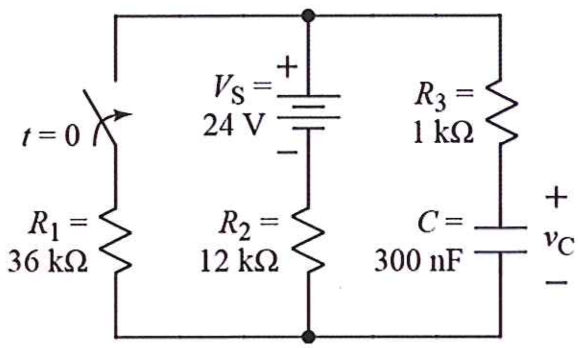
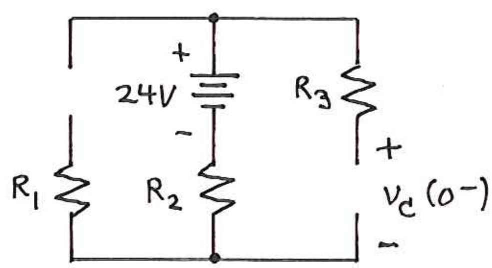
Ex:



The switch has been open for a long time and is closed at $t = 0$.

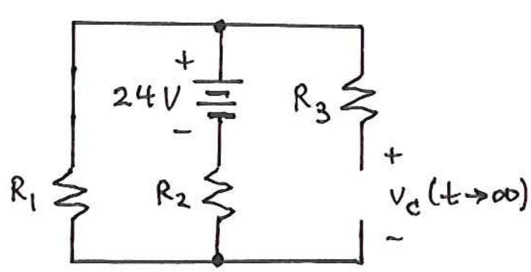
Write the full expression for $v_C(t)$ for $t > 0$, including all the numerical constants that you find.

sol'n: a) At $t = 0^-$ the switch is open and C = open.



No current flows, so R's all have 0V drops.
From V-loop around center and right side,
$v_c(0^-) = 24V$.

For $t \to \infty$ the switch is closed and C = open.



There is no current in R_3 and no V-drop across R_3. So V_C is the same as the V across the center branch and the same as the V across R_1. We use the V-divider formula to find the V-drop across R_1.

$$V_C(t\to\infty) = 24V \cdot \frac{R_1}{R_1 + R_2} = \frac{(24V)36k\Omega}{36k\Omega + 12k\Omega}$$

$$V_C(t\to\infty) = 18V$$

For the time constant, $\tau = R_{Th}C$, we look in from the terminals for C with the 24V source turned off (= wire). We see R_3 in series with R_1 parallel R_2.

$$R_{Th} = R_3 + R_1 \| R_2 = 1k\Omega + 36k\Omega \| 12k\Omega$$

We have $36k\Omega \| 12k\Omega = 12k\Omega \cdot 3\|1 = 12k\Omega\left(\frac{3}{4}\right) = 9k\Omega$.

$$R_{Th} = 1k\Omega + 9k\Omega = 10k\Omega$$

We use the general formula for RC solutions:

$$V_C(t) = V_C(t\to\infty) + \left[V_C(0^+) - V_C(t\to\infty)\right]e^{-t/\tau}, \; t>0$$

where $V_C(0^+) = V_C(0^-)$

$$V_C(t) = 18V + \left[24V - 18V\right]e^{-t/10k\Omega \cdot 300nF}, \; t>0$$

or

$$V_C(t>0) = 18V + 6Ve^{-t/3\,ms}$$