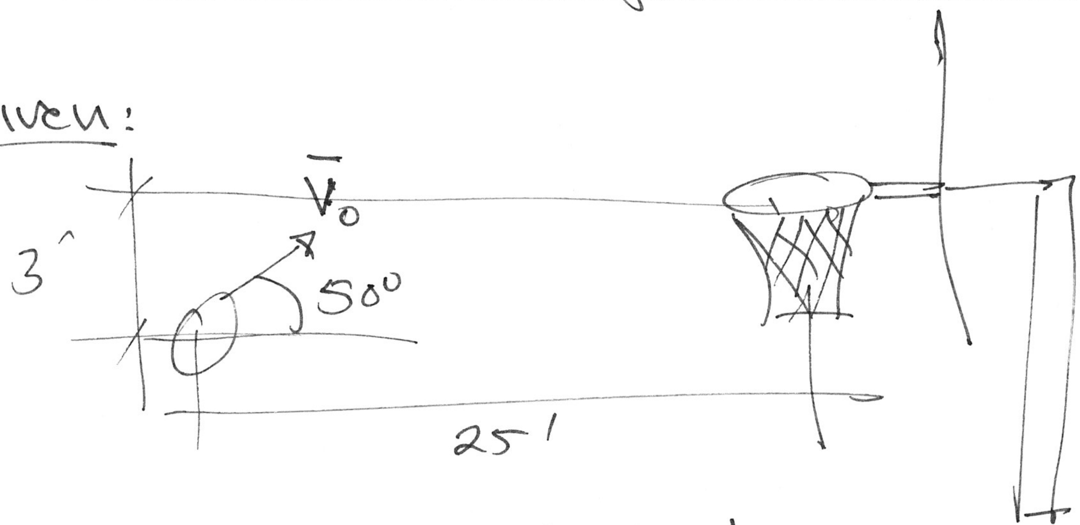
Given:



Req'd $\bar{v}_0$ to go through hoop.

Assump: $a_y = -32.2\, ft/s^2$, center of ball through center of hoop works

Strategy: 2 linear problems in $\hat{i}$ + $\hat{j}$, integrate and apply boundary cond.

Estimate: $v_0 < 10\, m/s$ (30'/s) from experience, expect $t_{flight} \leq 1s$

@ $t = .5s$ $V_{0x} = .7 V_0$ $\frac{25'}{.5s} = 50'/s \Rightarrow V_0 = 70'/s$ ← sheesh.

maybe $v_0 > 30'/s$?

Soln: $\bar{a} = 0\hat{i} - 32.2'/s^2 \hat{j}$ → separate!

i | j

$a_x = 0 \Rightarrow V_x = v_{ox} = V_o \cos 50^\circ$

$25' = x = \underbrace{x_o}_{0} + V_{ox} t = V_o \cos 50^\circ t$

$\Rightarrow 25' = \underline{\underline{V_o}} \cos 50^\circ \underline{\underline{t}}$ ①

2 unknown.
could solve for either V_o or t
and substitute

$$t = \frac{25'}{V_o \cos 50^\circ}$$

$$S_y = \cancel{V_o} \sin 50^\circ \left[\frac{25'}{\cancel{V_o} \cos 50^\circ}\right] - \frac{1}{2} 32.2'/s^2 \left[\frac{25'}{V_o \cos 50^\circ}\right]^2$$

$a_y = -g$

$\Rightarrow$ (integrate) $v_{fy} = V_{oy} + a_y(t - \underbrace{t_o}_{0})$

$\underline{\underline{V_{fy}}} = \underline{\underline{V_o}} \sin\theta - g\underline{\underline{t}}$ 3 unknown

integrate again

$S_y = \underbrace{S_o}_{0} + V_{oy} t + \frac{1}{2} a_y t^2$

② $S_y = V_o \sin\theta \underline{\underline{t}} - \frac{1}{2} g \underline{\underline{t}}^2$

2 unkn

$$3' = S_y = 25' \tan 50^\circ - 16.1'/s^2 \frac{25'^2}{V_o^2 \cos^2 50^\circ}$$

solve for V_o

$$\frac{16.1'/s^2 (25')^2}{V_o^2 \cos^2 50^\circ} = 25' \tan 50^\circ - 3' \Rightarrow \frac{16.1'/s^2 (25')^2}{[25' \tan 50^\circ - 3'] \cos^2 50} = V_o^2$$

Soln: cont

$$V_0^2 = \frac{16.1\ {}^{1}/_{s^2} \cdot (25')^2}{\underbrace{[25\tan 50^\circ - 3']}_{29.8}\ \underbrace{\cos^2 50^\circ}_{.413}} = \frac{10{,}062\ {}^{1^2}/_{s^2}}{11.07} = 909\ {}^{1^2}/_{s^2}$$

$$\Rightarrow \boxed{V_0 = 30.2\ {}^{1}/_{s}}$$

just for giggles

$$t = \frac{25'}{V_0 \cos 50^\circ} = \frac{25'}{30.2\ {}^{1}/_{s} \cdot \cos 50^\circ} = \frac{25}{19.4}\ s = \boxed{1.29\ s}$$

Discussion: I feel like my estimate was a little shakey even though it generally agrees w/ my results. Checking on google the top of the NBA 3pt line is 24' so that is roughly what we are talking about. I took a quick look at some NBA video and I'm pretty happy w/ the #'s relative to reality. If I had taken $t = 1\,s$ as my estimate flight time I would have had a closer estimate!