it perfectly correct. If they did this they were often able to find an expression for *h*; however, simplifying this equation proved difficult for some with candidates making errors in expanding brackets, collecting like terms and rearranging to get a correct expression for *h*. The algebraic manipulation required after substituting for *h* was an improvement on previous years, hence those with a correct expression for *h* usually produced the given result.

The second part of the question was easier. Just a few candidates failed to find the correct derivative and ended up with wrong value of *x* and hence an incorrect final answer for the volume. Many candidates tested the value to demonstrate that the value of *x* obtained would give a maximum. For those who did this as well as finding the maximum volume this was not a problem in terms of marks but clearly time was wasted. For some, however, the volume itself was never found. The lesson here is that candidates should read and answer the question set rather than assume it is the same as ones they encountered in practice.

Question 8

This was slightly less well answered, with some candidates clearly unprepared and so not knowing what was required of them. A few blank responses were seen here.

In part (a) the majority of candidates could state the sum of the roots (usually – *p*) and product of the roots. Most could also evaluate (i) and (ii). However, a substantial minority made (i) $p-14$ instead of p^2-14. This caused them problems, as only one (incorrect) value of *p* could be obtained, and a substantial loss of marks for the rest of the question.

Part (b) was generally well answered with most candidates getting at least 1 mark, following through incorrect working from part (a).

Candidates who had been successful in parts (a) and (b) usually achieved well in part (c). A few could not add the fractions for the sum while others forgot that this gave the negative of the coefficient of *x*. Some did not make their expression equal to zero and so lost the final mark.

Question 9

This question was relatively straightforward and in many cases candidates scored high marks. Most got part (a) correct with many not showing working but using their calculators to do the work. The favoured method was to factorise to give the quadratic $x^2 - 2x - 8$ which was then factorised to give the two answers. The common error was to get $x^2 + 2x - 8$. The majority got part(b) correct with the most common error being to use the information in part (c) to get the gradient from difference in *y* values/difference in *x* values rather than differentiating – this was not allowed. Part(c) was always correct when part(b) was correct. Part (d) had many correct solutions. Most set up the area integral as the difference between the line and the curve but some had problems with the correct limits, with some going from -2 to 4 or 2 to 4. A few gave the line integral as the area of a triangle (usually correctly) and then subtracted the curve integral from 0 to 2 before doing ± the curve integral from 2 to 4, but often still got to the correct answer.

Question 10

The candidates' marks were quite polarised in this question. There were many very good solutions where the work was easy to follow with extra annotated diagrams. Candidates who drew diagrams of the relevant triangle for each part were almost always successful. Answers were usually given to the required degree of accuracy, although exact answers for lengths were seen in a number of responses. In part (d) in particular a significant number of responses lost the final accuracy mark by working with rounded answers for lengths. However many less successful candidates presented solutions which consisted of poorly annotated work with no diagrams or even letters to explain precisely what length or angle they were calculating.
In part (a),the great majority of candidates could use Pythagoras' theorem and then trigonometry to successfully find the lengths *AC* and *CH* respectively.
In part (b), many were able to use either trigonometry or Pythagoras' theorem to find the length *AH*.
In part (c), some failed to apply Pythagoras' theorem for the triangle *FHN* by spotting the right angle at *H*. A common mistake was to assume angle *HFN* or *HAC* = 22.5^{o} and then apply the cosine rule to find *HN* or *CN*.
Parts (d) and (e) were generally not answered well. Candidates often did not find the required angles or they used the rounded answers from (a), (b) and (c) losing the final marks.
In part (d), many candidates used the rounded value of 8.54 cm for the length of *CG* or *GB* and achieved an answer of 70.6^{0}, when the correct answer was 70.7^{o}. The cosine rule seemed to be as popular as Pythagoras in attempting this part, except for candidates who drew a

separate diagram of the relevant triangle. A noticeable minority of candidates failed to identify the required angle between the planes.
In part (e), a minority of candidates recognised that triangle *FGN* was right angled and that the angle *FNG* could be found from simple trigonometry. Many candidates again used the cosine rule in triangle *FGN* with a common mistake being to assume that $GN = FN$ and therefore that the triangle was isosceles.

Question 11

Candidates who attempted this question usually showed some basic knowledge of log theory. There were many blank responses.

In part (a) a few candidates lost marks for failing to state their conclusion. The most common error in this part of question was to arrive at $\log pq^2$ as a simplified expression for both sides of the given equation. Candidates who made this error were generally unable to make further worthwhile progress.

The majority of candidates who attempted part (b) made some progress in finding the first term of the series. Although many started with an appropriate method, no marks could be awarded for the incorrect application of log theory that followed.

In part (c), the correct formula for the sum of the first *n* terms was usually applied correctly and candidates who persevered with the question were often able to achieve marks here. However, very few candidates were able to establish a correct expression in the required form as the required algebraic manipulation combined with the log theory proved to be too great a challenge.

Some candidates re-wrote the question so that all logs were to base *p* or even, in some cases, base *pq*. The unlikely answers they obtained should have alerted them to their error. They were awarded a few marks as a special case but their error could not be classed as a mis-read (loss of only 2 A marks) as the work was significantly simplified compared with that needed for the printed question.

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