Dr. Bob

1. a) y_f when $v_y = 0$

   b) $v_{iy} = 0$ m/s

   c) $y_f = 0$ m

   d) $v_y < 0$ m/s

   e) $y_i = y_f$ $x_i = x_f$

   f) $\theta = 45°$

2. Because the arrow will be falling downwards throughout the flight. By aiming upwards the arrow first rises & then falls to the height of the target.

3. a)

Vmax is at the moment of release.

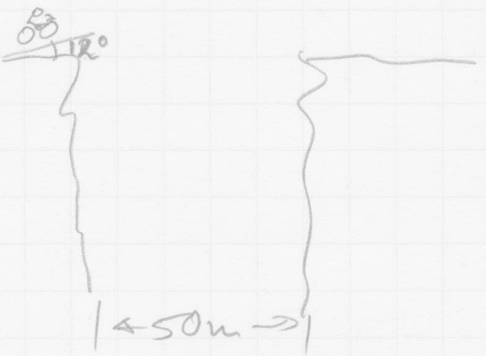
Vmin is when the pojectile reaches it maximum height whether at the arrival point or before the arrival point.

b)

Vmax at the lowest point - the arrival point.

Vmin at the highest point.

4. Evil Knevil!



$y_i = y_f = 0m$

$x_i = 0m \quad x_f = 50m$

$a_y = -9.8 m/s^2$

$V_i = ?$

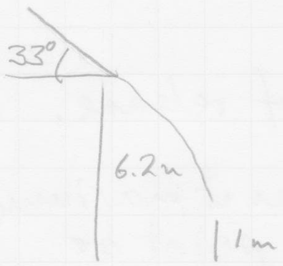
$$Range = \frac{V_i^2 \sin 2\theta_i}{g}$$

$$V_i = \sqrt{\frac{(Range)\, g}{\sin 2\theta_i}} = \sqrt{\frac{(50m)(9.8m/s^2)}{\sin(2(12^\circ))}}$$

$$V_i = 34.71 \frac{m}{s}\left(\frac{3600s}{1h}\right)\left(\frac{1km}{1000m}\right)$$

$$\boxed{V_i = 125 km/h}$$

5.



$y_i = 6.2m$

$y_f = 1.0m$

$a_y = -9.8m/s^2$

$V_i = 3.2 m/s$

$x_i = 0m$

$x_f = ?$

$V_{iy} = (-3.2m/s) \sin 33^\circ = -1.74 m/s$

$V_{ix} = (3.2 m/s) \cos 33^\circ = 2.68 m/s$

a) $t_f = ?$ $0 = (y_i - y_f) + V_i\Delta t + \frac{1}{2} a_y \Delta t^2$

$$\frac{1}{2}(-9.8m/s^2)\Delta t^2 - (1.74m/s)\Delta t + 5.2m = 0$$

$$\Delta t = \frac{1.74m/s \pm \left[(-1.74m/s)^2 - 4(-4.9m/s^2)(5.2m)\right]^{1/2}}{2(-4.9m/s^2)}$$

$$= -0.178 m/s \pm 1.045 m/s$$

$$\boxed{\Delta t = 0.87s}$$

p. 261 5. (cont'd)

b) $X_f = ?$ $X_f = X_i + V_x \Delta t$

$= 0m + (2.68 m/s)(0.87 s)$

$$X_f = 2.33 m$$

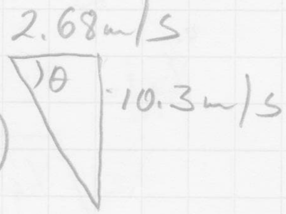
c) $V_{yf} = ?$ $V_{yf} = V_{yi} + a_y \Delta t$

$= -1.74 m/s + (-9.8 m/s^2)(0.87 s)$

$V_{fy} = -10.3 m/s$

$V = \sqrt{V_x^2 + V_y^2} = \sqrt{(2.68 m/s)^2 + (10.3 m/s)^2}$

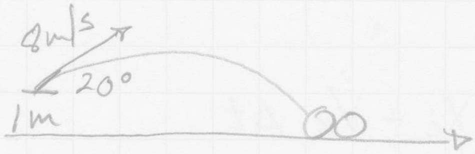
$$V = 10.6 m/s$$



$\theta = \tan^{-1}\left(\frac{V_y}{V_x}\right) = \tan^{-1}\left(\frac{-10.3 m/s}{2.68 m/s}\right)$

$$\theta = -75.4° \text{ or } 284.6°$$

6.



