LEARNING ASSESSMENT

E10.17 Determine $\mathbf{I}_1$, $\mathbf{I}_2$, $\mathbf{V}_1$, and $\mathbf{V}_2$ in the network in Fig. E10.17.

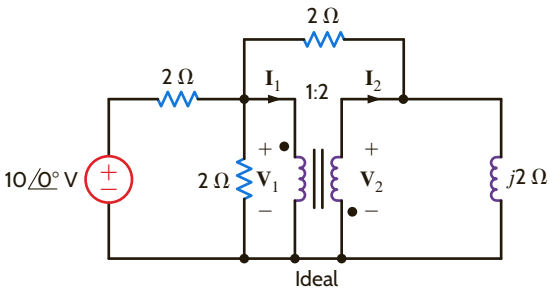

Figure E10.17

ANSWER:
$\mathbf{I}_1 = 3.08\angle -13.7°$ A;
$\mathbf{I}_2 = 1.54\angle 166.3°$ A;
$\mathbf{V}_1 = 0.85\angle 20°$ V;
$\mathbf{V}_2 = 1.71\angle -160°$ V.

Before we move on to the next topic, let's return to Faraday's law. For the ideal transformer, Faraday's law tells us that $v_1(t) = N_1 \frac{d\phi}{dt}$ and $v_2(t) = N_2 \frac{d\phi}{dt}$. What if a dc voltage is applied to our transformer? In that case, the magnetic flux ϕ is a constant, $v_1 = v_2 = 0$, and our transformer is not very useful. What if an ac voltage is applied to our transformer? The magnetic flux is sinusoidal and time-varying. Transformers allow the ac voltage value to be stepped up or down easily and efficiently; it is much more difficult to efficiently step up or down the dc voltage value. The ease with which transformers allow us to change the voltage level is one of the main reasons that ac voltages and currents are utilized to transmit the bulk of the world's electrical power.

10.4 Safety Considerations

Transistors are used extensively in modern electronic equipment to provide a low-voltage power supply. As examples, a common voltage level in computer systems is 5 V dc, portable radios use 9 V dc, and military and airplane equipment operates at 28 V dc. When transformers are used to connect these low-voltage transistor circuits to the power line, there is generally less danger of shock within the system because the transformer provides electrical isolation from the line voltage. However, from a safety standpoint, a transformer, although helpful in many situations, is not an absolute solution. When working with any electrical equipment, we must always be vigilant to minimize the dangers of electrical shock.

In power electronics equipment or power systems, the danger is severe. The problem in these cases is that of high voltage from a low-impedance source, and we must constantly remember that the line voltage in our homes can be lethal.

Consider now the following example, which illustrates a hidden danger that could surprise even the experienced professional, with devastating consequences.

EXAMPLE 10.13

Two adjacent homes, *A* and *B*, are fed from different transformers, as shown in Fig. 10.27a. A surge on the line feeding house *B* has caused the circuit breaker *X*-*Y* to open. House *B* is now left without power. In an attempt to help his neighbor, the resident of house *A* volunteers to connect a specialized extension cord between a wall plug in house *A* and a wall plug in house *B*, as shown in Fig. 10.27b. Later, the line technician from the utility company comes to reconnect the circuit breaker. Is the line technician in any danger in this situation?