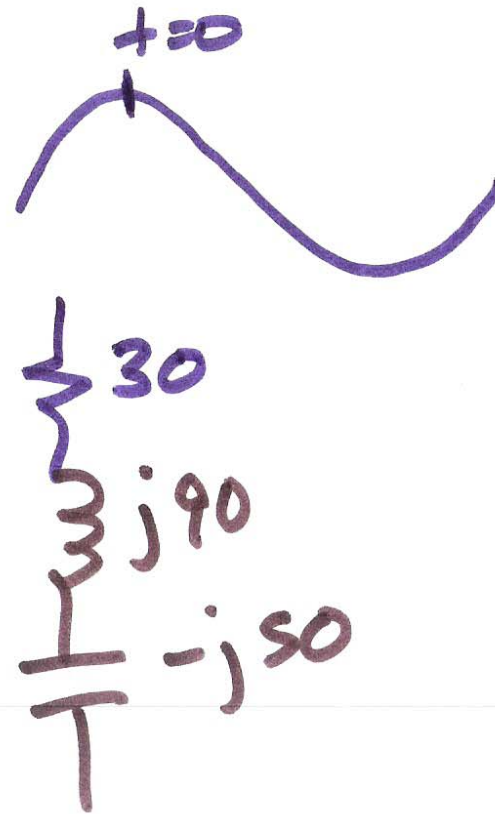
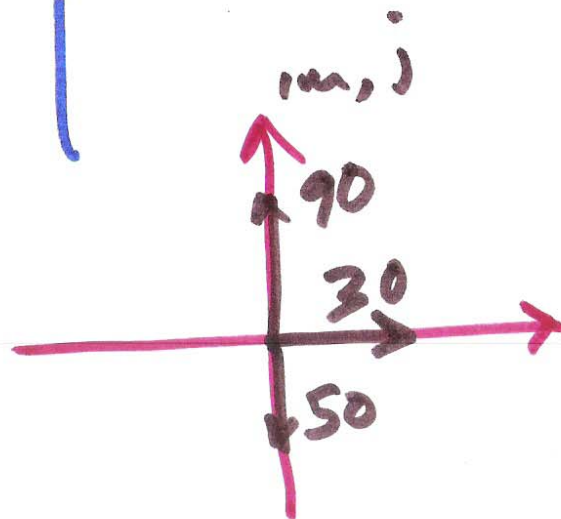
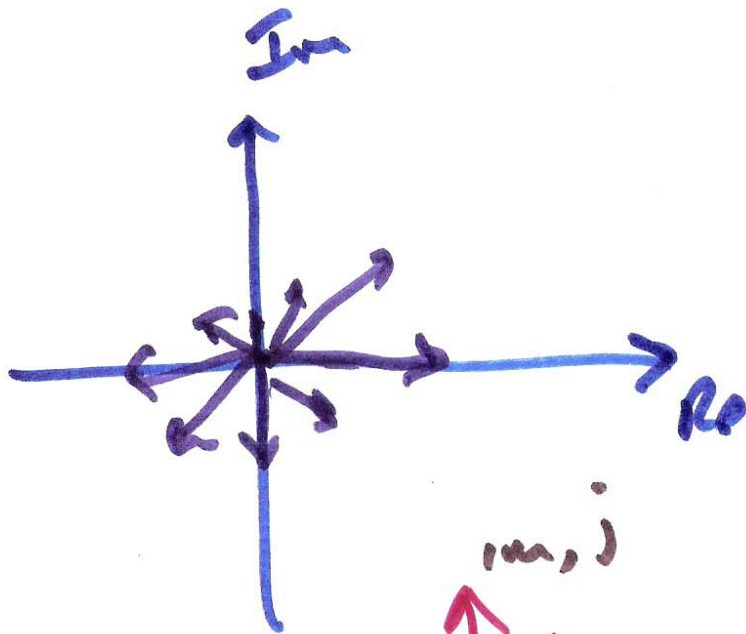


FE Review circuits

March 17, 2011

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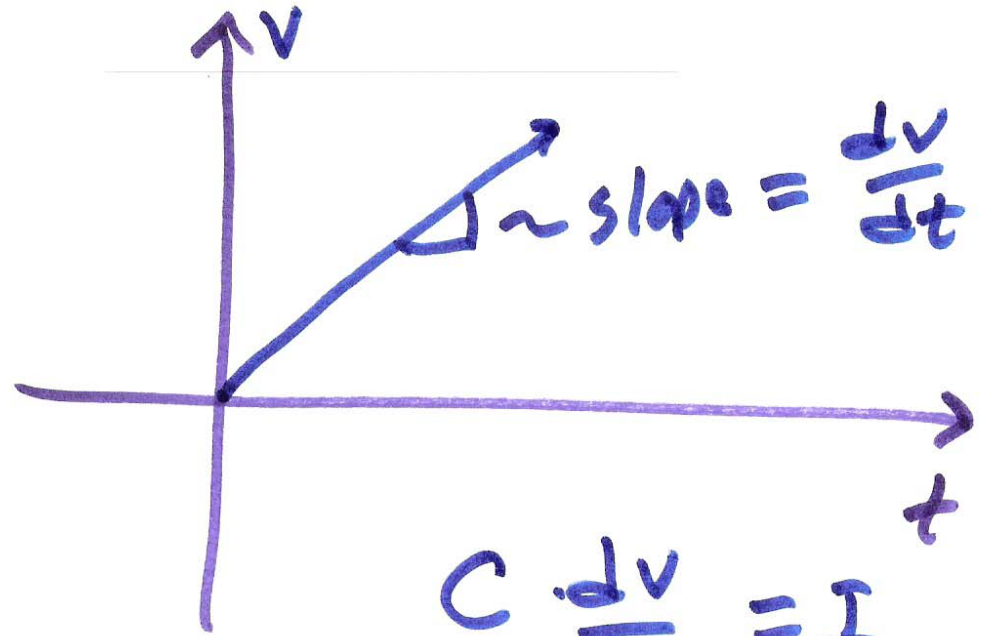


