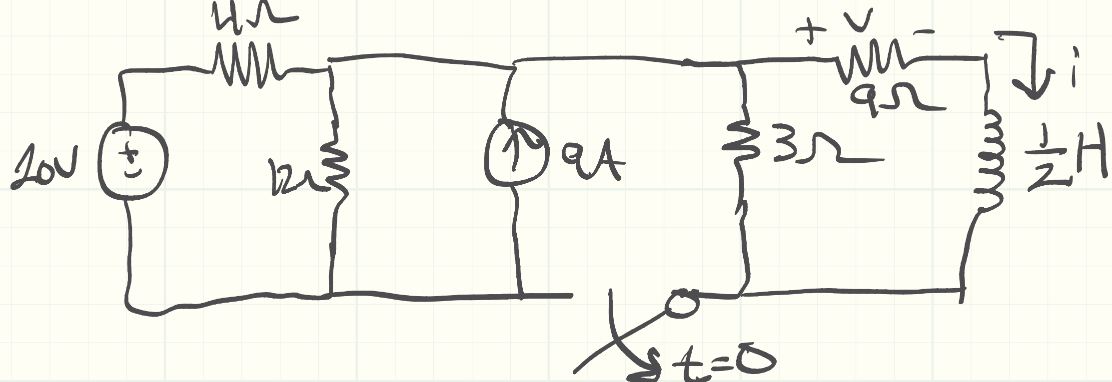
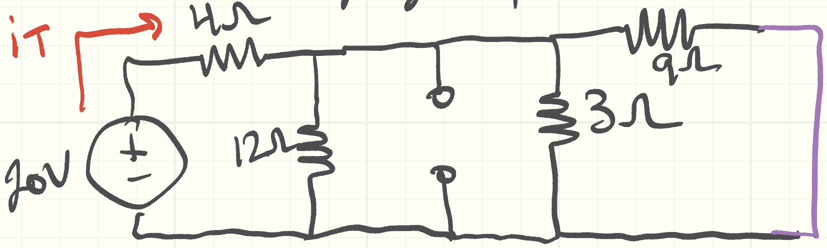


