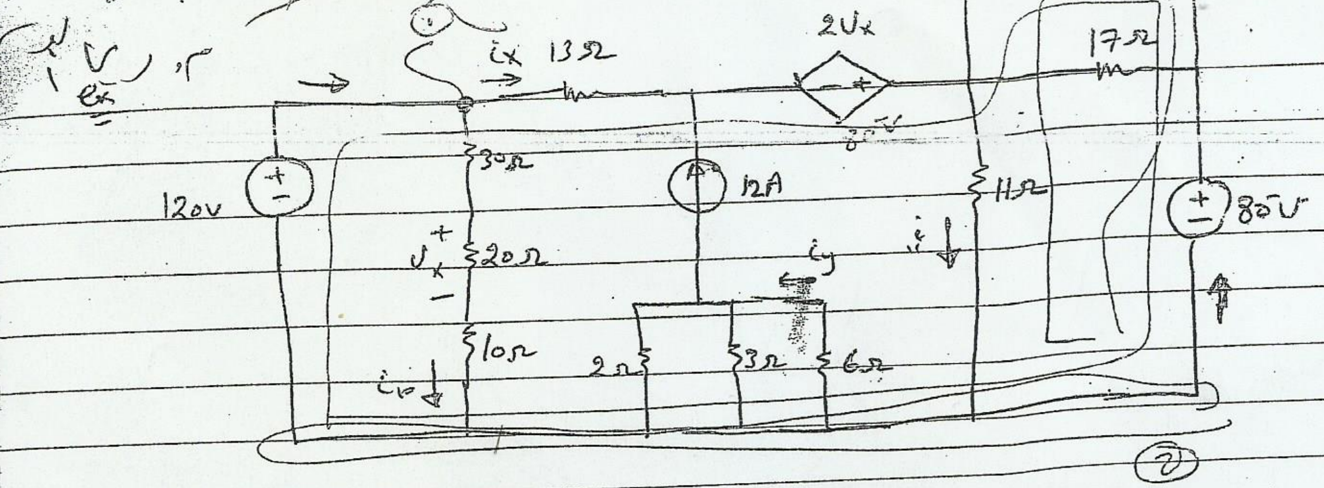
CIRCUITS I

SUGGESTED PROBLEM

ENG REEM EL DEBES

POWER UNIT
ELECTRICAL ENGINEERING



find i_y, i_x & V_x.

$P_{supp}(80V)$.

$i_y = 12 \frac{1/6}{1/6 + 1/2 + 1/3} = 12 \frac{1}{1+3+2} = \boxed{2A}$

$V_x = 120 \frac{20}{20+30+10} = \boxed{40V}$

$-120 + 13 i_x - 80 + 20 + 80 = 0$

$\boxed{i_x = 7.7A}$

$-80 - 20 + 11 i_{11} = 0 \longrightarrow i_{11} = \frac{100}{11} = 9.1$

$i_{10} = \frac{40}{20} = \boxed{2A}$

① $i_{120} = 7.7 + 2 = 9.7A$.

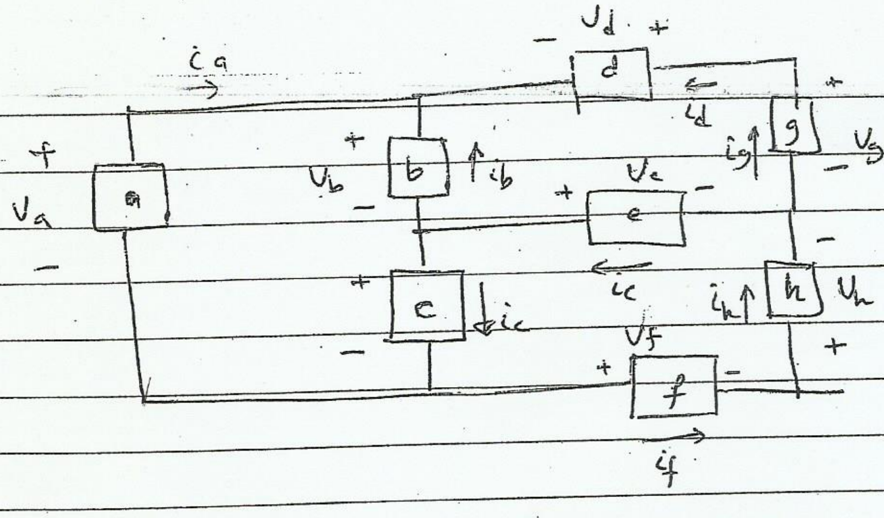
② $2 + 9.1 = i_{80} + 12 + 9.7$

$i_{80} = -10.6$

$P = (-10.6)(80) = -848 \ W$.

ex

(abs)



