Flipping Physics Lecture Notes:
A Free-Fall Problem That You Must Split Into Two Parts

Example Problem: Mr.p throws a ball straight up and lets it fall to the ground. If the ball leaves his hand 124 cm above the ground and it lands on the ground 1.14 seconds later, to what maximum height did the ball go above the ground?

The key to understanding this problem is that you have to split the event into two parts. We will call them Part 1: Going Up and Part 2: Falling Down. However, you actually have to start by looking at the whole event first.

Total Event: Knowns: $\Delta y_t = -124cm \times \frac{1m}{100cm} = -1.24m;\ a_y = -9.81\frac{m}{s^2};\ \Delta t_t = 1.14\,\text{sec};\ v_{ti} = ?$

$$\Delta y_t = v_{ti}\Delta t_t + \frac{1}{2}a_y \Delta t_t{}^2 \Rightarrow -1.24 = v_{ti}(1.14) + \frac{1}{2}(-9.81)(1.14)^2 = 1.14v_{ti} - 6.374538$$

$$\Rightarrow 1.14v_{ti} = -1.24 + 6.374538 = 5.134538 \Rightarrow v_{ti} = \frac{5.134538}{1.14} = 4.503981\frac{m}{s} = v_{1i}$$

(The initial velocity for the Total Event is the same as the initial velocity for Part 1: Going Up)

Now we just look at Part 1: Going Up: Knowns: $v_{1i} = 4.503981\frac{m}{s};\ a_y = -9.81\frac{m}{s^2};\ v_{top} = v_{1f} = 0;\ \Delta y_1 = ?$

$$v_{1f}{}^2 = v_{1i}{}^2 + 2a_y\Delta y_1 \Rightarrow (0)^2 = v_{1i}{}^2 + 2a_y\Delta y_1 \Rightarrow -\left(v_{1i}{}^2\right) = 2a_y\Delta y_1$$

$$\Rightarrow \Delta y_1 = \frac{-\left(v_{1i}{}^2\right)}{2a_y} = \frac{-(4.503981)^2}{(2)(-9.81)} = 1.033937m$$

We have the displacement while going up, however, we need to add the initial height to that to get the maximum height the ball went above the ground.

$$h_{\max} = h_{initial} + \Delta y_1 = 1.24 + 1.033937 = 2.273937 \approx \boxed{2.27m}$$