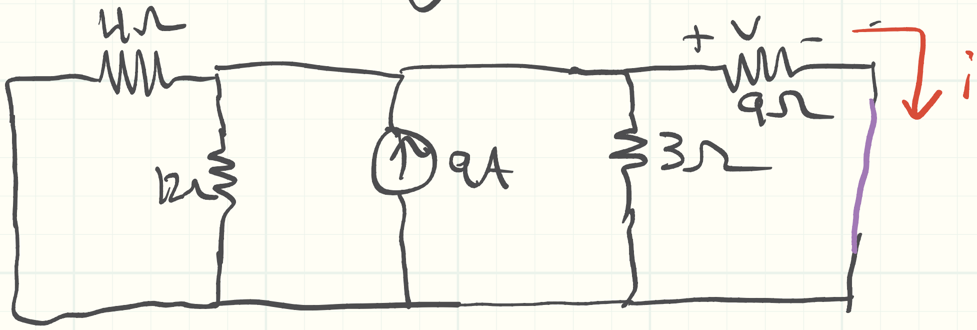
@ $t<0$ applying superposition



$$i_T = \frac{20}{(4+12\|3\|9)} = 3.39A$$

$$i_{9\Omega} = \frac{3\|12}{3\|12+9}(3.39) = 0.714A$$

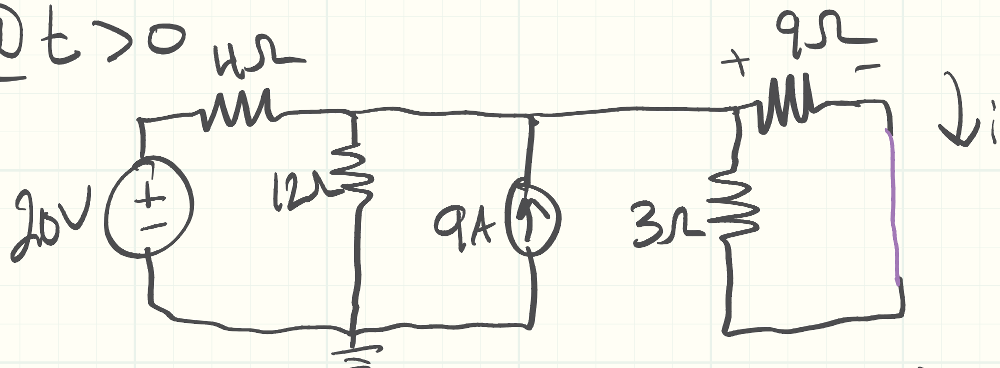
⇓



$$i = \frac{12\|4\|3}{12\|4\|3+9}(9) = 1.28A$$

$$\Rightarrow i(0) = i_9 + i = 0.714 + 1.28 = 1.994A$$

@ t > 0



$i(\infty) = 0\,A$ since $V_L(\infty) = 0$

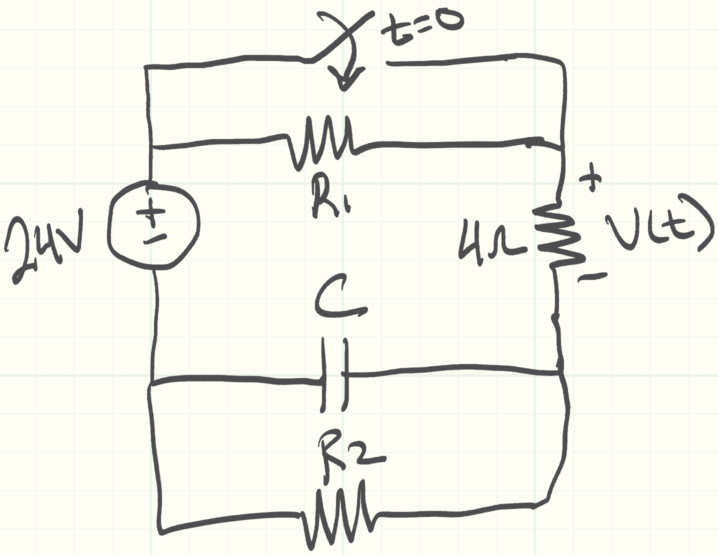
$\Rightarrow i(t) = i_L(\infty) + \left[i_L(0) - i_L(\infty) \right] e^{-\frac{t}{\tau}}$