17

$$I = C \frac{dv}{dt}$$



$$v = IR$$



$$Z = \frac{1}{j\omega C} \cdot \frac{j}{j} = \frac{-j}{j\omega C}$$

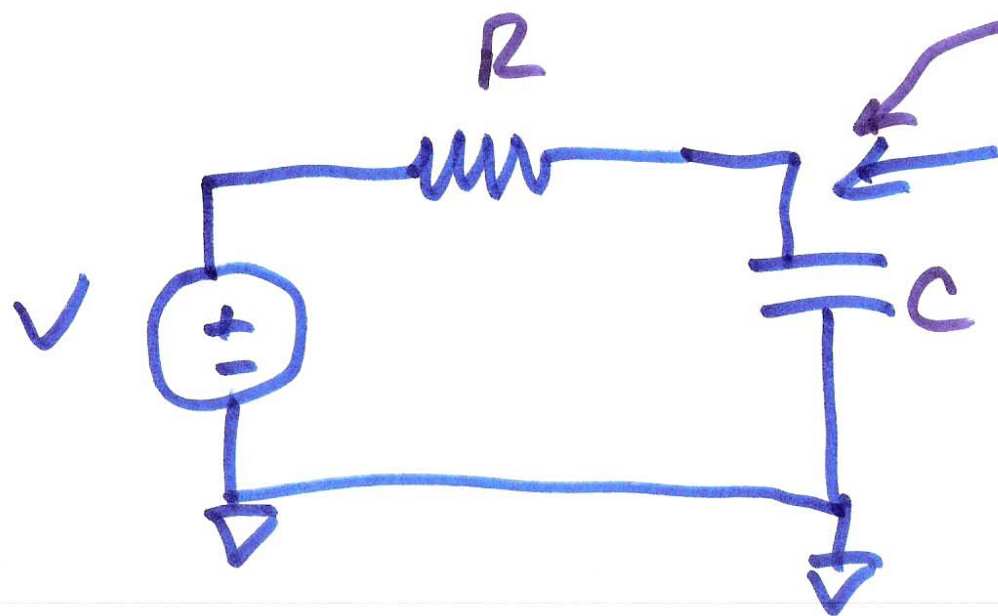
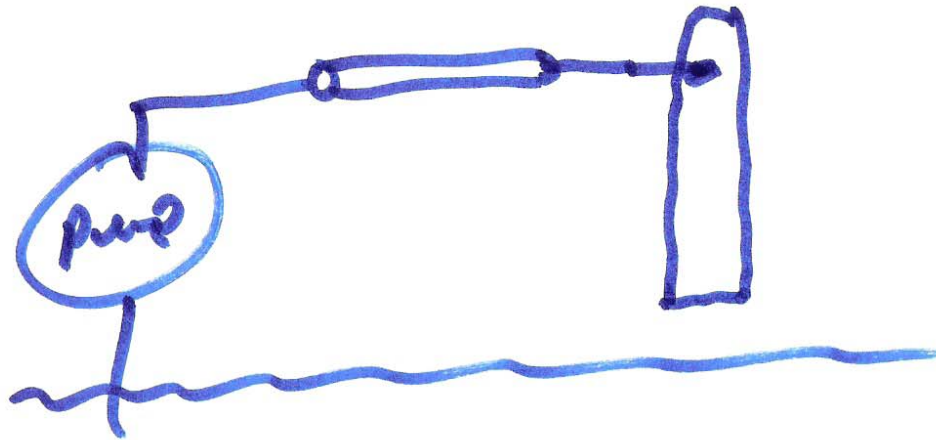
$$C \frac{dv}{dt} = I$$

$$i = C \cdot j\omega \cdot v$$

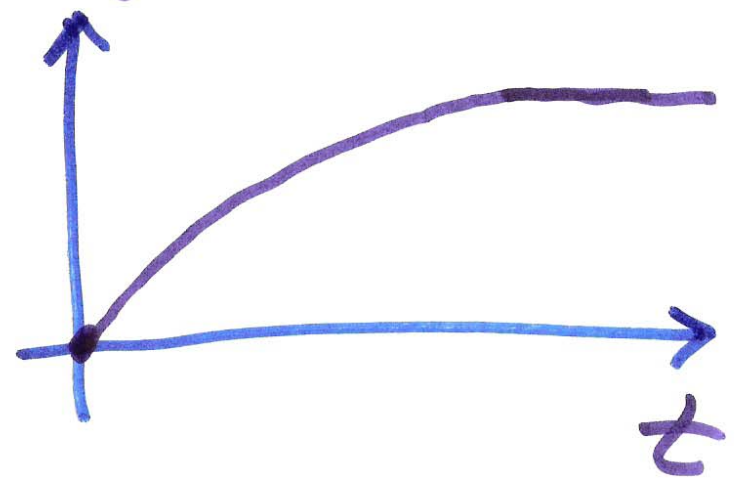
$$v = i \cdot \frac{1}{j\omega C}$$

$$\omega = 2\pi \cdot f$$

2)

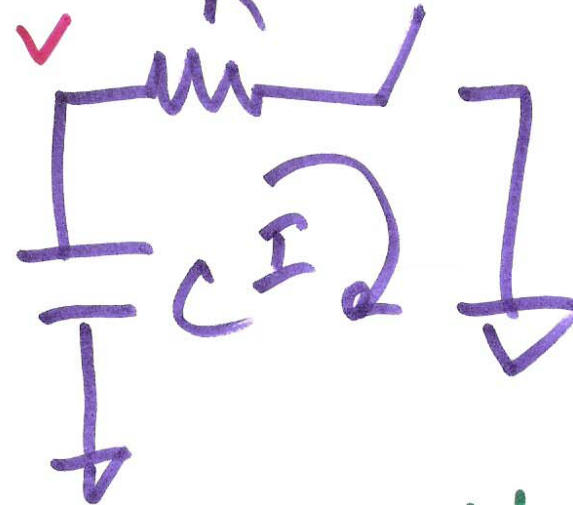
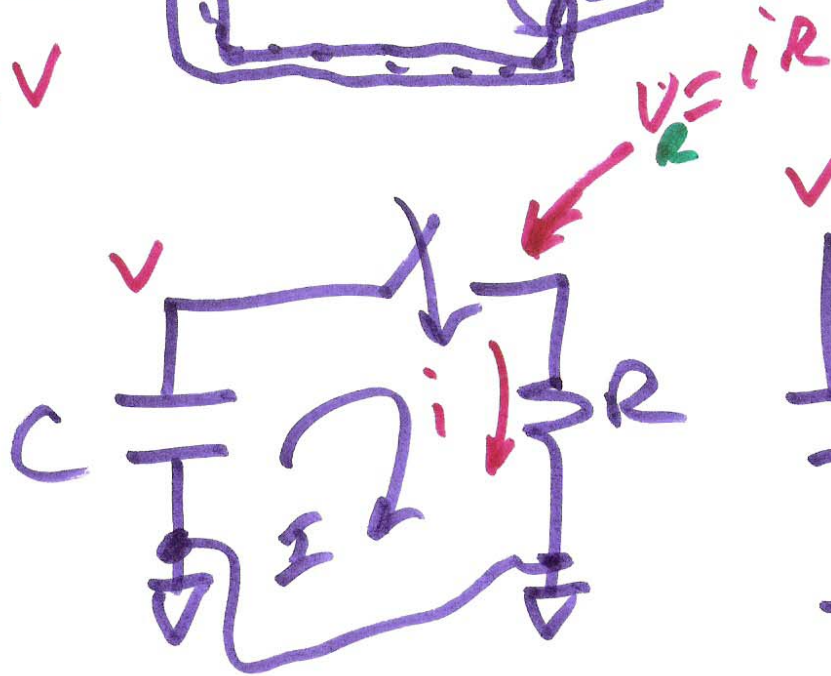
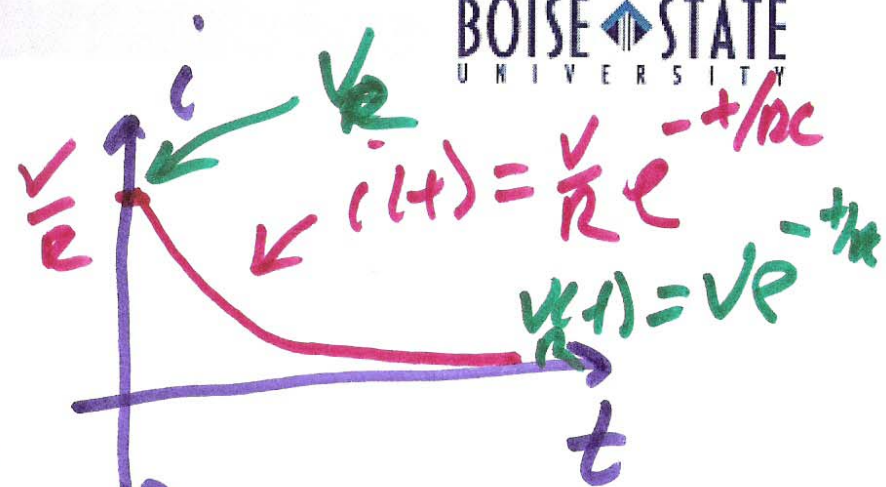
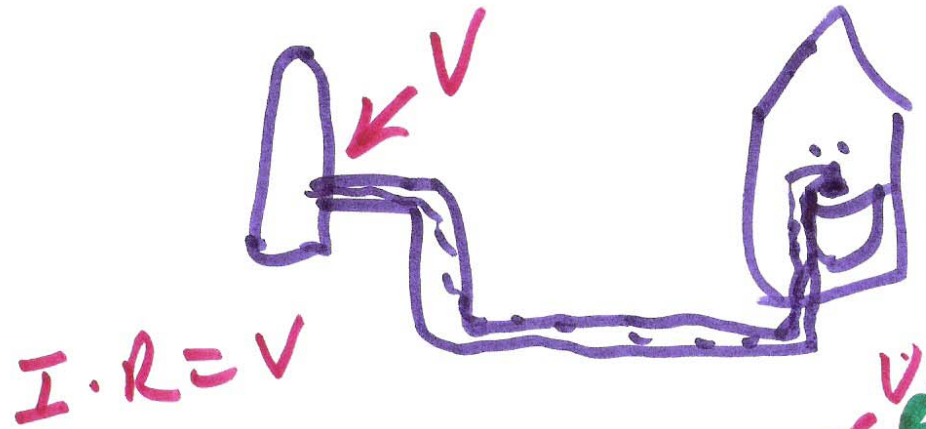


