4) $a=5 \quad b=1 \quad h=\frac{25}{4} \quad P(0)=P_0$

$$\frac{dP}{dt} = P(a-bP) - h$$

$$\frac{dP}{dt} = P(5-P) - \frac{25}{4}$$

$$\frac{dP}{dt} = -(P^2 - 5P + \frac{25}{4})$$

$$\frac{dP}{P^2-5P+\frac{25}{4}} = -dt$$

$$\int \frac{dP}{(P-\frac{5}{2})^2} = -\int dt$$

$$-\frac{1}{P-\frac{5}{2}} = -t + C \qquad t=0$$

$$-\frac{1}{P_0-\frac{5}{2}} = C$$

$$\frac{1}{P-\frac{5}{2}} = t + \frac{1}{P_0-\frac{5}{2}}$$

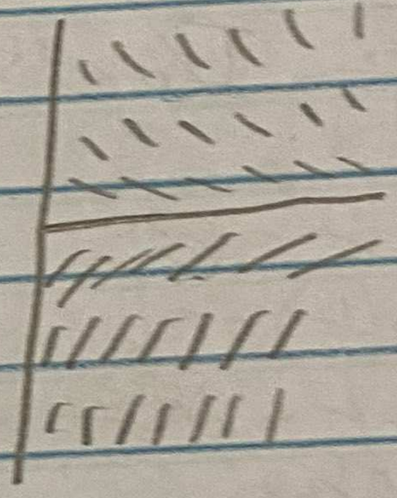
$$t = \frac{2}{(2P-5)} - \frac{2}{(2P_0-5)}$$