$R_{eq} = 9 + 3 = 12\,\Omega$

$\tau = \frac{L}{R_{eq}} = \frac{1/2}{12} = \frac{1}{24}$

$i(t) = 1.994\, e^{-24t}\ A$

$V(t) = 9 * i(t) = \boxed{17.946\, e^{-24t}\ V}$

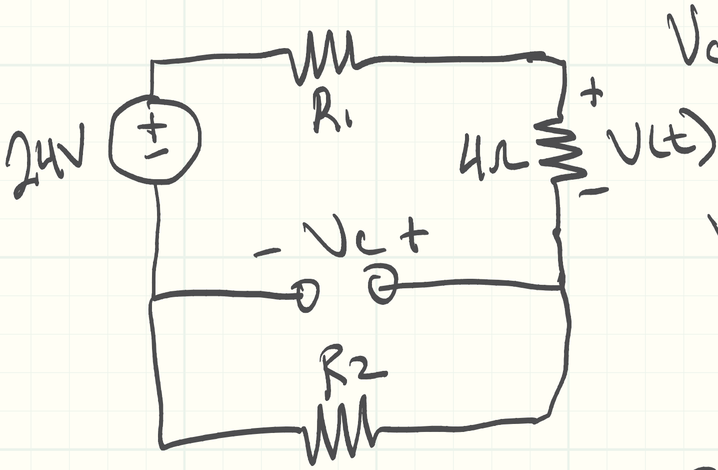


Given

$v(t) = 8 + 4e^{-2t}\ V$ for $t > 0$

Find R_1, R_2, C

@t<0

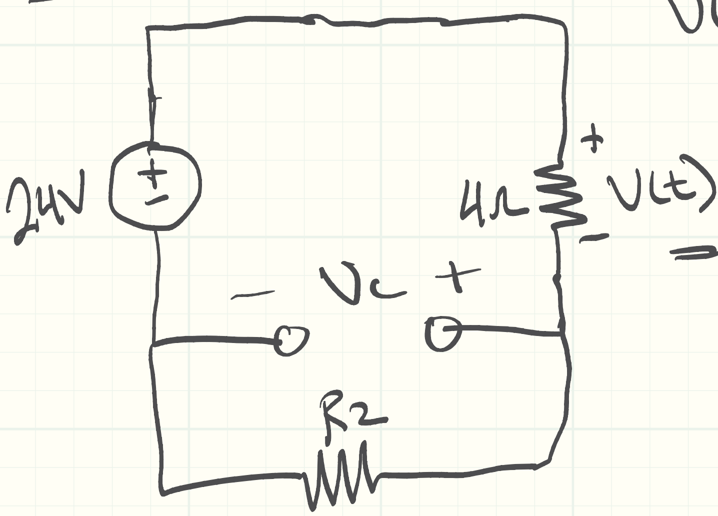


$V_c(0) = -V(0) - (-24)$

$V(0) = 8 + 4e^{0} = 12V$

$V_c(0) = -12 + 24 = 12V$

@t>0



*R_1 is bypassed by short circuit

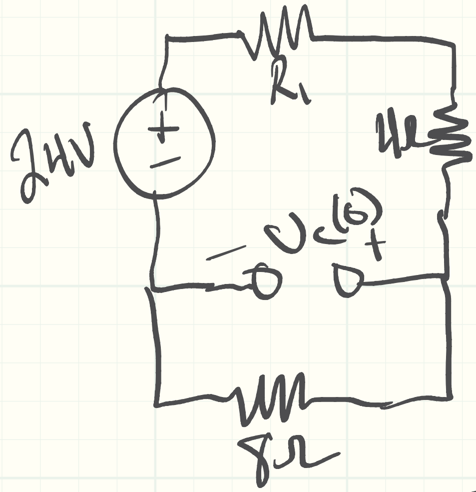
$V(\infty) = 8 + 4e^{-\infty} = 8V$

$8 = \frac{4}{4+R_2} * 24$

$\Rightarrow 4 + R_2 = \frac{4}{8} * 24$

$\Rightarrow \boxed{R_2 = 8\Omega}$

*Now with R_2, back to circuit for $t<0$



$$V_c(0) = \frac{8}{8+4+R_1} * 24$$

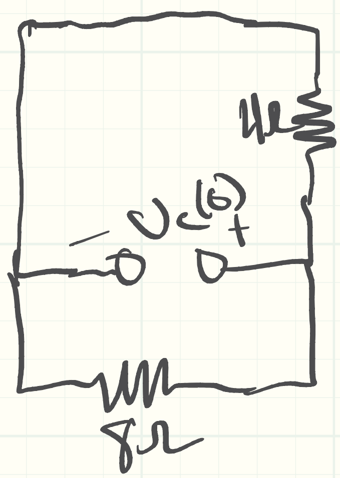
$$\Rightarrow 12 = \frac{8}{12+R_1} * 24$$

$$\Rightarrow \boxed{R_1 = 4\Omega}$$

From $v(t) = 8+4e^{-2t}$

$$\tau = \frac{1}{2} \Rightarrow R_{eq}C = \frac{1}{2}$$

R_{eq} for $t>0$



$$R_{eq} = 4 \| 8 = \frac{8}{3}\Omega$$

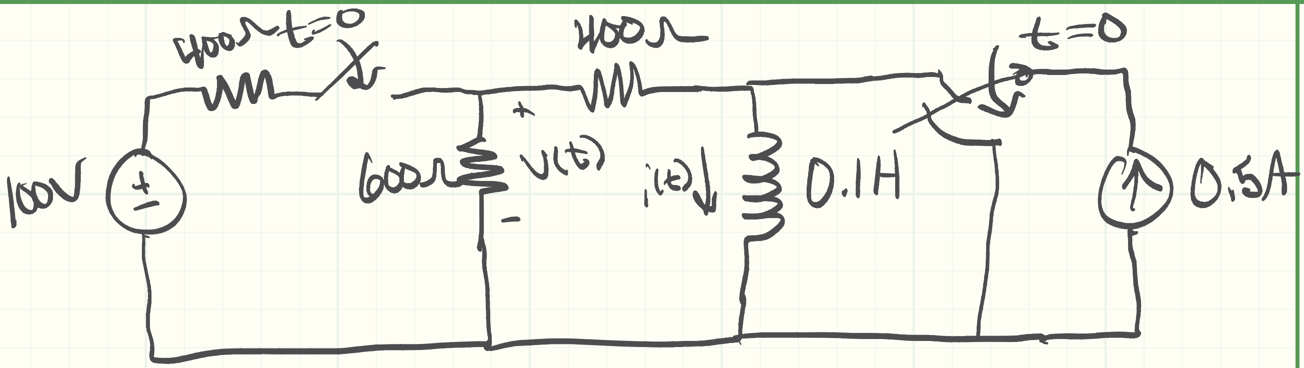
$$\tau = \left(\frac{8}{3}\right)C = \frac{1}{2}$$