$$V_c(t) = V(e^{-t/\tau} - 1)$$



RC has units of seconds

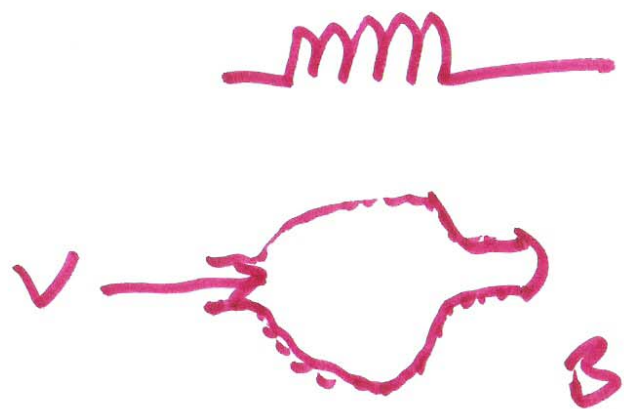
3)



$V_R(t) = V_{init} e^{-t/RC}$

4)

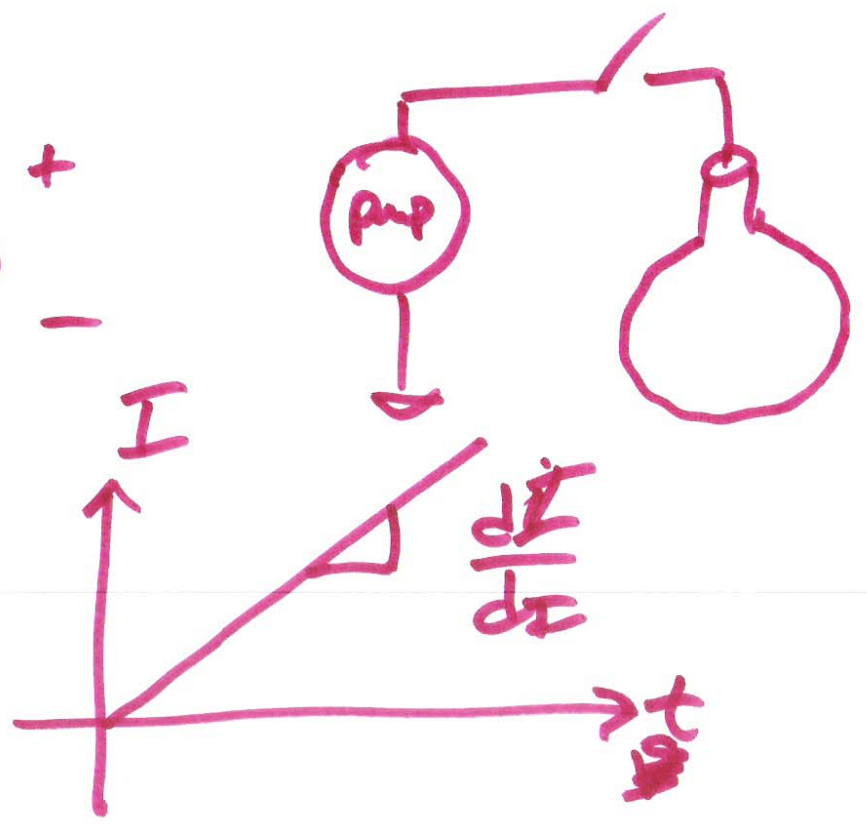
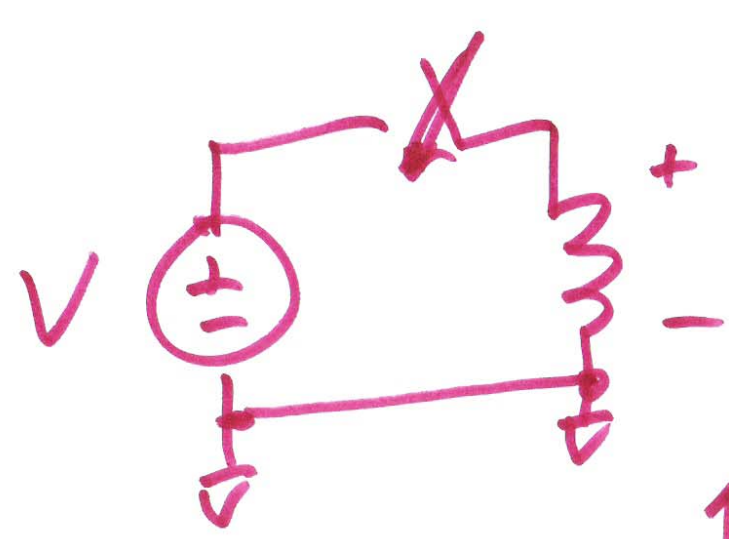
$$i = \dot{Q} = \sqrt{L} \cdot \dot{I}$$



