1423 Q10.

(a) $\sin x \frac{dy}{dx} = y \cos x$.

$\Rightarrow \int \frac{dy}{y} = \int \frac{\cos x}{\sin x} dx$

$\Rightarrow \ln y = \int \frac{\cos x}{\sin x} dx$.

// Let $u = \sin x$

$\frac{du}{dx} = \cos x$

$du = \cos x \, dx$ //

$\Rightarrow \ln y = \int \frac{du}{u} + A$.

$\ln y = \ln u + A$

$\ln y = \ln|\sin x| + A$

// $y = 2$ when $x = \frac{\pi}{6}$

$\Rightarrow \ln 2 = \ln\left(\sin \frac{\pi}{6}\right) + A$

$\Rightarrow \ln 2 = \ln \frac{1}{2} + A$.

$\Rightarrow \ln 2 - \ln \frac{1}{2} = A$

$\Rightarrow \ln\left[\frac{2}{\frac{1}{2}}\right] = A$

$\Rightarrow \ln 4 = A$ //

$\Rightarrow \ln y = \ln|\sin x| + \ln 4$

$\Rightarrow \ln y = \ln 4 \sin x$

$\Rightarrow \boxed{y = 4 \sin x}$.

Signs: 0 ——+——▶

Initially $v = 0$, $x = 0$; Later $v = ?$, $x = 100$

Forces:

NII: $ma = \sum F$.

$\rightarrow 8a = 40 - 3\sqrt{x}$

link speed, distance $\Rightarrow 8v\frac{dv}{dx} = 40 - 3\sqrt{x}$

$\Rightarrow v\,dv = \left(5 - \frac{3}{8}\sqrt{x}\right)dx$

$\Rightarrow \int v\,dv = \int \left(5 - \frac{3}{8}x^{\frac{1}{2}}\right)dx + A$

$\Rightarrow \frac{v^2}{2} = 5x - \frac{3}{8}\frac{x^{\frac{3}{2}}}{\frac{3}{2}} + A$

$\Rightarrow \frac{v^2}{2} = 5x - \frac{3}{8}\left(\frac{2}{3}\right)x^{\frac{3}{2}} + A$

$\Rightarrow \frac{v^2}{2} = 5x - \frac{1}{4}x^{\frac{3}{2}} + A$.

// $v = 0$ when $x = 0$ $\Rightarrow$

$0 = 0 - 0 + A$

$\boxed{0 = A}$ //

$\Rightarrow \frac{v^2}{2} = 5x - \frac{1}{4}x^{\frac{3}{2}}$.

$\Rightarrow \boxed{v^2 = 10x - \frac{1}{2}x^{\frac{3}{2}}}$, use this to answer questions.

At $x = 100$: $v = ?$

$v^2 = 10(100) - \frac{1}{2}(100)^{\frac{3}{2}}$

$v^2 = 1000 - \frac{1}{2}1000$

$v^2 = 500$

$v = \sqrt{500}\ ms^{-1}$

Find when next comes to instantaneous rest ie

Find x when $v = 0$

$\Rightarrow 0^2 = 10x - \frac{1}{2}x^{\frac{3}{2}}$.

$\Rightarrow 0 = x\left[10 - \frac{1}{2}x^{\frac{1}{2}}\right]$

$\Rightarrow 0 = x$ OR $0 = 10 - \frac{1}{2}x^{\frac{1}{2}}$

$\Rightarrow 0 = x$ OR $10 = \frac{1}{2}x^{\frac{1}{2}}$

$\Rightarrow 0 = x$ OR $20 = \sqrt{x}$

$\Rightarrow \boxed{0 = x}$ OR $\boxed{(20)^2 = x}$

Next at $\boxed{400_m = x}$