$$C = \frac{3}{16}$$

or

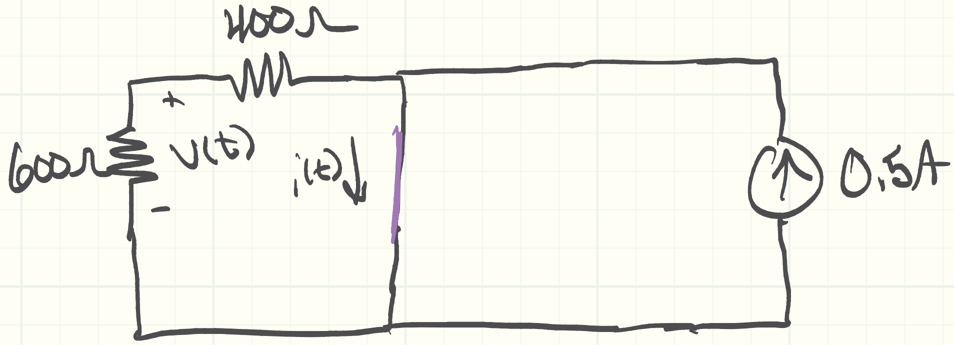
$$\boxed{C = 187.5\,mF}$$

P 8.3-18

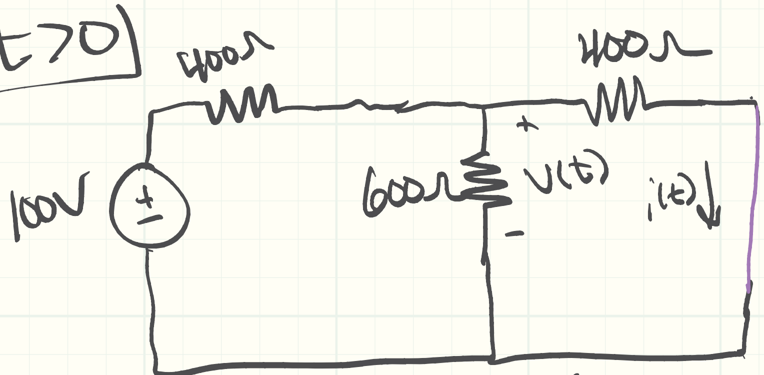


@t<0

$i(0) = 0.5A$



t>0

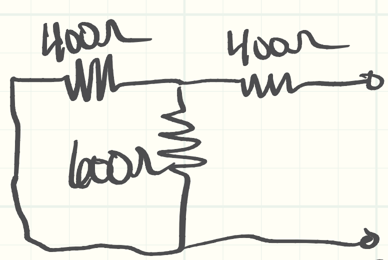


$$V(\infty) = \frac{600 \| 400}{600 \| 400 + 400} * 100$$

$$V(\infty) = 37.5$$

$$i(\infty) = \frac{37.5}{400} = 93.75\ mA$$

Req)



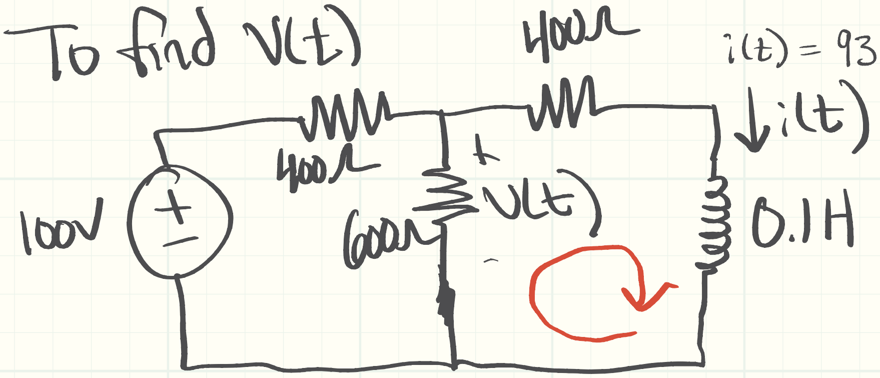
$$R_{eq} = 400 \| 600 + 400 = 640\Omega$$

$$\tau = \frac{L}{R_{eq}} = \frac{0.1}{640} = \frac{1}{6400}$$

$$i(t) = 93.75\times10^{-3} + \left[0.5 - 93.75\times10^{-3}\right] e^{-6400t}$$

$$i(t) = 93.75 + 406.25 e^{-6400t}\ mA$$

To find V(t)



