2/51 Up:

$$a_u = -g - kv^2 = v\frac{dv}{dy}$$

$$\int_0^h dy = -\int_{v_0}^{0} \frac{v\,dv}{g+kv^2}$$

$$h = -\frac{1}{2k}\ln\left[g+kv^2\right]_{v_0}^{0} = \frac{1}{2k}\ln\left[\frac{g+kv_0^2}{g}\right]$$

$$h = \frac{1}{2(0.002)}\ln\left[\frac{32.2+0.002(100)^2}{32.2}\right] = \underline{120.8 \text{ ft}}$$

Down:

$$a_d = -g + kv^2 = v\frac{dv}{dy}$$

$$\int_h^0 dy = \int_0^{v_f} \frac{v\,dv}{-g+kv^2}$$

$$-h = \frac{1}{2k}\ln\left[-g+kv^2\right]\Big|_0^{v_f} = \frac{1}{2k}\ln\left[\frac{g-kv_f^2}{g}\right]$$

$$\Rightarrow v_f = \sqrt{\frac{g}{k}\left(1-e^{-2kh}\right)}$$

$$= \sqrt{\frac{32.2}{0.002}\left(1-e^{-2(0.002)(120.8)}\right)} = \underline{78.5 \frac{\text{ft}}{\text{sec}}}$$