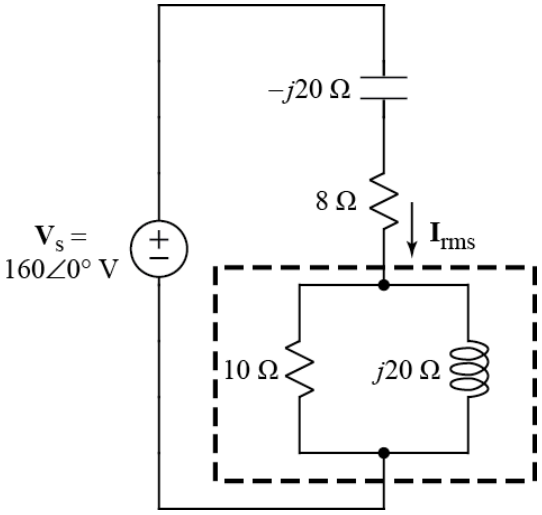
Ex:



a) Calculate the value of rms current, $\mathbf{I}_{rms}$, flowing down through the dashed box.

b) Calculate the complex power, S, for the circuitry inside the dashed box.

soln: a) $\mathbb{I}_{rms} = \frac{V_s}{\sqrt{2}} \frac{1}{z_{tot}} = \frac{160\angle 0^\circ V}{\sqrt{2}} \frac{1}{z_{tot}}$

We divide V_s by $\sqrt{2}$ to convert to rms.

$z_{tot} = -j20\,\Omega + 8\,\Omega + 10\,\Omega \| j20\,\Omega$

where $10\,\Omega \| j20\,\Omega = 10\,\Omega \cdot 1 \| j2$

$= 10\,\Omega \frac{j2}{1+j2} \frac{1-j2}{1-j2} = \frac{10\,\Omega\,(4+j2)}{5}$

$= 2(4+j2)\,\Omega = 8+j4\,\Omega$

$z_{tot} = -j20\,\Omega + 8\,\Omega + 8\,\Omega + j4\,\Omega = 16 - j16\,\Omega$

$\mathbb{I}_{rms} = \frac{160\angle 0^\circ V_{rms}}{\sqrt{2}} \frac{1}{16 - j16\,\Omega}$

$= \frac{160}{\sqrt{2}} \frac{1}{16\sqrt{2}\angle -45^\circ} A_{rms}$

$= \frac{160}{32} \angle 45^\circ A_{rms}$

$\mathbb{I}_{rms} = 5 \angle 45^\circ A_{rms}$

b) $\vec{S} = \left|\mathbb{I}_{rms}\right|^2 \vec{z}$

$= 5^2 \cdot (8+j4)$ VA

$\vec{S} = 200 + j\,100$ VA