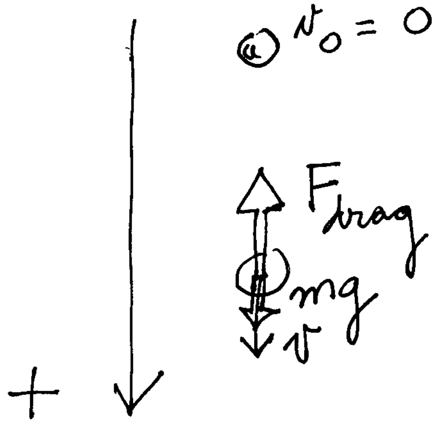


EOM: $m \frac{dv}{dt} = -c_1 v + mg$

It reaches terminal velocity v_t:

$$0 = -c_1 v_t + mg \rightarrow v_t = \frac{mg}{c_1}$$

$$\therefore \boxed{\frac{dv}{dt} = -\frac{v}{v_t} \cdot g + g = g\left(1 - \frac{v}{v_t}\right)}$$

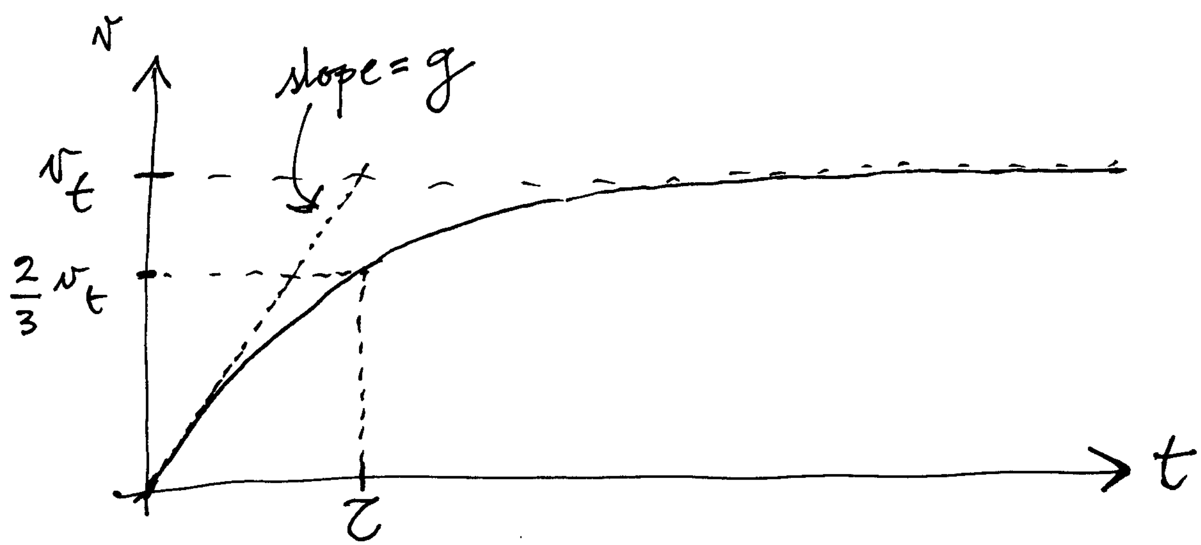
$$\int_{0 = v_0}^{v(t)} \frac{dv}{g\left(1 - \frac{v}{v_t}\right)} = \int_0^t dt$$

$$\rightarrow \left[-\frac{v_t}{g} \ln\left(1 - \frac{v}{v_t}\right) \right]_0^{v(t)} = t$$

$$\ln\left(1-\frac{v}{v_t}\right) = -\frac{g}{v_t}\cdot t$$

$$1-\frac{v}{v_t} = e^{-\frac{g}{v_t}\cdot t}$$

$$v = v_t\left(1 - e^{-\frac{g}{v_t}t}\right)$$



If $1/\tau = \frac{g}{v_t}$, $v = v_t\left(1 - e^{-t/\tau}\right)$

Linear or quadratic drag?

We found $v_{critical} = \dfrac{7.05 \times 10^{-4}}{D}$

In general, it reaches v_t when $\uparrow^{+}$

$$0 = -mg + c_1 |v_t| + c_2 |v_t|^2$$

$$\rightarrow \quad |v_t| = -\frac{v_c}{2} + \sqrt{\left(\frac{v_c}{2}\right)^2 + \frac{mg}{c_2}}$$