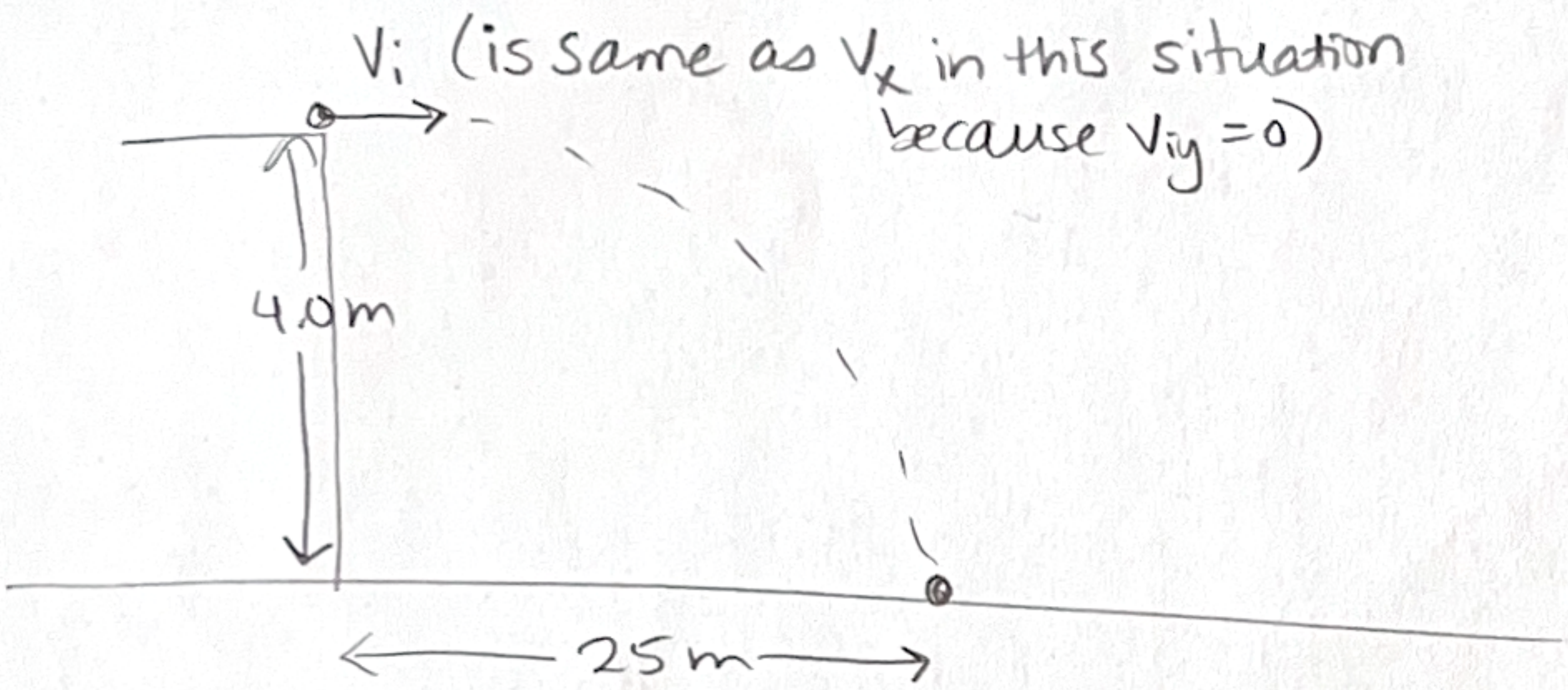
Ch4 p.106 #17; Also find velocity at impact




Interval: Launch to Landing

| Horiz | Vert |
|---|---|
| $\Delta x = 25m$ | $\Delta y = -4.0m$ |
| $V_x =$ | $V_{iy} = 0$ |
| $\Delta t =$ | $V_{fy} =$ |
| | $a = -9.8 m/s^2$ |
| | $\Delta t =$ |

I am looking for $V_x$, but I don't have enough information yet to find it, so let's see if I can find $\Delta t$ from the vertical variables:

$$\Delta y = V_{iy} \Delta t + \frac{1}{2} a_y \Delta t^2$$

$$-4.0m = 0(\Delta t) + \frac{1}{2}(-9.8 m/s^2)\Delta t^2$$

$$-4 = -4.9 \Delta t^2$$

$$.904s = \Delta t$$

Now I can find $\Delta x$:

$$\Delta x = V_x \Delta t$$

$$25m = V_x (.904s)$$

$$27.7 \frac{m}{s} = V_x$$

$$28 \frac{m}{s} = V_x$$

I also need to find the velocity at impact.


To find this, I need to know $V_x$ and $V_{fy}$.

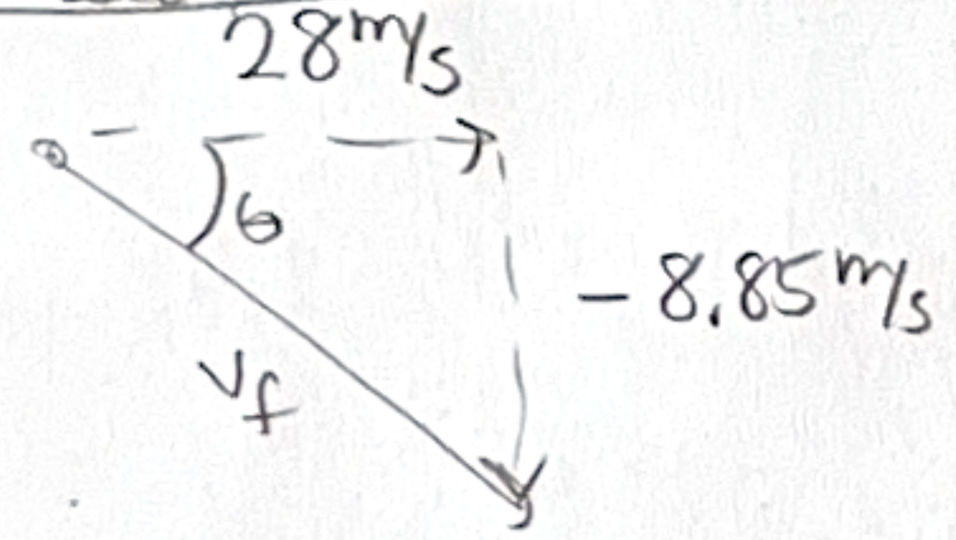
I need to find $V_{fy}$:

$$V_{fy}^2 = V_{iy}^2 + 2a_y \Delta y$$

$$V_{fy}^2 = 0 + 2(-9.8\,m/s^2)(-4.0\,m)$$

$$V_{fy} = -8.85\,m/s$$

Now I need to find the velocity by combining the x and y components:




Use pythagorean theorem:

$$V_f^2 = V_x^2 + V_{fy}^2$$

$$V_f^2 = (28\,m/s)^2 + (8.85\,m/s)^2$$

$$V_f = 29.4\,m/s$$

This is the speed at landing. I also need the direction:

$$\tan\theta = \frac{V_{fy}}{V_x}$$

$$\tan\theta = \frac{8.85\,m/s}{28\,m/s}$$

$$\theta = 18°$$

$\vec{V}_f$ is 29.4 m/s at 18° below the horizontal.

⇩

Another way to write this is

$$\vec{V}_f = (28\hat{i} - 8.85\hat{j})\,m/s$$