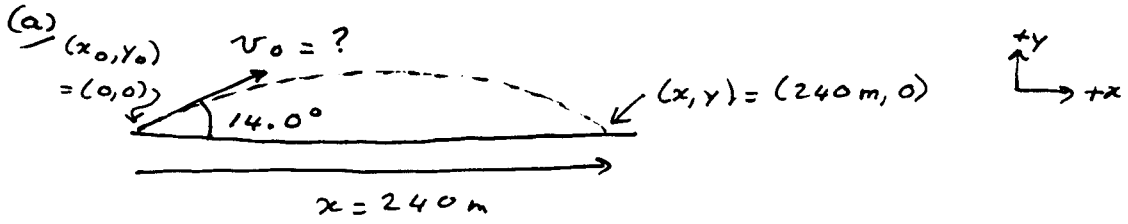
Problem 7-29

(a)



$v_{0x} = v_0 \cos 14.0°$ and $v_{0y} = v_0 \sin 14.0°$

$a_x = 0$ and $a_y = -9.80\text{ m/s}^2$

In x-direction: $x = x_0 + v_{0x} t$ [1]

$\therefore 240 = 0 + v_0(\cos 14.0°)\, t$ [2]

In y-direction: $y = y_0 + v_{0y} t + \frac{1}{2} a_y t^2$

$\therefore 0 = 0 + v_0(\sin 14.0°)\, t - 4.90\, t^2$

$\therefore t = \dfrac{v_0 \sin 14.0°}{4.90}$ [3]. Subst. in [2].

$\therefore 240 = v_0 \cos 14.0° \times \dfrac{v_0 \sin 14.0°}{4.90}$

$\Rightarrow v_0^2 = 5010\text{ m}^2/\text{s}^2$

and $v_0 = 70.8\text{ m/s}$ (70.7_8 m/s)

(b) Now, $v_0 = (70.7_8 + 0.6)\text{ m/s} = 71.3_8\text{ m/s}$

Eq. [3] still applies: $\therefore t = \dfrac{71.3_8 \sin 14.0°}{4.90} = 3.52_4\text{ s}$

Now use [1]: $x = x_0 + v_{0x} t$

$= 0 + (71.3_8 \cos 14.0°)(3.52_4)$

$= 244\text{m}$, i.e., 4m farther

(c) Now the angle is 14.5° and $v_0 = 70.7_8\text{ m/s}$.

Use [3] with angle of 14.5°:

$t = \dfrac{70.7_8 \sin 14.5°}{4.90} = 3.61_7\text{ s}$

Use [1] again: $x = 0 + (70.7_8 \cos 14.5°)(3.61_7)$

$= 248\text{m}$, i.e., 8m farther