7.) $m = 10\,kg$ $F_1(x=1) = 20N$ $F_2 = -b\dot{x}$ $v_0 = 0$

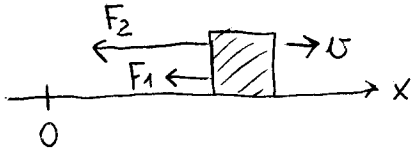
$F_1 = -Dx$

$D = 20\frac{N}{m}$

$\vec{a} = \frac{\vec{F_e}}{m}$

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

$T = ?$



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

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

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

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

$x(t) = Ae^{-\alpha t}\cos(\gamma t + \delta)$ $\gamma = \sqrt{\omega^2 - \alpha^2}$

$x(0) = A\cos\delta$

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

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

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

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

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

$\omega^2 - \left(\frac{\ln 10}{3T}\right)^2 = \frac{4\pi^2}{T^2}$

$\Downarrow$

T

$\equiv$