Question 1 (18 pts)

3Ω $\frac{9}{8}H$ $\frac{1}{2}\Omega$

v_{s_1} 3 $\frac{9}{2}J$ 3:1

B $-\frac{1}{36}F$ L

A v_{s_2} $-J9$

$(w=4)$ Z_{Th}

$v_{s_1}(t) = A\cos(4t)\ V,$
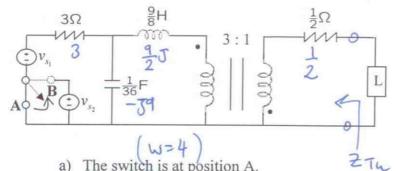
$v_{s_2}(t) = A\cos(4t + 60°)\ V$

a) The switch is at position A.
   The load is adjusted for the maximum power transfer.
   The real power delivered to the load is 300 Watts.
   Find the reactive power delivered to the load.

b) The switch is moved to position B.
   Find the real power delivered to the load.

a) $Z_L = Z_{Th}^*$; $Z_{Th} = \left[(3 \| -J9) + \frac{9}{2}J\right]\frac{1}{9} + \frac{1}{2}$

$$= \left[\left(\frac{1}{3} \| -J\right) + \frac{J}{2}\right] + \frac{1}{2}$$

$$= \left[\frac{-J/3}{\frac{1}{3} - J} + \frac{J}{2}\right] + \frac{1}{2}$$

$$= \left[\frac{-J(1+3J)}{10} + \frac{J}{2}\right] + \frac{1}{2}$$

$$= 0.8 + J0.4$$

$Z_L = 0.8 - J0.4 \longrightarrow P_{Load} = \left(I_{Load}^{RMS}\right)^2 \cdot (0.8) = 300$ Watt ← given

$Q_{Load} = \left(I_{Load}^{RMS}\right)^2 \cdot (-0.4) = -150$ Var. ← then

b)

$A\angle 0$ $H(Jw)$ $I_L^{RMS}\angle A$

$P_{Load} = 300$

$A\angle 0$ $A\angle 60$

$A\angle 60$ A

$\pm\sqrt{3}A\angle 30$

$A\angle 0$ $A\angle 60$ $H(Jw)$ $I_{L®}^{RMS}$

$I_{L®}^{RMS} = \sqrt{3}\ I_{L④}^{RMS}$

$P_{Load} = 3\times300 = 900$