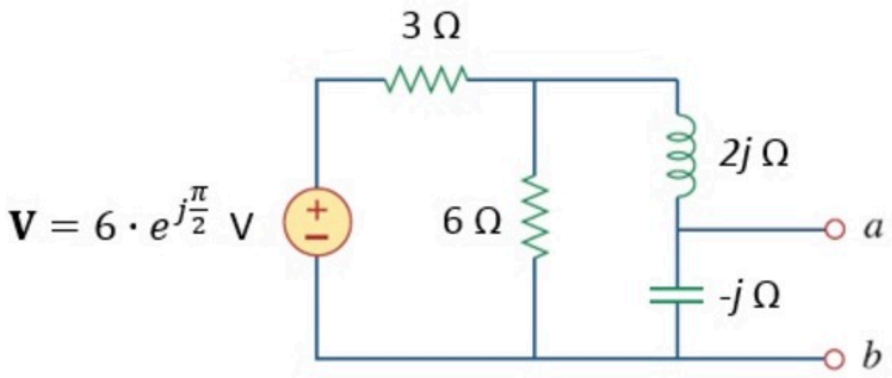
PP Phasors 021

Unlimited Attempts.

Find the Thevenin equivalent model between a and b, in phasor notation:

$\mathbf{V_{Th}} = a + jb$

$\mathbf{Z_{Th}} = c + j\mathrm{d}$



Given Variables:

Calculate the following:

a (V) :

1.6 ✓

b (V) :

-0.8 ✓

c (ohm) :

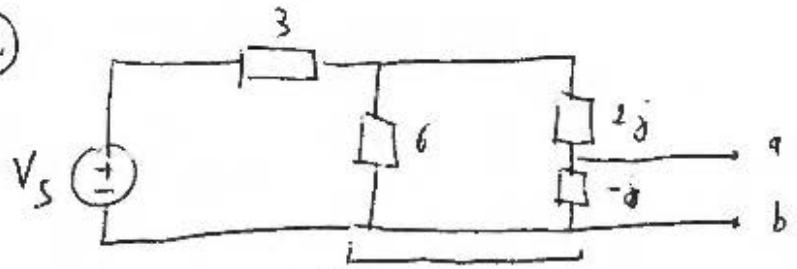
0.4 ✓

d (ohm) :

-1.2 ✓

Hint: You can use voltage divider and series/parallel connections of impedances

(a)



$$\rightarrow Z_1 = 6 \,/\!/\, (2j - j) = 6 \,/\!/\, j = \frac{1}{\frac{1}{6} + \frac{1}{j}} = \frac{6j}{6+j}$$

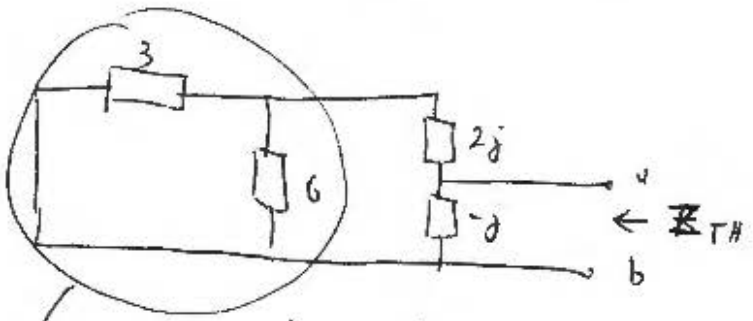
$$V_{ab} = V_s \frac{Z_1}{Z_1 + 3} \cdot \frac{-j}{2j - j} = V_s \cdot \frac{6j}{6j + 3(6+j)} \frac{-j}{j} = -V_s \frac{6j}{18 + 9j}$$

$$= \frac{-6e^{j\frac{\pi}{2}} \cdot 6j}{9(2+j)} \frac{(2-j)}{(2-j)} = \frac{-6j \cdot 6j}{9} \frac{(2-j)}{(4+1)} = \frac{36}{9} \cdot \frac{2-j}{5} = \frac{4}{5}(2-j)$$

$$V_{TH} = V_{ab} = \frac{8}{5} - \frac{4}{5}j$$

$a = 1.6\,V$ $\quad$ $b = -0.8\,V$

(b)



$$\rightarrow 3 \,/\!/\, 6 = \frac{1}{\frac{1}{3} + \frac{1}{6}} = \frac{6}{3} = 2\,\Omega$$

$$Z_{TH} = (2+2j) \,/\!/\, (-j) = \frac{1}{\frac{1}{2+2j} + \frac{1}{-j}} = \frac{-j(2+2j)}{-j + 2 + 2j} = \frac{2 - 2j}{2 + j}$$

$$= \frac{(2-2j)(2-j)}{(2+j)(2-j)} = \frac{(4 - 2j - 4j - 2)}{5} = \frac{2}{5} - \frac{6}{5}j$$

$Z_{TH} = \frac{2}{5} - \frac{6}{5}j$

$c = 0.4\,\Omega$ $\quad$ $d = -1.2\,\Omega$