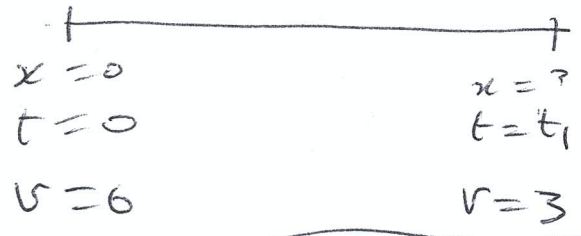


2000

10(b)

deceleration = $-4e^{\frac{v}{6}} \Rightarrow a = -4e^{\frac{v}{6}}$

$v \frac{dv}{dx} = -4e^{\frac{v}{6}}$ $\frac{dv}{dt} = -4e^{\frac{v}{6}}$



(i) linky speed and time $\Rightarrow \frac{dv}{dt} = -4e^{\frac{v}{6}}$ (5)

(5) $\Rightarrow \int_6^3 \frac{1}{e^{\frac{v}{6}}} dv = \int_0^{t_1} -4 dt$

$\Rightarrow \int_6^3 e^{-\frac{1}{6}v} dv = \int_0^{t_1} -4 dt$

$\Rightarrow \left. \frac{e^{-\frac{1}{6}v}}{-\frac{1}{6}} \right|_6^3 = -4t \Big|_0^{t_1}$

$\Rightarrow -6e^{-\frac{1}{6}v} \Big|_6^3 = -4t_1 + 0$

$\Rightarrow t_1 = \frac{6}{4} [e^{-\frac{1}{2}} - e^{-1}] = \frac{3}{2} \left[\frac{1}{\sqrt{e}} - \frac{1}{e} \right]$

(ii) linky speed time again $\int_6^0 e^{-\frac{v}{6}} dv = \int_0^{t_2} -4 dt$

$-6 \left[e^{-\frac{v}{6}} \right]_6^0 = -4t \Big|_0^{t_2}$

$-6 [1 - e^{-1}] = -4t_2 + 0$

$\Rightarrow t_2 = \frac{3}{2} [1 - \frac{1}{e}]$

(iii) Algebra!

$\frac{t_2 - t_1}{t_1} = \frac{\frac{3}{2} [1 - \frac{1}{e}] - \frac{3}{2} [\frac{1}{\sqrt{e}} - \frac{1}{e}]}{\frac{3}{2} [\frac{1}{\sqrt{e}} - \frac{1}{e}]}$

multiply top and bottom by e

(5 only)

$= \frac{e - 1 - \sqrt{e} + 1}{\sqrt{e} - 1} = \frac{e - \sqrt{e}}{\sqrt{e} - 1} = \frac{\sqrt{e}(\sqrt{e} - 1)}{1(\sqrt{e} - 1)} = \sqrt{e}$