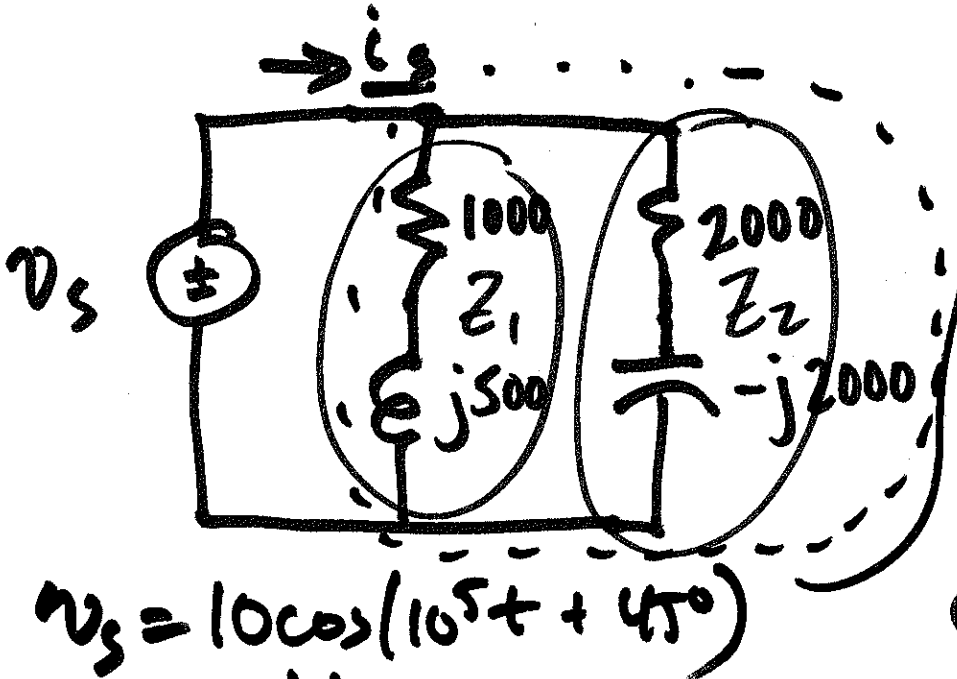


$V_s = 10 \angle 45°$ $\omega = 10^5$

$R_1 = 1k\Omega = 1000\Omega$

$R_2 = 2k\Omega$

$L = 5mH \Rightarrow Z_L = j\omega L$

$= j500$

$C = 5nF \Rightarrow Z_C = \frac{-j}{\omega C} = -j2000$

$(10^5)(5\times10^{-9}) = 5\times10^{-4}$

$v_s = 10\cos(10^5 t + 45°)$

$$I_s = \frac{V_s}{Z_{total}}$$

$$Z_{total} = \frac{Z_1 Z_2}{Z_1 + Z_2}$$

$Z_1 = 1000 + j500$

$Z_2 = 2000 - j2000$

$$= \frac{(1000 + j500)(2000 - j2000)}{3000 - j1500}$$

$$Z_{total} = \frac{(1000)(1000)}{1000}\left[\frac{(1000+j500)(2000-j2000)}{1000}\right]$$

$$= 1000\left[\frac{(1+j0.5)(2-j2)}{3-j1.5}\right]$$

$1k\Omega$

$$= 1000\left[\frac{2+j-j2+1}{3-j1.5}\right] = 1000\,\frac{3-j}{3-1.5j}$$

$e^{j\theta}\ e^{j\phi}$

$= e^{j(\theta+\phi)}$

$$= 1000\,\frac{3.16\angle -18.4}{3.35\angle -26.6} \leftarrow \text{negative}$$

$\leftarrow |\angle| < 90°$

$$Z_{total} = 943\angle 8.2° \leftarrow -18.4-(-26.6)$$

$$I_s = \frac{V_s}{Z_{total}} = \frac{10\angle 45°\ V}{943\angle 8.2°\ \Omega} = 0.0106\angle 36.8°\ A$$

$$= 10.6\angle 36.8°\ mA$$

$7\angle 25 + 3\angle 62 = 10\angle 87$

$7\angle 25 \xrightarrow{P\to R} 6.34 + j2.96$ + $3\angle 62 \xrightarrow{P\to R} 1.41 + j2.65$ $= 7.45 + j5.61 = 9.33\angle 37.0°$

