

STEP III, 2008 Q6

6 In this question, p denotes $\frac{dy}{dx}$.

(i) Given that

$$y = p^2 + 2xp,$$

show by differentiating with respect to x that

$$\frac{dx}{dp} = -2 - \frac{2x}{p}.$$

Hence show that $x = -\frac{2}{3}p + Ap^{-2}$, where A is an arbitrary constant.

Find y in terms of x if $p = -3$ when $x = 2$.

(ii) Given instead that

$$y = 2xp + p \ln p,$$

and that $p = 1$ when $x = -\frac{1}{4}$, show that $x = -\frac{1}{2} \ln p - \frac{1}{4}$ and find y in terms of x .



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