

Question 9

$$(a) (i) \quad \angle ADC = \frac{\pi - \frac{\pi}{5}}{2}$$

$$= \frac{\frac{4\pi}{5}}{2}$$

$$= \frac{2\pi}{5}$$

$$= 2\left(\frac{\pi}{5}\right)$$

$$= 2\theta$$

$$(ii) \quad x^2 = 1^2 + 1^2 - 2(1)(1) \cos(\pi - 2\theta)$$

$$x^2 = 1 - 2$$

(iii)



(b) (i) $\frac{dV}{dt}$ when $t=0$

$$\frac{dV}{dt} = 2e^0 + 2e^{-0}$$

$$= 2 + 2 = 4 \text{ l/h}$$

(ii) $V = \int 2e^t + 2e^{-t} dt$

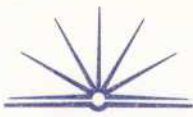
$$= 2e^t - 2e^{-t} + C$$

when $t=0$, $V=0$

$$0 = 2e^0 - 2e^{-0} + C$$

$$\therefore C = 0$$

$$\therefore V = 2e^t - 2e^{-t}$$



$$(iii) \quad V = 2e^t - 2e^{-t}$$

$$3 = 2e^t - 2e^{-t}$$

$$\times e^t \quad 3e^t = 2e^{2t} - 2$$

$$\therefore 2e^{2t} - 3e^t - 2 = 0$$

$$(iv) \quad \text{Let } e^t = y$$

$$2y^2 - 3y - 2 = 0$$

$$(2y+1)(y-2) = 0$$

$$\therefore y = -\frac{1}{2}, 2$$

$$e^t \neq -\frac{1}{2} \quad \text{as } e^t \geq 0$$

$$\therefore e^t = 2$$

$$t = \ln 2$$

$$= 0.693147\dots$$

$$= 0.6931 \text{ hours}$$

$$= 0.6931 \times 60 \text{ minutes}$$

$$= 41.59 \text{ minutes}$$

$$= 42 \text{ minutes.}$$