$\boxed{2/52}$ Up : $a_u = -g - kv^2 = \frac{dv}{dt}$

$$\int_0^{t_u} dt = -\int_{v_0}^{0} \frac{dv}{g+kv^2}$$

$$t_u = \frac{1}{\sqrt{gk}} \tan^{-1}\left(\frac{v\sqrt{gk}}{g}\right)\Bigg|_0^{v_0} = \frac{1}{\sqrt{gk}} \tan^{-1}\left(v_0\sqrt{\frac{k}{g}}\right)$$

$$t_u = \frac{1}{\sqrt{32.2(0.002)}} \tan^{-1}\left(100\sqrt{\frac{0.002}{32.2}}\right) = \underline{2.63 \text{ sec}}$$

(Down) : $a_d = -g + kv^2 = \frac{dv}{dt}$

$$\int_0^{t_d} dt = \int_0^{v_f} \frac{dv}{-g+kv^2}$$

$$t_d = \frac{1}{\sqrt{gk}} \tanh^{-1}\left(\frac{v\sqrt{gk}}{g}\right)\Bigg|_0^{v_f} = \frac{1}{\sqrt{gk}} \tanh^{-1}\left(v_f\sqrt{\frac{k}{g}}\right)$$

$$= \frac{1}{\sqrt{32.2(0.002)}} \tanh^{-1}\left(78.5\sqrt{\frac{0.002}{32.2}}\right)$$

$$= \underline{2.85 \text{ sec}}$$

(Refer to solution of Prob. 2/51)