Chapter 11, Solution 73.

(a) $\mathbf{S} = 10 - j15 + j22 = 10 + j7$ kVA

   $S = |\mathbf{S}| = \sqrt{10^2 + 7^2} = \mathbf{12.21}$ **kVA**

(b) $\mathbf{S} = \mathbf{V}\mathbf{I}^* \longrightarrow \mathbf{I}^* = \dfrac{\mathbf{S}}{\mathbf{V}} = \dfrac{10{,}000 + j7{,}000}{240}$

   $\mathbf{I} = 41.667 - j29.167 = \mathbf{50.86\angle - 35°}$ **A**

(c) $\theta_1 = \tan^{-1}\!\left(\dfrac{7}{10}\right) = 35°$, $\theta_2 = \cos^{-1}(0.96) = 16.26°$

   $Q_c = P_1[\tan\theta_1 - \tan\theta_2] = 10[\tan(35°) - \tan(16.26°)]$

   $Q_c = \mathbf{4.083}$ **kVAR**

   $C = \dfrac{Q_c}{\omega V_{rms}^2} = \dfrac{4083}{(2\pi)(60)(240)^2} = \mathbf{188.03}\ \boldsymbol{\mu}\mathbf{F}$

(d) $\mathbf{S}_2 = P_2 + jQ_2,\ \ P_2 = P_1 = 10$ kW

   $Q_2 = Q_1 - Q_c = 7 - 4.083 = 2.917$ kVAR

   $\mathbf{S}_2 = 10 + j2.917$ kVA
   But $\mathbf{S}_2 = \mathbf{V}\mathbf{I}_2^*$

   $\mathbf{I}_2^* = \dfrac{\mathbf{S}_2}{\mathbf{V}} = \dfrac{10{,}000 + j2917}{240}$

   $\mathbf{I}_2 = 41.667 - j12.154 = \mathbf{43.4\angle - 16.26°}$ **A**