9. The ellipse E has equation

$$\frac{x^2}{9} + \frac{y^2}{4} = 1$$

The line l has equation $y = kx - 3$, where k is a constant.

Given that E and l meet at 2 distinct points P and Q

(a) show that the x coordinates of P and Q are solutions of the equation

$$(9k^2 + 4)x^2 - 54kx + 45 = 0$$

(2)

The point M is the midpoint of PQ

(b) Determine, in simplest form in terms of k, the coordinates of M

(3)

(c) Hence show that, as k varies, M lies on the curve with equation

$$x^2 + py^2 = qy$$

where p and q are constants to be determined.

(5)

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 10 marks)

TOTAL FOR PAPER IS 75 MARKS

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