Problems

2.1 For the circuit shown in Fig. P2.1, select node *d* as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.

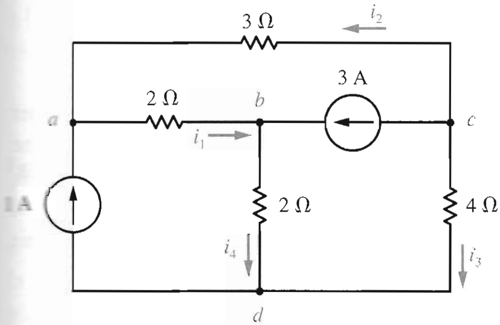

Fig. P2.1

2.2 For the circuit shown in Fig. P2.1, select node *c* as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.

2.3 For the circuit shown in Fig. P2.1, select node *b* as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.

2.4 For the circuit shown in Fig. P2.1, select node *a* as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.

2.5 Find the node voltages for the circuit shown in Fig. P2.5.

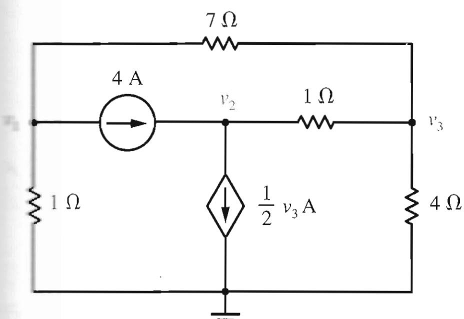

Fig. P2.5

2.6 Find the node voltages for the circuit shown in Fig. P2.6.

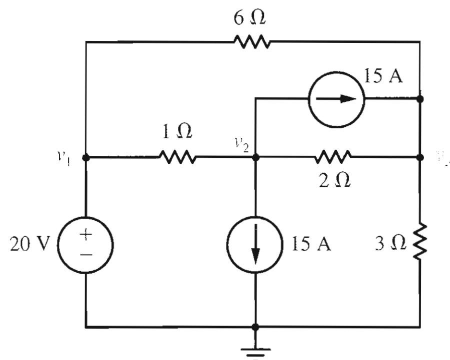

Fig. P2.6

2.7 Find the node voltages for the circuit shown in Fig. P2.7. (See p. 100.)

2.8 Find the node voltages for the circuit shown in Fig. P2.8.

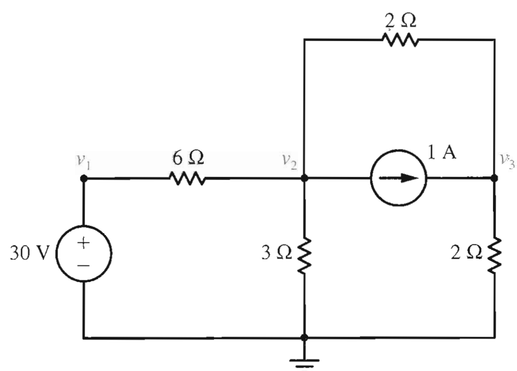

Fig. P2.8

2.9 Find the node voltages for the circuit shown in Fig. P2.9.

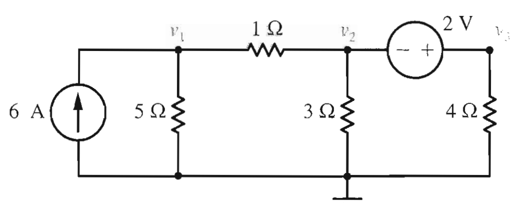

Fig. P2.9

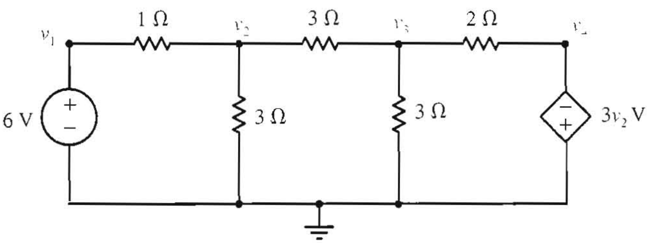

Fig. P2.7

2.10 Find the node voltages for the circuit shown in Fig. P2.10.

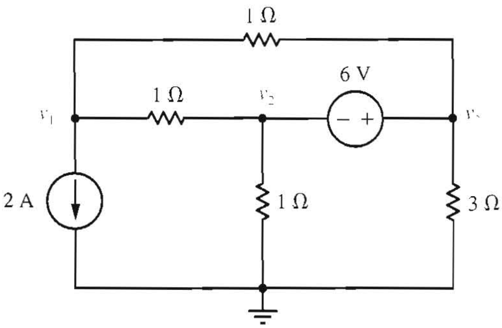

Fig. P2.10

2.11 Fig. P2.11 shows a single transistor amplifier circuit where the portion in the shaded box is the ***hybrid-*** or ***h-parameter model*** of a bipolar junction transistor (BJT). Note that h_i is a resistance and h_o is a conductance. Suppose that $h_i = 1$ kΩ, $h_r = 2.5 \times 10^{-4}$, $h_f = 50$, and $h_o = 25$ μ℧. (a) Use nodal analysis to find the voltage gain v_2/v_1 of this amplifier. (b) Determine the input resistance v_1/i_1 of this amplifier.

