HOMEWORK #9 solution

Ex: The following equation describes the voltage, v_C, across a capacitor as a function of time. Find the time, t, at which v_C is equal to -4 V.

$$v_C(t) = -12 + 10(1 - e^{-t/2\text{ms}})\ \text{V}$$

Sol'n: We begin by substituting the value of –4 V for $v_C(t)$ on the left side.

$$-4\ \text{V} = -12 + 10(1 - e^{-t/2\text{ms}})\ \text{V}$$

or

$$-4\ \text{V} = -12 + 10 - 10e^{-t/2\text{ms}}\ \text{V}$$

We move constant terms to the left side in order to isolate the exponential.

$$\text{-2 V} = -10e^{-t/2\text{ms}}\ \text{V}$$

or

$$\frac{1}{5} = e^{-t/2\text{ms}}$$

or

$$\ln\frac{1}{5} = -t/2\text{ms}$$

Using $\ln(1/x) = -\ln(x)$ and multiplying both sides by 2 ms isolates the t:

$$t = 2\ \text{ms} \cdot \ln 5 = 3.29\ \text{ms}$$