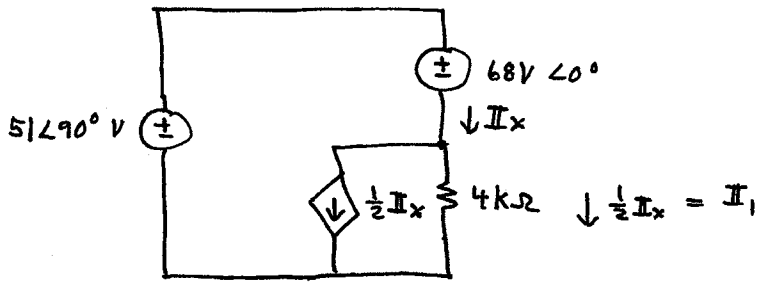
soln: 3.a) The $-j3k\Omega$ and $j3k\Omega$ sum to zero and act like a wire. Thus, they do not affect $\mathbb{I}_x$. So we have:



Clearly, $\frac{1}{2}\mathbb{I}_x$ flows thru the $4k\Omega$ (for sum of currents at node above $4k\Omega = 0$).

But the current thru $4k\Omega$ is $\frac{5|\angle 90^\circ V - 68\angle 0^\circ V}{4k\Omega}$

or $\frac{1}{2}\mathbb{I}_x = \mathbb{I}_1 = \frac{17.3\angle 90^\circ - 17.4\angle 0^\circ V}{4k\Omega}$

$$\mathbb{I}_1 = 17\ \frac{j3-4}{4k\Omega} = \frac{17}{4}(-4+j3)\ mA = \frac{17.5V\angle 143^\circ}{4}\ mA$$

$$\mathbb{I}_1 = -17 + j\,12.75\,mA = 21.25\angle 143^\circ\,mA$$

b) $i_1(t) = 17\cos(\pi t + 180^\circ) - 12.75\sin(\pi t)\ mA$

$\quad = 21.25\cos(\pi t + 143^\circ)\ mA$