$$t = \frac{4P_0 - 10 - 4P + 10}{(2P-5)(2P_0-5)}$$

$$t = \frac{4(P_0-P)}{(2P-5)(2P_0-5)}$$

$$4(P_0-P) = (2P-5)(2P_0-5)t$$

$$P = P_0 - \frac{(2P-5)(2P_0-5)t}{4}$$




$0 < P_0 < 5/2$

$P = 0$

$$0 = P_0 - \frac{(0-5)(2P_0-5)t}{4}$$

$$P_0 = \frac{-5(2P_0-5)t}{4}$$

$$t = \frac{4P_0}{-10P_0-5}$$

# Chapt 3 Classwork

Marcelino Davila

1) $\frac{dI}{dt} kI$

$\int \frac{dI}{I} = \int k\,dt$

$\ln|I| = kt + c$

$I = e^{kt-c}$

$I = C_1 e^{kt}$

$I(0) = I_0 \quad t = 0$

$I_0 = C_1 e^0$

$I_0 = C_1$

$I = I_0 e^{kt}$

$I(3) = \frac{I_0}{4}$

$\frac{I_0}{4} = I_0 e^{3k}$

$\frac{1}{4} = e^{3k}$

$\ln(\frac{1}{4}) = 3k$

$k = \frac{\ln(\frac{1}{4})}{3}$

$I = I_0 e^{(\frac{\ln 1/4}{3})t}$

$t = 15$

$I = I_0 e^{(\ln 1/4)15}$

$I = I_0 e^{-5\ln 4}$

3) $\frac{dv}{dt} = kv^2$ $\quad \frac{dV}{dt} = -1$ when $V = 5$

$-1 = k5^2$

$-\frac{1}{25} = k$

$\frac{dV}{dt} = -\frac{1}{25}V$ $\quad V_0 = 10\ m/s$

$\int \frac{dV}{V^2} = \int -\frac{1}{25}dt$

$-\frac{1}{V} = -\frac{1}{25}t + C$

$-\frac{1}{10} = -\frac{1}{25}(0) + C$

$-\frac{1}{10} = C$

$V = 1 \quad \frac{1}{V} = \frac{2t+5}{50}$

$1 = \frac{2t+5}{50}$

$50 = 2t + 5$

$45 = 2t$

$22.5 = t$

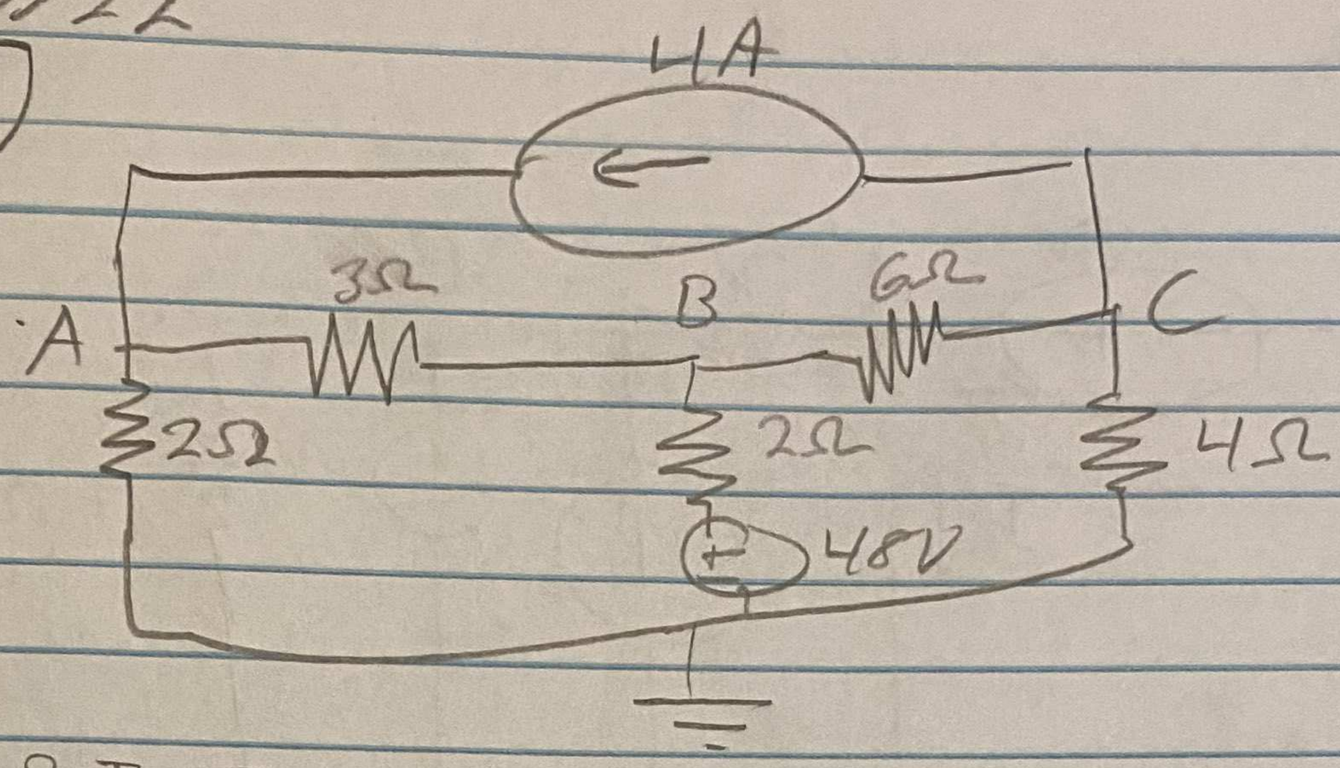
$V = 0$

$\lim_{V \to 0} \frac{1}{V} = \frac{2t+5}{20}$

# EGRB 206
## Homework #4
Marcelino Davila

9/26/22

3.31




$B: I_1 + I_2 + I_3 = 0$

$\frac{V_B - V_A}{3\Omega} + \frac{V_B - V_C}{6\Omega} + \frac{V_B - 48V}{2\Omega} = 0$

$2V_B - V_A + V_B - V_C + 3V_B - 144V = 0$

$6V_B - V_A - V_C = 144V$

$A: -4A + I_4 + I_5 = 0$

$-4A + \frac{V_A - V_B}{3\Omega} + \frac{V_A}{2\Omega} = 0$

$-24V + 2V_A - 2V_B + 3V_A = 0$

$5V_A - 2V_B = 24V$

$C: 4A + I_6 + I_7 = 0$

$4A + \frac{V_C - V_A}{6\Omega} + \frac{V_C}{4\Omega} = 0$

$48V + 2V_C - 2V_A + 3V_C = 0$

$5V_C - 2V_A = -48V$

$V_C = \frac{-48V + 2V_A}{5}$ $\quad V_B = \frac{24V - 5V_A}{2}$

$144V = \left(\frac{48V + 2V_A}{5}\right) - V_A + 6\left(\frac{24V - 5V_A}{2}\right)$

$\left(144V = \left(\frac{48 + 2V_A}{5}\right) - V_A + 72V - 15V_A\right) 5$

$720V = 408V - 78V_A$

$4V = V_A$

$V_C = \frac{-48V + 2(8V)}{5}$

$V_C = -6.4$

$V_B = \frac{24 - 5(8V)}{2}$

$V_B = -8V$

$I_2 = \frac{V_B - V_C}{6\Omega}$

$P = I^2 R$

$P = \left(\frac{-8V + 6.4V}{6\Omega}\right)^2 6\Omega = \boxed{0.4267W}$ MSD

5.) $R_{in} = \frac{6 \text{ lb}}{2 \text{ gal}} \frac{\text{gal}}{\text{min}} = 3 \text{ lb/min}$

$$R_{out} = \frac{4A}{100+2t} = \frac{2A}{50+t}$$

$$\frac{dA}{dt} + \frac{2A}{50+t} = 3$$

$$e^{\int \frac{2}{50+t} dt}$$

$$e^{2 \ln|50+t|}$$

$$(50+t)^2 \frac{dA}{dt} + 2(50+t)A = 3(50+t)^2$$

$$\int \frac{d}{dt}\left[(50+t)^2 A\right] = \int 3(50+t)^2$$

$$(50+t)^2 A = 3 \cdot \frac{1}{3}(5+t)^3 + C$$

$$A = 50 + t + \frac{C}{(50+t)^2}$$

$A_0 = 10$

$$10 = 50 + 0 + \frac{C}{(50+0)^2}$$

$$-40 = \frac{C}{2500}$$

$$-100000 = C$$

$$A = 50 + t + \frac{-100000}{(50+t)^2}$$

$$A = 50 + 30 + \frac{-100000}{(50+30)^2}$$

$$A = 64.375$$

$$200 = 3 - \frac{2A}{50+t}$$

$$200 = 3 - \frac{2\left(50 + t - \left(\frac{100000}{50+t^2}\right)\right)}{50+t}$$