$V_a = 990V$, $i_a = \pm 22.5$ A ⟶ $P = +2227.5$

$V_b = 600V$; $i_b = \pm 30$ A ⟶ $P = +18{,}000$

$v_c = 300V$; $i_c = 60$ A ⟶ $P = 18{,}000$

$v_d = 105V$; $i_d = 52.5$ A ⟶ $P = 5512.5$

$v_e = \pm 120V$; $i_e = 30A$ ⟶ $P = 3600$

$v_f = 165V$; $i_f = 82.5A$ ⟶ $P =$ ~~[illegible]~~ 13612.5

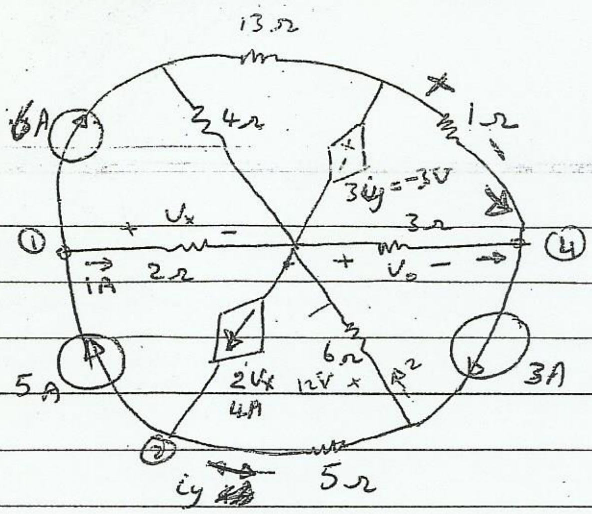
$v_g = 585V$; $i_g = 52.5A$ ⟶ $P = -30712.5$

$v_h = -585V$; $i_h = 82.5A$ ⟶ $P = -48262.5$

Does the interconnection satisfy the power check ??

$\Sigma P_{abs} = -18022.5$ X.

ex



① $\Sigma I_{in} = \Sigma I_{out}$

✓ $5 + i = 6 \longrightarrow i = 1A$

✓ $\therefore V_x = 1 \times 2 = 2V$

② $\Sigma I_{in} = \Sigma I_{out}$

$5 + i_y = 4 \longrightarrow i_y = -1 \ A$

③ $\frac{V_o}{3} + \frac{V_1}{1} = 3$

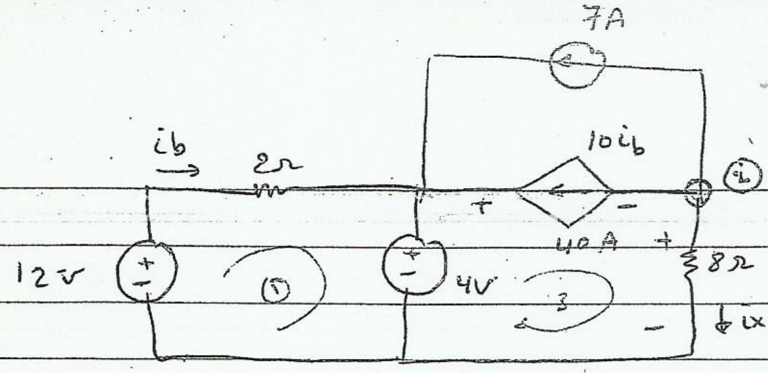
$-V_o - (-3) + V_1 = 0$

$V_1 = V_o - 3$

$\frac{V_o}{3} + V_o - 3 = 3$

$\frac{4}{3} V_o = 6 \longrightarrow V_o = \frac{18}{4} = \frac{9}{2} = 4.5V$

ex



find gen power by $(10 i_b)$ source.