$i_s = 10.6 \cos(10^5 t + 36.8°)$ mA

$Y = \frac{1}{Z}$ $\quad V_s = Y_{total} I_s$ $\quad Y_{total} = 1.06\angle -8.2$ mS (mV)

$$Y = Y_1 + Y_2 = \frac{1}{1000 + j500} + \frac{1}{2000 - j2000}$$

$$= \frac{1000 - j500}{1000^2 + (500)^2} + \frac{2000 + j2000}{(2000)^2 + (2000)^2}$$

$$= \frac{1}{1000}\left[\frac{1 - 0.5j}{1.25} + \frac{2 + j2}{8}\right]$$

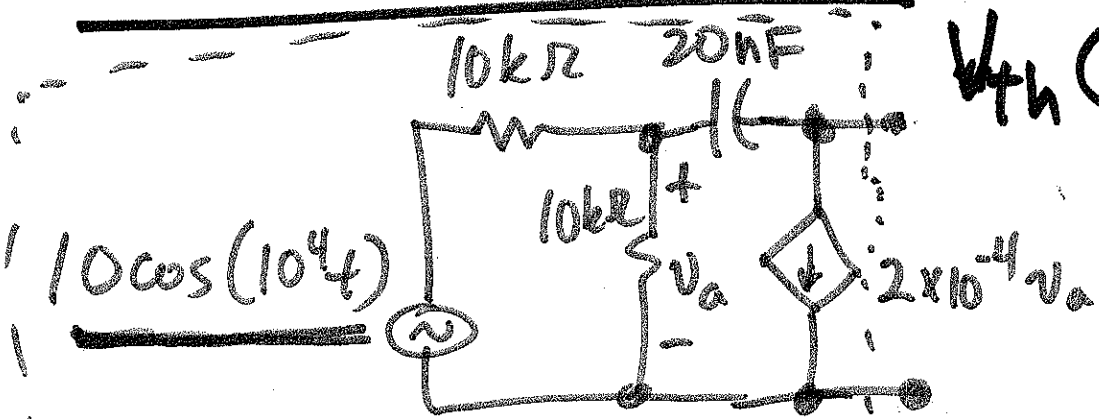
$$= \frac{1}{1000}\left[0.8 - 0.4j + 0.25 + 0.25j\right]$$