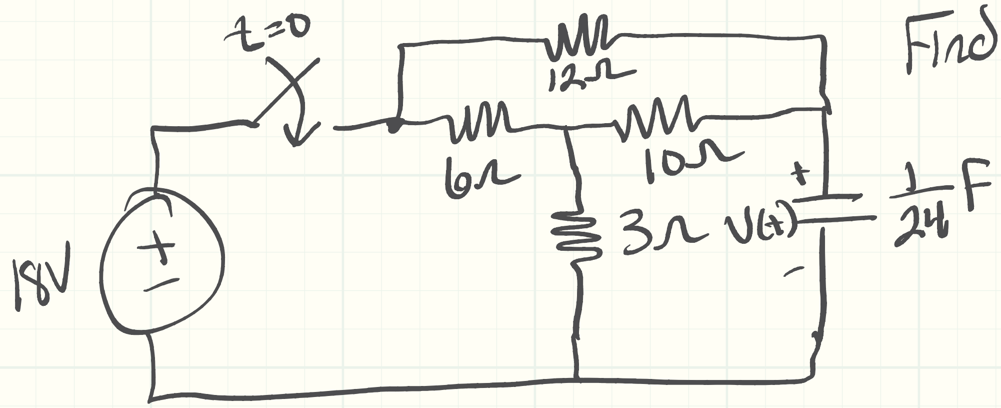
$i(t) = 93.75 + 406.25e^{-6400t}$ mA

$\frac{di(t)}{dt} = -2600e^{-6400t}$

$$V(t) = 400\,i(t) + 0.1\frac{di(t)}{dt}$$

$$\Rightarrow v(t) = \left[37.5 + 162.5e^{-6400t}\right] + \left[-260e^{-6400t}\right] \checkmark$$

$$\boxed{V(t) = 37.5 - 97.5e^{-6400t}} \checkmark$$

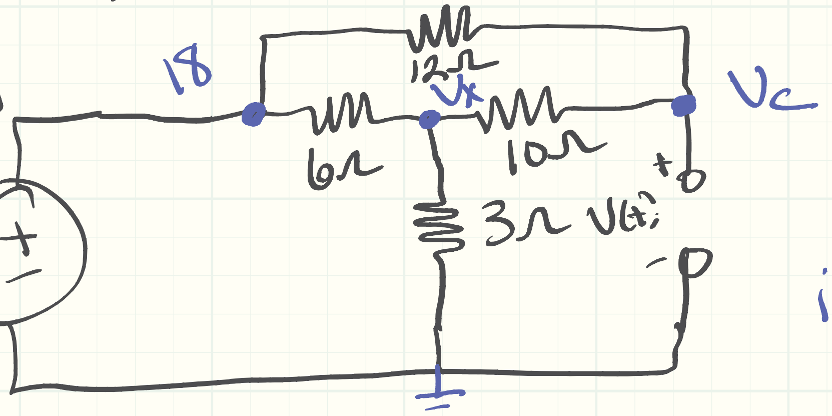


Find v(t)

t<0|

$V_c(0) = 0V$ since no source is connected.

t>0|



$i_c = C\frac{dv_c}{dt}$

@Vx|

$$\frac{1}{6}(V_x-18) + \frac{1}{3}(V_x-0) + \frac{1}{10}(V_x - V_c) = 0$$

$$\left[\frac{1}{6}+\frac{1}{3}+\frac{1}{10}\right]V_x + \left[-\frac{1}{10}\right]V_c = 3$$

@Vc|

$$\frac{1}{12}(V_c-18) + \frac{1}{10}(V_c-V_x) = 0$$

$$\left[-\frac{1}{10}\right]V_x + \left[\frac{1}{12}+\frac{1}{10}\right]V_c = 1.5$$

Solving yields

$V_x = 7V \quad V_c = 12V = v(\infty)$