Due: November 16, 2006   Name _____

wlg   Print(last, first)

circle: 2:10 section   3:40 section

Use Engineering Paper. Work only on one side of the paper. Use this sheet as your cover sheet, placed on top of your work and stapled in the top left-hand corner. Number the problems at the top of the page, in the center of the sheet. **Do neat work**. **Underline your answers. Show how you got your equations**. **Be sure to show how you got your answers.** Each problem counts 10 points.

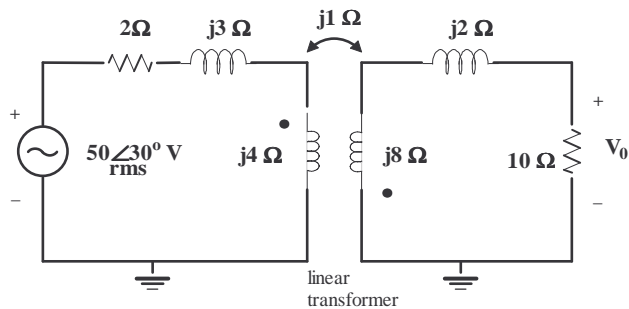(1) For the linear transformer of Figure 1, find the phasor voltage V_o. (Ans: on your own)

Figure 1: Circuit for problem 1.

(2) Find the rms phasor current I_o in the circuit of Figure 2. Ans $I_o = 1.52\angle 92^o$ A rms
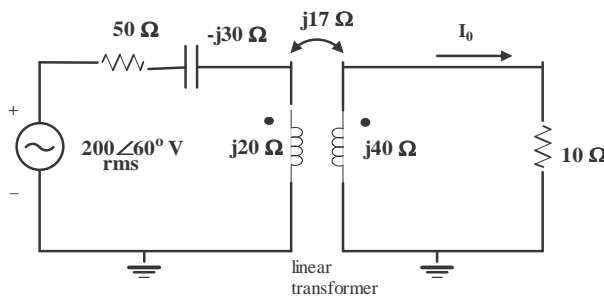

Figure 2: Circuit for problem 2.

(3) You are given the linear transformer circuit of Figure 3. Find the input impedance Z_{in} of the circuit. Hint: Assume a convenient source voltage to place between terminals a-b, say $V_s = 1\angle0$ V vms, positive at terminal a. Calculate the resulting current (call it I_1) leaving "a" and going through the 1 Ω resistor. The input impedance is then $Z_{ab} = V_s/I_1$. Ans: $Z_{ab} = 9.22\angle79.9^o$ Ω
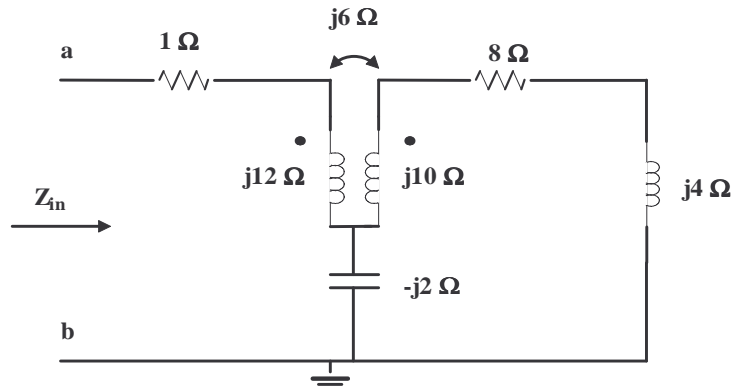

Figure 3: Circuit for problem 3.

(4) You are given the ideal transformer circuit of Figure 4. Determine I_1, I_2, V_1 and V_2.
Ans: $I_1 = 1.07\angle5.87$ A, $I_2 = 0.535\angle-174.1^o$ A, $V_1 = 4.36\angle-101.8$ V, $V_2 = 8.72\angle78.2^o$ V
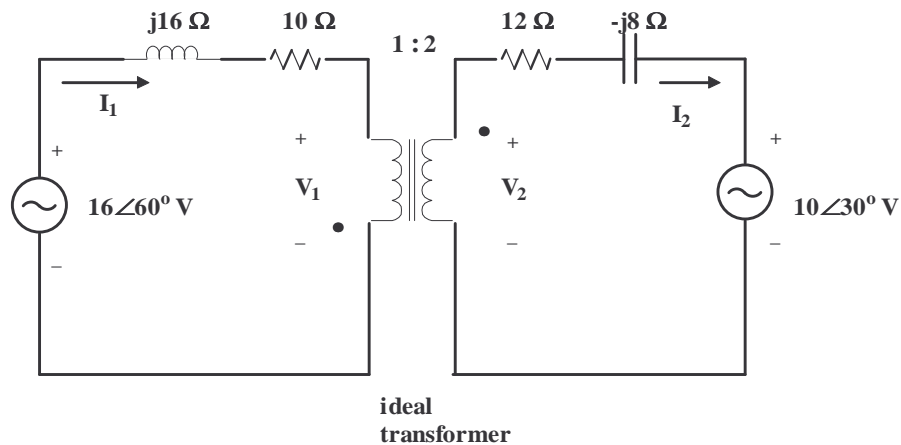

Figure 4: Circuit for problem 4.

