Q8

a) $Q = Q_0 e^{-kt}$

(i) $Q_0 = 6$

$$\frac{3}{6} = \frac{6e^{-15k}}{6}$$

$$\frac{1}{2} = e^{-k15}$$

$$\ln \frac{1}{2} = \ln e^{-k15}$$

$$\ln \frac{1}{2} = -15k$$

$$k = 0.046209812$$

(ii) $$\frac{\frac{3}{4}}{6} = \frac{6e^{0.046209812(t)}}{6}$$
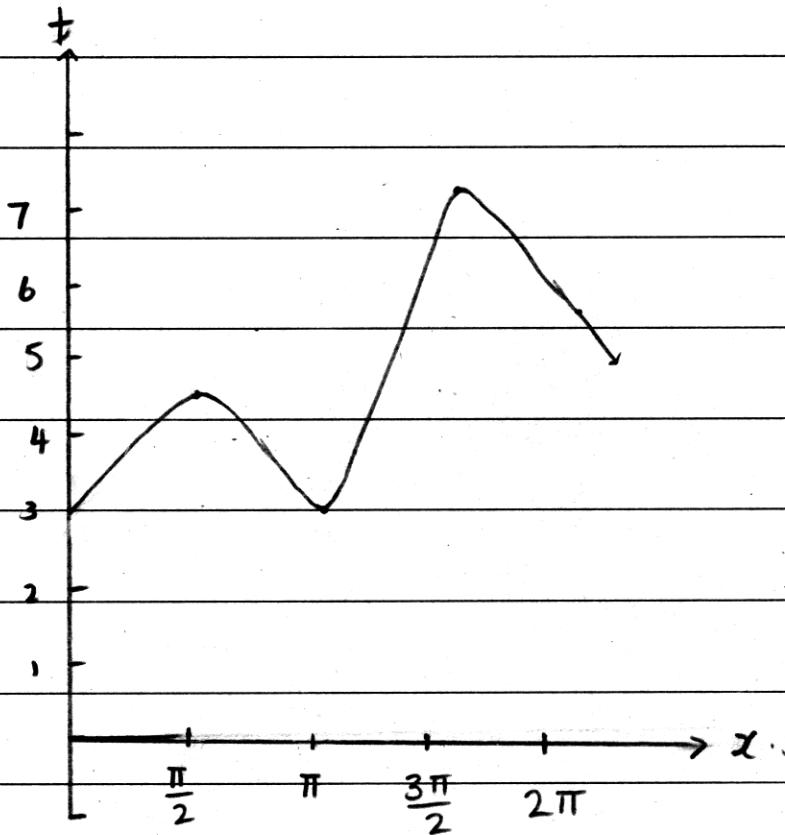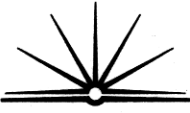
$$\frac{1}{8} = e^{0.046209812t}$$

$$\ln \cdot \frac{1}{8} = 0.046209812t$$

$$t = 45.00000004$$

$$= 45 \text{ hrs (nearest hr)}$$

b) $x = \sin 2t + 3$

(graph over the page →)

t

7
6
5
4
3
2
1

$\frac{\pi}{2}$ π $\frac{3\pi}{2}$ 2π $\to x$

(ii) $V = 2\cos 2t$

$0 = 2\cos 2t$

$2(\cos t)$

$2 \neq 0 \qquad \cos t = 0$

$t = 1.$

$\therefore$ the particle was at rest when
$t = 1.$