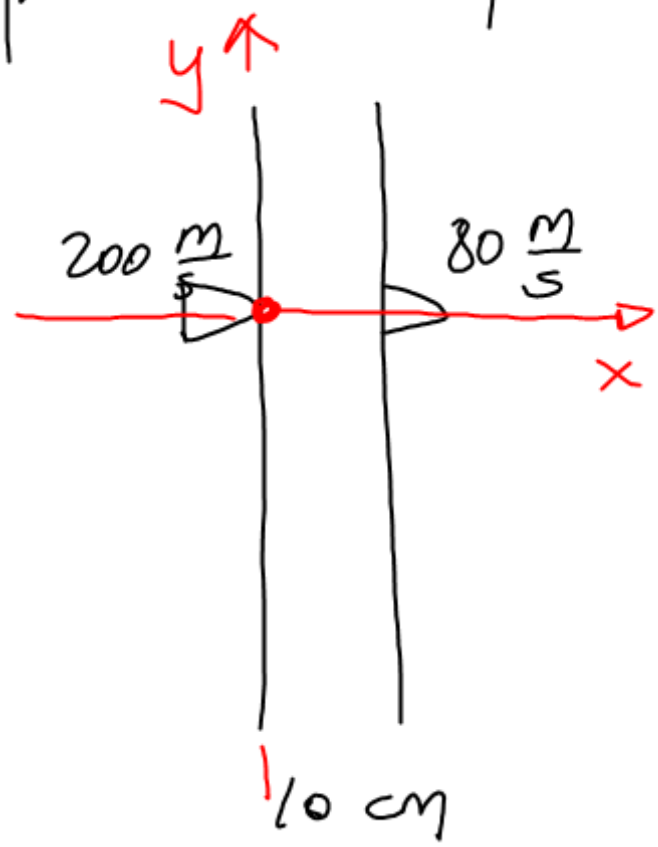
Problema 1.4 p. 37



EDO(1) NL

$$\frac{dV}{dt} = -kV^2$$

$t_f = ?$

$$\frac{dV}{dt} = -kV^2 \qquad V_0 = 200$$

$$\frac{dV}{V^2} = -k\,dt$$

$$\frac{dV}{V^2} + k\,dt = 0$$

SG

$$\int \frac{dV}{V^2} + k\int dt = C_1$$

$$\int V^{-2}\,dV + kt = C_1$$

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

$$-\frac{1}{V} = C_1 - kt$$

$$\boxed{V = -\frac{1}{C_1 - kt}}$$ SG. $V(0) = 200$

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

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

$$V = -\frac{1}{\left(-\frac{1}{200}\right) - kt}$$

$$\boxed{V = \frac{1}{\frac{1}{200} + kt}}$$ SP. Velocidad

$$\frac{dx}{dt} = \frac{1}{\left(\frac{1}{200}\right) + kt} \qquad x(0) = 0$$

$$\frac{dx}{dt} = \frac{1}{\left(\frac{1}{200}\right)+kt} \qquad x(0)=0$$

EDO(1) NL

$$dx = \frac{dt}{\left(\frac{1}{200}\right)+kt}$$

$$dx - \frac{dt}{\left(\frac{1}{200}\right)+kt} = 0$$

Sg.

$$\int dx - \frac{1}{k}\int \frac{k\,dt}{\left(\frac{1}{200}\right)+kt} = C_2$$

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

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

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

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

$$kx = L\left(\frac{\frac{1}{200}+kt}{\frac{1}{200}}\right)$$

$$kx = L\left(\frac{\frac{1+200kt}{200}}{\frac{1}{200}}\right)$$

$$kx = L(1+200kt)$$

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

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

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

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

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

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

$$V = \frac{1}{\frac{1}{200} + 10L\left(\frac{200}{80}\right)t}$$

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

$$x = \frac{L(1 + 200kt)}{k}$$

$$x = \frac{L\left(1 + 200\left(10L\left(\frac{200}{80}\right)\right)t\right)}{10L\left(\frac{200}{80}\right)}$$

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

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

$$V \Rightarrow \frac{200}{e^{\frac{k}{10}}} = 80$$

$$200 = 80e^{\frac{k}{10}}$$

$$\frac{200}{80} = e^{\frac{k}{10}}$$

$$L\left(\frac{200}{80}\right) = \frac{k}{10}$$

$$k = 10L\left(\frac{200}{80}\right)$$

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

$$t_p = \frac{e^{L\left(\frac{200}{80}\right)} - 1}{200\left(10L\left(\frac{200}{80}\right)\right)}$$

$$t_p = \frac{\frac{200}{80} - 1}{2000L\left(\frac{200}{80}\right)}$$