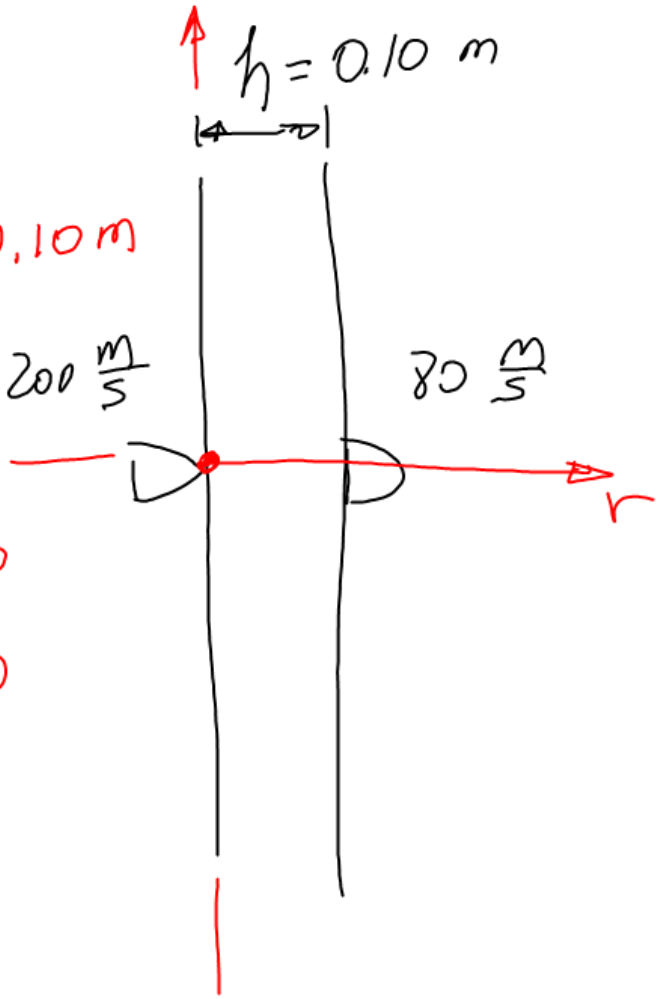
$r(0) = 0$

$r(t_r) = 0.10\ m$

$V(0) = 200$

$U(t_r) = 80$



EDO(1) NL

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

$t_r = ?$

$\frac{dr}{dt} \Rightarrow V$

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

$$M(t,v) = kV^2$$

$$N(t,v) = 1$$

$$\frac{dV}{dt} + kV^2 = 0$$

$$P(t) = k \qquad R(t) = 1$$

$$Q(V) = V^2 \qquad S(V) = 1$$

SOL. GRAL

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

$V(0) = 200$

$V(t_r) = 80$

$r(t_r) = 0.10\ m$

$r(0) = 0$

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

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

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

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

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

$$V(0) = 200$$

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

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

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

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

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

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

EDO(1) NL

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

$$\int dr - \int \frac{dt}{kt+\left(\frac{1}{200}\right)} = C_1$$

$$r -$$

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

$$du = k\,dt + 0$$

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

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

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

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

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

$$r(0) = 0$$

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

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

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

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