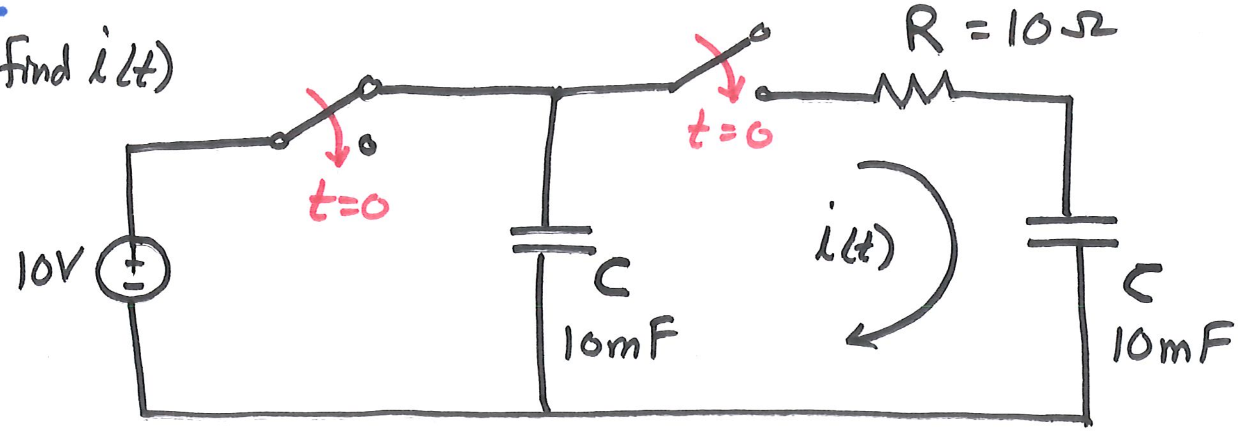
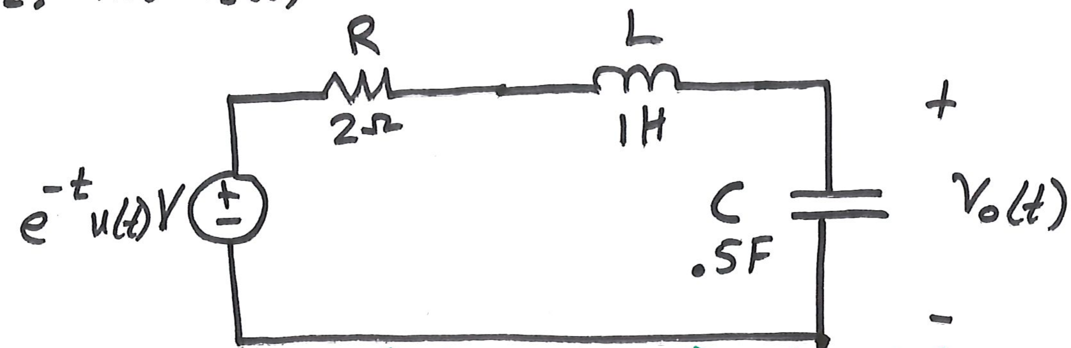
LT #5

