1988 Q10 : [DE].

(a)

$$\frac{dx}{dt} = \sqrt{100-4x^2}$$

$$\Rightarrow \int \frac{dx}{\sqrt{100-4x^2}} = \int dt + A$$

$$\Rightarrow \int \frac{dx}{\sqrt{4}\sqrt{25-x^2}} = t + A$$

$$\Rightarrow \frac{1}{2}\int \frac{dx}{\sqrt{5^2-x^2}} = t + A$$

$$\Rightarrow \frac{1}{2}\sin^{-1}\frac{x}{5} = t + A$$

// $x = 5$ when $t = 0$.

$$\Rightarrow \frac{1}{2}\sin^{-1}\left(\frac{5}{5}\right) = 0 + A$$

$$\Rightarrow \frac{1}{2}\left(\frac{\pi}{2}\right) = A$$

$$\Rightarrow \frac{\pi}{4} = A \;//$$

$$\Rightarrow \frac{1}{2}\sin^{-1}\frac{x}{5} = t + \frac{\pi}{4}$$

$$\Rightarrow \sin^{-1}\frac{x}{5} = 2t + \frac{\pi}{2}$$

$$\Rightarrow \boxed{x = 5\sin\left(2t + \frac{\pi}{2}\right)}$$

(β) Position :

$+\uparrow$

- stops $x = H$ greatest height
  $v = 0$.
  $t = T$, time to reach greatest height

- Initial $x = 0$
  $v = 120\ ms^{-1}$,
  $t = 0$.

Forces :

$-(m \cdot 098 v^2)\ mg$

NII $\Rightarrow ma = \sum F$

$$\Rightarrow ma = -m\,0.098v^2 - mg$$

$$\Rightarrow a = -0.098v^2 - 9.8 \qquad [g = 9.8].$$

Linking $v\,dt$: $\left[a = \frac{dv}{dt}\right]$

$$\Rightarrow \frac{dv}{dt} = -9.8[.01v^2 + 1]$$

$$\Rightarrow \frac{dv}{dt} = -.098[v^2 + 100]$$

[Belt-er] ! than

$$\Rightarrow \int_{120}^{0} \frac{dv}{v^2+100} = \int_0^T -.098\,dt$$

$$\frac{1}{10}\tan^{-1}\left(\frac{v}{10}\right)\Big|_{120}^{0} = -.098\Big|_0^T$$

$$\frac{1}{10}\left[\tan^{-1}(0) - \tan^{-1}(12)\right] = -.098T$$

$$\frac{1}{10}[0 - 1.4876551] = -.098T.$$

$$-.14876551 = -.098T$$

$$+\left(\frac{.14876551}{.098}\right) = T$$

$$\boxed{1.5\ \text{secs} = T}$$

[EASY QUESTION]