



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

$$6m_0 = Q_0 e^0$$

$$6m_0 = Q_0 (1)$$

$$Q_0 = 6m_0$$

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

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

$$\log_e \frac{1}{2} = -k \cdot 15$$

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

$$k = 0.046209812$$

$$k = 0.04621 \quad \text{to 4 S.F.}$$

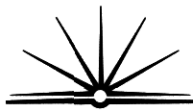
$$ii) 0.75 = 6 e^{-kt}$$

$$\frac{0.75}{6} = e^{-kt}$$

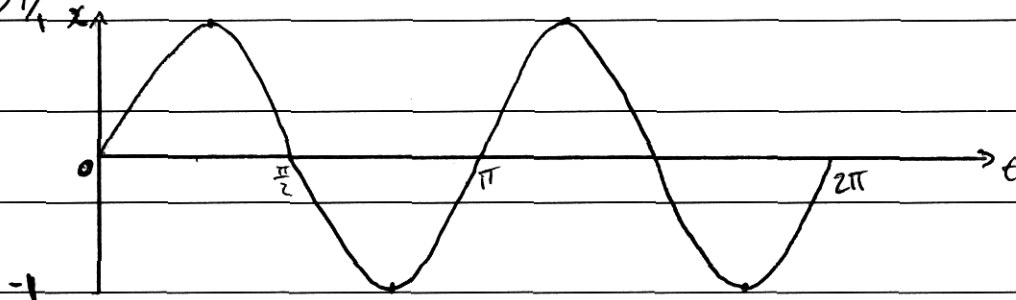
$$\ln \frac{0.75}{6} = -kt$$

$$\frac{\ln \frac{0.75}{6}}{-k} = t$$

$$t = 45 \text{ hours}$$



b) i)



ii) particle at rest at $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

iii) the motion of the particle is simple harmonic motion where the particle oscillates from origin to a point x metres in positive direction and back to origin then x metres in negative direction and soon the particle is at max velocity when at origin and decelerates as it approaches the turning pt then accelerates in opp direction to a max at origin again