①

$-12 + 2 i_b + 4 = 0 \longrightarrow i_b = 4\ A$

② $\Sigma I_{in} = \Sigma I_{out}$

$i_x + 40 + 7 = 0$

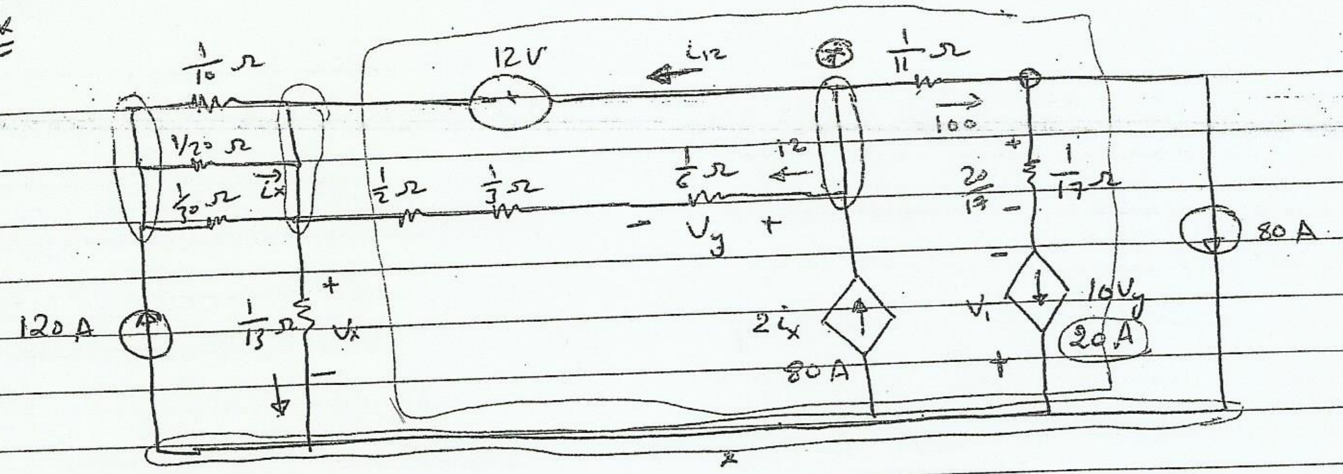
$i_x = -47\ A.$

③ $-4 + V + (8)(-47) = 0$

$V = 380$

$\therefore P = (380)(40) = 15.2\ kW.$

ex



find i_x, V_y, V_x, the power consumed (abs) by 12V source, and the power generated by the $10V_y$ source

$$i_x = 120 \frac{\frac{1}{1/20}}{\frac{1}{1/10}+\frac{1}{1/20}+\frac{1}{1/30}} = 120\frac{20}{20+10+30} = 40\,A$$

$$V_y = 12 \frac{\frac{1}{6}}{\frac{1}{6}+\frac{1}{3}+\frac{1}{2}} = 12\frac{1}{1+2+3} = 2\,V.$$

$\Sigma I_{in} = \Sigma I_{out}$

$80 + 20 + i_{1/13} = 80 + 120 \rightarrow i_{1/13} = 100\,A$

$\therefore V_x = 100 \times \left(\frac{1}{13}\right) = 7.7\,V.$

$\Sigma I_{in} = \Sigma I_{out}$

$80 = 100 + 12 + i_{12} \rightarrow i_{12} = -32$

$\therefore P_{12V} = (-32)(12) = -384\,W.$

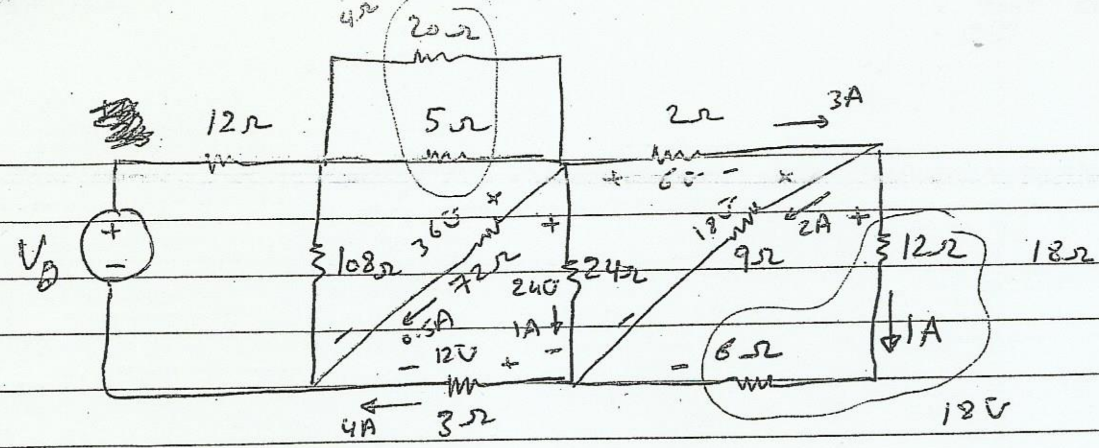
KVL

$+12 + 7.7 + V_1 - \frac{20}{17} - 100\left(\frac{1}{11}\right) = 0$

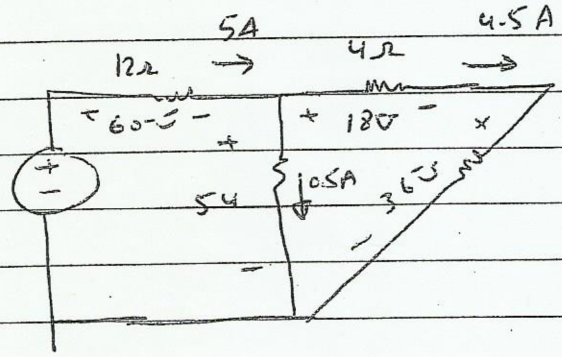
$V_1 = -9.4$

$P_{10V_y} = (20)(-9.4) = -188.7$

ex



find V_g, power dissipated in the 20Ω resistor.



$$v_g = 60 + 54 = 114\ V.$$

$$i_{20\Omega} = 4.5 \frac{\frac{1}{5}}{\frac{5+20}{5}} = 0.9$$

$$P_{20\Omega} = (0.9)^2 (20) = 16.2\ W.$$

UNIVERSITY OF JORDAN
FACULTY of ENGINEERING & TECH.
ELECTRICAL ENGINEERING DEPT.