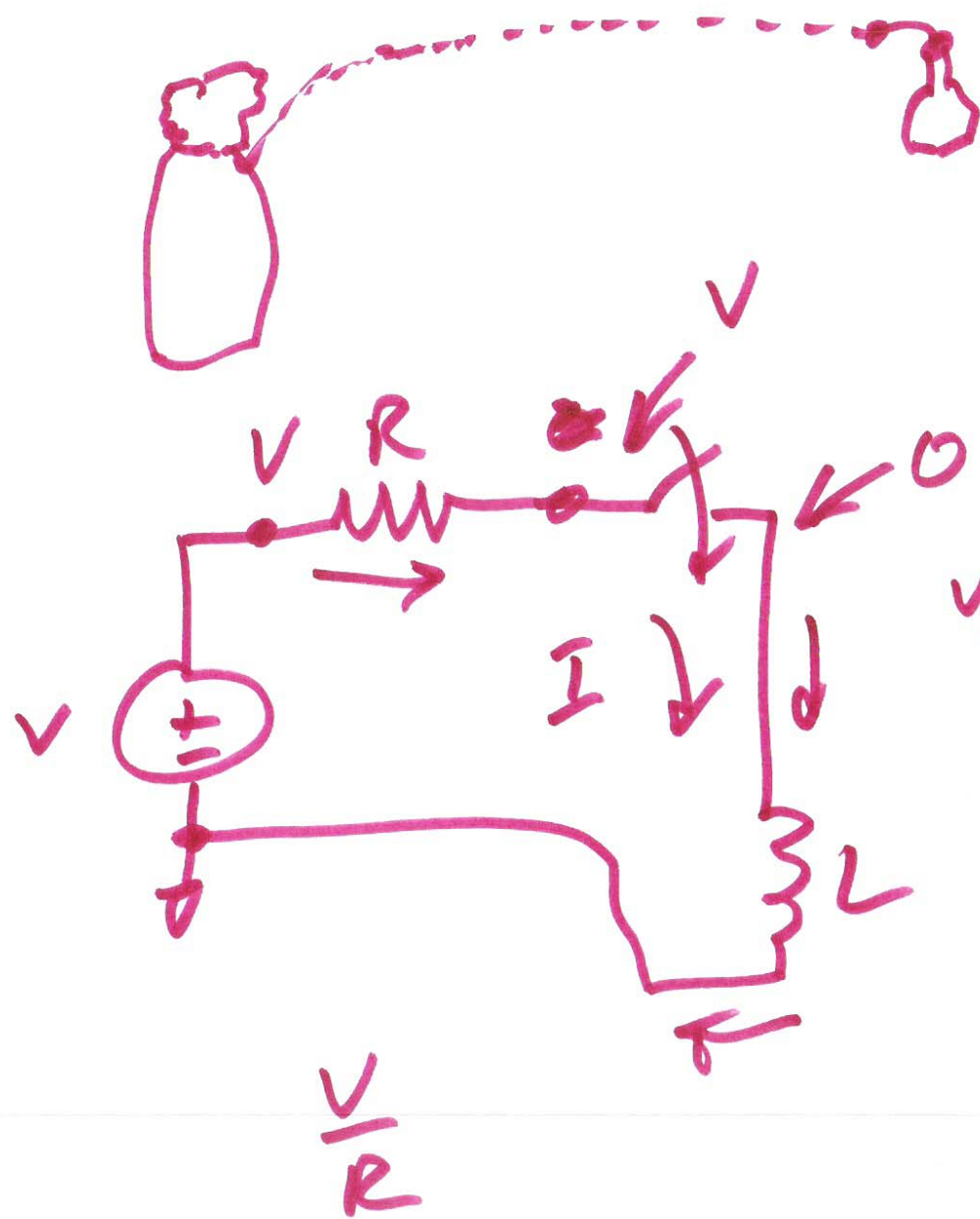
Bladder

$$v = L \cdot \frac{dI}{dt}$$

$$v = j\omega L$$

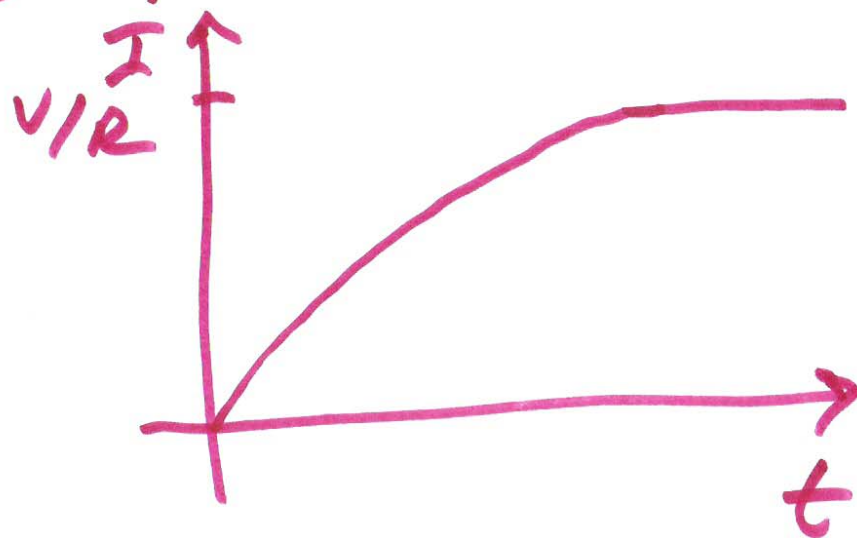


5)