2.12 Fig. P2.11 shows a single transistor amplifier circuit where the portion in the shaded box is the hybrid- or h-parameter model of a BJT. Note that h_i is a resistance and h_o is a conductance. Use nodal analysis to show that the voltage gain v_2/v_1 of this amplifier is

$$\frac{v_2}{v_1} = \frac{-h_f R_L}{h_i + (h_i h_o - h_f h_r) R_L}$$

2.13 Fig. P2.11 shows a single transistor amplifier circuit where the portion in the shaded box is the hybrid- or h-parameter model of a BJT. Note that h_i is a resistance and h_o is a conductance. Use the result given in Problem 2.12 to show that the input resistance v_1/v_1 of this amplifier is

$$\frac{v_1}{i_1} = h_i - \frac{h_f h_r}{h_o + 1/R_L}$$

2.14 The circuit shown in Fig. P2.14 is a single BJT amplifier with "feedback." The portion of the circuit in the shaded box is an approximate T-model of a transistor in the common-emitter configuration. (a) Use nodal analysis to find the voltage gain

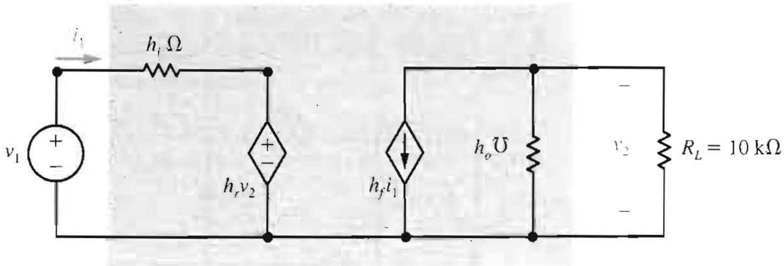

Fig. P2.11

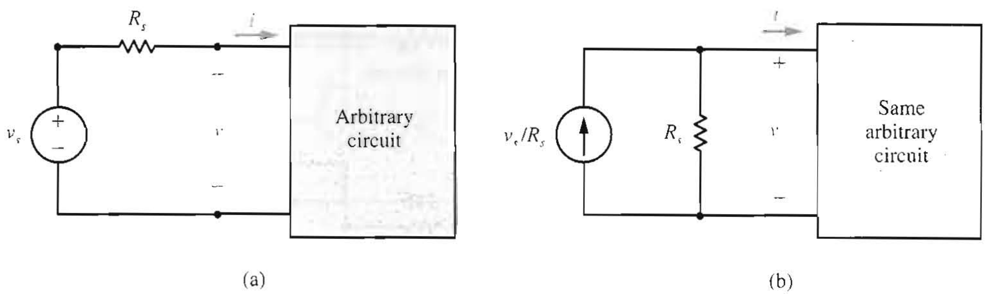

Fig. P2.49 *a,b*

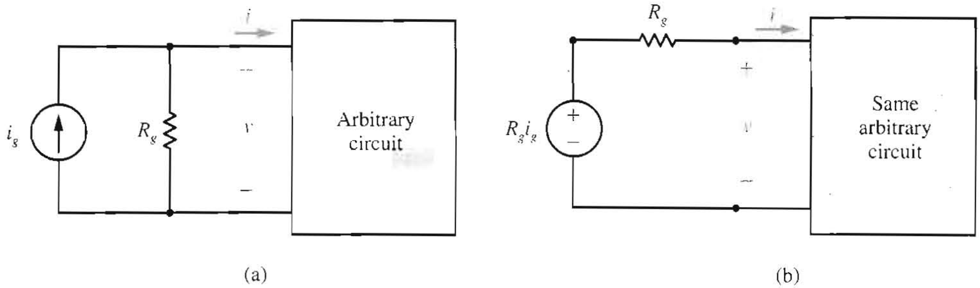

Fig. P2.50 *a,b*

2.54 Confirm that the source transformations described in Problems 2.49 and 2.50 can be applied to dependent sources, as well as independent sources, by reducing the circuit given in Fig. P2.7 to a circuit with one independent and one dependent current source, and then determining v_2.

