$V_{max} = 10\frac{cm}{sec} = .1\frac{m}{sec}$ $T_n = 2sec$ $X_0 = 2cm = .02m$ $V_0 = ?$ $a_{max} = ?$ $\Sigma = ?$ $\phi = ?$

$\omega_n \cdot T_n = 2\pi$ $\omega_n = \frac{2\pi}{T_n} = \pi = 3.1416 \frac{rad}{s}$

$V_{max} = \Sigma \omega_n = .1\frac{m}{s}$ $\Sigma = \frac{V_{max}}{\omega_n} = \frac{.1}{3.1416} = .031831\ m$

$a_{max} = \Sigma \omega_n^2 = (0.031831)(3.1416)^2 = .31446\ m/s^2$

$\Sigma = \sqrt{X_0^2 + \left(\frac{V_0}{\omega_n}\right)^2}$ $\sqrt{(\Sigma^2 - X_0^2)\omega_n^2} = V_0 = .077796\ m/s$

$\tan\phi = \frac{X_0 \omega_n}{V_0} = 0.80765 \Rightarrow \phi = .67939\ rad$

$X(t) = \Sigma \sin(\omega_n t + \phi) = .031831 \sin(3.1416t + .67939)\ m$

$\Delta_{st} = \frac{W}{k}$

2.6 $f_n = 10Hz = 10\frac{cycles}{sec}$ when k is decreased by 800 N/m then f_n is altered by 45%

k, m

$k' = k - 800$

$\omega_n = 2\pi f_n = 2\pi(10) = 62.832 \frac{rad}{s} = \sqrt{\frac{k}{m}}$

$\omega_n' = \sqrt{\frac{k-800}{m}} = 0.55\omega_n = 34.558 \frac{rad}{s}$

$\frac{k-800}{m} = (34.558)^2$ $\frac{k}{m} = (62.832)^2$

$\frac{k}{m} - \frac{800}{m} = "$

$(62.832)^2 - (34.558)^2 = \frac{800}{m} \Rightarrow m = 0.29053\ kg$

$k = \omega_n^2 \cdot m = (62.832)^2 \cdot (0.29053) = 1147\frac{N}{m}$