Chapter 11, Solution 82.

(a) $P_1 = 5,000, \quad Q_1 = 0$

$P_2 = 30,000 x 0.82 = 24,600, \quad Q_2 = 30,000 \sin(\cos^{-1} 0.82) = 17,171$

$\overline{S} = \overline{S}_1 + \overline{S}_2 = (P_1 + P_2) + j(Q_1 + Q_2) = 29,600 + j17,171$

$$S = |\overline{S}| = \mathbf{34.22 \, kVA}$$

(b) $\qquad\qquad\qquad\qquad Q = \mathbf{17.171 \, kVAR}$

(c) $pf = \dfrac{P}{S} = \dfrac{29,600}{34,220} = 0.865$

$Q_c = P(\tan\theta_1 - \tan\theta_2)$
$= 29,600\left[\tan(\cos^{-1} 0.865) - \tan(\cos^{-1} 0.9)\right] = \mathbf{2833 \, VAR}$

(c) $\qquad C = \dfrac{Q_c}{\omega V^2_{rms}} = \dfrac{2833}{2\pi x 60 x 240^2} = \mathbf{130.46\mu F}$