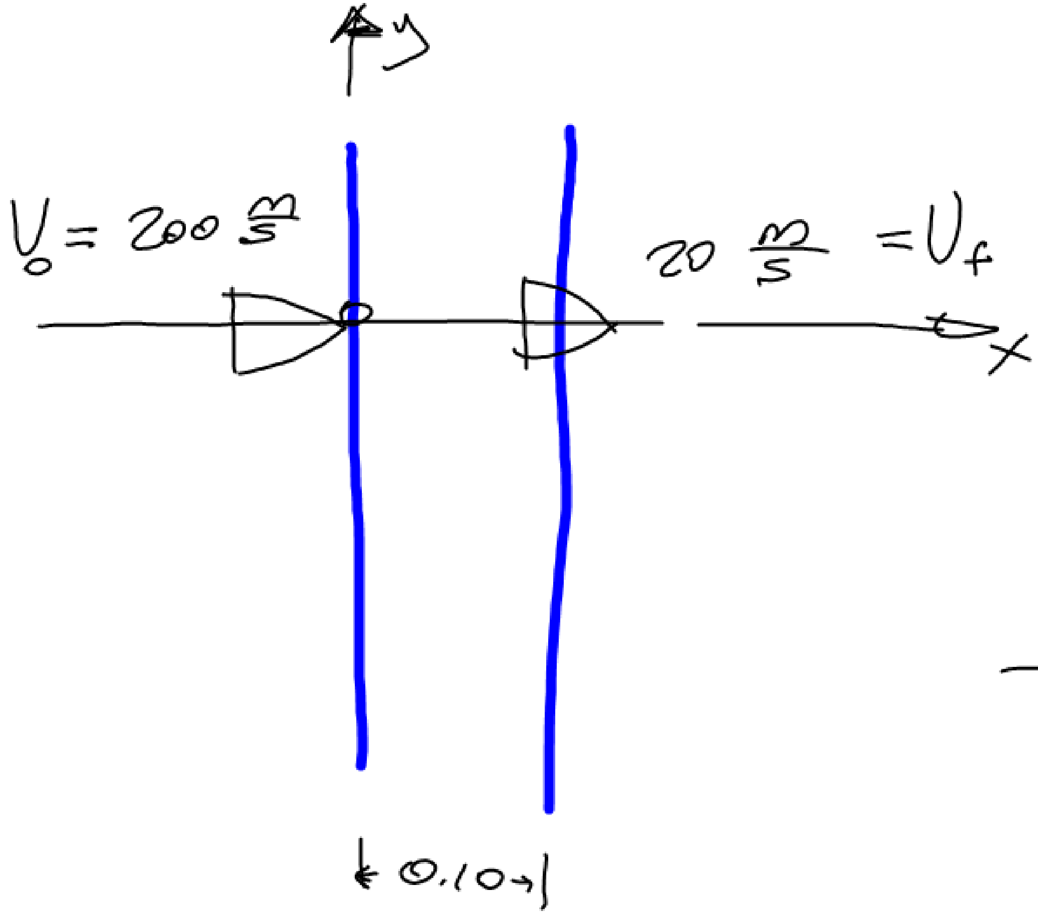

$$\boxed{\frac{dv}{dt} = -k\,v^2}$$

$$v_0(0) = 200 \ \frac{m}{s}$$

$$x_0(0) = 0 \ m$$

$$v(t_f) = 20 \ \frac{m}{s}$$

$$x(t_f) = 0.10 \ m$$

$$\frac{dU}{dt} = kU^2$$

Método Variables Separables.

$$\frac{dU}{U^2} = k\,dt$$

$$\int \frac{dU}{U^2} = k \int dt$$

$$\int U^{-2}\,dU = kt + C_1$$

$$\frac{U^{-1}}{-1} = kt + C_1 \qquad U(0) = 200$$

$$-\frac{1}{U} = kt + C_1$$

$$\boxed{U = -\frac{1}{(kt + C_1)}}$$

Solución general

$$200 = -\frac{1}{k(0) + C_1}$$

$$200 = -\frac{1}{C_1}$$

$$\boxed{C_1 = -\frac{1}{200}}$$

$$\boxed{U(t) = -\frac{1}{kt - \frac{1}{200}}}$$

Solución Particular

$$v(t) = \frac{1}{\frac{1}{200} - kt}$$

$$\frac{dx}{dt} = \frac{1}{\frac{1}{200} - kt}$$

$$dx = \frac{dt}{-kt + \frac{1}{200}}$$

Variables separables

$$\int dx = \int \frac{dt}{-kt + \frac{1}{200}}$$

$x(0) = 0$

$$\int dx = -\frac{1}{k} \int \frac{-k\,dt}{-kt + \frac{1}{200}}$$

$$x(t) = -\frac{1}{k} L\left(-kt + \frac{1}{200}\right) + C_2$$

$$0 = -\frac{1}{k} L\left(-k(0) + \frac{1}{200}\right) + C_2$$

$$0 = -\frac{1}{k} L\left(\frac{1}{200}\right) + C_2$$

$$0 = -L\left(\frac{1}{200}\right)^{+\frac{1}{k}} + C_2$$

$$C_2 = L\left(\frac{1}{200}\right)^{\frac{1}{k}}$$

$$x(t) = L\left(-kt + \frac{1}{200}\right)^{-\frac{1}{k}} + L\left(\frac{1}{200}\right)^{\frac{1}{k}}$$

$$x(t) = L\left(\frac{\frac{1}{200}}{-kt + \frac{1}{200}}\right)^{\frac{1}{k}}$$

$$e^{x} = \left(\frac{\frac{1}{200}}{-kt + \frac{1}{200}}\right)^{\frac{1}{k}}$$

$$e^{kx} = \frac{\frac{1}{200}}{-kt + \frac{1}{200}}$$

$$e^{kx} = \frac{1}{-200kt + 1}$$

$$\frac{1}{e^{kx}} = -200kt + 1$$

$$\frac{1}{e^{kx}} - 1 = -200kt$$

$$t = \frac{\frac{1}{e^{kx}} - 1}{-200k}$$

$$\boxed{t_f = \frac{\frac{1}{e^{\frac{k}{10}}} - 1}{-200k}}$$