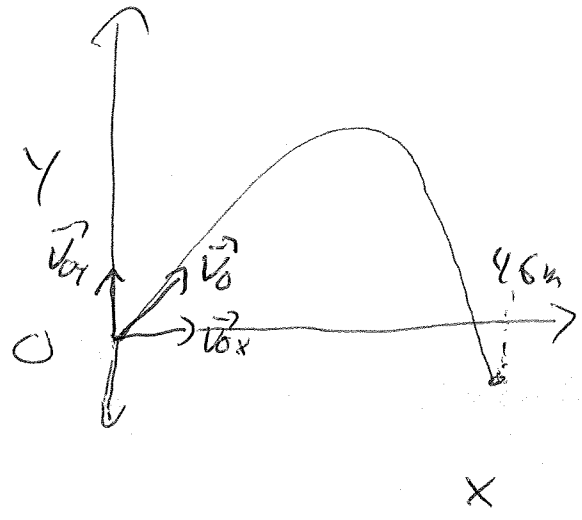
4-117 Punter hits football 150cm above the ground, it stays in the air 4.5s and travels 46m.

What's initial "$\vec{v}$" (mag. + direction?)



Football moves in both $\vec{x}$ and $\vec{y}$ directions independantly.

In x, it's just going $\vec{v}_{0x}$ at a constant velocity for as long as it has before it hits the ground.

So the equations like 4.22 work, let's set $y = 0$ at the punter's foot and the ground at $y = -1.50\,m$

if $\Delta x = \vec{v}_{0x} \cdot t$, then $\vec{v}_{0x} = \frac{\Delta x}{t} = \frac{46\,m}{4.5\,s} = 10.2\,m/s\ \hat{x}$

in y, there's a constant acceleration $a = -g = -9.8\,m/s^2$

4-22) $\Delta y = \vec{v}_{0y} t - \frac{1}{2} a t^2$

so $\vec{v}_{0y} = \frac{\Delta y + \frac{1}{2} a t^2}{t} = \frac{-1.50\,m - \frac{1}{2}(-9.8\,m/s^2)(4.5s)^2}{4.5s}$

$\vec{v}_{0y} = 21.7\,m/s\ \hat{y}$

so: $|v_0| = \sqrt{v_{0y}^2 + v_{0x}^2} = \sqrt{(10.2\,m/s)^2 + (21.7\,m/s)^2} = 24\,m/s$

$\tan\theta = \frac{v_{0y}}{v_{0x}}$

$\theta = \tan^{-1}\left(\frac{21.7}{10.2}\right) = 65^\circ$ from Horizontal