# EE 210 PROBLEM SET 3

**3.8** Find the equivalent resistance $R_{ab}$ for each of the circuits in Fig. P3.8.

**P**

Figure P3.8

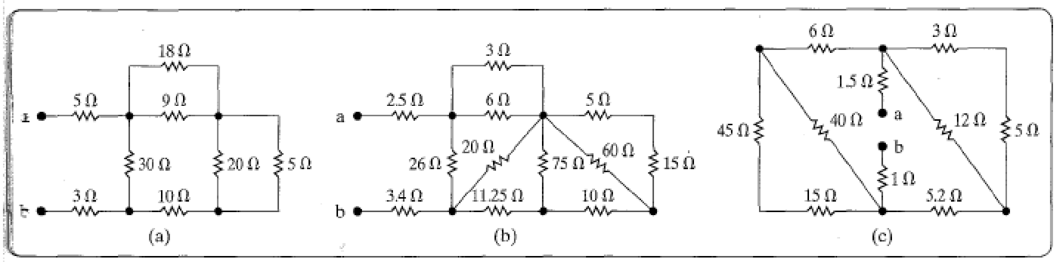
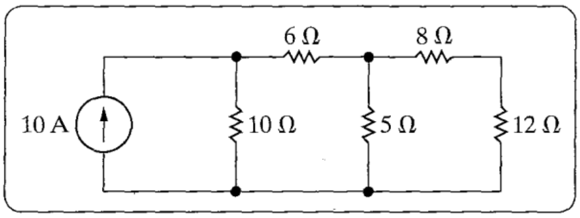



Figure P3.9

**3.10** Find the power dissipated in the 5 Ω resistor in the circuit in Fig. P3.10.

**P**

Figure P3.10




**3.11** For the circuit in Fig. P3.11 calculate

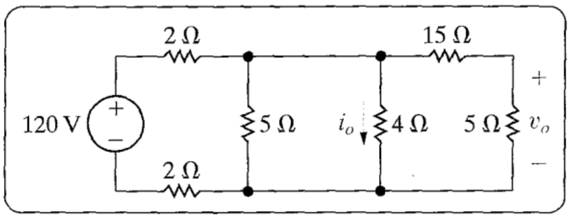
**P**

a) $v_o$ and $i_o$

b) the power dissipated in the 15 Ω resistor

c) the power developed by the voltage source

Figure P3.11



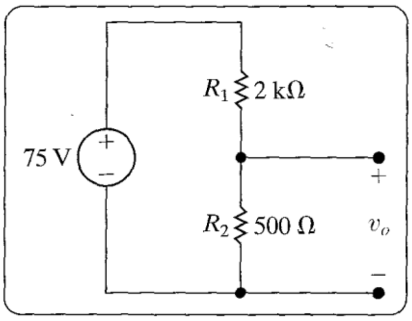

**3.13** a) Calculate the no-load voltage $v_o$ for the voltage-divider circuit shown in Fig. P3.13.

**P**

b) Calculate the power dissipated in $R_1$ and $R_2$.

c) Assume that only 1 W resistors are available. The no-load voltage is to be the same as in (a). Specify the ohmic values of $R_1$ and $R_2$.

Figure P3.13

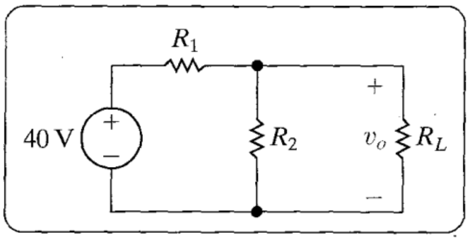



**3.15** The no-load voltage in the voltage-divider c
shown in Fig. P3.15 is 8 V. The smallest load re
that is ever connected to the divider is 3.6 kΩ. W
the divider is loaded, $v_o$ is not to drop below 7

a) Design the divider circuit to meet the sp cations just mentioned. Specify the num value of $R_1$ and $R_2$.

b) Assume the power ratings of comme available resistors are 1/16, 1/8, 1/4, 1 2 W. What power rating would you spe