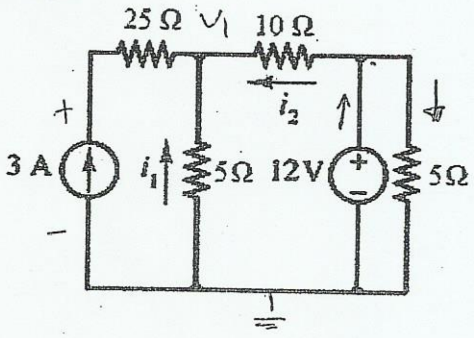
EE 211 1[st] Exam
23-10-2013 T: 60 min

.... الرقم الجامعي: .... الاسم :

Instructor:

Dr. Othman Alsmadi	Dr. Raed Alzubi	Eng. Reem Aldebs

Q1) (6 points)
For the following circuit, find:
a) *The currents i_1 and i_2* (2)
b) *The power delivered by the 3A current source and by the 12V voltage source.* (3)
c) *The total power dissipated by the circuit.* (1)



(a)

$3 + i_1 + i_2 = 0$

$+5i_1 - 10i_2 + 12 = 0$

$i_1 = \boxed{-2.8\ A}$

$i_2 = \boxed{-0.2 A}$

OR

$3 - \frac{V_1}{5} + \frac{12 - V_1}{10} = 0$

$V_1 = 14v$

$i_1 = \frac{-V_1}{5} = \frac{-14}{5} = \boxed{-2.8A}$

$i_2 = \frac{12 - V_1}{10} = \boxed{-0.2A}$

(b) $-V + 3\times25 - 5i_1 = 0$

$V = 75 - 5(-2.8) = 89$

$\therefore P_{3A} = VI = 3\times89 = \boxed{267}$

$I_{12} = \frac{12}{5} + (-0.2) = 2.2$

$P_{12V} = 12 \times 2.2 = \boxed{26.4}$

(c) $P = \frac{12^2}{5} = 28.8$

$P_{25} = 3^2 \times 25 = 225$

$P_{10} = (0.2)^2 \times 10 = 0.4$ 264.6

$P_5 = (2.8)^2 \times 5 = 39.2$

OR

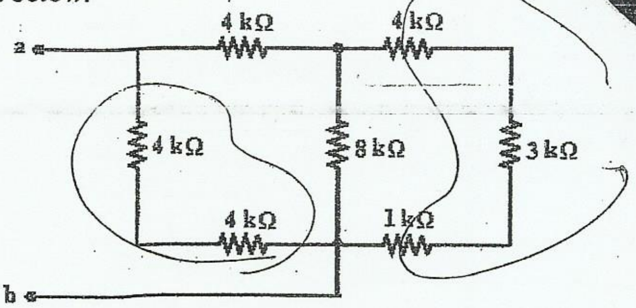
$P_{12v} = \left(-0.2 + \frac{12}{5}\right) \times 12 = 26.4$

$P_{3A} = 267$

$\therefore \sum P_{diss} = \boxed{293.4\ \omega}$

Q2) (2 points)

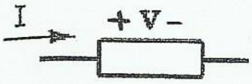
Find the equivalent resistance of the connection shown below.



$R = 4\,k\Omega$

2

Q3) (2 points)



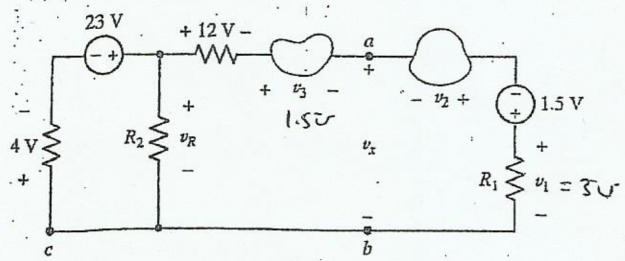
1. *If I=-3A and V=4V, this element could be:*
   a) *Voltage source only*
   b) *Current source only*
   c) *Voltage or current source*
   d) *Resistor*
   e) *We can't know*

   1

2. *This element generates positive power. (Yes No)* 1

Q4) (3 points)

In the circuit shown below, it is determined that v_1=3 V *and* v_3=1.5 V. *Calculate* v_R *and* v_2.



~~4+12+1.8~~

$4 - 23 + 12 + 1.5 - V_2 - 1.5 + 3 = 0$

1.5

$V_2 = \boxed{-4}$

$4 - 23 + V_R = 0$

1.5

$V_R = \boxed{19\,V}$

OR

$4 - 23 + 12 + 1.5 + V_x = 0$

$V_x = \boxed{5.5\,V}$

1.5

سكشن ٢ ٥/٣/٢٠١٤ الاربعاء

5. Referring to the circuit depicted in Fig. 3.43,

(a) If a second wire is connected between points E and D of the circuit, how many nodes does the new circuit have?

