6. The ellipse E has equation

$$\frac{x^2}{25} + \frac{y^2}{9} = 1$$

The line l is the normal to E at the point $P(5\cos\theta, 3\sin\theta)$ where $0 < \theta < \frac{\pi}{2}$

(a) Using calculus, show that an equation for l is

$$5x\sin\theta - 3y\cos\theta = 16\sin\theta\cos\theta$$

(4)

Given that

- l intersects the y-axis at the point Q
- the midpoint of the line segment PQ is M

(b) determine the exact maximum area of triangle OMP as θ varies, where O is the origin.

You must justify your answer.

(5)

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Question 6 continued

(Total for Question 6 is 9 marks)