Question 8

BOARD OF STUDIES
NEW SOUTH WALES

8ai Q = initial dose $t=0$, 6mg

$6 = Q_0 e^{-k(0)}$

$= Q_0 e^0$

$= Q_0 \times 1$

$6 = Q_0$

half initial dose $= \frac{6}{2}$

$= 3$

at $t=15$, $Q = 3$

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

$= 6e^{-15k}$

$0.5 = e^{-15k}$

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

$= -15k \cdot 1$

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

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

$k = 0.04260981$

$k = 0.04$ (2 dec places)

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8a ii) ~~8a.~~ $6 \times \frac{1}{8}$ (for $\frac{1}{8}$ initial dose).

$= \frac{3}{4}$.

using k in memory

$\frac{3}{4} = 6e^{-0.04t}$

$\frac{1}{8} = e^{-0.04t}$

$\ln \frac{1}{8} = \ln e^{-0.04t}$

$= -0.04t \ln e$

$= -0.04t \cdot 1$

$-0.04t = \ln \frac{1}{8}$

$t = \frac{\ln \frac{1}{8}}{-0.04}$

$t = 4s$

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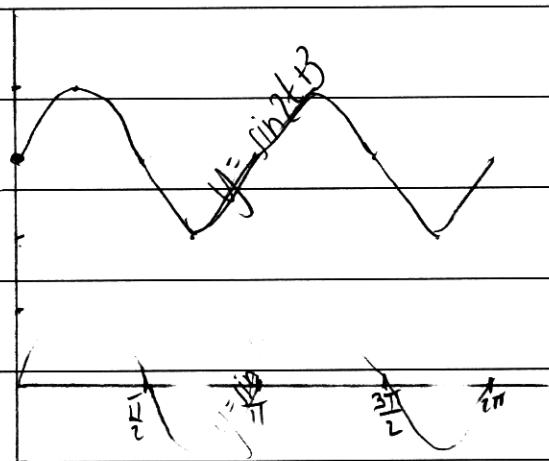
8bi $a = 1$ ∴ cos

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

$= \pi$



for particle at rest

$v = 0$, $v = 2\sin 2t$

$0 = 2\sin 2t$

at rest at $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4} + \frac{7\pi}{4}$.

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iii The particle is resting at $\frac{\pi}{4}$ (max point), $\frac{3\pi}{4}$ (min) $\frac{5\pi}{4}$ (max), $\frac{7\pi}{4}$ (min)

Point of inflection at $\frac{\pi}{2}$, π & $\frac{3\pi}{2}$.

$0 - \frac{\pi}{4}$ v is increasing

$\frac{\pi}{4} - 3\frac{\pi}{4}$, v is decreasing

$\frac{3\pi}{4} - \frac{5\pi}{4}$, v is increasing

$\frac{5\pi}{4} - 7\frac{\pi}{4}$, v is decreasing.

$\frac{7\pi}{4} - 2\pi$, v is increasing.