1. find $i(t)$



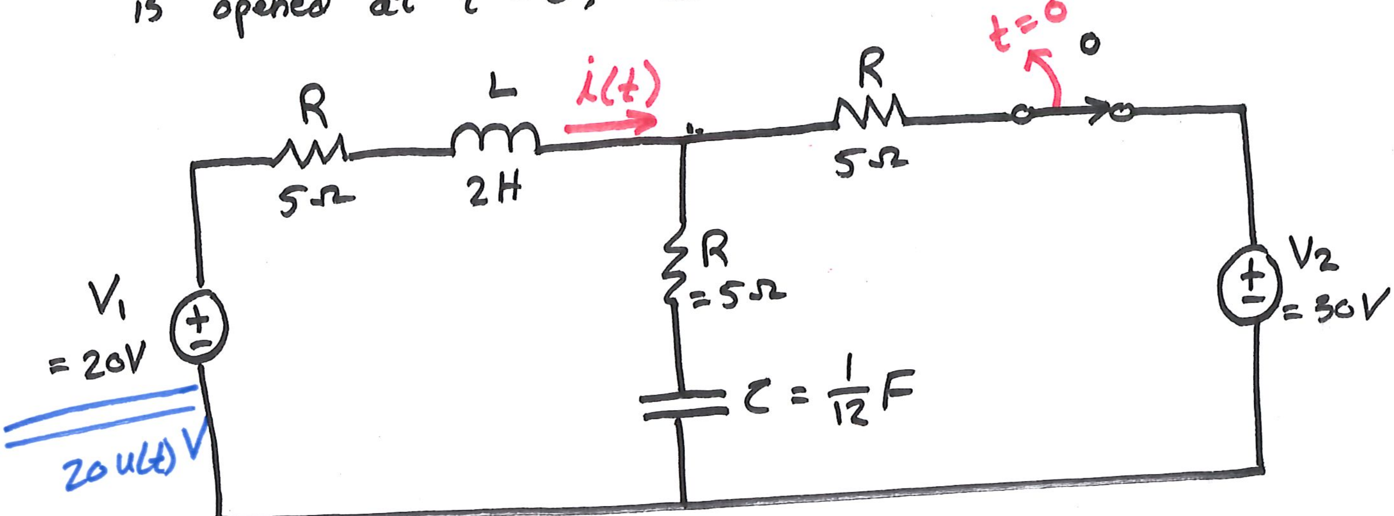
$i(t) = e^{-20t}u(t)\ A$

2. find $V_o(t)$



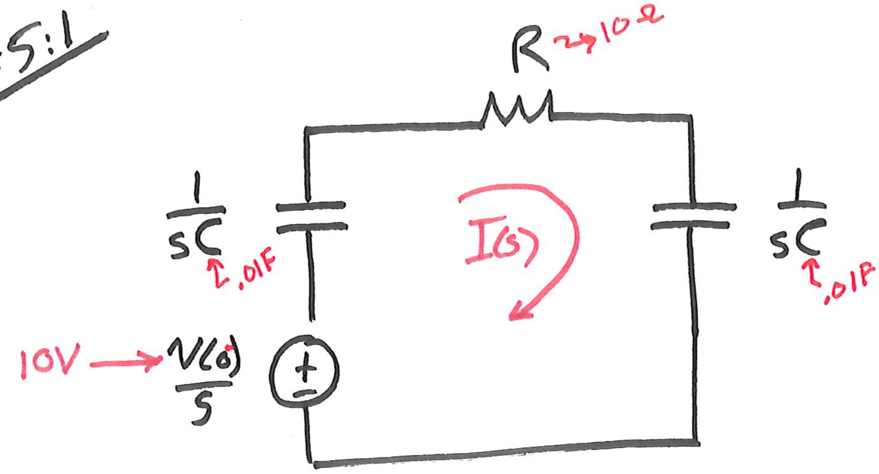
$V_o(t) = 2e^{-t}(1-\cos t)u(t)\ V$

3. The switch in the circuit shown has been closed a long time. It is opened at $t=0$. Calculate $i(t)$.



$i(t) = -.5u(t)(e^{-3t} + e^{-2t})A$ ✓

LT#5:1



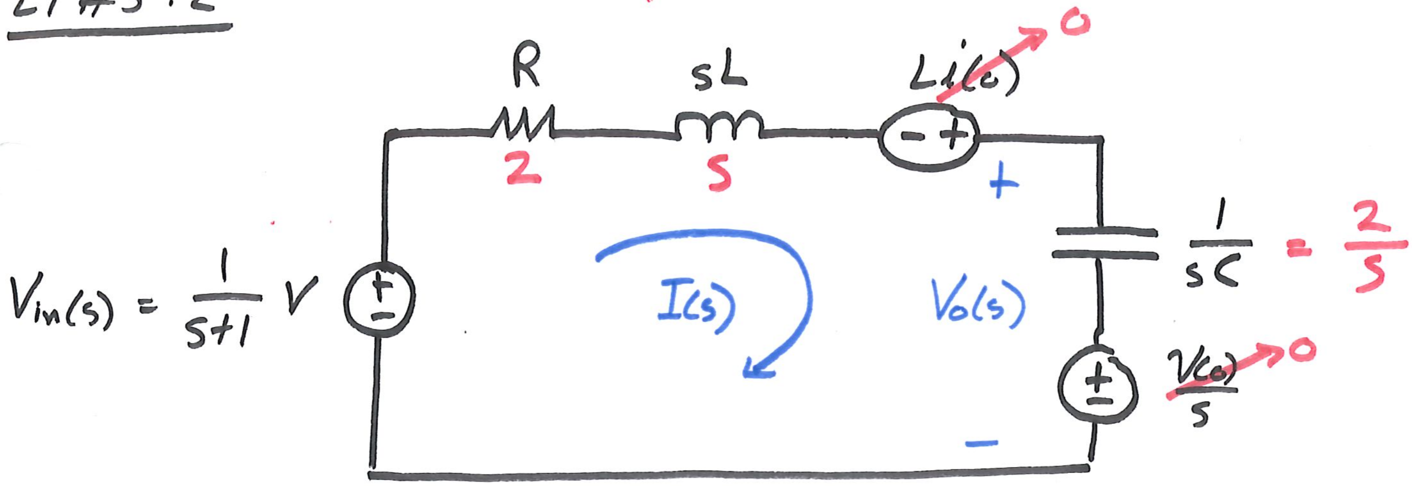
$$\frac{10}{s} = I(s)\left(\frac{1}{s\,.01} + \cancel{R}^{\,10} + \frac{1}{s\,.01}\right)$$

$$= I(s)\left(\frac{100}{s} + 10 + \frac{100}{s}\right) = I(s)\left(\frac{200}{s} + 10\right)$$

$$I(s) = \frac{10}{s}\,\frac{1}{\frac{200}{s}+10} = \frac{10}{10s+200} = \underline{\frac{1}{s+20}}$$

$$\underline{i(t) = e^{-20t}\,u(t)\ A}$$