Figure P3.15



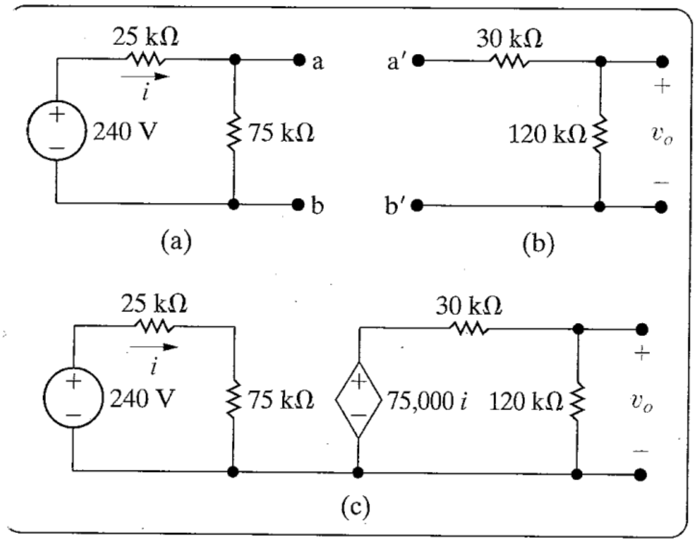
**3.17** **P**

a) The voltage divider in Fig. P3.17(a) is loaded with the voltage divider shown in Fig. P3.17(b); that is, a is connected to a′, and b is connected to b′. Find $v_o$.

b) Now assume the voltage divider in Fig. P3.17(b) is connected to the voltage divider in Fig. P3.17(a) by means of a current-controlled voltage source as shown in Fig. P3.17(c). Find $v_o$.

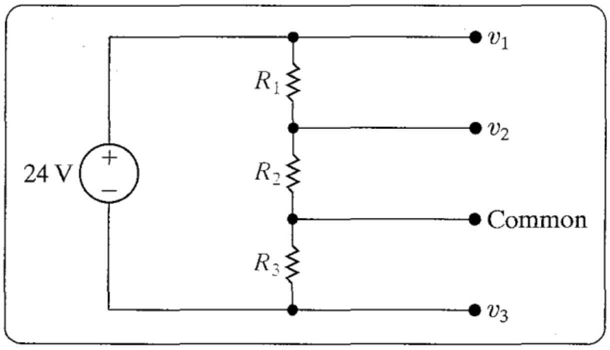
c) What effect does adding the dependent-voltage source have on the operation of the voltage divider that is connected to the 240 V source?

**Figure P3.17**




**3.18** ❖ There is often a need to produce more than one voltage using a voltage divider. For example, the memory components of many personal computers require voltages of −12 V, 6 V, and +12 V, all with respect to a common reference terminal. Select the values of $R_1$, $R_2$, and $R_3$ in the circuit in Fig. P3.18 to meet the following design requirements:

Figure P3.18

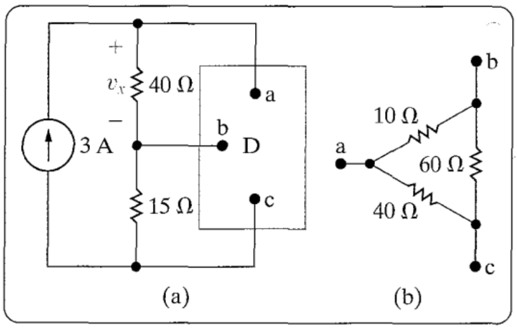



a) The total power supplied to the divider circuit by the 24 V source is 36 W when the divider is unloaded.

b) The three voltages, all measured with respect to the common reference terminal, are $v_1 = 12$ V, $v_2 = 6$ V, and $v_3 = -12$ V.

**3.30** **P** In the circuit in Fig. P3.30(a) the device labeled D represents a component that has the equivalent circuit shown in Fig. P3.30(b). The labels on the terminals of D show how the device is connected to the circuit. Find $v_x$ and the power absorbed by the device.