(5) You are given the circuit of Figure5.

    (a) Determine n so that the maximum power will be delivered to the load resistor.   Ans: n = 4

    (b) Determine the power delivered to the load under the condition of maximum power transfer.
        Ans: 60.5 W
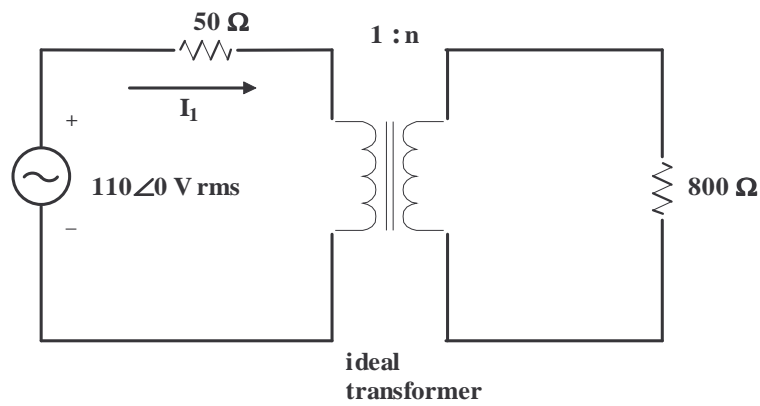

Figure 5: Circuit for problem 5.

(6) Consider Figure 6. The $4400\angle0$ V rms is supplied by your local utility to the primary of a
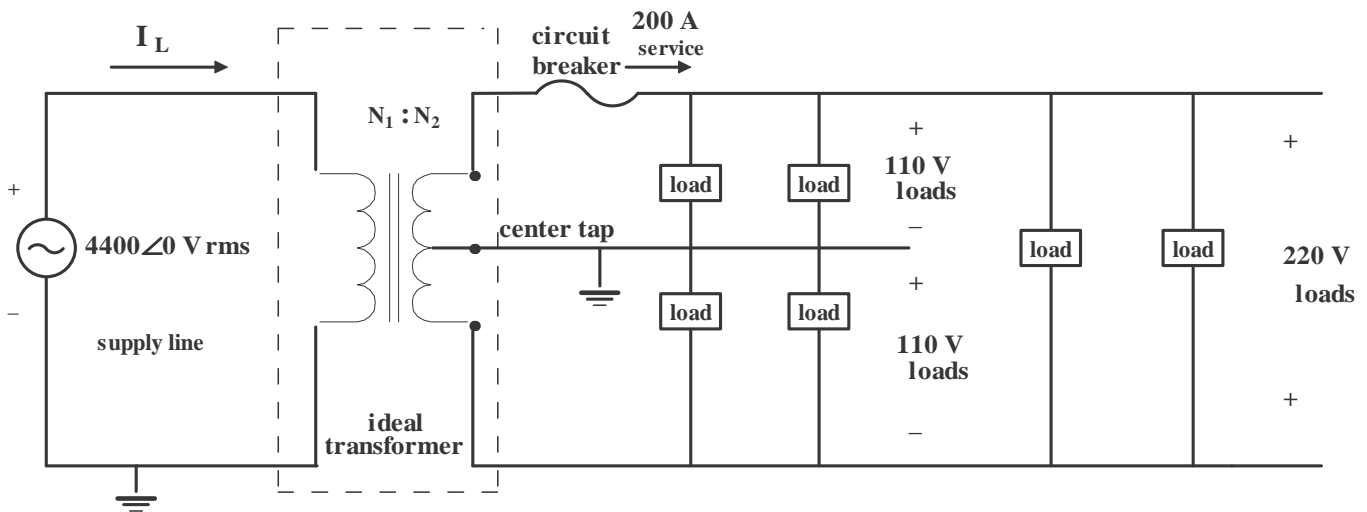transformer (assumed ideal) as shown.

Figure 6: System for Problem 6.

The secondary of the transformer represents the power supplied to your home. Your home is wired so as to provide 110 V rms and 220 V rms circuits (safety ground wire is omitted for convenience in making the drawing).

A typical home might have a circuit breaker box that can handle up to 200 A rms (called 200 amp service) as shown.

(a) What is the ratio of $N_1 : N_2$ so that the voltage is stepped-down from 4400 V rms to 220 V rms?
    Ans: 20

(b) If your load happens to be pulling max current of 200 A rms, what will be the current I_L on the supply line side of the transformer? Ans: 10 A.

(c) When pulling 200 A at your residence, how much average real power is the power company Supplying to you if the transformer is lossless? Ans: 44 kW

(d) If you operated your home pulling 200 A, 24-7, for 30 days and energy cost 7 cents per KWH (kilo watt hour) how much would you owe the power company for the 30 day period?

(e) As a side note: Suppose you connected 100 light bulbs, rated at 100 watts, and burned them for 24-7 for 30 days (long Christmas). How much would you owe the power company? Explain.