2006

(6) a. $T = 3\pi$.

(i). @ $t = 0$, $x = 0$ $\therefore$ (sin function!)

@ $x = 4$, $v = 5$

- $a = -\omega^2 x$.

$a_{max} = \omega^2 A$ ← max acceleration when particle at extreme positions! (ie. $x = A$)

- we need to find (ω) and (A)

– $\omega = \frac{2\pi}{T} = \frac{2\pi}{3\pi} = \boxed{2/3}$ rad/s

– $v^2 = \omega^2 (A^2 - x^2)$

$5^2 = \left(\frac{2}{3}\right)^2 (A^2 - 4^2)$

$25 = \frac{4}{9}(A^2 - 16)$

$225 = 4A^2 - 64$.

$4A^2 = 225 + 64$

$4A^2 = 289$

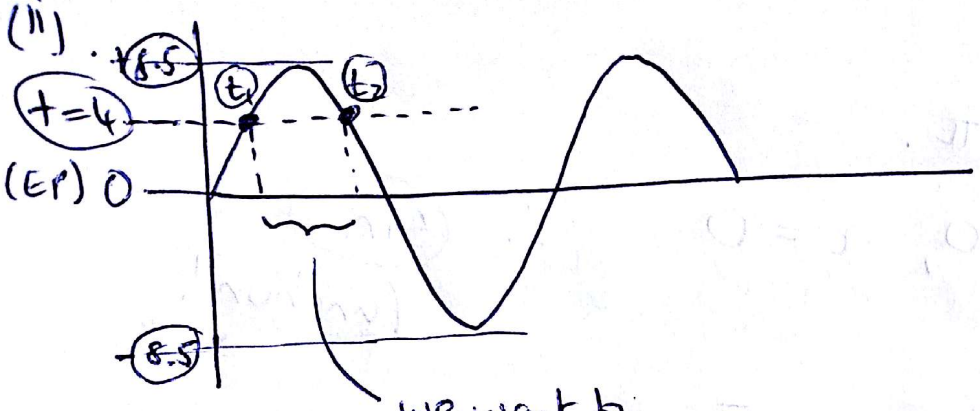
$A^2 = \frac{289}{4}$

$A = \frac{17}{2} = \boxed{8.5}$ m

$$\therefore a_{max} = \left(\frac{2}{3}\right)^2 \left(\frac{17}{2}\right)$$

$$= \left(\frac{\cancel{4}^{2}}{9}\right)\left(\frac{17}{\cancel{2}}\right) = \frac{34}{9} = \boxed{3.78} \text{ m/s}^2$$

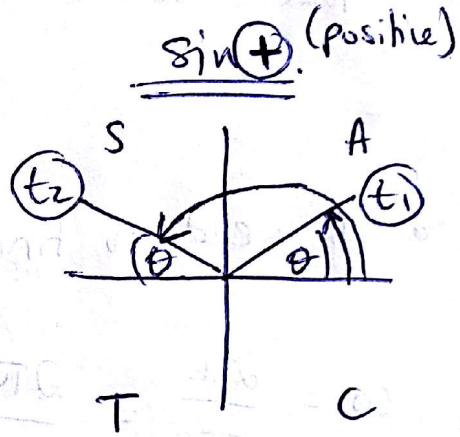
(ii)



we want to know this time.

$$x = a \sin \omega t$$

$$x = 8.5 \sin\left(\frac{2}{3}t\right)$$



- $4 = 8.5 \sin\left(\frac{2}{3}t\right)$.

$$\sin\left(\frac{2}{3}t\right) = \frac{4}{8.5}.$$

ref angle $= 0.48996$ rads.

t_1: $\frac{2}{3}t = 0.48996$

$$t_1 = 0.7349\,s$$

t_2: $\frac{2}{3}t = \pi - 0.48996$

$$t_2 = 3.9775\ s.$$

∴ time elapsed $= t_2 - t_1 =$ **3.24 s**