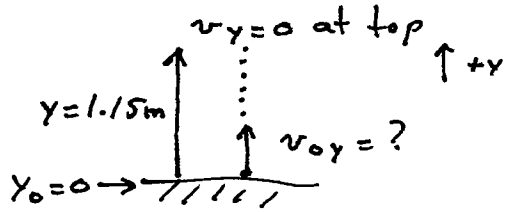
Problem 8-33

First, determine velocity when jumper leaves ground.



$$v_y^2 = v_{oy}^2 + 2a_y(y - y_o)$$

$$\therefore 0^2 = v_{oy}^2 + 2(-9.80)(1.15)$$

$$\therefore v_{oy} = 4.748\ m/s$$

This velocity of $4.748\ m/s$ is the final velocity of the ground-contact phase of the jump. Consider this phase now.

$$v_y = 4.748\ m/s$$

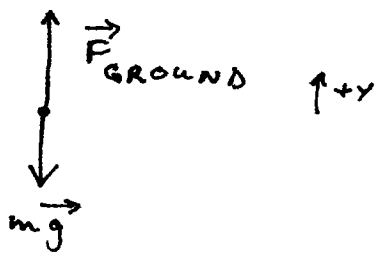
$$v_{oy} = 0\ m/s$$

$$t = 0.290\ s$$

Use $v_y = v_{oy} + a_y t$

$$\Rightarrow a_y = 16.37\ m/s^2$$

FBD for jumper:



$$\Sigma F_y = ma_y$$

$$\therefore F_{GROUND} - mg = ma_y$$

$$\therefore F_{GROUND} = m(g + a_y)$$

Now, $mg = 870\,N \therefore m = \dfrac{870\,N}{g} = 88.78\ kg$

$$\therefore F_{GROUND} = 88.78(9.80 + 16.37) = 2.32 \times 10^3\,N$$

This is the force exerted by the ground on the jumper. By Newton's 3rd law, the jumper exerts a force of equal magnitude ($2.32 \times 10^3\,N$) on the ground.