Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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In Pure Mathematics P1 (WMA11) Paper 01

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General Comments

This paper proved to be a good test of candidates' ability on the WMA11 content and plenty of opportunity was provided for them to demonstrate what they had learnt. Marks were available to candidates of all abilities and the questions that proved to be the most challenging were 3(b), 6(c), 7 and particularly 10 where although most candidates made some attempt at part (a), the rest of the question proved to be particularly challenging for many.
Presentation was generally good and candidates often showed sufficient working to make their methods clear. It does need to be stressed however that candidates should take careful notice of the warning in bold, when given, at the start of a question, not to use a calculator. Question 1 was a particular case where this warning was given yet candidates clearly solved either the quadratic equation or the quadratic inequality on a calculator.

Question 1

This quadratic inequality question proved to be a straightforward start to the paper for most students, though many did not achieve full marks. Almost all rearranged correctly and were able to achieve the correct critical values. Factorisation was the most common method used, followed by the quadratic formula, usually correctly applied. However a significant number either stated the roots or the inequalities, with no working, or wrote down the incorrect factorisation $((x + \frac{1}{4})(x - 2)$. It is worth stressing here that the question had the clear warning that calculators should not be used and a significant minority of candidates did not show working to solve the quadratic equation. The majority who found correct critical values remembered to continue to write inequalities and then chose the outside region, but poor notation such as $-1/4 > x > 2$ lost many the final mark.

Question 2

In parts (a) and (b), the vast majority of candidates were able to state the required equations correctly and it was rare to see any other expressions for the perimeter and area of the rectangle.

In part (c), the substitution of either x or y into either of their equations was successful however of those who tried using $x = 7350/y$ or $y = 7350/x$ some had difficulty with the algebraic manipulation and were unable to form a 3 term quadratic equation or formed an incorrect equation. The method of solution for the quadratic equation was usually shown clearly,

although a calculator method was acceptable in this question, and candidates were usually good at finding the correct values for either x or y.
The final A1 mark was sometimes lost because candidates did not realise the requirement that $x > y$ and had 2 pairs of solutions without a final answer from this restriction.

A very small minority attempted (c) by just trying numbers in their equations. If they fell upon the correct values then they could access the first two marks as a special case.

Overall, this question gave many candidates full marks.

Question 3

Part (a) was generally well attempted. Almost all students were able to identify $a = 3$ and take this out as a factor. Most of these were then able to find $b = 2$ although they were errors seen here. Many of these went to on to find $c = 1$ as well but, again, some errors were made.
The most common error was to find $c = 9$ but many other values of c were also seen.

Fewer marks were gained for part (b). A small number failed to draw a graph at all, suggesting they did not understand the link between the completed square form and the significant points on the graph. These scored no marks in (b).

Many students who had the correct answer in (a) were also able to sketch the graph correctly, although a few did not label the required points, thus losing marks. Some candidates who answered (a) incorrectly were still able to sketch the correct graph and gain full marks in (b). There was a follow through mark available for the turning point using their incorrect b and c from (a).

Question 4

This differentiation question proved fairly discriminating. In part (a) there was widespread mishandling of the conversion of the radicals. For example $\sqrt{x^3}$ was sometimes written as $x^{\frac{2}{3}}$ or correctly given as $(x^3)^{\frac{1}{2}}$ followed by the incorrect $x^{\frac{7}{2}}$. It was common to see $\sqrt[3]{8x}$ written as $8x^{\frac{1}{3}}$ or $2x$ and occasionally the cube root was treated as a square root. The need to split the fraction to progress was not realised by all. Attempts to bring up the term from the denominator, sometimes as an attempt to rationalise it were very unsuccessful. Those who acknowledged that the subtraction law of indices was required usually carried this out appropriately but overall there were a smaller number of correct answers than expected.

In part (b) the method of differentiation was generally well known although there were some very weak attempts seen - such as attempting to differentiate both the numerator and denominator of the original expression.

The most common incorrect response seen in this question was to obtain
$\frac{5x^2+x^{\frac{3}{2}}}{8x^{1/3}} = \frac{5}{8}x^{\frac{5}{3}} + \frac{1}{8}x^{\frac{7}{6}}$ in part (a) and then to differentiate this to $\frac{25}{24}x^{\frac{2}{3}} + \frac{7}{48}x^{\frac{1}{6}}$ in part (b).

