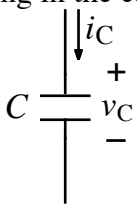
HOMEWORK #9 solution

Ex: In (a)-(c), the voltage $v_C(t)$ across a 500 nF capacitor is listed. Find the current, $i_C(t)$, flowing in the capacitor in each case as a function of time:



a) $v_C(t) = 5$ V
b) $v_C(t) = 30t$ kV/s
c) $v_C(t) = 1 - e^{-t/10\mu s}$ V

Sol'n: We use the defining equation for a capacitor in each case:

$$i_C = C\frac{dv_C}{dt}$$

a)

$$i_C = C\frac{d}{dt}5\text{ V} = 0\text{ A}$$

b)

$$i_C = C\frac{d}{dt}30t\text{ kV/s} = 500\text{ nF}\cdot 30\text{ kV/s} = 15\text{ mA}$$

c)

$$i_C = C\frac{d}{dt}(1 - e^{-t/10\mu s})\text{ V} = 500\text{ nF}\cdot\left(-\frac{-1}{10\mu s}e^{-t/10\mu s}\right)$$

$$i_C = 50\text{ mA}\ e^{-t/10\mu s}$$