Practice problems

–P15.7, P15.12, P15.37, P15.62, P15.63, P15.68

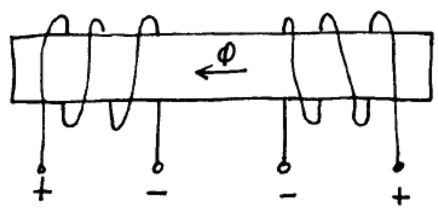
P15.7* Equation 15.4 in the text states:

$$f = i\ell B \sin\theta$$

Since the wire is perpendicular to the field, $\theta = 90^\circ$. Solving for the magnetic flux density and substituting values, we have:

$$B = \frac{f}{i\ell} = \frac{3}{10 \times 0.5} = 0.6 \text{ T}$$

P15.12 Using Lenz's law, we find that the polarities of the induced voltages are:



P15.37* According to Equation 15.25, inductance is given by:

$$L = \frac{N^2}{R}$$

Thus, inductance is proportional to the square of the number of turns, and the inductance of the 200 turn coil is 800 mH.

P15.62 For the ideal transformer, we have:

$$V_{2rms} = \frac{N_2}{N_1} \times V_{1rms}$$

The load current is

$$I_{2rms} = \frac{V_{2rms}}{R_L}$$

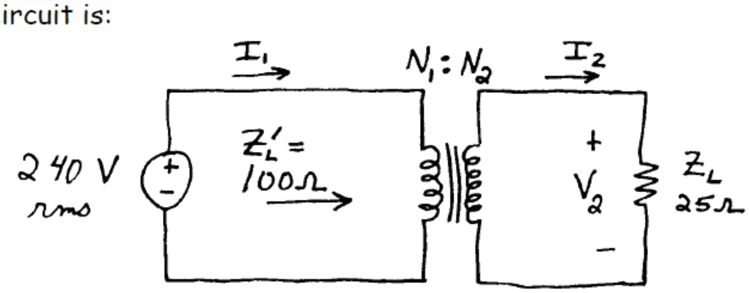
The load power is given by

$$P_L = V_{2rms} I_{2rms}$$

The results for the various turns ratios are:

Turns Ratio (N_1/N_2)	V_{2rms}	I_{2rms}	P_L
10	10 V	0.1 A	1 W
1	100 V	1.0 A	100 W
0.1	1000 V	10.0 A	10 kW

P15.63 The circuit is:



According to Equation 15.62, impedances are reflected to the primary by the square of the turns ratio.

$$Z_L' = \left(\frac{N_1}{N_2}\right)^2 Z_L$$

We have $Z_L = 25\ \Omega$ and want $Z_L' = 100\ \Omega$. Thus, we need a turns ratio $N_1/N_2 = 2$.

The secondary voltage and currents are:

$$V_2 = V_1(N_2/N_1) = 120 \text{ V rms}$$
$$I_1 = 240/100 = 2.4 \text{ A rms}$$
$$I_2 = 120/25 = 4.8 \text{ A rms}$$

P15.68 $R_L' = 40\ \Omega$

$C_L' = 0.25\ \mu\text{F}$