



$$\frac{dv}{dt} = -k v^2 \rightarrow \frac{dv}{dt} + k v^2 = 0$$

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

$$\boxed{\frac{dv}{v^2} + k dt = 0} \quad \begin{array}{l} \text{Variables} \\ \text{Separables} \end{array}$$

$$\int v^{-2} dv + k \int dt = C_1$$

$$\frac{v^{-1}}{-1} + kt = C_1$$

$$-\frac{1}{v} + kt = C_1 \quad \begin{array}{l} \text{Solución} \\ \text{general} \end{array}$$

$$-\frac{1}{V} + kt = C_1 \quad \leftarrow U(0) = 200$$

$$\frac{1}{V} = kt - C_1 \quad t_f = ?$$

$$V = \frac{1}{kt - C_1} \quad U(t_f) = 20$$

$$S(0) = 0$$

$$S(t_f) = 0.10 \text{ m}$$

$$V = \frac{1}{kt + \frac{1}{200}} \quad \text{Solución particular}$$

$$\frac{ds}{dt} = \frac{1}{kt + \frac{1}{200}}$$

$$ds = \frac{dt}{kt + \frac{1}{200}}$$

$$\int ds = \int \frac{dt}{kt + \frac{1}{200}} + C_2$$

~~Do (1) de Ntt.~~

Variables separables

$$s = \frac{1}{k} \int \frac{k dt}{kt + \frac{1}{200}} + C_2$$

$$S = \frac{1}{k} \ln \left(kt + \frac{1}{200} \right) + C_2$$

$$S(0) \Rightarrow 0 = \frac{1}{k} \ln \left(\frac{1}{200} \right) + C_2$$

$$C_2 = -\frac{1}{k} \ln \left(\frac{1}{200} \right)$$

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

$$S(t) = \frac{1}{k} \ln \left(kt + \frac{1}{200} \right) - \frac{1}{k} \ln \left(\frac{1}{200} \right)$$

$$kS = \ln \left(\frac{kt + \frac{1}{200}}{\frac{1}{200}} \right) \Rightarrow \ln(200kt + 1)$$

$$200kt + 1 = e^{kS}$$

$$200kt = e^{kS} - 1$$

$$t = \frac{e^{kS} - 1}{200k} \quad t_f = \frac{e^{\frac{k}{10}} - 1}{200k}$$

$$V = \frac{1}{kt + \frac{1}{200}}$$

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

$$20 = \frac{1}{k \left(\frac{e^{\frac{k}{10}} - 1}{200k} \right) + \frac{1}{200}}$$

$$t_f = \frac{e^{\frac{10L(10)}{10}} - 1}{200(10L(10))}$$

$$t_f = \frac{e^{L(10)}}{2000L(10)}$$

$$20 = \frac{1}{\frac{e^{\frac{k}{10}} - 1}{200} + \frac{1}{200}}$$

$$t_f = \frac{1}{200L(10)}$$

$$20 = \frac{200}{e^{\frac{k}{10}}} \quad \frac{1}{20} = \frac{e^{\frac{k}{10}}}{200}$$

$$e^{\frac{k}{10}} = \frac{200}{20} \quad e^{\frac{k}{10}} = 10$$

$$L e^{\frac{k}{10}} = L(10) \quad k = 10 L(10)$$

$$\frac{k}{10} = L(10)$$

$$k = 23.0258$$

$$t_f = 0.0021714 \text{ s}$$

$$U = \frac{1}{23.026t + 0.005}$$

$$23.026S = L(4605.2t + 1)$$

$$S = \frac{L(4605.2t + 1)}{23.026}$$

$$U = \frac{1}{23.026t + 0.005}$$

$$\frac{1}{U} = 23.026t + 0.005$$

$$23.026t = \frac{1}{U} - 0.005$$

$$t = \frac{\frac{1}{U} - 0.005}{23.026}$$

$$t_2 = \frac{\frac{1}{10} - 0.005}{23.026} \Rightarrow 0.004125$$

$$S = \frac{L(4605.2(0.004125) + 1)}{23.026} \Rightarrow 0.13$$