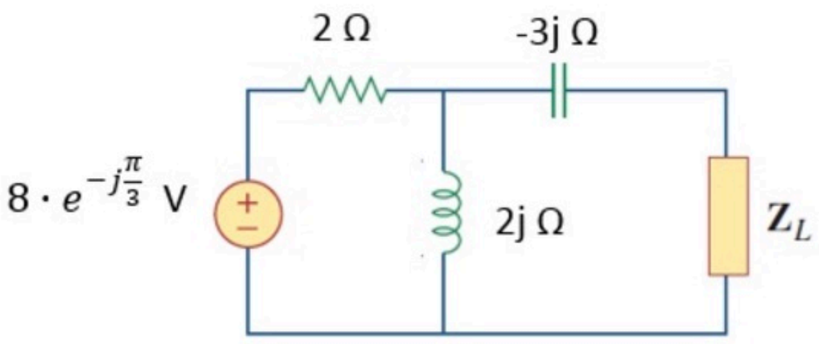
PP AC power 008

Unlimited Attempts.

Find the value of $\mathbf{Z_L} = a + jb$ that will receive the maximum amount of power

Find the resulting complex power $\mathbf{S} = c + jd$ received by the load.



Given Variables:

. : . .

Calculate the following:

a (ohm) :

1 ✓

b (ohm) :

2 ✓

c (W) :

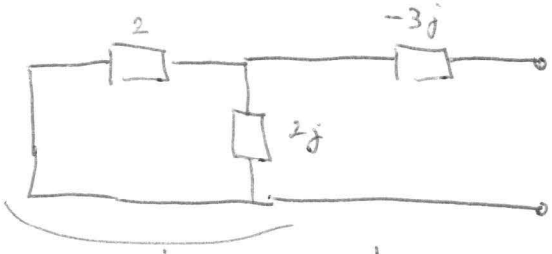
4 ✓

d (VAR) :

8 ✓

Hint: Set the independent source to zero. Find Zth.

(1)



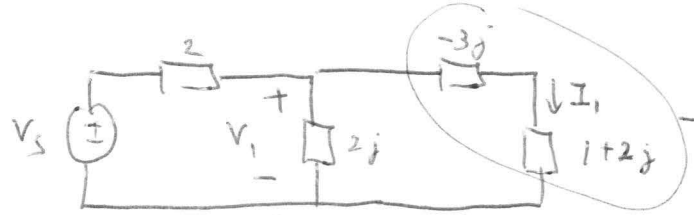
Z_{TH}

$\hookrightarrow Z_1 = \dfrac{1}{\frac{1}{2}+\frac{1}{2j}} = \dfrac{4j}{2+2j} = \dfrac{2j}{1+j} = \dfrac{2j(1-j)}{2} = 1+j$

$\Rightarrow Z_{TH} = Z_1 - 3j = 1-2j$

MAX POWER: $\boxed{Z_L = Z_{TH}^* = 1+2j}$

(2) OPTION 1:



$\hookrightarrow Z_2 = 1-j$

$\hookrightarrow Z_3 = \dfrac{1}{\frac{1}{2j}+\frac{1}{1-j}} = \dfrac{2j(1-j)}{1-j+2j} = \dfrac{2j+2}{1+j} = 2$

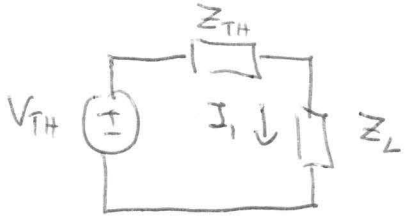
$V_1 = V_S \dfrac{Z_3}{Z_3+2} = \dfrac{V_S}{2}$

$I_1 = \dfrac{V_1}{Z_2}$ $\Rightarrow S_L = \frac{1}{2} Z_L \cdot |I_1|^2 = \frac{1}{2}(1+2j)\dfrac{|V_S|^2}{4}\cdot\dfrac{1}{|Z_2|^2}$

$= \frac{1}{2}\cdot\frac{64}{4}\cdot\frac{1}{2}(1+2j)$

$\boxed{S_L = 4+8j}$

OPTION 2: FIND $V_{TH} \Rightarrow V_{OC} = V_S \cdot \dfrac{2j}{2+j} = V_S \cdot \dfrac{j}{1+j} = V_{TH}$



$I_1 = \dfrac{V_{TH}}{Z_{TH}+Z_L} = \dfrac{V_{TH}}{(1-2j)+(1+2j)} = \dfrac{V_{TH}}{2}$

↳ AS EXPECTED

$S_L = \frac{1}{2} Z_L |I_1|^2 = \frac{1}{2}(1+2j)\dfrac{|V_{TH}|^2}{4} = \dfrac{(1+2j)}{8}|V_S|^2\dfrac{|j|^2}{|1+j|^2}$

$S_L = (1+2j)\cdot\dfrac{64}{8}\cdot\dfrac{1}{2} \Rightarrow \boxed{S_L = 4+8j}$