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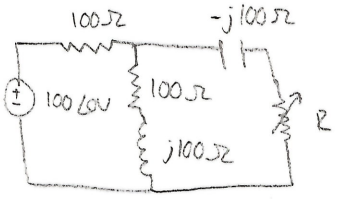
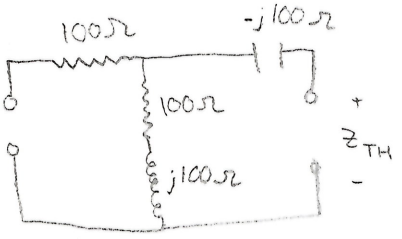
4655 4192

EECS 215 HW 11

19.



solve for Z_{TH}



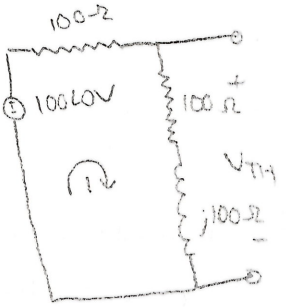
$$Z_{TH} = -j100 + (100 + j100 \,||\, 100)$$

$$= -j100 + \frac{(100+j100)100}{100+j100+100} = -j100 + \frac{10000+j10000}{200+j100} = 100\angle -53.13^\circ\ \Omega$$

$$R_L = |Z_{TH}| = \boxed{100\ \Omega}$$

$$P_{max} = \frac{|V_{TH}|^2}{8R_{TH}}$$

To find V_{TH}:



$Z = 200 + j100$

$I = V/Z = 0.4 - j0.2$

$V_{TH} = IZ = 60 + j20$

$$P_{max} = \frac{|V_{TH}|^2}{8R_{TH}} = \boxed{6.25\ W}$$

27. $$I_{rms}^2 = \frac{1}{5}\int_0^5 t^2\,dt = \frac{1}{5}\,\frac{t^3}{3}\Big|_0^5 = \frac{125}{15}$$

$$\boxed{I_{rms} = 2.887\ A}$$

16.b. $V = 250\angle -10\ V_{rms}$

$I = 6.2\angle -25\ A_{rms}$

$S = VI^* = (250\angle -10)(6.2\angle 25) = 1550\angle 15^\circ = 1497 + j401\ VA$

apparent power = 1550 VA

real power = 1497 W

reactive power = 401 VAR

Power factor lags because current lags voltage

d. $V = 160\angle 45\ V_{rms}$

$I = 8.5\angle 90\ A_{rms}$

$S = VI^* = (160\angle 45)(8.5\angle -90) = 1360\angle -45 = 962 + j962$

apparent power = 1360 VA

real power = 962W

reactive power = 962VAR

Power factor is leading because current leads voltage

4.18 a. $P = 269W$; $Q = 150$ VAR

$S = P - jQ =$ **$269 - j150$ VA**

c. $S = 600$ VA ; $Q = 450$ VAR

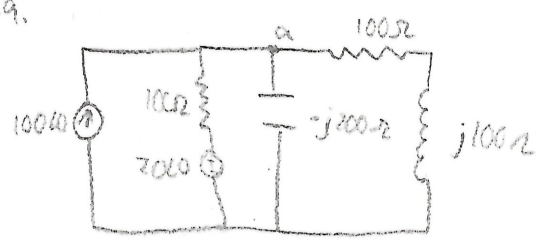
$S = P + jQ = \sqrt{P^2 + Q^2}$

$P^2 = S^2 - Q^2 = 600^2 - 450^2$

$P = 396.86W$

$S =$ **$396.86 + j450$ VA**

5.9.



KCL @ a: $\frac{a-20}{100} + \frac{a}{-j200} = 0.1 + \frac{a}{100+j100} = 0$

$a\left(\frac{1}{100} + \frac{1}{-j200} + \frac{1}{100+j100}\right) = 0.1 + 0.2$

$a = 0.3\left(\frac{1}{100} + \frac{1}{-j200} + \frac{1}{100+j100}\right)^{-1}$

$= 18 - j6 = 18.97\angle -18.43$ V

current through inductor:

$I_1 = \frac{a}{100+j100} = 0.06 - j0.12 = 0.134\angle -63.43$

$I_2 = \frac{a}{-j200} = 0.03 + j0.09 = 0.095\angle 71.57°$

$S_L = VI_1^* = (18.97\angle -18.43)(0.134\angle 63.43) = 2.54\angle 58.31 = 1.3416 + 2.1592j$

$S_C = VI_2^* = (18.97\angle -18.43)(0.095\angle -71.57) = 1.80\angle -116.62 = -1.6728 + j0.6720$

$Q_L = j2$ VAR

$Q_C = -j2$ VAR

75. a. $Z_1 = 10 - j30$ $I_1 = 41.4 + j13.2$

$Z_2 = 10 + j10$ $I_2 = 22 - j22$

$Z_3 = 10$ $I_3 = 41.4$

$\sum Z = 70.4 - j8.8$

$P = .5(440)(70.4 - j8.8) = 32,111 + j3,36$ kVAR

b. 0.97 lagging

c.