AC power 006

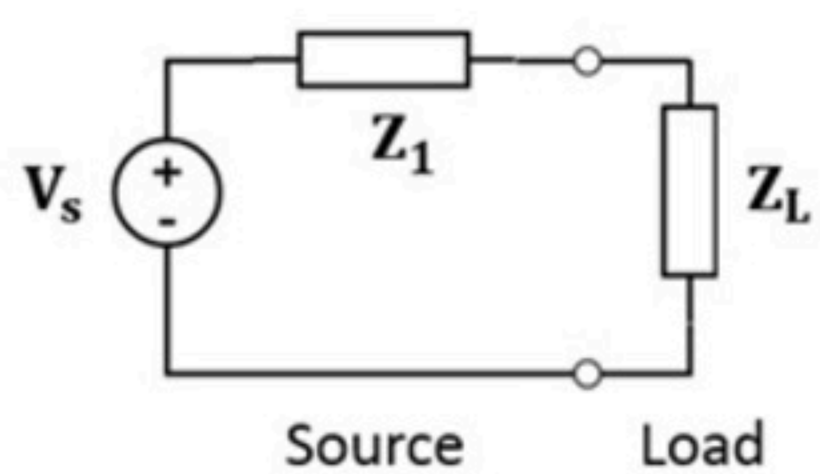
No more attempts left.

For the system below, the source is represented in phasor-notation as:

$$\mathbf{Z_1} = A_1 + jB_1 \qquad \mathbf{V_S} = A_2 \cdot e^{jB_2}$$

(a) Find the load impedance $\mathbf{Z_L} = A_3 + jB_3$ that results in the maximum power being received by this load.

(b) Find the maximum average power P received by the load.



Given Variables:

A1 : 5 ohm

B1 : 4 ohm

A2 : 2 V

B2 : 75 degrees

Calculate the following:

A3 (ohm) :

5

B3 (ohm) :

-4

P (W) :

0.1

Hint: Keep your calculations algebraic as long as you can.

For the system below, the source is represented in phasor-notation as:

A1 : 1 ohm

B1 : -8 ohm

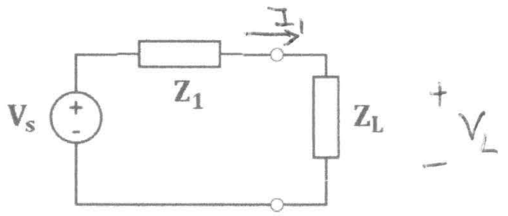
A2 : 4 V

B2 : 65 degrees

$$\mathbf{Z_1} = A_1 + jB_1 \qquad \mathbf{V_S} = A_2 \cdot e^{jB_2}$$

(a) Find the load impedance $\mathbf{Z_L} = A_3 + jB_3$ that results in the maximum power being received by this load.

(b) Find the maximum average power P received by the load.



ⓐ $Z_L = Z_1^* \Rightarrow Z_L = 1 + j8$

$\boxed{A_3 = 1\Omega}$

$\boxed{B_3 = 8\Omega}$

ⓑ $I_1 = \dfrac{V_S}{Z_1 + Z_L}$ $\qquad Z_1 + Z_L = 2$

$V_S = 4e^{j65°}$ $\qquad V_L = Z_L \cdot I_1$

$S_L = \frac{1}{2} V_L \cdot I_1^* = \frac{1}{2} Z_L \cdot I_1 \cdot I_1^* = \frac{Z_L}{2}|I_1|^2 = \frac{Z_L}{2}\dfrac{|V_S|^2}{|Z_1+Z_L|^2}$

$= \dfrac{(1+j8)}{2} \cdot \dfrac{4^2}{2^2} = (1+j8) \cdot 2 = \underbrace{2}_{P} + \underbrace{16j}_{Q}$

$\boxed{P = 2W}$