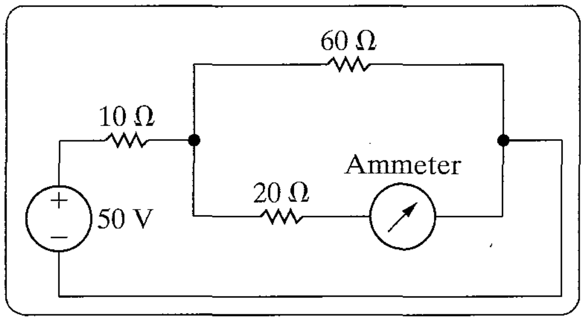
Figure P3.30



**3.32** The ammeter in the circuit in Fig. P3.32 has a resistance of 0.1 Ω. What is the percentage of error in the reading of this ammeter if

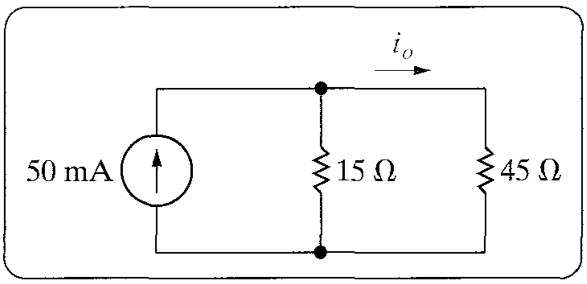
$$\% \text{ error} = \left( \frac{\text{measured value}}{\text{true value}} - 1 \right) \times 100?$$

**Figure P3.32**




**3.33** The ammeter described in Problem 3.32 is used to measure the current $i_o$ in the circuit in Fig. P3.33. What is the percentage of error in the measured value?

**Figure P3.33**

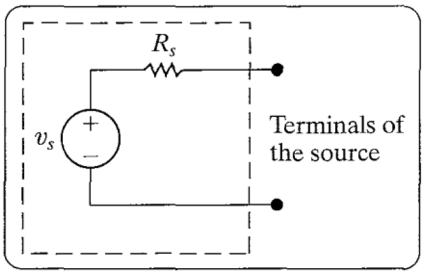


3.47 The circuit model of a dc voltage source is shown in Fig. P3.47. The following voltage measurements are made at the terminals of the source: (1) With the terminals of the source open, the voltage is measured at 50 mV, and (2) with a 15 MΩ resistor connected to the terminals, the voltage is measured at 48.75 mV. All measurements are made with a digital voltmeter that has a meter resistance of 10 MΩ.

a) What is the internal voltage of the source ($v_s$) in millivolts?

b) What is the internal resistance of the source ($R_s$) in kilo-ohms?

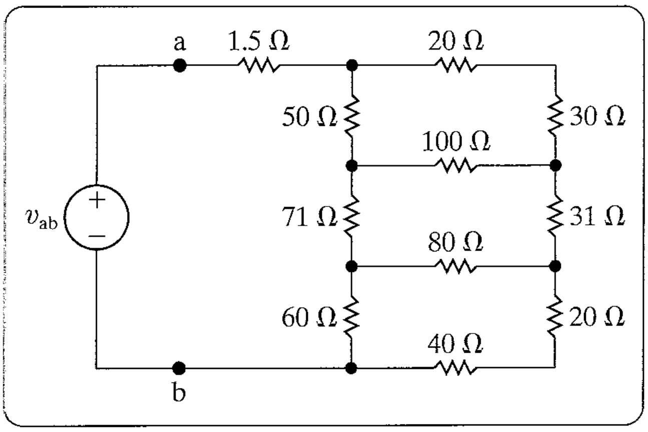
**Figure P3.47**




3.58 a) Find the resistance seen by the ideal voltage source in the circuit in Fig. P3.58.

b) If $v_{ab}$ equals 400 V, how much power is dissipated in the 31 Ω resistor?

**Figure P3.58**



3.59 Use a Y-to-Δ transformation to find (a) $i_o$; (b) $i_1$; (c) $i_2$; and (d) the power delivered by the ideal voltage source in the circuit in Fig. P3.59.

P

Figure P3.59