(b) If a resistor is added to the circuit so that one terminal is connected to point C and the other terminal is left floating, how many nodes does the new circuit have?

(c) Which of the following represent loops?

(i) Moving from A to B to C to D to E to A.

(ii) Moving from B to E to A.

(iii) Moving from B to C to D to E to B.

(iv) Moving from A to B to C.

(v) Moving from A to B to C to B to A.

3.2 Kirchhoff's Current Law

6. (a) Determine the current labeled i_z in the circuit shown in Fig. 3.45. (b) If the resistor carrying 3 A has a value of 1 Ω, what is the value of the resistor carrying −5 A?

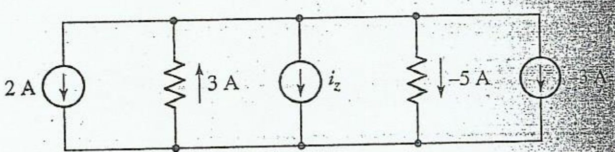


FIGURE 3.45

Find i_x in each of the circuits in Fig. 3.46.

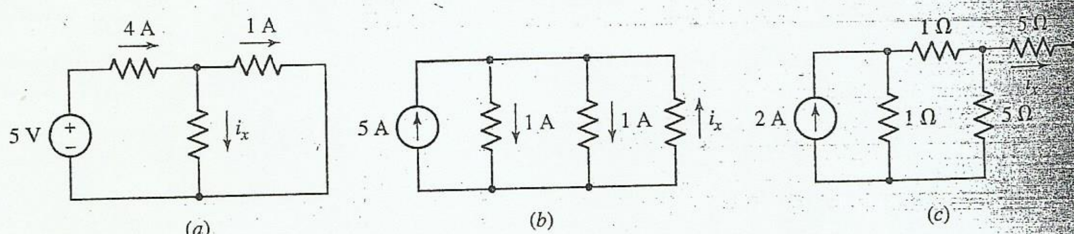


FIGURE 3.46

8. Referring to Fig. 3.47,

(a) Find i_x if $i_y = 2$ A and $i_z = 0$ A. (b) Find i_y if $i_x = 2$ A and $i_z = 2$ A. (c) Find i_z if $i_x = i_y = i_z$.

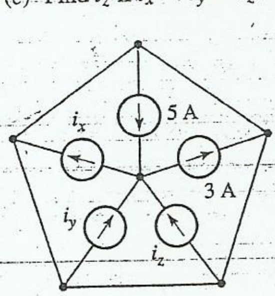


FIGURE 3.47

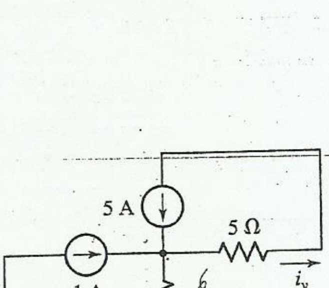


FIGURE 3.48

Find i_x and i_y in the circuit of Fig. 3.48.

10. A 100 W light bulb, a 60 W light bulb, and a 40 W light bulb are connected in parallel to each other and to a standard North American household 115 V supply. Compute the current flowing through each light bulb and the total current delivered by the voltage supply.

11. The digital multimeter (DMM) is a device commonly used to measure voltages. It is equipped with two leads (usually red for the positive reference and black for the negative reference) and an LCD display. Let's suppose a DMM is connected to the circuit of Fig. 3.46*b* with the positive lead at the top node and the negative lead on the bottom node. Using KCL, explain why we would ideally want a DMM used in this way to have an infinite resistance as opposed to zero resistance.

12. A local restaurant has a neon sign constructed from 12 separate bulbs; when a bulb fails, it appears as an infinite resistance and cannot conduct current. In wiring the sign, the manufacturer offers two options (Fig. 3.49). From what you've learned about KCL, which one should the restaurant owner select? Explain.

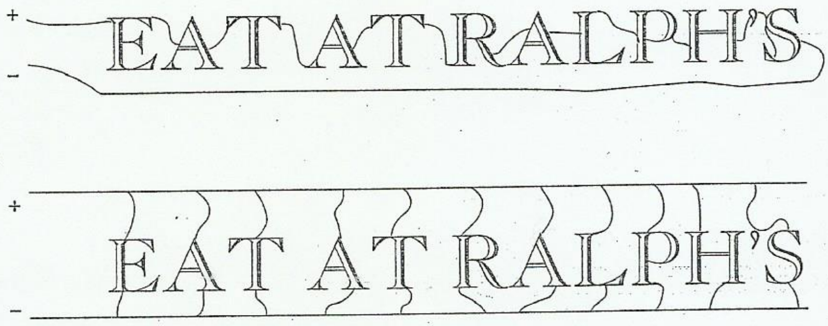


FIGURE 3.49

13. In the circuit of Fig. 3.50,

(*a*) Calculate v_y if $i_z = -3$ A.

