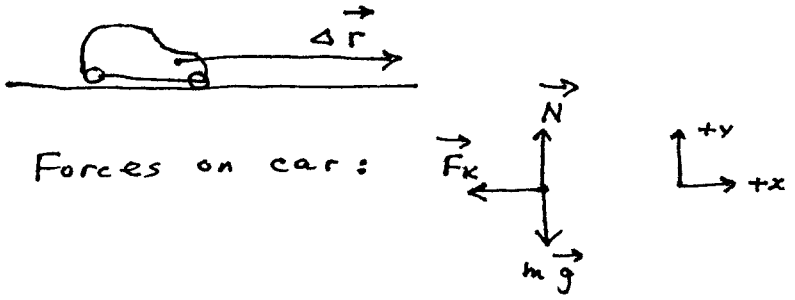
Exercise 8-25

(a) Work-energy theorem: total work done by all the forces equals change in KE.

$$W_{TOT} = \Delta KE$$



$$\Sigma F_y = m a_y = 0$$

$$\therefore N = mg$$

$$\therefore F_K = \mu_K N = \mu_K mg$$

$$W_{TOT} = \Delta KE$$

$$\therefore N \Delta r \underbrace{\cos 90^\circ}_{0} + mg \Delta r \underbrace{\cos 90^\circ}_{0} + \mu_K mg \Delta r \underbrace{\cos 180^\circ}_{-1} = \frac{1}{2} m (\underbrace{v^2}_{0} - v_0^2)$$

Solve for $\Delta r \Rightarrow \Delta r = \dfrac{v_0^2}{2g\mu_K}$ [1]

(b) $\Delta r \propto v_0^2$ (from [1])

For $v_0 = 90.0$ km/h, $\Delta r = 89.5$ m.

$\therefore$ for $v_0 = 60.0$ km/h, Δr can be determined from:

$$\frac{\Delta r}{89.5\text{ m}} = \frac{(60.0\text{ km/h})^2}{(90.0\text{ km/h})^2}$$

$$\therefore \Delta r = 39.8\text{ m}$$