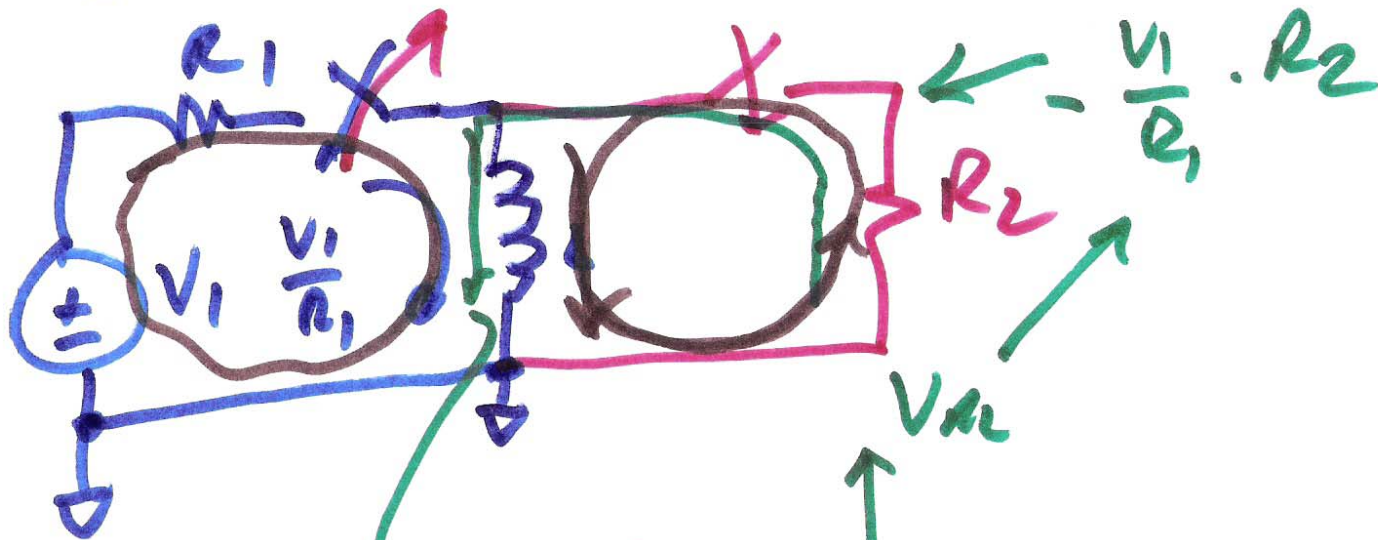
$$\tau = RC$$

$$I(t) = \frac{V}{R} (1 - e^{-t/\tau})$$



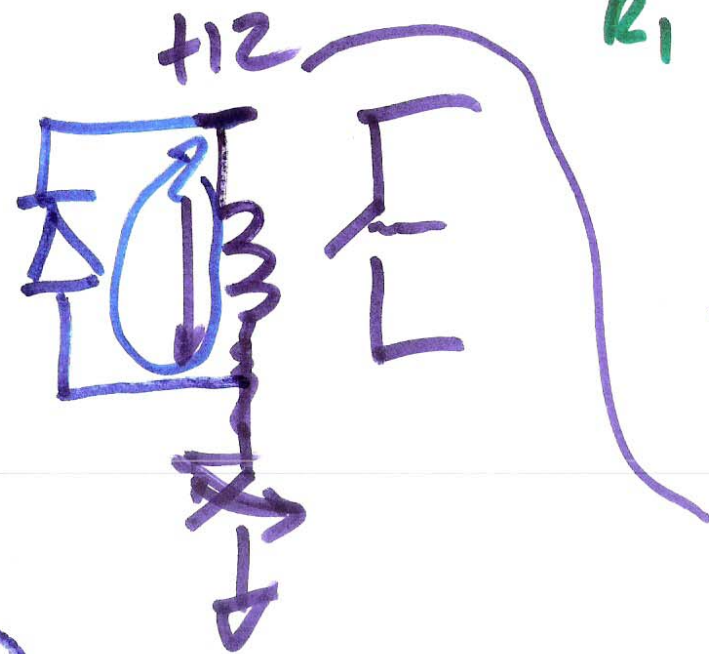
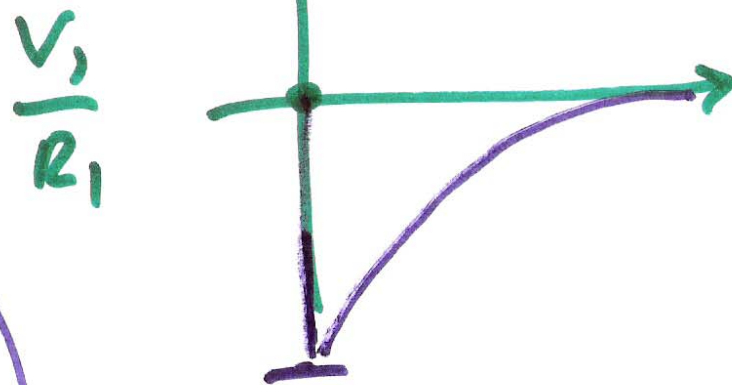
6)

$$\frac{1}{2}LI^2 \rightarrow \frac{1}{2}CV^2$$



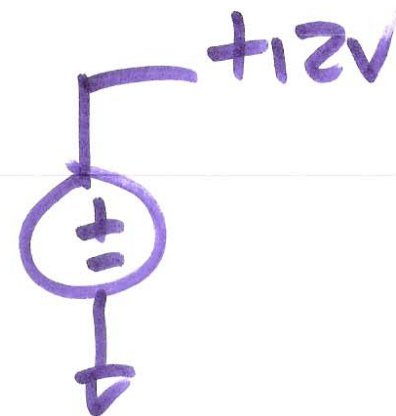
$$I \downarrow \begin{matrix} + \\ v \\ - \end{matrix} \\ v = R \cdot I$$