(*b*) What voltage would need to replace the 5 V source to obtain $v_y = -6$ V if $i_z = 0.5$ A?

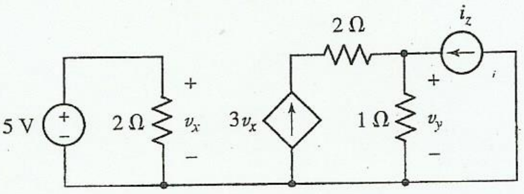


FIGURE 3.50

14. Referring to the circuit in Fig. 3.51*a*,

(*a*) If $i_x = 5$ A, find v_1 and i_y. (*b*) If $v_1 = 3$ V, find i_x and i_y.

(*c*) What value of i_s will lead to $v_1 \neq v_2$?

15. Find R and G in the circuit of Fig. 3.51*b* if the 5 A source is supplying 100 W and the 40 V source is supplying 500 W.

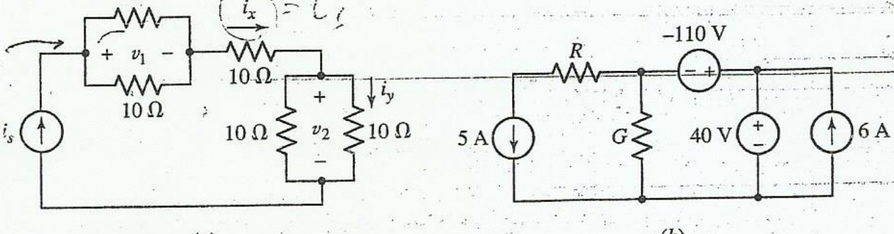


FIGURE 3.51

3.3 Kirchhoff's Voltage Law

16. In the circuits of Fig. 3.52*a* and *b*, determine the current labeled *i*.

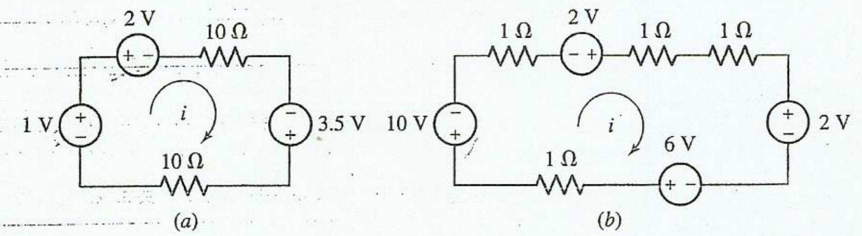


FIGURE 3.52

17. Calculate the value of *i* in each circuit of Fig. 3.53.

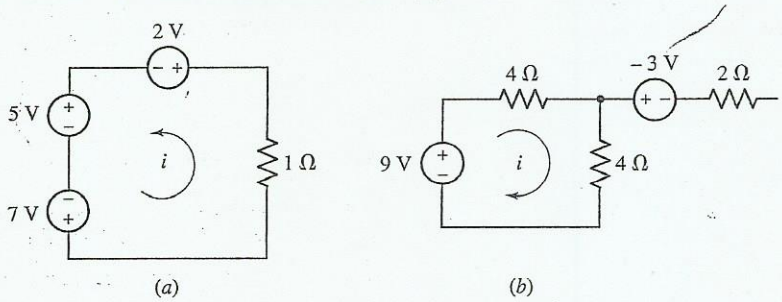


FIGURE 3.53

18. Consider the simple circuit shown in Fig. 3.54. Using KVL, derive the expressions

$$v_1 = v_s \frac{R_1}{R_1 + R_2} \quad \text{and} \quad v_2 = v_s \frac{R_2}{R_1 + R_2}$$

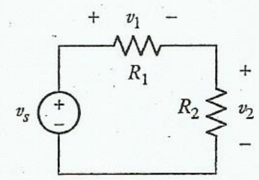


FIGURE 3.54

19. The circuit shown in Fig. 3.55 includes a device known as an op amp. This device has two unusual properties in the circuit shown: (1) $V_d = 0$ V, and (2) no current can flow into either input terminal (marked "−" and "+" inside the symbol), but it *can* flow through the output terminal (marked "OUT"). This seemingly impossible situation—in direct conflict with KCL—is a result of power leads to the device that are not included in the symbol. Based on this information, calculate V_{out}. (Hint: two KVL equations are required, both involving the 5 V source.)

