1999

10 (a) Solve the differential equation

$$\left(\frac{7}{v^2+1}\right)\frac{dv}{dx} = \frac{1}{x}$$

given that $v = 0$ when $x = 1$.

$$7\int\frac{dv}{v^2+1} = \int\frac{dx}{x} \qquad 5$$

$$7\tan^{-1} v = \ell n\, x + A \qquad 5{,}5$$

$v = 0, x = 1$

$$7\tan^{-1} 0 = \ell n\, 1 + A$$

$$\Rightarrow \quad A = 0 \qquad 5$$

$$7\tan^{-1} v = \ell n\, x$$

$$\tan^{-1} v = \frac{\ell n\, x}{7}$$

$$v = \tan\left(\frac{\ell n\, x}{7}\right) \qquad 5$$