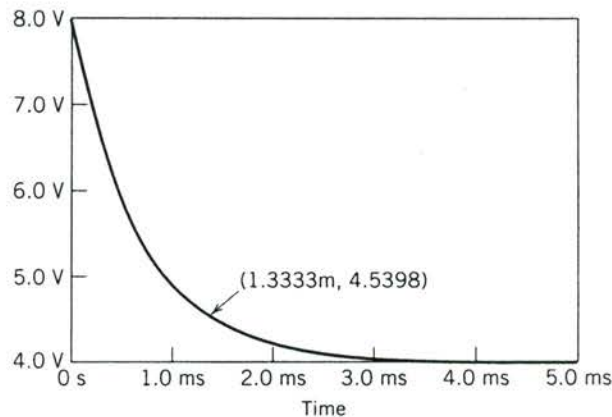
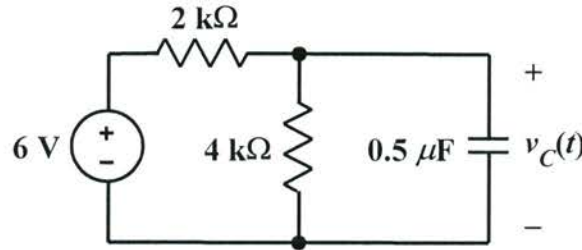
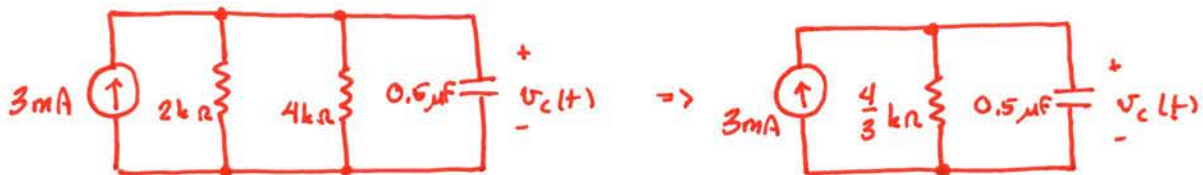


EE 2240
Problem #02

Consider the RC circuit shown below, where $v_C(0) = 8 \text{ V}$. The accompanying plot is alleged to show the transient response of the circuit. A point on the curve has been labeled, indicating a time and the corresponding capacitor voltage. Determine whether or not the plot is a true representation of the capacitor voltage in this circuit.



A source transformation yields the following circuit:



From KCL :

$$(0.5 \times 10^{-6} \text{ F}) \frac{dv_C}{dt} + \frac{v_C}{\left(\frac{4}{3} \text{ k}\Omega\right)} = 3 \text{ mA}$$

$$\text{or } \frac{dv_C}{dt} + 1500 v_C = 6000$$

Therefore,

$$v_c(t) = K_1 e^{-1500t} + K_2$$

or, upon solving for K_1 and K_2 , we have

$$v_c(t) = 4e^{-1500t} + 4 \text{ V}, \quad t \geq 0$$

The initial and final values of this expression correspond to those shown in the plot.

To check the labeled point, substitute $t = 1.3333 \text{ ms}$ in the solution to obtain

$$v_c(1.3333 \text{ ms}) = 4e^{-2} + 4 = 4.54 \text{ V}.$$

The plot appears to be correct.