LT#5:2



$$V_{IN}(s) = I(s)\left(2 + s + \frac{2}{s}\right)$$

$$I(s) = \frac{V_{IN}(s)}{2 + s + \frac{2}{s}}$$

$$V_o(s) = \frac{1}{sC} I(s) = \frac{2}{s}\;\frac{1}{2+s+\frac{2}{s}}\;\frac{1}{s+1}$$

$$V_o(s) = \frac{2}{(s+1)(s^2+2s+2)}$$

$$s = \frac{-2 \pm \sqrt{2^2 - 4(2)}}{2} = -1 \pm \frac{1}{2}\sqrt{-4}$$

$$\underline{= -1 \pm j1}$$

$$V_o(s) = \frac{2}{(s+1)(s+1-j)(s+1+j)} = \frac{C_1}{s+1} + \frac{C_2}{s+1-j} + \frac{C_3}{s+1+j}$$

$$C_1 = \left.\frac{2}{s^2+2s+2}\right|_{s=-1} = \frac{2}{1-2+2} = \underline{2}$$

$$c_2 = \left.\frac{2}{(s+1)(s+1+j)}\right|_{s=-1+j} = \frac{2}{(j)(+j2)} = \underline{-1}$$

$$c_3 = \left.\frac{2}{(s+1)(s+1-j)}\right|_{s=-1-j} = \frac{2}{(-j)(-j2)} = \underline{-1}$$