Question 5

Many students were able to score full marks in this question, but candidates should be advised to explain their methods clearly, as many solutions were extremely hard to follow.
In (a) many candidates found the given value correctly, though a significant number missed this part out, despite gaining full marks in the rest of the question. The most common method was to calculate $\frac{\pi}{2} - \sin^{-1}\left(\frac{1.5}{4}\right)$. Some used the more direct $\cos^{-1}\left(\frac{1.5}{4}\right)$ and a small number used methods involving Pythagoras' Theorem. It was quite common to see the sine rule used unnecessarily in a right-angled triangle. A few candidates worked in degrees, meaning that they also had to show a correct conversion to radians.

In part (b) almost all students correctly found the length of the arc *AB*. The most challenging part of this question was to find length *BC*, which required the use of trigonometry or Pythagoras' Theorem. Some assumed that *BC* = 2 and failed to score any further marks. Most who correctly evaluated arc *AB* and *BC* were able to find the correct perimeter, with only a very few summing an incorrect combination of sides. A few candidates did not attempt to calculate *BC* and assumed it was 2 which scored no further marks as the 3rd method was dependent on both previous method marks

In part (c) most students used the correct formula to find the area of sector *AOB*. Various combinations of areas were seen in an attempt to find area *OBCD*, with the most successful being the use of the trapezium area formula. A significant number of students used an incorrect combination of triangles and rectangles. Some stated a valid combination of areas but then used one or more incorrect lengths in their attempt. A number who attempted to use $\frac{1}{2}ab\sin C$ to find the area of a triangle applied it incorrectly. It was possible to gain follow through method marks if their *BC* was incorrect in part (b), provided a correct method had been attempted and so many students were able to gain all three method marks in part (c).

Question 6

This question on surds saw quite a mixed response. Marks were widely scored in (b) and to a lesser extent in (a) - but marks were quite rarely awarded in (c).

In part (a), most knew what the word “expand” required but there was some very poor algebra seen including sign errors and issues dealing with $r \times -\frac{1}{r}$. Some obtained only the first and last terms believing that there would be no “middle” terms. Some expressions were not simplified and a significant number changed a correct expression into an incorrect one by attempting to multiply through by r^2.

The most common incorrect expansion seen were, $r^2 - 2r - \frac{1}{r^2}$, $r^2 - 2 - \frac{2}{r}$, $r^2 - \frac{1}{r^2}$ and $r^2 + \frac{1}{r^2}$.

Part (b) was a good source of marks for most with a relatively small number unaware of the need and the method to rationalise the denominator. A few errors were seen multiplying out the numerator but the most common mistake was to not show an intermediate step – the question stated the need to show all stages of working. A small number tried to multiply both the numerator and the denominator by $3 + 2\sqrt{2}$ instead of $3 - 2\sqrt{2}$ and gained no marks. Some candidates wrote the answer directly without showing any working and did not heed the warning not to use a calculator.

Although there were some fully correct solutions with some confident mathematics seen in part (c) it was not attempted by many. The question was a “Hence, or otherwise” and a variety of successful methods were seen by the best students. A small number of these went on to justify how –2 was not a possible value. The “Hence” route did not turn out to always be the most successful one although those who chose it were generally more able to access at least the first mark of the three available. Those who had reconfigured a correct answer to (a) often struggled to make much progress even if they were still working with an appropriate expression for the expanded brackets. Most attempts were short-lived and had basic misconceptions such as replacing $(a-b)^2$ with a^2+b^2. Many students who offered a response did not seem to have any strategy and became quickly confused amongst the multiple square root signs. For example, some chose to assume the result first but were not generally sure what they could do to progress.

Question 7

Candidates had varying success with part (a) of this question, mostly scoring 0, 1 or 4 marks. The correct x intercept was often seen, and many were able to find an x-coordinate for finding $x = 5$ or $x = 4$ but candidates struggled with the trapezium area in terms of a, so the method mark was often not awarded. Some split the region into a triangle and a trapezium, or even a triangle, rectangle and trapezium, but these attempts were often not successful either. A common error was to give the sum of the two parallel sides as $5 - a + 5$. Many did go on to find a value for k using their a, but unfortunately this gained no marks unless their trapezium area method was correct.

Many students attempted part (b) despite not scoring in part (a), leaving their inequalities in terms of a and k, gaining the method mark. Those who had correct answers for a and k from part (a) often scored both marks here. Some lost the accuracy mark by not having a strict inequality on their x values. A few found an upper limit for x, and these usually gained full marks. A very small number also included extra limits on y, but again, this did not often result in a mark being withheld. In a very few cases candidates appeared to find the coordinates of the vertices or the area of the region R_2 instead of defining it using inequalities. A significant proportion of candidates incorrectly gave inequalities in terms of R.