$$I \uparrow \begin{matrix} + \\ v \\ - \end{matrix} \\ v = -I \cdot R$$

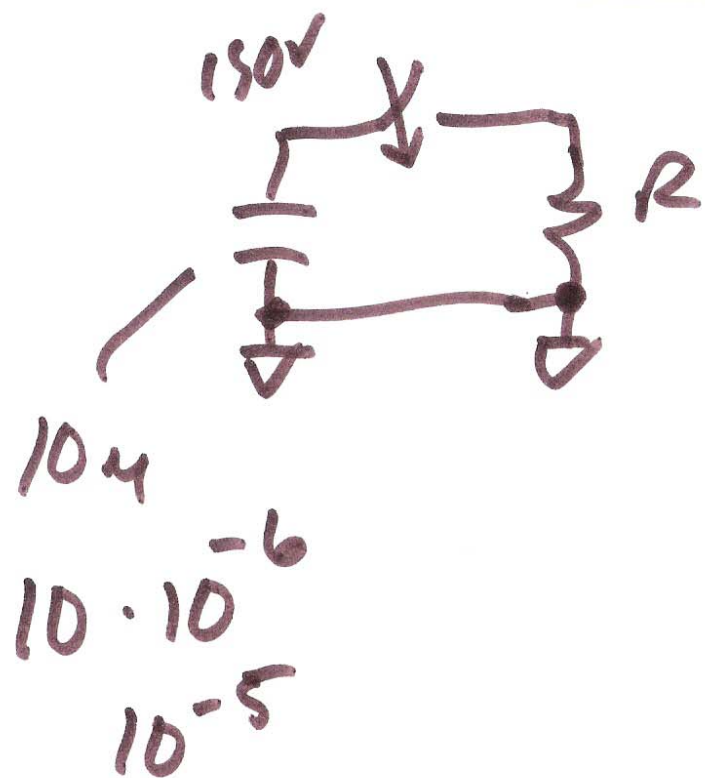


$$-\frac{v_1}{R_1} \cdot R_2$$

$$+12V \Rightarrow$$

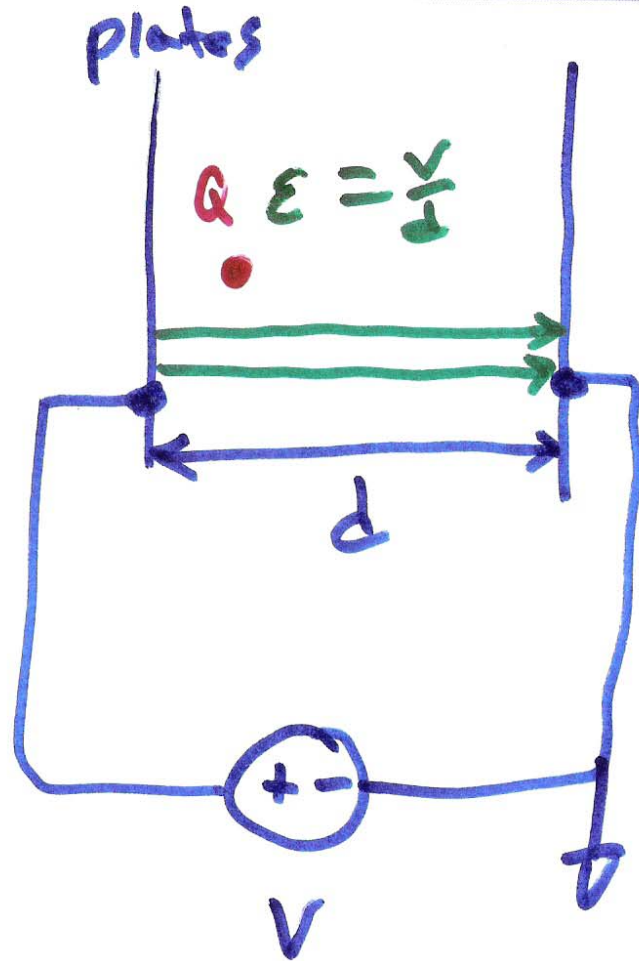


L



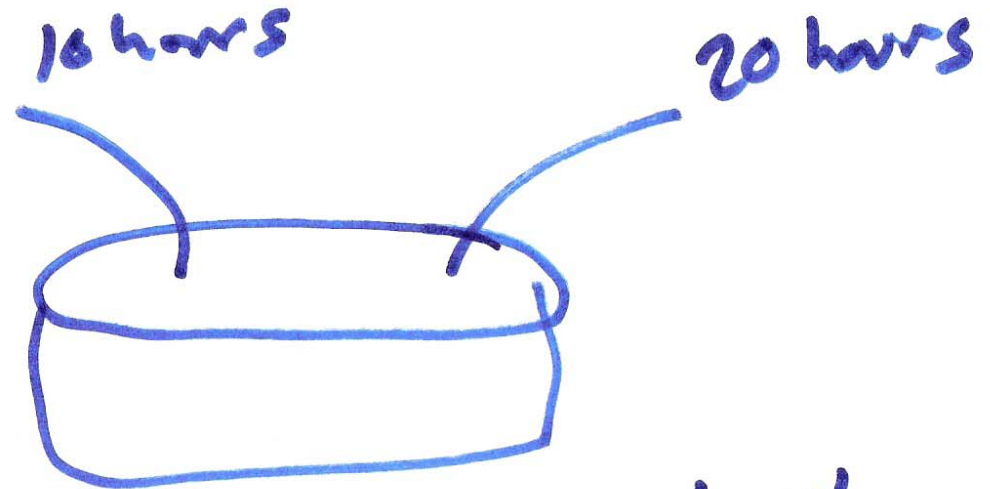
$$\begin{aligned}
 \mathcal{E} &= \frac{1}{2} C v^2 \\
 &= \frac{1}{2} \cdot 10^{-5} \cdot (1.5)^2 \cdot 10^4 \\
 &= \frac{1}{2} \cdot 10^{-5} \cdot 2.25 \\
 &= \frac{1}{2} \cdot 225 \\
 &= \underline{\underline{.1125 \text{ J}}}
 \end{aligned}$$

8)



$$F = q \cdot E$$

$$F = q \cdot \frac{V}{d}$$

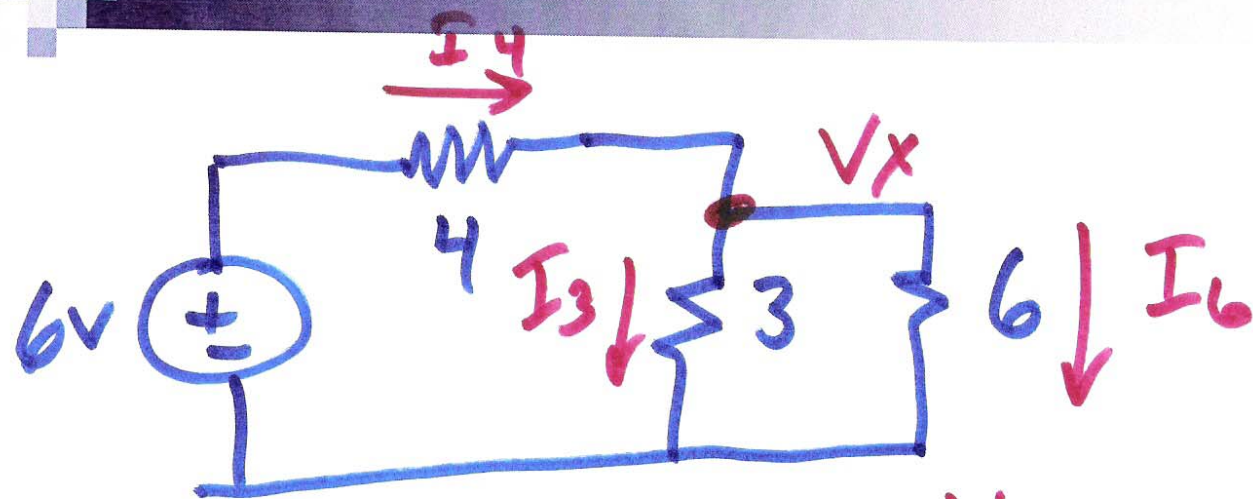


$$\frac{1}{10} + \frac{1}{20} = \frac{1}{T}$$

$$\frac{1 \text{ pool}}{10} + \frac{1 \text{ pool}}{20} = \frac{1 \text{ pool}}{\text{comp}}$$

$$T = \frac{10 \cdot 20}{10 + 20} = \frac{200}{30} = \underline{\underline{6.66 \text{ Hours}}}$$

