9. The parabola C has equation $y^2 = \frac{1}{2}x$

The point $P\left(\frac{t^2}{8}, \frac{t}{4}\right)$, where $t \neq 0$, lies on C.

(a) Use calculus to show that the tangent to C at P has equation

$$8yt - 8x = t^2$$

(3)

Given that

- the tangent to C at P meets the y-axis at the point A
- the line l_1 is the perpendicular bisector of the line segment OA where O is the origin
- the line l_2 is the perpendicular bisector of the line segment AP
- l_1 and l_2 intersect at the point Q

(b) show that, as t varies, the coordinates of Q satisfy the equation

$$y^2 = \alpha x + \beta$$

where α and β are constants to be determined.

(5)

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Question 9 continued

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(Total for Question 9 is 8 marks)

TOTAL FOR PAPER IS 75 MARKS

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