2.80 $W = 500\,N \quad m = \frac{W}{g} = \frac{500}{9.81} = 50.97\,kg$

in b) $x_0 - x_1 = x_1 - x_2 = 2\,mm \Rightarrow$ coulomb since linear decrement

a) $x_0 - x_1 = 4 \neq x_1 - x_2 = 2 \Rightarrow$ viscous since $\frac{x_0}{x_1} = 2 = \frac{x_1}{x_2} \Rightarrow$ log decrement

for a) $\delta = \ln \frac{x_0}{x_1} = \ln 2 = 0.6931 = \frac{2\pi\zeta}{\sqrt{1-\zeta^2}} \Rightarrow \zeta = \frac{\delta}{\sqrt{4\pi^2 + \delta^2}}$ or $\zeta \cong \frac{\delta}{2\pi} = .1096$

now for b) $\tau_n = 0.2\,sec$, $f_n = \frac{1}{\tau_n} = 5 \quad \omega_n = 2\pi f_n = 31.42\,rad/s$

a) $\tau_d = 0.2\,sec \quad f_d = \frac{1}{\tau_d} = 5 \quad \omega_d = 2\pi f_d = 31.42\,rad/s$; $\omega_d = \omega_n\sqrt{1-\zeta^2} \Rightarrow \omega_n = \frac{\omega_d}{\sqrt{1-\zeta^2}} = 31.61\,rad/s$

now for a) $k = m\omega_n^2 = 50.97\,(31.61)^2 = 50929\,\frac{N}{m}$

b) $k = m\omega_n^2 = 50.97\,(31.42)^2 = 50{,}319\,N/m$

for a) $\omega_n = 31.61\,rad/s \quad \omega_d = 31.42\,rad/s$

b) $\omega_n = \omega_d = 31.42\,rad/s$

to determine what the friction value is

for a) since viscous damping ζ is damping ratio $\quad c_{crit} = 2m\omega_n = 2(50.97)(31.61) = 3222.3\,N\text{-}s/m$

$c/c_{crit} = \zeta \Rightarrow c = \zeta \cdot c_{crit} = .1096(3222.3) = 353.2\,\frac{N\text{-}s}{m}$

for b) $x_0 - x_1 = 2mm = .002\,m = 4\,f/k \quad \therefore f = \frac{.002k}{4} = \frac{.002\,(50319)}{4} = 25.16\,N = \mu W$

$\therefore \mu = f/W = \frac{25.16}{500} = .0503$