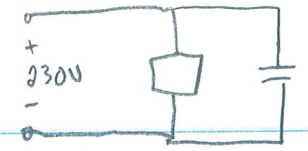
11.25



$P_{avg} = 40\,kW$

$pf = 0.7$ lagging

$\omega = 120\pi$

find C for $pf = 0.9$.

$$Q_{old} = P\sqrt{\frac{1}{pf^2} - 1} = 40000\sqrt{\frac{1}{.7^2} - 1} = 40808.2 \text{ VAR}$$

$$Q_{new} = 40000\sqrt{\frac{1}{.9^2} - 1} = 19372.9 \text{ VAR}$$

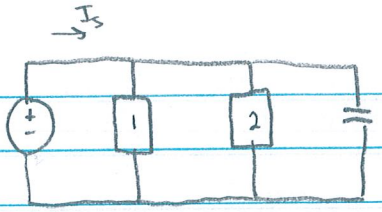
$$Q_{cap} = Q_{new} - Q_{old} = 19372.9 - 40808.2 = -21435.3 \text{ VAR}$$

$$-jQ_c = V_c I_c^* = (j\omega C V_c)^* V_c = -j\omega C |V_c|^2$$

$$Q_c = -\omega C |V_c|^2 = -120\pi C (230v)^2 = -21435.3$$

$$\rightarrow C = 1.07\,mF$$

11.27



1: 360W pf = .9

2: 1440W pf = .866

$V_s = 120\sqrt{2}\angle 0°$

$\omega = 120\pi$

find C for $|I_s| = 16$ Arms. $\quad V_{rms} = 120\sqrt{2}/\sqrt{2} = 120\ V_{rms}$

$Q_1 = 360\sqrt{\frac{1}{.9^2}-1} = 174.4$ VAR $\quad S_1 = 360 + j174.4$

$Q_2 = 1440\sqrt{\frac{1}{.866^2}-1} = 831.5$ VAR $\quad S_2 = 1440 + j831.5$

$$pf = \frac{P_{avg}}{V_{srms} I_{srms}} = \frac{360+1440}{(120)(16)} = \boxed{.9375}$$

$Q_{old} = 174.4 + 831.5$

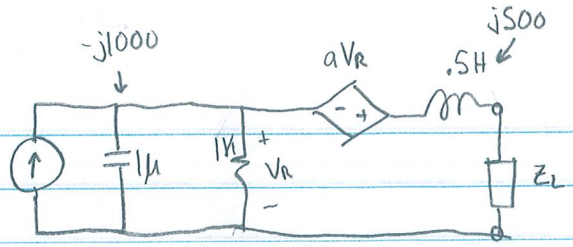
$$Q_{new} = (16)(120)\sqrt{\frac{1}{.9375^2}-1} = 712.67$$

$$Q_c = Q_{new} - Q_{old} = -293.23$$

$$Q_c = -\omega C |V_s|^2 = -120\pi C |120\sqrt{2}|^2 = -293.23$$

$$\boxed{C = 27\,\mu F}$$

11.32



$a = 3$

$I_s = 2\angle 0$ A$_{rms}$

$\omega = 1000$

Find V_{oc}: KCL @ V_R: $-2 + \frac{V_R}{-j1000} + \frac{V_R}{1000} = 0 \rightarrow V_R\left(\frac{1}{1000} + \frac{j}{1000}\right) = 2$

$V_R = 1000 - j1000$

$V_{oc} = V_R + aV_R = 4V_R = \underline{4000 - j4000}$

Find i_{sc}: KCL @ V_R: $-2 + \frac{V_R}{-j1000} + \frac{V_R}{1000} + i_{sc} = 0$

$$i_{sc} = \frac{V_R + aV_R}{j500}$$

$V_R\left(\frac{1}{-j1000} + \frac{1}{1000} + \frac{4}{j500}\right) = 2 \rightarrow V_R = 40 + j280$

$i_{sc} = 4V_R / j500 = 2.24 - j0.32$

$Z_{th} = V_{oc} / i_{sc} = 2000 - j1500\ \Omega$

$$\boxed{Z_L = Z_{th}^* = 2000 + j1500\ \Omega}$$

$$P_{max} = \frac{V_{rms}^2}{4R_e(Z_L)} = \frac{4000^2}{4(2000)} = \boxed{2000\ W}$$