

STEP II, 2008, Q7

- 7 (i) By writing $y = u(1 + x^2)^{\frac{1}{2}}$, where u is a function of x , find the solution of the equation

$$\frac{1}{y} \frac{dy}{dx} = xy + \frac{x}{1 + x^2}$$

for which $y = 1$ when $x = 0$.

- (ii) Find the solution of the equation

$$\frac{1}{y} \frac{dy}{dx} = x^2y + \frac{x^2}{1 + x^3}$$

for which $y = 1$ when $x = 0$.

- (iii) Give, without proof, a conjecture for the solution of the equation

$$\frac{1}{y} \frac{dy}{dx} = x^{n-1}y + \frac{x^{n-1}}{1 + x^n}$$

for which $y = 1$ when $x = 0$, where n is an integer greater than 1.



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