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 2 V.

$$v_C(t) = 1 + 3(1 - e^{-t/8\text{ms}})\ \text{V}$$

SOL'N: We begin by substituting for the value of $v_C(t)$ on the left side.

$$2\ \text{V} = 1 + 3(1 - e^{-t/8\text{ms}})\ \text{V}$$

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

$$2\ \text{V} = 4 - 3e^{-t/8\text{ms}}\ \text{V}$$

or

$$-2\ \text{V} = -3e^{-t/8\text{ms}}\ \text{V}$$

or

$$\frac{2}{3} = e^{-t/8\text{ms}}$$

or

$$\ln\frac{2}{3} = -t/8\text{ms}$$

Using $\ln(1/x) = -\ln(x)$ and multiplying both sides by 8ms isolates the t.

$$t = 8\text{ms} \cdot \ln\frac{3}{2} = 3.24\ \text{ms}$$