

$$7a) \frac{dv}{dt} = x-1.$$

$$\begin{aligned} a) v^2 &= 2 \int a dx. \\ &= 2 \int (x-1) dx \\ &= 2 \times \frac{(x-1)^2}{2} + c. \end{aligned}$$

$$= (x-1)^2 + c.$$

$$\text{sub } v=1, x=0.$$

$$1 = (0-1)^2 + c$$

$$\therefore c=0$$

$$\therefore v^2 = (x-1)^2.$$

$$\begin{aligned} ii) v &= \pm \sqrt{(x-1)^2} & \therefore t = \ln(x-1), x > 1. \\ &= \pm (x-1). \end{aligned}$$

$$\text{take } v = (x-1)$$

$$\frac{dx}{dt} = x-1$$

$$dt$$

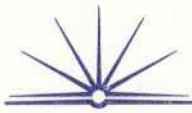
$$\frac{dt}{dx} = (x-1)^{-1}$$

$$dx$$

$$t = \ln(x-1) + c.$$

$$\text{sub } t=0, x=0.$$

$$0 = \ln(-1) + c.$$



$$AP^2 = a^2 + b^2 - 2bc \cos A.$$

$$7b). \quad \tan \frac{\pi}{4} = \frac{h}{OA}.$$

$$\cos A = \frac{c^2 + b^2 - a^2}{2bc}.$$

$$1 = \frac{h}{OA}$$

$$\therefore OA = h.$$

$$\tan d = \frac{h}{OP}.$$

$$\therefore OP = h \cot d.$$

$$\begin{aligned} \therefore AP^2 &= h^2 + (h \cot d)^2 - 2 \times h \times h \cot d \times \cos \frac{\pi}{3} \\ &= h^2 + h^2 \cot^2 d - 2h^2 \cot d \times \frac{1}{2}. \end{aligned}$$

$$\therefore AP^2 = h^2 + h^2 \cot^2 d - h^2 \cot d.$$

$$ii). \quad \sin \frac{\pi}{4} = \frac{h}{TA}.$$

$$\therefore TA = \frac{h}{\frac{1}{\sqrt{2}}}$$

$$\therefore TA = \sqrt{2}h.$$

$$\sin d = \frac{h}{TP}$$

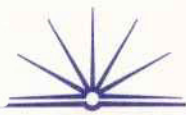
$$\therefore TP = \frac{h}{\sin d}.$$

$$AP^2 = (\sqrt{2}h)^2 + h^2$$

$$\cos \theta = \frac{(\sqrt{2}h)^2 + \left(\frac{h}{\sin d}\right)^2 - AP^2}{2 \times \sqrt{2}h \times \frac{h}{\sin d}}$$

$$= \frac{2h^2 + \frac{h^2}{\sin^2 d} - [h^2 + h^2 \cot^2 d - h^2 \cot d]}{2\sqrt{2}h^2 / \sin d}.$$

$$= \frac{h^2 + \frac{h^2}{\sin^2 d} - h^2 \cot^2 d + h^2 \cot d}{2\sqrt{2}h^2}$$



$$= k^2 \left[1 + \frac{1}{\sin^2 \alpha} - \cot^2 h + \cos \alpha \right] \times \frac{\sin \alpha}{2\sqrt{2}k^2}$$

$$= \frac{\sin \alpha}{2\sqrt{2}} + \frac{1}{2\sqrt{2}\sin \alpha} - \frac{\cos^2 h}{2\sqrt{2}\sin h} + \frac{\sin \alpha \cos \alpha}{2\sqrt{2}}$$