Free Fall

$$a_y = -9.8\ m/s^2$$

Vertically down

(towards center of Earth)

$\int 1 \frac{dx}{dt} dt$

$$V_x = \frac{dx}{dt}$$

$$a_x = \frac{dV_x}{dt}$$

area under V vs t

$$\int_{t_1}^{t_2} V_x \, dt = \int_{x_1}^{x_2} 1 \, dx$$

$$= \left[x \right]_{x_1}^{x_2}$$

$$= x_2 - x_1$$

$$= \Delta x$$

displacement

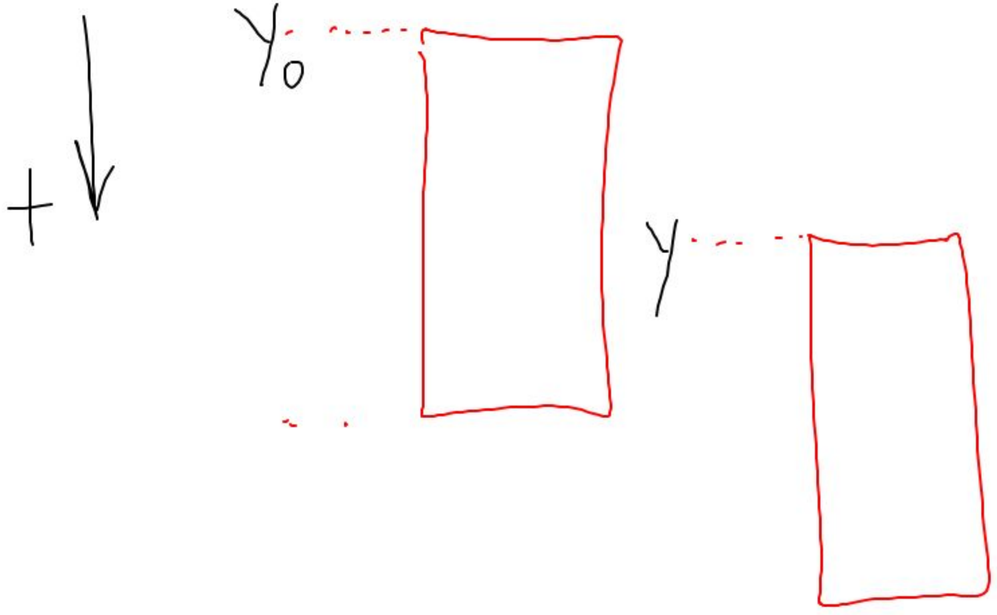
area under a vs t

$$\int_{t_1}^{t_2} a_x \, dt = \int_{V_1}^{V_2} 1 \, dV_x$$

$$= \left[V_x \right]_{V_1}^{V_2}$$

$$= V_2 - V_1$$

$$= \Delta V_x$$



How long?

$y_0 = 0$

$y = +8.0\,cm$

$V_{oy} = 0$

$V_y = ?$

$a_y = +9.8\,m/s^2$

$$y = y_0 + \cancel{V_{oy}t}^{0} + \frac{1}{2}a_y t^2$$

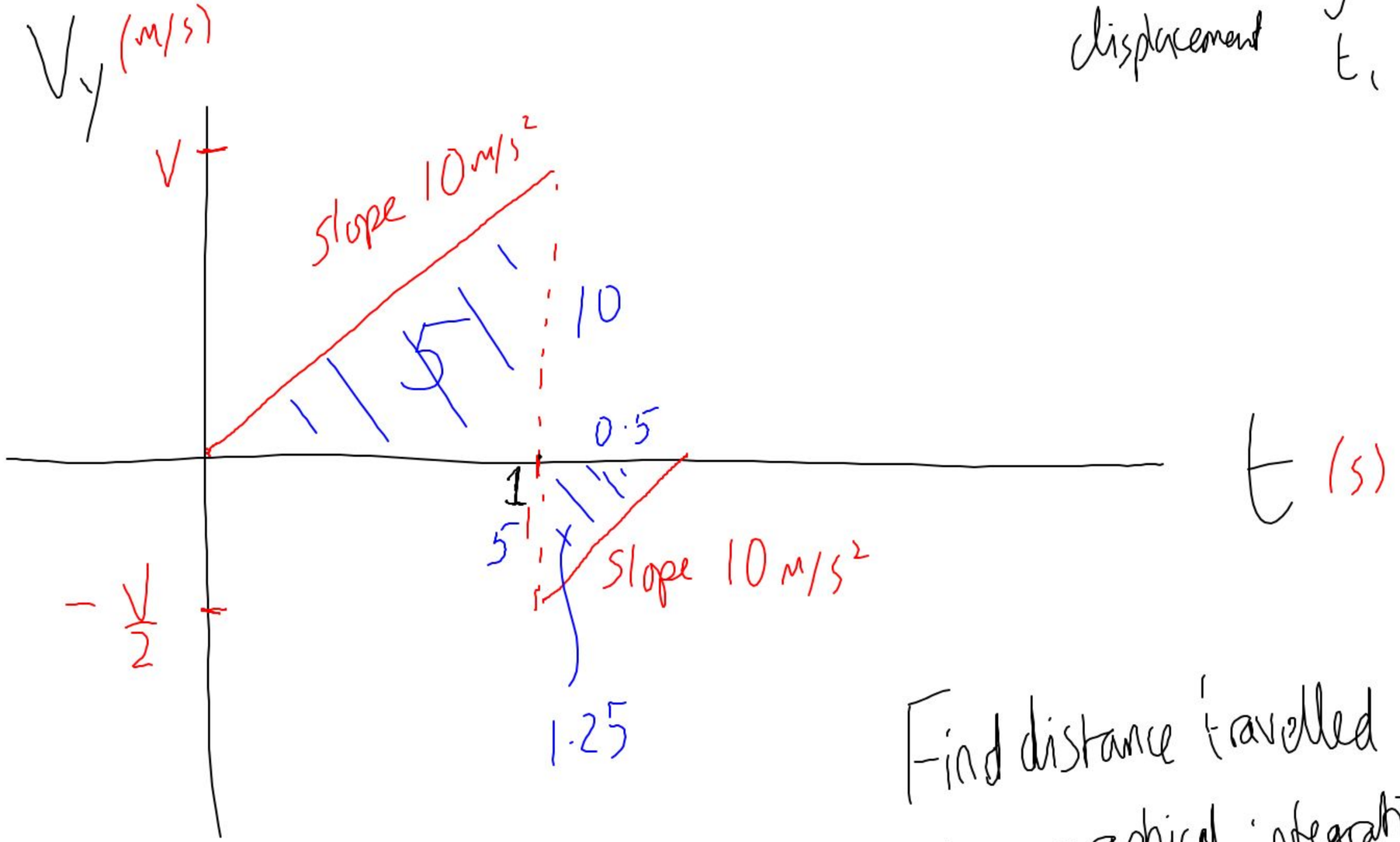
$$\sqrt{\frac{2(y-y_0)}{a_y}} = t \Rightarrow t = \sqrt{\frac{2(8-0)}{9.80}} = 0.127..s = 0.13s$$

Choose $\downarrow +$

Take $a_y \approx +10\ m/s^2$

$$\Delta x = \int_{t_1}^{t_2} V_x\, dt$$

displacement — area under V vs. t



Find distance travelled using graphical integration.

$5 + 1.25 = 6.25\ m$

If a_x constant

can use constant acc^n formulas.