Question 8

This question on differentiation and integration was a good source of marks on the whole and a reasonable number of students emerged with full marks.

In part (a), those who knew to differentiate tended to make good progress. There were a number of weaker attempts which tried to use the coordinates of the point in the curve equation to obtain a gradient. Those who had differentiated usually proceeded to find a value for their derivative. The tendency at this level to put all manner of expressions = 0 and solve was noticeable on occasion. The straight line method was well-known with few changing the gradient to the normal instead of the tangent but there was often poor algebra - particularly with finding c in $y = mx + c$ approaches. As is common with this question many responses did not give their answer in the form requested – leading to answers with terms uncollected, no "= 0" and non-integer coefficients.

Part (b) saw a similar level of success. Most knew integration was required and the initial method mark was widely scored. Some fell foul of typical processing errors such as computing $-\frac{8}{\frac{1}{2}}$ as –4 instead of –16. Unfortunately many students were unaware of the need to find a constant. Those who did have a "+ c" usually attempted to find it using f (4) =12 but use of f (4) = 0 was occasionally seen. There were a few slips finding c with some basic algebraic errors seen such as not changing the sign of terms when changing side. A small number of students unfortunately stopped after the finding the value of c and failed to present the full expression for f (x).

Question 9

Part (i)(a) was answered well with many candidates obtaining a cosine function, although many only gained the first mark as their expression was not fully accurate. Common errors were to write cos x, or cos λx. Many showed a poor understanding of the use of function notation, for example by writing y = 3f (cos x). Some just gave the answer as 3f (x), without identifying the trigonometric function.

The graph sketching in part (i)(b) was often disappointing. Of those candidates who attempted this part most realised they needed to translate the curve to the left and some correctly obtained at least 2 of the 4 x intercepts but either failed to label the others or they were incorrect. Many obtained some of the correct intercepts but still sketched the graph with a maximum on the y-axis. The exact value of the y-intercept was rarely seen. Many forgot to multiply the y-intercept by 3, leaving it as $\sqrt{2}/2$. This was the case even when they had correctly identified the function as $3\cos x$.

In part (ii)(a), again many recognised that the graph represented some kind of sine function, gaining the first mark. A common error was $\sin(x/2)$ instead of $\sin 2x$. As in part (i), there was confusion with function notation, and the majority only scored the method mark.

In part (ii)(b) many realised the graph was a translation downwards, but the graphs either did not have the same number of cycles as the original graph, or appeared to have also been translated horizontally, so the first B mark was often not given. Many did however give a correct y-intercept of -2, so common mark profiles were 1010 or 1001.

Question 10

This question proved to be a challenge for a large majority of the students. The responses seen that were totally correct were rare, either because they had run out of time or simply because they did not know how to proceed beyond the very first part.

In part (a), most obtained a correct equation for line 1, but for many that was the only mark scored. The problem encountered with (a) part (ii) was that after writing the line equation as $y = 1/2x + 1$, it was difficult to spot that $(x + 2)$ was a common factor in their quadratic equation. Consequently, candidates ended up trying to solve a quadratic equation in terms of b and x, and most did not succeed, gaining no marks. A common error was to consider the discriminant, but this approach usually did not lead to values for x. Most who tried to solve the quadratic missed the fact that $x + 2$ must be a factor anyway as line 1 and the parabola both passed through the point $(-2, 0)$. Some assumed that the y coordinate of P was the same as the y intercept of C, but this needed to be justified in some way to score any marks.

Part (b) was after part (a)(i) the most well answered part. Some candidates used the coordinates for P instead of $(b, 0)$ and effectively used the method for part (c) not part (b). Parts (b) and (c) were often muddled, with candidates not sure what was being asked for. Part (b) scored a little better than part (c), and a correct equation for line 2 was often given. In part (c) a mark could be obtained provided they used a gradient of -2 and their coordinates for P from part (a), so most candidates could only score the method mark here.

There were many possible approaches to part (d), but the majority of candidates made no attempt. Some candidates equated the expression of part (c) to the curve and did not progress further or progressed incorrectly. Some students seemed to arrive at the conclusion that $b = 8$

with little working, which was deemed acceptable. Many students were restricted to a method mark only as their previous work was incorrect.

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