BOARD OF STUDIES
NEW SOUTH WALES

Question 8

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

initially $Q_0 = 6$

$Q = 3$

i find Q_0 as when $t = 0$

$Q = Q_0 e^0$

$Q = Q_0 \times 1$

$Q = Q_0$

$Q = 3$

$\therefore 3 = Q_0$

$Q = 6e^{-kt}$

$Q = 6 \times 1$

$Q = 6$

i initially $Q = 6$ ant $t = 0$

~~$3 = 6$~~ $6 = Q_0 e^0$

i ~~$6 = Q_0$~~ $6 = Q_0 e^1$

$\therefore 6 = Q_0$

$Q = Q_0 e^{-kt}$

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

$\frac{1}{2} = e^{-15k}$

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

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

$= 0.046209812\ldots$

BOARD OF STUDIES
NEW SOUTH WALES

find t when $Q = \frac{3}{4}$

$$\frac{3}{4} = 3e^{-0.46t}$$

$$\frac{1}{4} = e^{-0.46t}$$

$$e^{-0.46t} = \ln\frac{1}{4}$$

~~$-0.46t$~~

$$te^{-0.46} = \ln\frac{1}{4}$$

$$t = \frac{\ln\frac{1}{4}}{e^{-0.46}}$$

=

$$\frac{3}{4} = 6e^{-0.46t}$$

$$\frac{1}{24} = e^{-0.46t}$$

$$-0.46t = \ln\frac{1}{24}$$

$$t = \frac{\ln\frac{1}{24}}{-0.46}$$

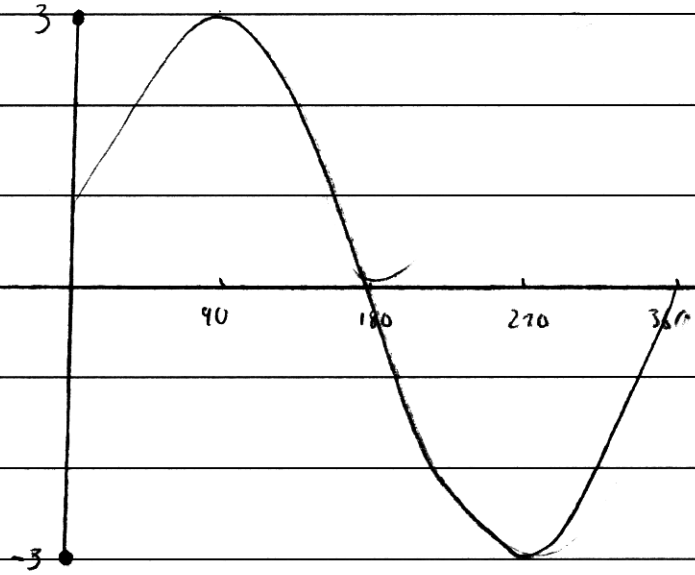
$$t = 68.77 \text{ hours}$$

S C T
C -S $\sec^2$.

BOARD OF STUDIES
NEW SOUTH WALES

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

t	-3	-2	-1	0	1	2	3
x	2.895	2.93	2.965	3	3.034	3.06	3.1



ii at rest when $V=0$

D
V
A.

$x = \sin 2t + 3$

$V = \frac{dx}{dt} = 2\cos 2t$

$0 = 2\cos 2t$

$t = \frac{0}{2\cos 2t}$

$t = 0$ — particle is at rest when $t = 0$.

iii The particle continues in a positive manner until reaching a 1st turning point, where it remains stationary as it turns. The particle continues negatively until another turning point occurs, in which it is stationary for next period before continuing positively.