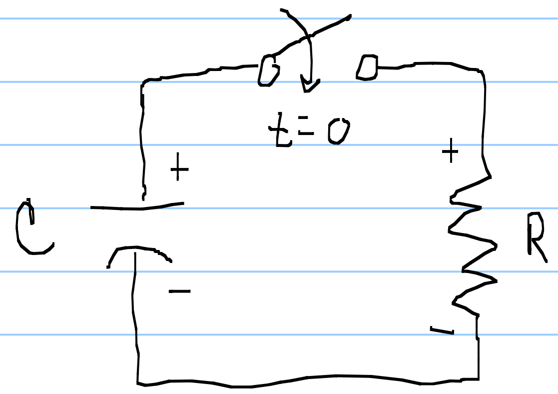

Using KVL...

$$-v_c(t) + v_R(t) = 0$$

$$v_R(t) = i_R(t)\,R \ldots$$

$$v_c(t) = v_R(t) = i_R(t)\,R$$

because it is a series circuit, $i_R(t) = i_c(t) = C\dfrac{dv(t)}{dt} \ldots$

$$v_c(t) = \left(C\frac{dv(t)}{dt}\right)R = RC\frac{dv(t)}{dt}$$

rearranging...

$$\frac{dv_c(t)}{dt} - \frac{v_c(t)}{RC} = 0$$

Using an integrating factor...

$$u(t) = e^{\int -1/RC\,dt} = e^{-t/RC + K} = e^{K} e^{-t/RC} = Ke^{-t/RC}$$

$$Ke^{-t/RC}\left(\frac{dV_c(t)}{dt} - \frac{V_c(t)}{RC}\right) = 0$$

left hand side is equivalent to...

$$\frac{d}{dt}\left(Ke^{-t/RC} V_c(t)\right)$$

So...

$$\frac{d}{dt}\left(Ke^{-t/RC} V_c(t)\right) = 0$$

integrating to eliminate derivative...

$$\int \frac{d}{dt}\left(Ke^{-t/RC} V_c(t)\right) dt = \int 0 \, dt$$

$$Ke^{-t/RC} V_c(t) + K_2 = K_3$$

Solving for $V_c(t)$ and combining constants where appropriate...

$$V_c(t) = Ke^{t/RC}$$

using initial values to solve for K...

$$V_c(0) = V_0 = Ke^{(0)} = K$$

So...

$$V_c(t) = V_0 e^{t/RC} \longleftarrow \text{ should be } e^{(-t/RC)}$$

Notice if I switch the polarity of either C or R the equation becomes correct...