Chapter 11, Solution 50.

(a) $\mathbf{S} = P - jQ = 1000 - j\frac{1000}{0.8}\sin(\cos^{-1}(0.8))$

$\mathbf{S} = 1000 - j750$

But, $\mathbf{S} = \frac{|\mathbf{V}_{rms}|^2}{\mathbf{Z}^*}$

$\mathbf{Z}^* = \frac{|\mathbf{V}_{rms}|^2}{\mathbf{S}} = \frac{(220)^2}{1000 - j750} = 30.98 + j23.23$

$\mathbf{Z} = \mathbf{[30.98 - \mathit{j}23.23]\ \Omega}$

(b) $\mathbf{S} = |\mathbf{I}_{rms}|^2 \mathbf{Z}$

$\mathbf{Z} = \frac{\mathbf{S}}{|\mathbf{I}_{rms}|^2} = \frac{1500 + j2000}{(12)^2} = \mathbf{[10.42 + \mathit{j}13.89]\ \Omega}$

(c) $\mathbf{Z}^* = \frac{|\mathbf{V}_{rms}|^2}{\mathbf{S}} = \frac{|\mathbf{V}|^2}{2\mathbf{S}} = \frac{(120)^2}{(2)(4500\angle 60°)} = 1.6\angle -60°$

$\mathbf{Z} = 1.6\angle 60° = \mathbf{[0.8 + \mathit{j}1.386]\ \Omega}$