2.55 Consider the circuit shown in Fig. 2.6 on p. 56. (a) Find the portion of i_3 that is due to the 6-A current source. (b) Find the portion of i_3 that is due to the 12-A current source. (c) Find i_3.

2.56 Consider the circuit shown in Fig. 2.10 on p. 66. (a) Find the portion of v_3 that is due to the 5-V voltage source. (b) Find the portion of v_3 that is due to the 10-V voltage source. (c) Find v_3.

2.57 Consider the circuit shown in Fig. P2.39, where $R_L = 6\ \Omega$. (a) Find the portion of i that is due to the 2-V voltage source. (b) Find the portion of i that is due to the 2-A current source. (c) Find i.

2.58 Consider the circuit shown in Fig. P2.40, where $R_L = 3\ \Omega$. (a) Find the portion of v that is due to the 2-V voltage source. (b) Find the portion of v that is due to the 8-A current source. (c) Find v.

2.59 Consider the circuit shown in Fig. P2.59. (a) Find the portion of i and the portion of v that are due to the 6-V voltage source. (b) Find the portion of i and the portion of v that are due to the 2-A current source. (c) Find i and v.

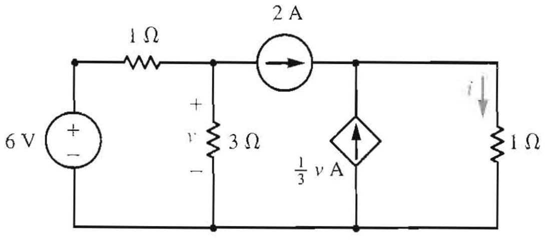

Fig. P2.59

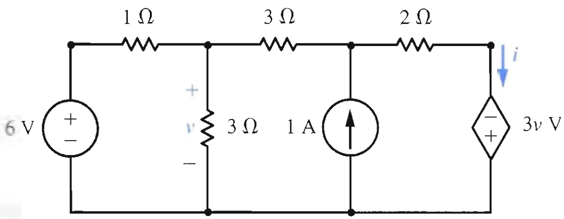

Fig. P2.60

2.60 Consider the circuit shown in Fig. P2.60. (a) Find the portion of i and the portion of v that are due to the 6-V voltage source. (b) Find the portion of i and the portion of v that are due to the 1-A current source. (c) Find i and v.

2.61 Consider the circuit shown in Fig. P2.61. (a) Find the portion of i and the portion of v that are due to the 2-A current source. (b) Find the portion of i and the portion of v that are due to the 6-V voltage source. (c) Find the portion of i and the portion of v that are due to the 4-V voltage source. (d) Find i and v.

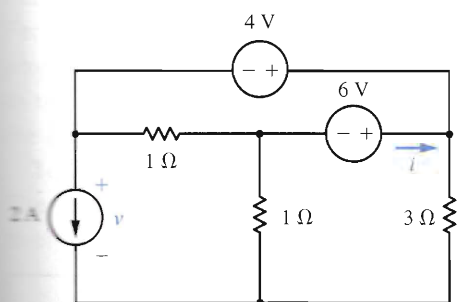

Fig. P2.61

2.62 Consider the circuit shown in Fig. P2.62. (a) Find the portion of i and the portion of v that are due to the 12-V voltage source. (b) Find the portion of i and the portion of v that are due to the 6-V voltage source. (c) Find the portion of i and the portion of v that are due to the 6-A current source. (d) Find i and v.

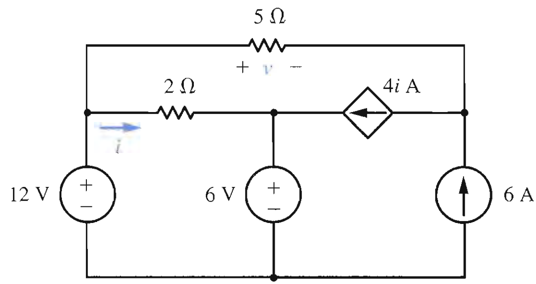

Fig. P2.62