Complex numbers 006

Hint: Solve this symbolically as much as you can and only plug in numbers at the very end.

Find P and Q.

Note: We've used bold capital letters to denote complex variables. The * operator stands for complex conjugate. The Re[] and Im[] operators stand for taking the real part and imaginary part respectively.

Solve without a calculator

$$V_0 = ae^{j\frac{\pi}{6}} \qquad Z_1 = 2 + j \qquad Z_2 = bj$$

$$I_1 = \frac{V_0}{Z_1} \qquad V_1 = Z_2 \cdot I_1 \qquad S = \frac{1}{2} \cdot V_1 \cdot I_1^*$$

$$P = \mathrm{Re}[S] \qquad Q = \mathrm{Im}[S]$$

Given Variables:

a : 2 .

b : 1 .

Calculate the following:

P (.) :

0 ✓

Q (.) :

0.4 ✓

Hint: Work this out symbolically first and only plug in numbers later.

Find P and Q.

Note: We've used bold capital letters to denote complex variables. The * operator stands for complex conjugate. The Re[] and Im[] operators stand for taking the real part and imaginary part respectively.

$a : 2.$

$b : 1.$

$$\mathbf{V_0} = ae^{j\frac{\pi}{6}} \qquad \mathbf{Z_1} = 2 + j \qquad \mathbf{Z_2} = bj$$

$$\mathbf{I_1} = \frac{\mathbf{V_0}}{\mathbf{Z_1}} \qquad \mathbf{V_1} = \mathbf{Z_2} \cdot \mathbf{I_1} \qquad \mathbf{S} = \frac{1}{2} \cdot \mathbf{V_1} \cdot \mathbf{I_1^*}$$

$$P = \text{Re}[\mathbf{S}] \qquad Q = \text{Im}[\mathbf{S}]$$

$$S = \frac{1}{2} V_1 I_1^* = \frac{1}{2} Z_2 I_1 \cdot I_1^* = \frac{1}{2} \cdot j \, |I_1|^2$$

$$I_1 = \frac{V_0}{Z_1} \implies |I_1|^2 = \frac{|V_0|^2}{|Z_1|^2} = \frac{a^2}{4+1} = \frac{4}{5}$$

$$\implies S = \frac{1}{2} \cdot j \cdot \frac{4}{5} = j \cdot \frac{4}{10}$$

$$\boxed{P = 0}$$

$$\boxed{Q = 0.4}$$