$$y'(x) \approx \frac{y(x+h) - y(x)}{h}$$

$F_{arrastre} \propto v^n$

Si $n = 2$

mg

$$F_{arrastre} - mg = -ma \qquad a = \frac{dv}{dt}$$

$$\underbrace{F_{arrastre}}_{\downarrow} - mg = -m\frac{dv}{dt}$$

$$bv^2 - mg = -m\frac{dv}{dt}$$ Ecuación de movimiento

E.D.O.

$$\int_{v_0}^{v} \frac{dv}{-bv^2 + mg} = \int_{t_0}^{t} \frac{1}{m} dt$$

Si $+bv^2 - mg = 0$ $\qquad v_{terminal} = \sqrt{\frac{mg}{b}} = v_t$

$$z = -bv^2 + mg$$

$$dz = -2bv\,dv \rightarrow \int -\frac{dz}{z\,2bv} = \frac{1}{m}(t - t_0)$$

$$dv = -\frac{dz}{2bv}$$

$$-\int_{v_0}^{v} \frac{dv}{-g + \frac{b}{m}v^2} \rightarrow \cancel{z = v_\ell \cdot v}$$

$$z \cdot v_\ell = v$$

$$\rightarrow z \cdot v_\ell = v$$

$$\int_{v_0}^{v} \frac{dv}{-g + \frac{b}{m} z \cdot v_\ell} \qquad dv = dz \cdot v_\ell \qquad dz = \frac{dv}{v_\ell}$$

$$-v_\ell \int_{v_0}^{v} \frac{dz}{-g + \frac{b}{m} z^2 \cdot v_{\ell imite}^2} \rightarrow v = z \cdot v_\ell \qquad v = z\sqrt{\frac{mg}{b}}$$

$$\rightarrow v_\ell \int_{v_0}^{v} \frac{dz}{-g + z^2 g} \qquad v^2 = z \cdot \frac{mg}{b}$$

$$\rightarrow v_\ell \int_{v_0}^{v} \frac{dz}{z^2 - 1} = \frac{v_\ell}{g} \int_{\frac{v_0}{v_\ell}}^{v_{lim}} \frac{dz}{z^2 - 1}$$

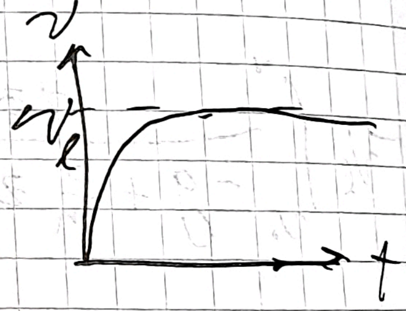
$$= \frac{v_{\ell im}}{g}\left[\int \frac{\frac{1}{2}dz}{z+1} - \int \frac{\frac{1}{2}dz}{z-1}\right]$$

$$= \frac{v_{lim}}{g}\left[\ln\left(\frac{z+1}{z-1}\right)\right]\Bigg|_{\frac{v_0}{v_{lim}}}^{v_{lim}} \qquad v = z \cdot v_{lim} \qquad z = \frac{v}{v_{lim}}$$

$$\frac{v_{lim}}{g}\left[\ln\left(\frac{\frac{v}{v_{lim}}+1}{\frac{v}{v_{lim}}-1}\right) - \ln\left(\frac{\frac{v_0}{v_{lim}}+1}{\frac{v}{v_{lim}}-1}\right)\right]$$

$$\rightarrow v(t) = -v_{lim}\,\frac{(v_0-v_{lim})\,e^{\left[\frac{g}{v_{lim}}(t-t_0)\right]} + (v_0+v_{lim})\,e^{\left[-\frac{g}{v_{lim}}(t-t_0)\right]}}{(v_0-v_{lim})\,e^{\left[g/v_{lim}(t-t_0)\right]} - (v_0+v_{lim})\,e^{\left[-\frac{g}{v_{lim}}(t-t_0)\right]}}$$

$$bv^2 - mg = -m\frac{dv}{dt}$$



$m = 70\,Kg$

$t_0 = 0$

$v_0 = 0$

$$b = \frac{\rho A \delta}{2} \qquad \rho_{aire} = 1$$

A = Araa se sección transversal → Area del Paracaidas

δ = Cooficiente de forma geometrica

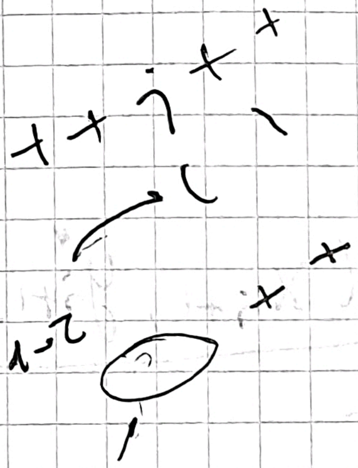
$\delta \approx 0.8$ $\qquad$ $A = 0.6\,m^2$

$$y'(x) = \frac{y(x+h) - y(x)}{h}$$

$$\frac{dv}{dt} = \frac{\boxed{v(0+\cancel{h}) - v_0)}}{\boxed{h}}$$

$v + h$

$v = 0$



$$-m\frac{dv}{dt} = bv^2 - mg$$

y

$$-\frac{dv}{dt} = \frac{bv^2}{m} - g$$

$$y_{n+1} = v_n$$

$$v_{n+1} = v_n + h \cdot \left(\frac{bv^2}{m} - g\right)$$