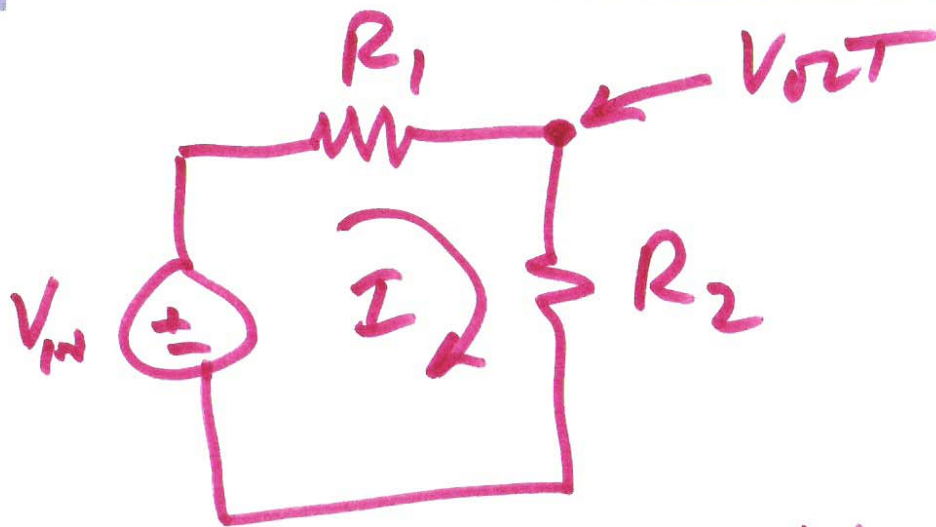
9)



$$I_4 = \frac{6 - V_x}{4}, \quad I_4 = I_3 + I_6$$

$$I_6 = \frac{V_x}{6}, \quad I_3 = \frac{V_x}{3}$$

10)

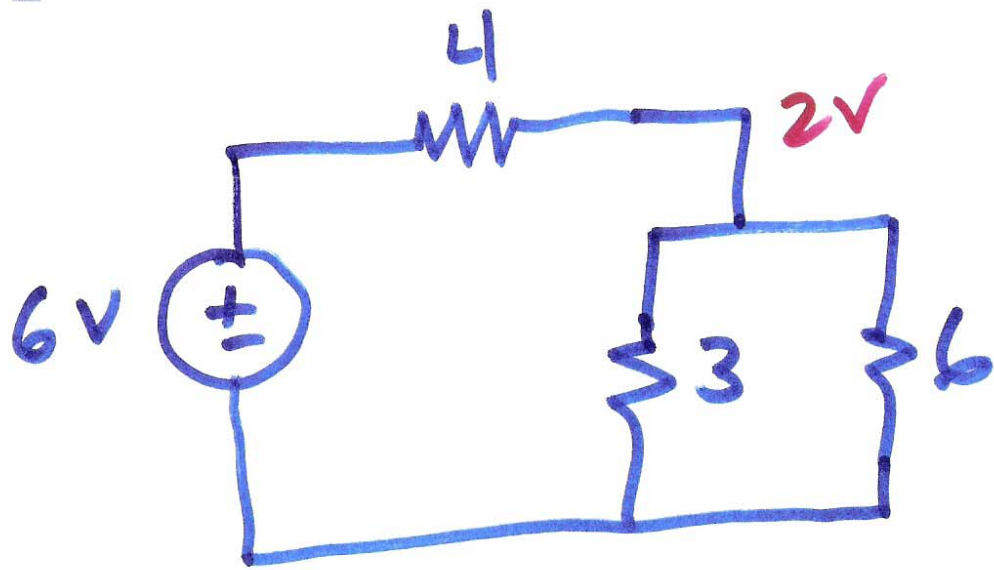


$$I = \frac{V_{in}}{R_1 + R_2}$$

$$V_{out} = I \cdot R_2$$

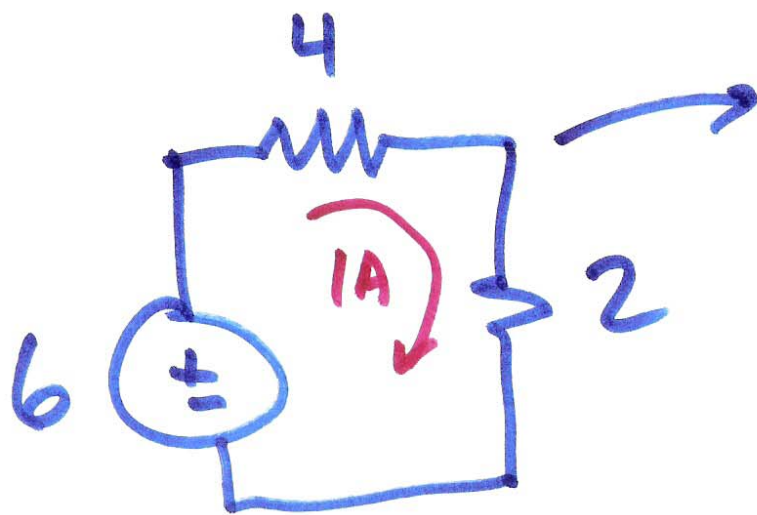
$$V_{out} = V_{in} \cdot \frac{R_2}{R_1 + R_2}$$

11)



$$\frac{3 \cdot 6}{3 + 6} = \frac{18}{9} = 2$$

$$\frac{2}{6} = \frac{1}{3} \text{ A}$$



$$6 \cdot \frac{2}{4 + 2} = \underline{\underline{2 \text{ V}}}$$

$$\tau = \frac{L}{R} = \frac{2}{5}$$

$$e^{-t/\tau} = e^{-2.5t}$$

(2)