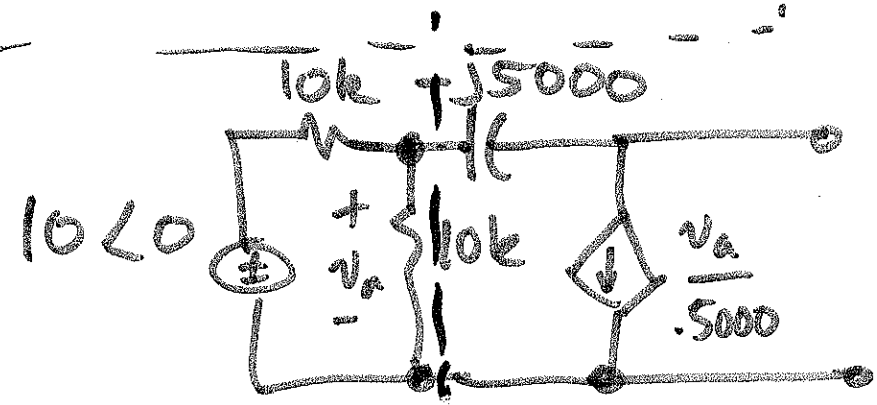
Answer checks ✓

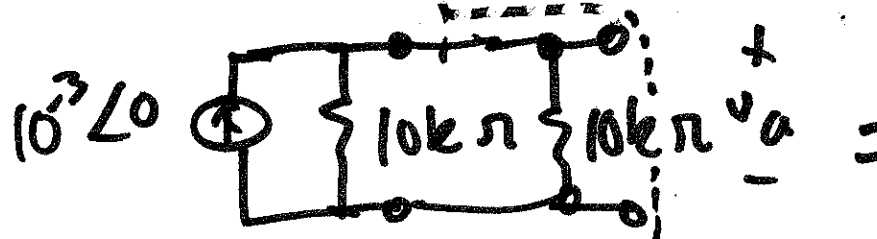
$$= \frac{1}{1000}\left[1.05 - j0.15\right] = 1.06\times10^{-3}\angle -8.1^\circ \text{ S}$$

