C13 problems

Practice Problem 13.2

Determine the phasor currents $\mathbf{I}_1$ and $\mathbf{I}_2$ in the circuit of Fig. 13.13.

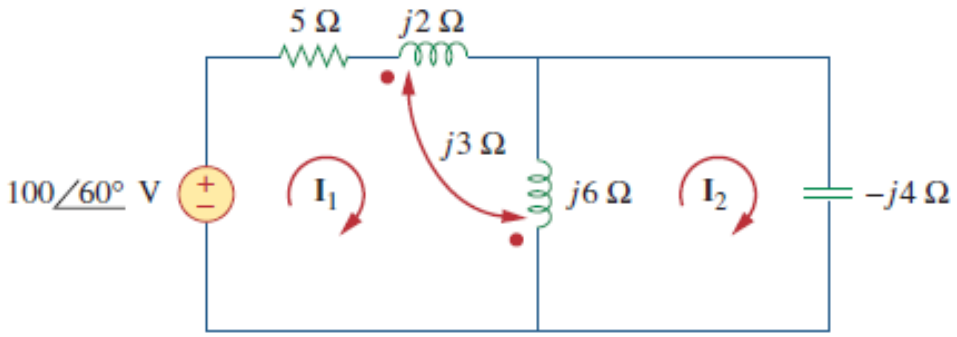

Figure 13.13
For Practice Prob. 13.2.

Answer: $\mathbf{I}_1 = 17.889\angle 86.57°$ A, $\mathbf{I}_2 = 26.83\angle 86.57°$ A.

Practice Problem 13.3

For the circuit in Fig. 13.18, determine the coupling coefficient and the energy stored in the coupled inductors at $t = 1.5$ s.

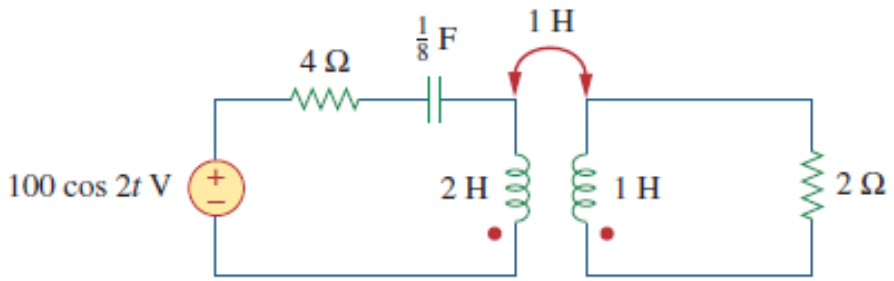

Figure 13.18
For Practice Prob. 13.3.

Answer: 0.7071, 246.2 J.

By MATLAB

```
a=[4 -j*2; -j*2 2+j*2];
a1=[100 -j*2; 0 2+j*2];
a2=[4 100; -j*2 0];

I1=det(a1)/det(a);
I2=det(a2)/det(a);

abs(I1);
angle(I1)*180/pi; %[degree]
abs(I2);
angle(I2)*180/pi; %[degree]

i1=abs(I1)*cos(3+angle(I1)); %[rad]
i2=abs(I2)*cos(3+angle(I2)); %[rad]

w=1/2*2*i1^2+1/2*1*i2^2-1*i1*i2;
```

```
w =

  245.1409
```

Practice Problem 13.5

For the linear transformer in Fig. 13.26(a), find the Π equivalent network.

Answer: $L_A = 18$ H, $L_B = 4.5$ H, $L_C = 18$ H.

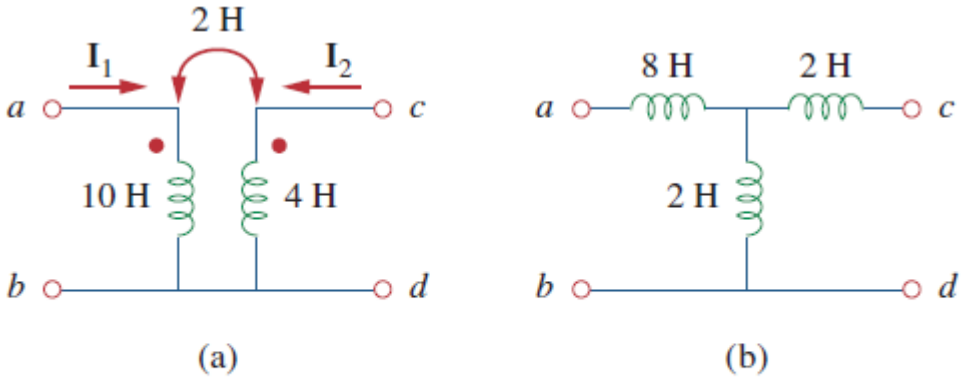

Figure 13.26
For Example 13.5: (a) a linear transformer, (b) its T-equivalent circuit.

Practice Problem 13.11

In the autotransformer circuit of Fig. 13.45, find currents $\mathbf{I}_1$, $\mathbf{I}_2$, and $\mathbf{I}_o$. Take $\mathbf{V}_1 = 2.5\,\text{kV}$, $\mathbf{V}_2 = 1\,\text{kV}$.

Answer: 6.4 A, 16 A, 9.6 A.

