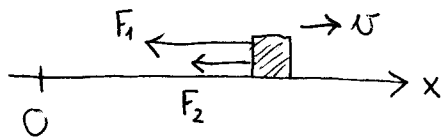


17.) $m = 10 \text{ kg}$ $F_1(x=1) = 20 \text{ N}$ $F_2 = -b\dot{x}$ $\dot{x}_0 = 0$

$F_1 = -Dx$
 $D = 20 \frac{\text{N}}{\text{m}}$

$$\vec{a} = \frac{\vec{F}_e}{m}$$

$x(t=3T) = \frac{x(0)}{10}$ $T = ?$



$$m\ddot{x} = -Dx - b\dot{x}$$

$$\ddot{x} + \frac{b}{m}\dot{x} + \frac{D}{m}x = 0$$

$\omega^2 = \frac{D}{m}$ $\frac{b}{m} = 2\alpha$

$$\gamma = \sqrt{\omega^2 - \alpha^2}$$

$$\ddot{x} + 2\alpha\dot{x} + \omega^2x = 0$$

$$\omega^2 = 2 \frac{1}{s^2}$$

$$x(t) = Ae^{-\alpha t} \cos(\gamma t + \delta) \rightarrow x(0) = A \cos \delta$$

$$\dot{x}(t) = -A\alpha e^{-\alpha t} \cos(\gamma t + \delta) - A\gamma e^{-\alpha t} \sin(\gamma t + \delta) \rightarrow 0 = -A(\alpha \cos \delta + \gamma \sin \delta)$$

$$x(3T) = Ae^{-3\alpha T} \cos(3T\gamma + \delta) = Ae^{-3\alpha T} \cos \delta$$

$$\frac{x(0)}{x(3T)} = 10 = \frac{\cancel{A} \cos \delta}{\cancel{A} e^{-3\alpha T} \cos \delta} = e^{3\alpha T} \rightarrow \ln 10 = 3\alpha T$$

$$\frac{\ln 10}{3T} = \alpha$$

$$\gamma^2 = \omega^2 - \alpha^2 = \left(\frac{2\pi}{T}\right)^2$$

$$\omega^2 - \alpha^2 = \frac{4\pi^2}{T^2}$$

$$\omega^2 - \frac{\ln^2 10}{9T^2} = \frac{4\pi^2}{T^2}$$

$$9T^2 \omega^2 - \ln^2 10 = 36\pi^2$$

$$18T^2 = 36\pi^2 + \ln^2 10$$

$$T^2 = 20,034 \text{ s}^2$$

$$\underline{T = 4,476 \text{ s}}$$