$X_f = ?$

$y_i = 1m \qquad V_{iy} = (8m/s)\sin 20° = 2.74m/s$

$y_f = 0m \qquad V_{ix} = (8m/s)\cos 20° = 7.52m/s$

$a_y = -9.8m/s^2$

$$y_f = y_i + V_{iy}\Delta t + \tfrac{1}{2} a_y \Delta t^2$$

$$0 = (y_i - y_f) + V_{iy}\Delta t + \tfrac{1}{2} a_y \Delta t^2$$

$$0 = (-4.9m/s^2)\Delta t^2 + (2.74m/s)\Delta t + 1m$$

$$\Delta t = \frac{-2.74m/s \pm [(2.74m/s)^2 - 4(-4.9m/s^2)(1m)]^{1/2}}{2(-4.9m/s^2)}$$

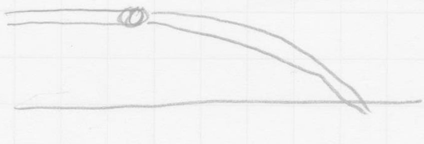
$$= 0.280s \pm 0.531$$

$$\Delta t = 0.811s$$

$$X_f = X_i + V_{ix}\Delta t = 0m + (7.52m/s)(0.811s)$$

$$\boxed{X_f = 6.1m}$$

7.



a) Measure height & calculate time to reach ground using

$$y_f \to 0 = y_i + V_{iy}\Delta t \to 0 + \tfrac{1}{2} a_y \Delta t^2$$

b). Measure distance traveled & use

$$V = \frac{X_f - X_i}{\Delta t}$$

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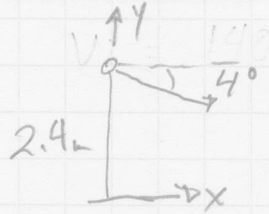


$y_f = ?$

$| 0.9m$

12m

$y_i = 2.4m$ $\quad V_i = 140\frac{km}{h}\left(\frac{1000m}{1km}\right)\left(\frac{1h}{3600s}\right)$

$y_f = ?$

$x_i = 0m$

$x_f = 12m$ $\quad V_i = 38.9m/s$

$$V_{iy} = (-38.9m/s)\sin 4° = -2.71m/s$$

$$V_{ix} = (38.9m/s)\cos 4° = 38.8m/s$$

$$x_f = \cancel{x_i}^{\,0} + V_{ix}\Delta t$$

$$\Delta t = \frac{x_f}{V_x} = \frac{12m}{38.8m/s} = 0.31s$$

$$y_f = y_i + V_{iy}\Delta t + \tfrac{1}{2}a_y\Delta t^2$$

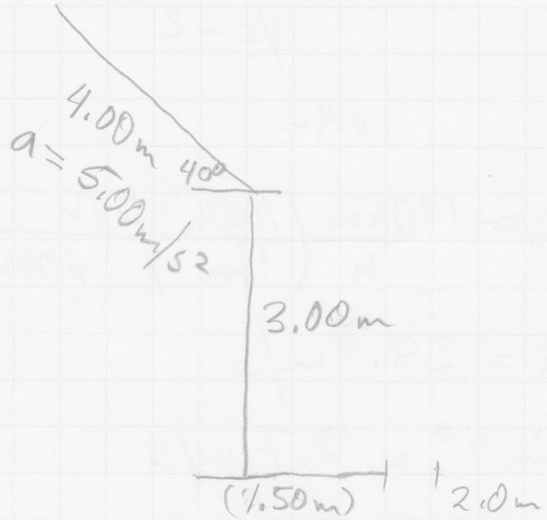
$$= 2.4m - (2.71m/s)(0.31s) + (-4.9m/s^2)(0.31)^2$$

$$y_f = 1.10m$$

The ball clears net by 1.10m − 0.90m

or $\boxed{0.2m}$.

9.



Part I The roof. $\Delta X = 4.00\,m$ $a = 5.00\,m/s^2$
$V_i = 0\,m/s$ $V_f = ?$

$$V_f^2 = \cancel{V_i^2}^{\,\to 0} + 2a\Delta X$$

$$V_f = \sqrt{2(5.00\,m/s^2)(4m)}$$

$$V_f = 6.325\,m/s$$

Part II The fall. $V_{iy} = (6.325\,m/s)\sin(-40°) = -4.065\,m/s$
$V_{ix} = (6.325\,m/s)\cos(-40°) = 4.845\,m/s$

$Y_f = 0\,m$ $a_y = -9.8\,m/s^2$ $\Delta t = ?$
$Y_i = 3.00\,m$

$$0 = (Y_i - Y_f) + V_{iy}\Delta t + \tfrac{1}{2}a_y\Delta t^2$$

$$0 = (-4.9\,m/s^2)\Delta t^2 - (4.065\,m/s)\Delta t + 3.00\,m$$

$$\Delta t = \frac{4.065\,m/s \pm [(-4.065\,m/s)^2 - 4(-4.9\,m/s^2)(3.00\,m)]^{1/2}}{2(-4.9\,m/s^2)}$$

$$\Delta t = -0.4148\,s \pm 0.8856\,s$$

$$\Delta t = 0.4708\,s$$

$$X_f = X_i + V_{ix}\Delta t = 0\,m + (4.845\,m/s)(0.4708\,s)$$

$$\boxed{X_f = 2.28\,m}$$

Does not hit planters
Falls beyond by 0.28m