$$= 1.06\angle -8.1^\circ \text{ mS}$$

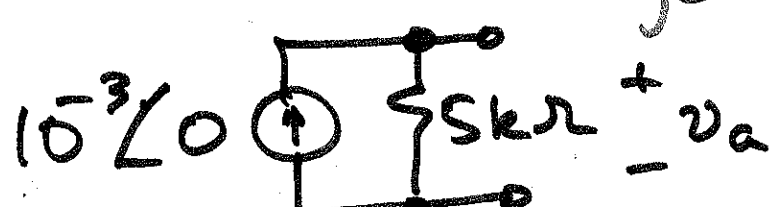
Thevenin / Norton

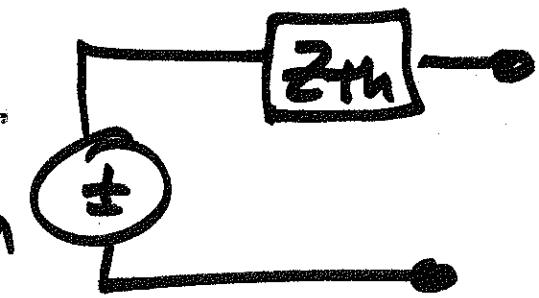


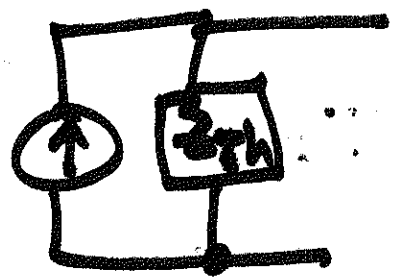




$\Rightarrow$





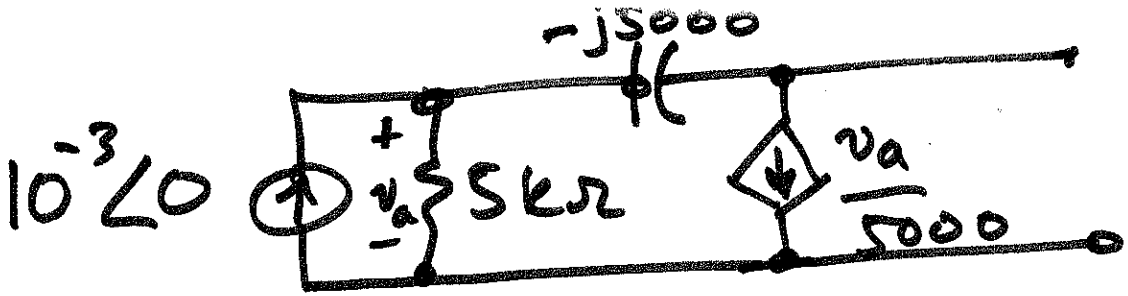


$$Z_N = Z_{th}$$

$$Z_C = -\frac{j}{\omega C} = -\frac{j}{\omega^4 (2\times10^{-8})}$$

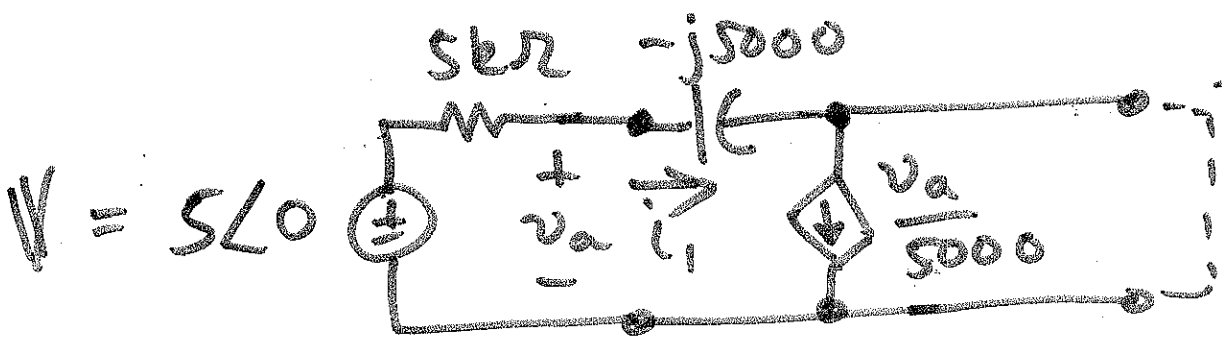
$$= -\frac{j}{2\times10^{-4}}$$

$$= -j5000$$



$$I_{sc} = \frac{5\angle 0}{5k - j5k} - \frac{v_a}{5k}$$

(1)



$$v_a = \frac{-j5k}{5k - j5k} \cdot 5\angle 0 \quad V$$

(voltage divider)

$$I_{sc} = \frac{5}{5k - j5k} + \frac{j5k \; 5\angle 0}{(5k - j5k)(5k)}$$

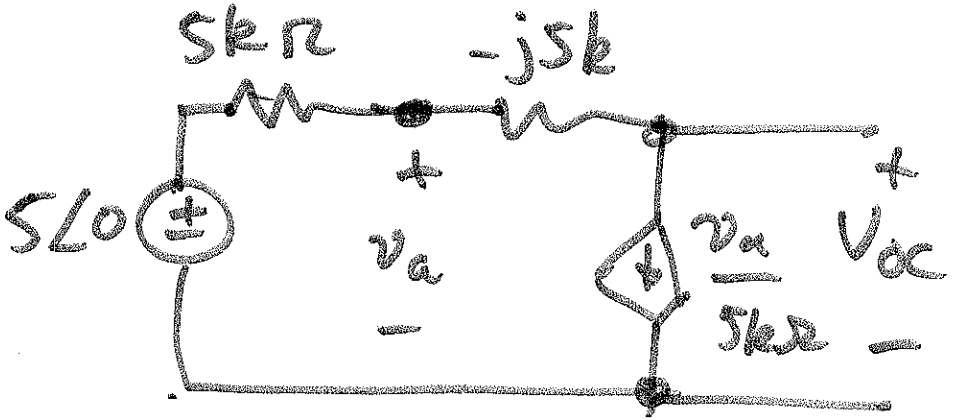
$$= \frac{5}{5k - j5k} + \frac{j5k \;\; 5}{(5k - j5k)(5k)} = \frac{5 + j5}{5k - j5k}$$

$$= \frac{5\sqrt{2}\angle 45^\circ \;\; V}{5\sqrt{2}\angle -45^\circ \; k\Omega}$$

$$= 1 mA \angle 90^\circ$$

$45^\circ - (-45^\circ) = 90^\circ$

$$V_{oc} = 5\angle 0 - \frac{v_a(5k - j5k)}{5k\Omega}$$



$$\frac{5\angle 0 - v_a}{5k\Omega} = \frac{v_a}{5k\Omega}$$

$$v_a = \frac{5\angle 0}{2} = 2.5\angle 0\ V$$

$$V_{oc} = 5\angle 0 - \frac{(2.5\angle 0)(5k - j5k)}{5k}$$

$$= 5 - 2.5(1 - j) = 2.5 + j2.5$$

$$= 2.5\sqrt{2}\angle 45°$$

$$Z_{TH} = Z_N = \frac{V_{Th}}{I_N} = \frac{2.5\sqrt{2}\angle 45°}{10^{-3}\angle 90°} = 3.53\angle -45°\ k\Omega$$