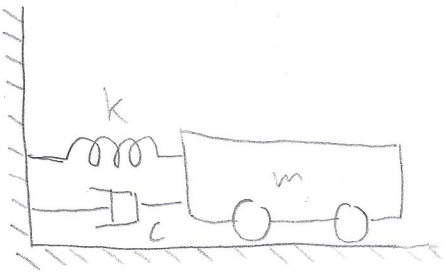
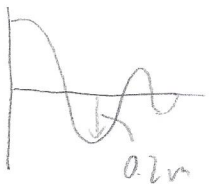
20-R-VIB-DY-28 Intermediate

A 0.5 kg toy car is attatched to the wall with a spring; $k = 20$ N/m, and damper, $c = 1$ Ns/m, in parallel. Given that the next amplitude is 0.12m, determine the initial displacement.



Solution:



$$\delta = \ln\left(\frac{x_i}{x_{i+1}}\right) = \zeta \omega_n T_d$$

$$= \frac{2\pi\zeta}{\sqrt{1-\zeta^2}}$$

$$\zeta = \frac{c}{2m\omega_n} \qquad \omega_n = \sqrt{\frac{k}{m}} = \sqrt{40}$$

$$= 0.158 \qquad \delta = 1.006$$

$$\frac{x_0}{0.2} = e^{\delta} \qquad x_0 = 0.547\ m$$