One of these three elements is a resistor, one is an inductor, and one is a capacitor, but you are not told in advance which one is which. You are given the voltages across and the currents through each one of the elements.

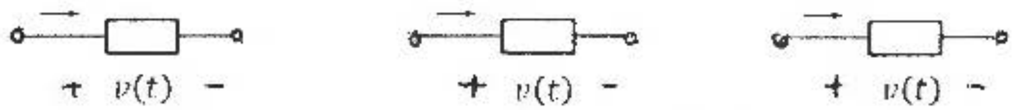
A1 = -96 mA

A2 = 12 mA

A3 = 3 mA

$$v(t) = 12\cos(4000t)\ \text{V}$$

$i_1(t) = A_1\sin(4000t)$ $\quad$ $i_2(t) = A_2\cos(4000t)$ $\quad$ $i_3(t) = A_3\sin(4000t)$



Find the value of the resistor *R*, the inductor *L* and the capacitor *C* (all three are positive values).

(For this problem, ignore the initial conditions. As we will see later in this course, this means we assume the system is in what is called "steady state".)

⊗ CAPACITOR: $i = C\dfrac{dv}{dt} = -C \cdot 12 \cdot 4000 \sin(4000t)$ (1)

⊗ INDUCTOR: $v = L\dfrac{di}{dt} \Rightarrow i = \dfrac{1}{L}\int v\,dt = \dfrac{12}{L}\cdot\dfrac{\sin(4000t)}{4000}$ (2)

⊗ RESISTOR: $v = iR \Rightarrow i = \dfrac{12}{R}\cos(4000t)$ (3)

⊗ ONLY i_2 IS $\cos(4000t) \Rightarrow$ FROM (3). $\dfrac{12}{R} = A_2 = 12 \cdot 10^{-3}$

$R = 10^3\ \Omega$ $\quad$ $\boxed{R = 1\ k\Omega}$

⊗ CAPACITOR HAS − SIGN FOR CURRENT

$\Rightarrow$ FROM (1). $-C \cdot 12 \cdot 4000 = A_1 = -96\ 10^{-3}$

$C = 2 \cdot 10^{-6}$ $\quad$ $\boxed{C = 2\ \mu F}$

⊗ INDUCTOR HAS + SIGN FOR CURRENT

$\Rightarrow$ FROM (2): $\dfrac{12}{4000L} = A_3 = 3 \cdot 10^{-3} \Rightarrow \boxed{L = 1\ H}$