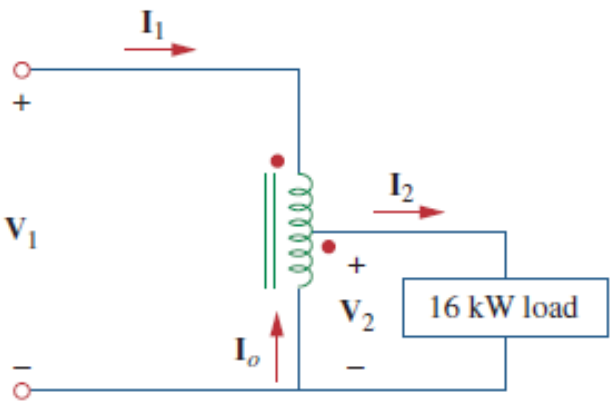

Figure 13.45
For Practice Prob. 13.11.

Example 13.17

A distribution transformer is used to supply a household as in Fig. 13.68. The load consists of eight 100-W bulbs, a 350-W TV, and a 15-kW kitchen range. If the secondary side of the transformer has 72 turns, calculate: (a) the number of turns of the primary winding, and (b) the current I_p in the primary winding.

Solution:

(a) The dot locations on the winding are not important, since we are only interested in the magnitudes of the variables involved. Since

$$\frac{N_p}{N_s} = \frac{V_p}{V_s}$$

we get

$$N_p = N_s \frac{V_p}{V_s} = 72 \frac{2{,}400}{240} = 720 \text{ turns}$$

(b) The total power absorbed by the load is

$$S = 8 \times 100 + 350 + 15{,}000 = 16.15 \text{ kW}$$

But $S = V_p I_p = V_s I_s$, so that

$$I_p = \frac{S}{V_p} = \frac{16{,}150}{2{,}400} = 6.729 \text{ A}$$

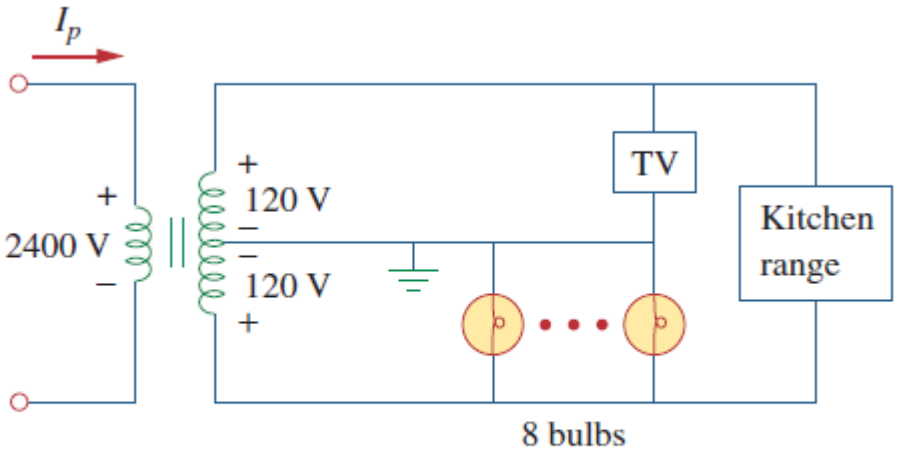

Figure 13.68
For Example 13.17.

Practice Problem 13.17

In Example 13.17, if the eight 100-W bulbs are replaced by twelve 60-W bulbs and the kitchen range is replaced by a 4.5-kW air-conditioner, find: (a) the total power supplied, (b) the current I_p in the primary winding.

Answer: (a) 5.57 kW, (b) 2.321 A.

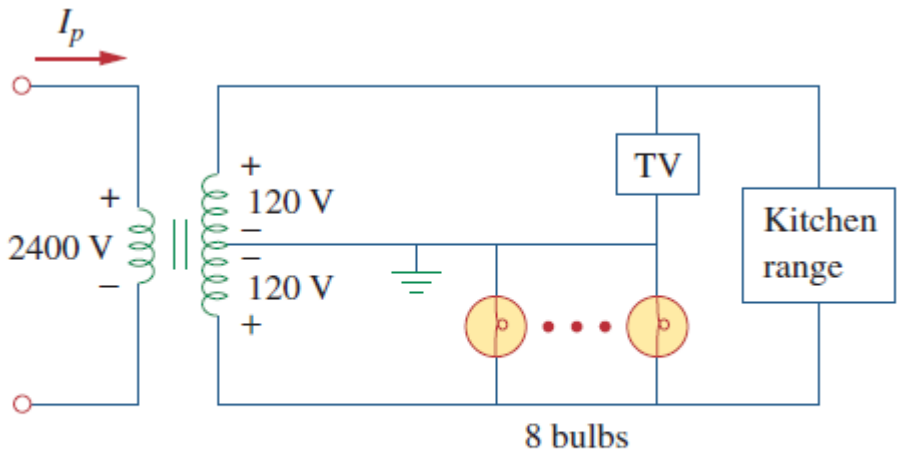

Figure 13.68
For Example 13.17.

- 13.2 (s13.2)
- 13.3 (s13.3)
- 13.5 (s13.4)
- 13.11 (s13.6)
- 13.17 (s13.9)