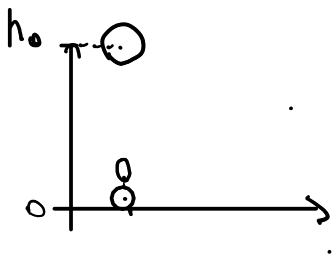
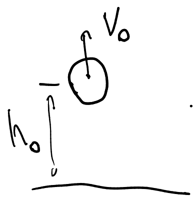


$h = h_0 - \frac{1}{2} g t^2$ ⇝ too limiting

$h_0 \to 0 \xrightarrow{\text{cste}} V_1 \to$

Sometimes your model is to narrow.

We need to move model.



$v = -g t + V_0$

$h = -\frac{1}{2} g t^2 + V_0 t + C$

More general!

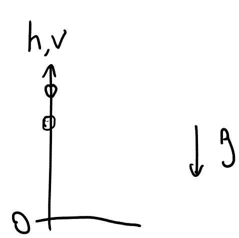
IF we go back to $t = 0$

$V_0 = 0$

$h = -\frac{1}{2} g t^2 + V_0 t + C$

$h_0 = -\frac{1}{2} g t^2 + C \Rightarrow C = h_0$

Define t_i as the ith time the ball hit the ground.



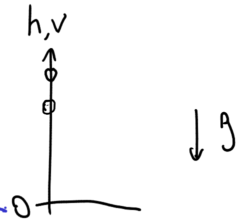
From $t = 0$ till $t = t_1$

$h = h_0 - \frac{1}{2} g t^2$

$v = -g t$

From $t = t_1$ till $t = t_2$

V_1 velocity immediately after the bounce



From $t=0$ till $t=t_1$

$$h = h_0 - \frac{1}{2} g t^2$$

$$v = -gt \rightarrow t_1 = \sqrt{\frac{2h_0}{g}}$$

From $t=t_1$ till $t=t_2$

v_1 velocity immediately after the bounce

$$v_1 = -k(-g t_1)$$

$$h = v_1 t - \frac{1}{2} g t^2$$ → relative time.

$$v = \frac{\partial h}{\partial t} = v_1 - g t$$

In absolute time

$$h = v_1 (t - t_1) - \frac{1}{2} g (t - t_1)^2$$

$$v = v_1 - g(t - t_1)$$

Side note.
maximum height at time between t_1 and t_1

$$\hat{t}_{12} = \frac{v_1}{g}$$

$$\hat{h}_{12} = \frac{v_1^2}{g} - \frac{1}{2}\frac{v_1^2}{g}$$

$$= v_1\left(\frac{v_1}{g}\right) - \frac{1}{2} g \left(\frac{v_1}{g}\right)^2$$

$$= \frac{v_1^2}{g} - \frac{v_1^2}{2g}$$

What will happen from $t_2 - t_3$

$$v_2 = -k(v_1 - g(t_2 - t_1))$$

t_2 can be calculated from the