$$V_o(s) = \frac{2}{s+1} + \frac{-1}{s+1-j} + \frac{-1}{s+1+j}$$

$$\Updownarrow \qquad \Updownarrow \qquad \Updownarrow$$

$$v_o(t) = \left(2e^{-t} \quad -1e^{-(1-j)t} \quad -1e^{-(1+j)t}\right)u(t)$$

$$-1e^{-t}e^{jt} \quad -1e^{-t}e^{-jt}$$

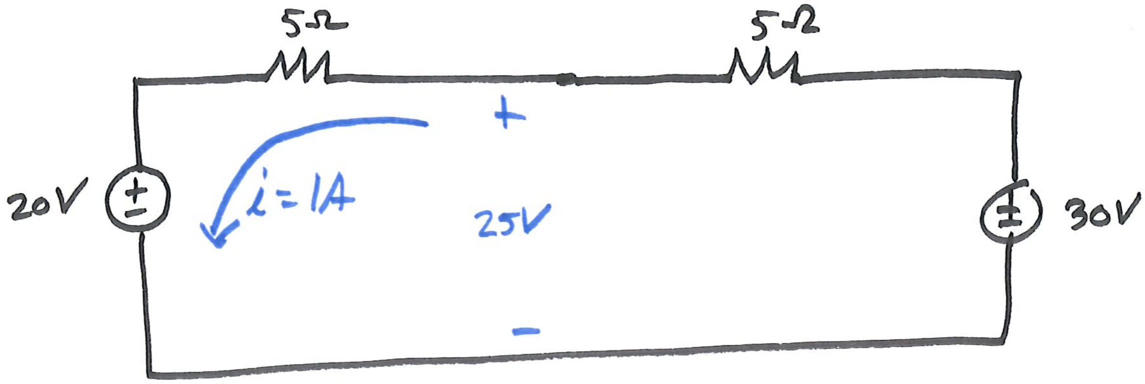
$$-e^{-t}\left(e^{jt} + e^{-jt}\right)$$

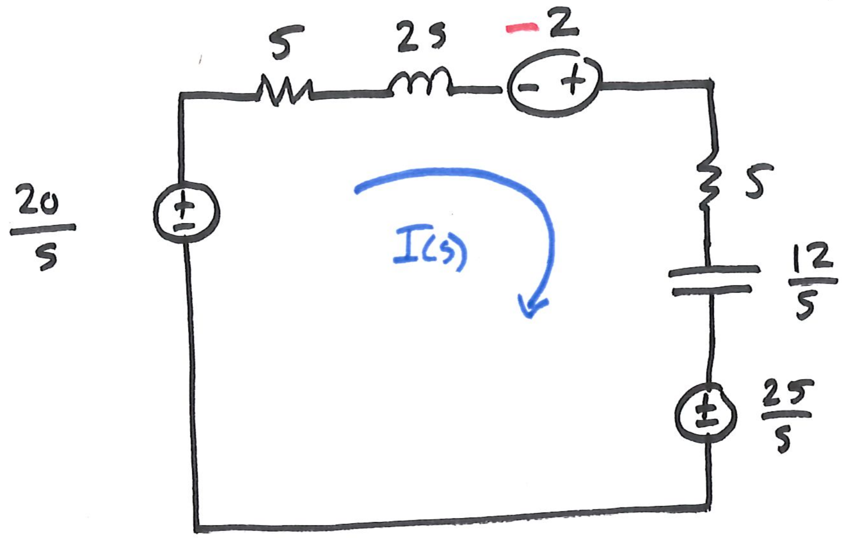
$$-e^{-t}\left(2\cos t\right)$$

$$\therefore \; v_o(t) = 2e^{-t}\left(1 - \cos t\right)u(t)\ V$$

LT#5:3

initial conditions:





$$\frac{20}{s} + 2 - \frac{25}{s} = I(s)\left(5 + 2s + 5 + \frac{12}{s}\right)$$

$$I(s) = \frac{2 - \frac{5}{s}}{2s + 10 + \frac{12}{s}} \begin{matrix} s \\ s \end{matrix} = \frac{2s - 5}{2s^2 + 10s + 12} \begin{matrix} \div 2 \\ \div 2 \end{matrix}$$

$$I(s) = \frac{s - 2.5}{s^2 + 5s + 6} = \frac{s - 2.5}{(s+3)(s+2)} = \frac{C_1}{s+3} + \frac{C_2}{s+2}$$

$$c_1 = \left.\frac{s-2.5}{s+2}\right|_{s=-3} = \frac{-5.5}{-1} = +5.5$$

$$c_2 = \left.\frac{s-2.5}{s+3}\right|_{s=-2} = \frac{-4.5}{1} = -4.5$$

$$I(s) = \frac{5.5}{s+3} + \frac{-4.5}{s+2}$$

$$\underline{\underline{i(t) = \left(5.5e^{-3t} - 4.5e^{-2t}\right)u(t)}}$$