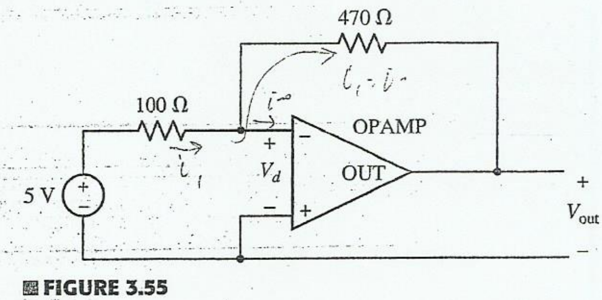
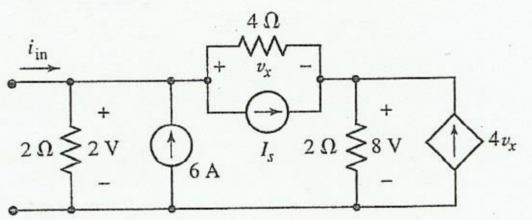


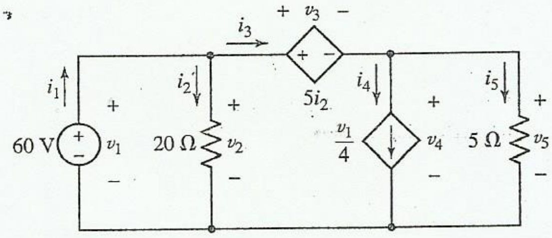
FIGURE 3.55

20. Use Ohm's and Kirchhoff's laws on the circuit of Fig. 3.56 to find (*a*) v_x; (*b*) i_{in}; (*c*) I_s; (*d*) the power provided by the dependent source.



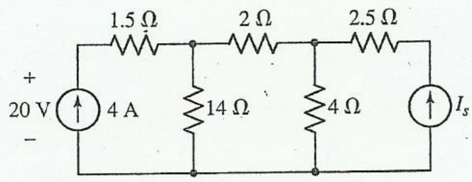
■ **FIGURE 3.56**

21. (*a*) Use Kirchhoff's and Ohm's laws in a step-by-step procedure to evaluate all the currents and voltages in the circuit of Fig. 3.57. (*b*) Calculate the power absorbed by each of the five circuit elements and show that the sum is zero.

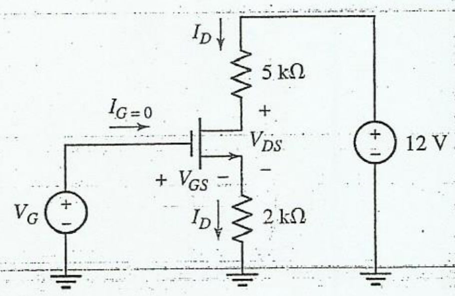


■ **FIGURE 3.57**

22. With reference to the circuit shown in Fig. 3.58, find the power absorbed by each of the seven circuit elements.



■ **FIGURE 3.58**



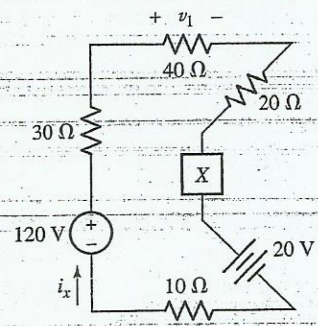
■ **FIGURE 3.59**

23. A certain circuit contains six elements and four nodes, numbered 1, 2, 3, and 4. Each circuit element is connected between a different pair of nodes. The voltage v_{12} (+ reference at first-named node) is 12 V, and $v_{34} = -8$ V. Find v_{13}, v_{23}, and v_{24} if v_{14} equals (*a*) 0; (*b*) 6 V; (*c*) −6 V.

24. Refer to the transistor circuit shown in Fig. 3.59. Keep in mind that although we do not know the current-voltage relationship for the device, it still obeys both KCL and KVL. (*a*) If $I_D = 1.5$ mA, compute V_{DS}. (*b*) If $I_D = 2$ mA and $V_G = 3$ V, compute V_{GS}.

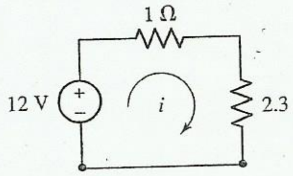
3.4 The Single-Loop Circuit

25. Find the power being absorbed by element X in Fig. 3.60 if it is a (*a*) 100 Ω resistor; (*b*) 40 V independent voltage source, + reference on top; (*c*) dependent voltage source labeled $25i_x$, + reference on top; (*d*) dependent voltage source labeled $0.8v_1$, + reference on top; (*e*) 2 A independent current source, arrow directed upward.

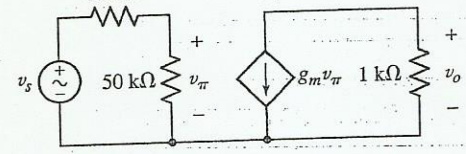


■ **FIGURE 3.60**

32. Referring to Table 2.4, if the bottom wire segment in the circuit of Fig. 3.65 is 22 AWG solid copper and 3000 ft long, compute the current i.



