# Phasors 005

Unlimited Attempts.

Each voltage-current pair below is the voltage across an element and the current through that element, adhering to the passive sign convention ($\omega$ is in units of rad/s).

$$v_1(t) = A_1 \cdot \cos(400t + 25°) \qquad i_1(t) = B_1 \cdot \sin(400t + 25°)$$
$$v_2(t) = A_2 \cdot \sin(500t + 70°) \qquad i_2(t) = B_2 \cdot \sin(500t + 160°)$$
$$v_3(t) = A_3 \cdot \cos(700t + 30°) \qquad i_3(t) = B_3 \cdot \sin(700t + 120°)$$

For each element:

a) Indicate the type of element. Enter 1 for resistor, 2 for inductor, and 3 for capacitor.
b) Find the value of the element. Assume the units are mΩ, mH or mF respectively.

Given Variables:

A1 : 12 V
B1 : 3 A
A2 : 20 V
B2 : 4 A
A3 : 2 V
B3 : 4 A

Calculate the following:

Type 1 (.) :

2 ✓

Value 1 (.) :

10 ✓

Type 2 (.) :

3 ✓

Value 2 (.) :

0.4 ✓

Type 3 (.) :

1 ✓

Value 3 (.) :

500 ✓

Hint: Convert to phasors and check if current lags or leads.

Each voltage-current pair below is the voltage across an element and the current through that element, adhering to the passive sign convention.

$v_1(t) = A_1 \cdot \cos(400t + 25)$ $\quad i_1(t) = B_1 \cdot \sin(400t + 25)$

$v_2(t) = A_2 \cdot \sin(500t + 70)$ $\quad i_2(t) = B_2 \cdot \sin(500t + 160)$

$v_3(t) = A_3 \cdot \cos(700t + 30)$ $\quad i_3(t) = B_3 \cdot \sin(700t + 120)$

For each element:

a) Indicate the type of element. Enter 1 for resistor, 2 for inductor, and 3 for capacitor.

b) Find the value of the element. Assume the units are mΩ, mH or mF respectively.

A1 : 16 V

B1 : 2 A

A2 : 32 V

B2 : 8 A

A3 : 3 V

B3 : 30 A

$\sin(\alpha) = \cos(\alpha - 90^\circ)$ $\qquad V = Z \cdot I$

$Z_L = j\omega L \Rightarrow \angle Z = 90^\circ$

$Z_C = \frac{1}{j\omega C} \Rightarrow \angle Z = -90^\circ$

$Z_R = R \Rightarrow \angle Z = 0^\circ$

① $V_1 = 16\, e^{j25^\circ}$ $\qquad I_1 = 2\, e^{j(25^\circ - 90^\circ)}$

$\angle Z_1 = \angle V_1 - \angle I_1 = 25^\circ - (25^\circ - 90^\circ) = 90^\circ \Rightarrow$ INDUCTOR

$|Z_1| = \frac{|V_1|}{|I_1|} = \frac{16}{2} = \omega L \Rightarrow L = \frac{16}{2} \cdot \frac{1}{400} \Rightarrow L = 20\ mH$

② $V_2 = 32\, e^{j(70^\circ - 90^\circ)}$ $\qquad I_2 = 8\, e^{j(160^\circ - 90^\circ)}$

$\angle Z_2 = \angle V_2 - \angle I_2 = (70^\circ - 90^\circ) - (160^\circ - 90^\circ) = -90^\circ$

$\Rightarrow$ CAPACITOR

$|Z_2| = \frac{|V_2|}{|I_2|} = \frac{32}{8} = \frac{1}{\omega C} \Rightarrow C = \frac{1}{500} \cdot \frac{8}{32} \Rightarrow C = 0.5\ mF$

③ $V_3 = 3\, e^{j30^\circ}$ $\qquad I_3 = 30\, e^{j(120^\circ - 90^\circ)}$

$\angle Z_3 = \angle V_3 - \angle I_3 = 30^\circ - (120^\circ - 90^\circ) = 0^\circ \Rightarrow$ RESISTOR

$|Z_3| = \frac{|V_3|}{|I_3|} = \frac{3}{30} = R \Rightarrow R = \frac{1}{10} \Rightarrow R = 100\ m\Omega$