$$\frac{(4 + j3) \cdot (-j12)}{4 + j3 + -j12}$$

$$-j \cdot 48 + 36$$

$$a + jb = c + jd$$

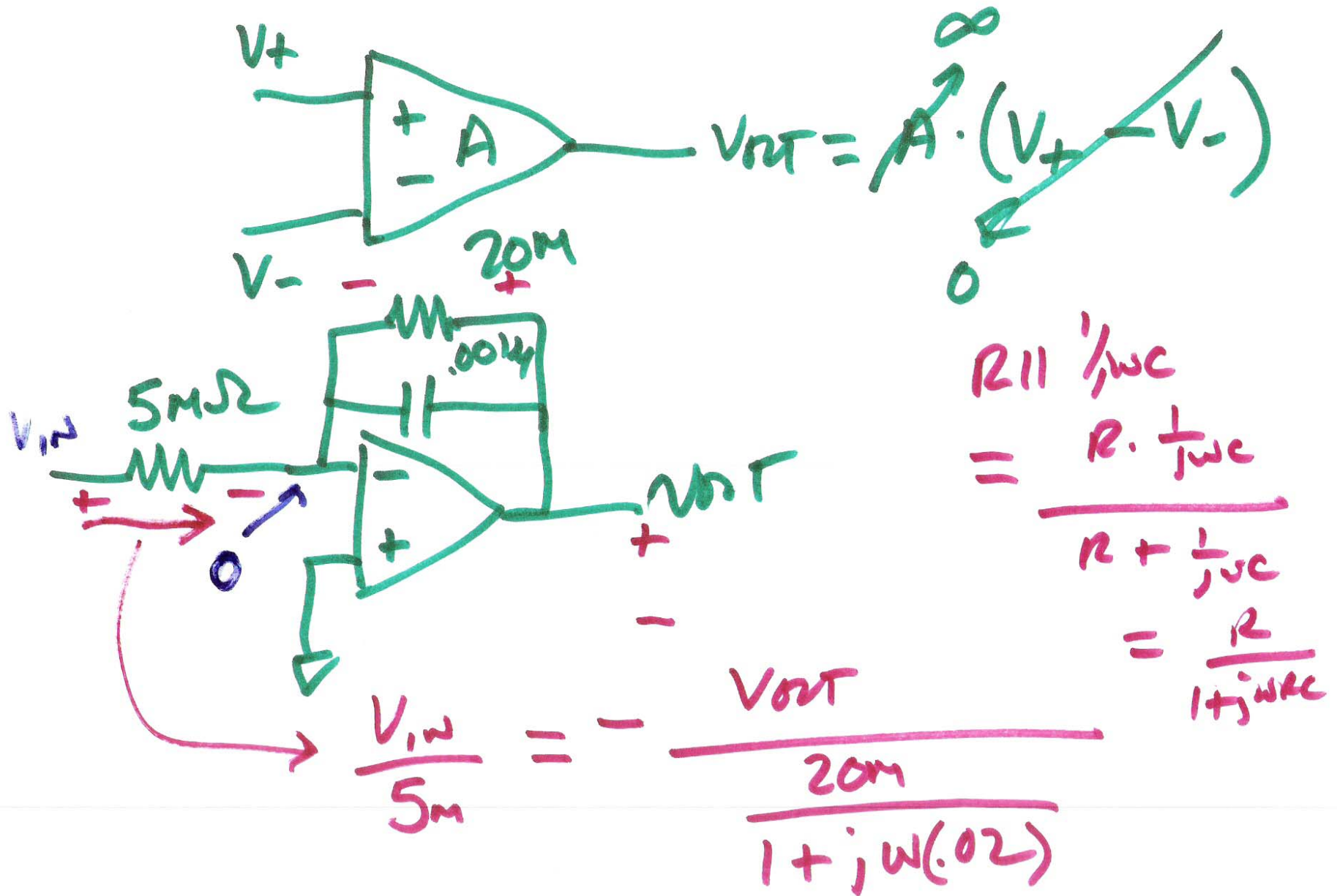
$$r \sin \theta = -j12$$

$$-j12 = \cos$$

$$12 \angle -90$$

$$r \angle \theta = r e^{j\theta} = r \cos \theta + j r \sin \theta$$

13)



14)

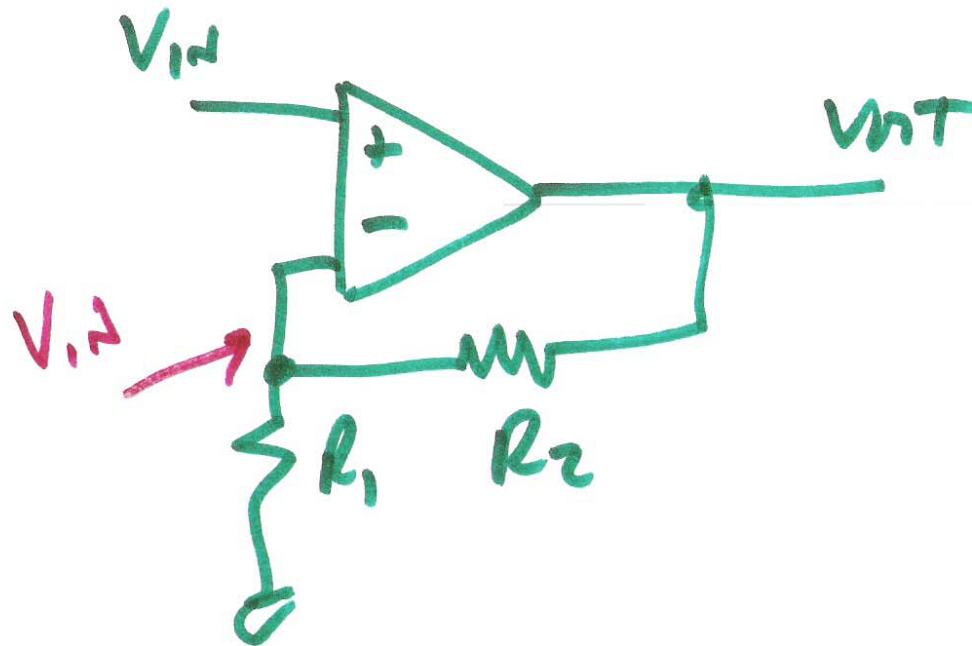
$$\frac{V_{out}}{V_{in}} = \frac{-20M}{5m} \cdot \frac{1}{1 + j \cdot 2\pi f \cdot (.02)}$$

60
60 · .02
1.2

$$\left| \frac{1}{a + jb} \right| = \frac{1}{\sqrt{a^2 + b^2}}$$

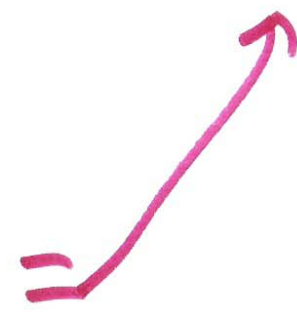
$$= -4 \cdot \frac{1}{\sqrt{1 + (6.28 \cdot 1.2)^2}}$$
$$= \frac{-4}{8} \approx -\frac{1}{2}$$

15)



$$\frac{V_{out}}{V_{id}} = \frac{R_1 + R_2}{R_1} = 1 + \frac{R_2}{R_1}$$

$$V_{in} = V_{out} \cdot \frac{R_1}{R_1 + R_2}$$



16)

$$\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}B\bar{C}\bar{D}$$

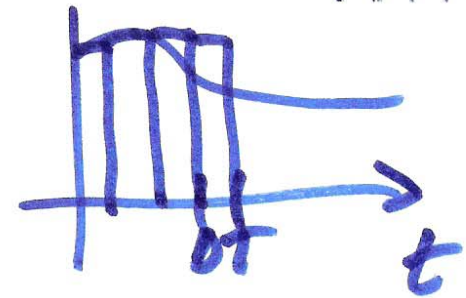
$$\bar{A}B + \bar{B}\bar{D}$$

$$\frac{dy}{dt} = y^3 + 1$$

$$y(0) = -2$$

$$\Delta t = 0.1$$

$$t = .1$$



17)