1

$$m\vec{a_0} = \vec{f_e} + m\vec{g} \tag{1}$$

$$x : ma_0 = mg - k\Delta \tag{2}$$

$$\Delta = \frac{m}{k}(g - a_0) \tag{3}$$

$$\frac{mv^2}{2} - \frac{0^2}{2} = \int_0^\Delta [mg - k\Delta] \cdot d[\Delta] \tag{4}$$

$$\frac{mv^2}{2} = mg\Delta - k\frac{\Delta^2}{2} \tag{5}$$

$$\frac{0^2}{2} - \frac{mv^2}{2} = \int_0^\delta [mg - k(\Delta + \delta)] \cdot d[\delta] \tag{6}$$

$$-\frac{mv^2}{2} = mg\delta - k\Delta\delta - k\frac{\delta^2}{2} \tag{7}$$

$$k\frac{\Delta^2}{2} - mg\Delta = mg\delta - k\Delta\delta - k\frac{\delta^2}{2} \tag{8}$$