■ FIGURE 3.65



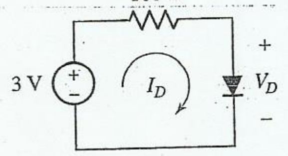
■ FIGURE 3.66

33. In Fig. 3.66, if $g_m = 25 \times 10^{-3}$ siemens and $v_s = 10 \cos 5t$ mV, find $v_o(t)$.

34. Kirchhoff's laws apply whether or not Ohm's law applies to a particular element. The I-V characteristic of a diode, for example, is given by

$$I_D = I_S\left(e^{V_D/V_T} - 1\right)$$

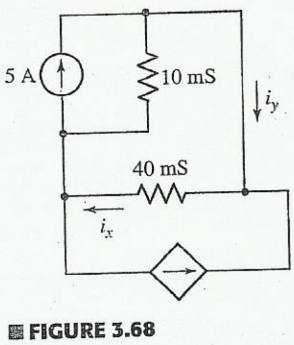
where $V_T = 27$ mV at room temperature and I_S can vary from 10^{-12} to 10^{-3} A. In the circuit of Fig. 3.67, use KVL/KCL to obtain V_D if $I_S = 3\ \mu$A. *(Note: This problem results in a transcendental equation, requiring an iterative approach to obtaining a numerical solution. Most scientific calculators will perform such a function.)*



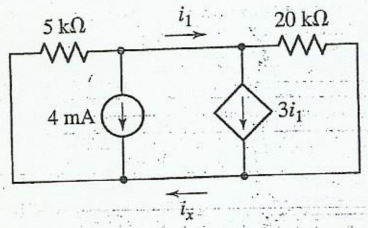
■ FIGURE 3.67

3.5 The Single-Node-Pair Circuit

35. Find the power absorbed by each circuit element of Fig. 3.68 if the control for the dependent source is (*a*) $0.8i_x$; (*b*) $0.8i_y$. In each case, demonstrate that the absorbed power quantities sum to zero.



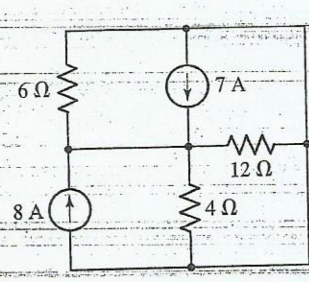
■ FIGURE 3.68



■ FIGURE 3.69

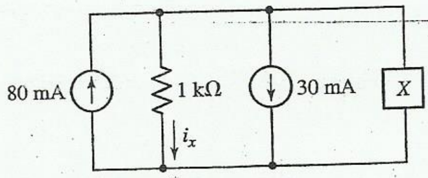
36. Find i_x in the circuit of Fig. 3.69.

37. Find the power absorbed by each element in the single-node-pair circuit of Fig. 3.70, and show that the sum is equal to zero.



■ FIGURE 3.70

38. Find the power absorbed by element X in the circuit of Fig. 3.71 if it is a (*a*) 4 kΩ resistor; (*b*) 20 mA independent current source, reference arrow downward; (*c*) dependent current source, reference arrow downward, labeled $2i_x$; (*d*) 60 V independent voltage source, + reference at top.



■ FIGURE 3.71

39. (*a*) Let element X in Fig. 3.72 be an independent current source, arrow directed upward, labeled i_s. What is i_s if none of the four circuit elements absorbs any power? (*b*) Let element X be an independent voltage source, + reference on top, labeled v_s. What is v_s if the voltage source absorbs no power?

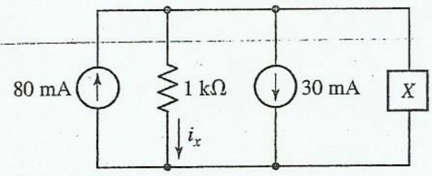


FIGURE 3.72

40. (*a*) Apply the techniques of single-node-pair analysis to the upper right node in Fig. 3.73 and find i_x. (*b*) Now work with the upper left node and find v_8. (*c*) How much power is the 5 A source generating?

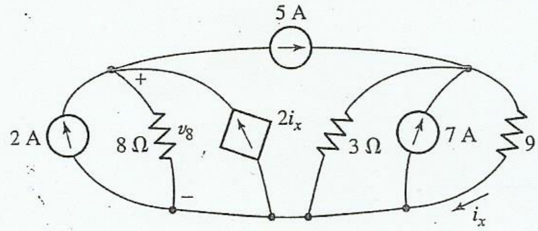


FIGURE 3.73

41. Find the power absorbed by the 5 Ω resistor in Fig. 3.74.

42. Compute the power supplied by each element shown in Fig. 3.75, and show that their sum is equal to zero.

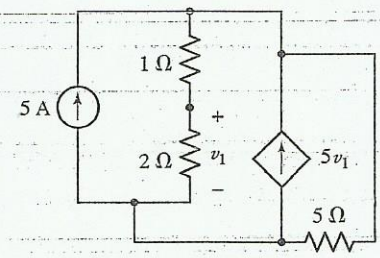


FIGURE 3.74

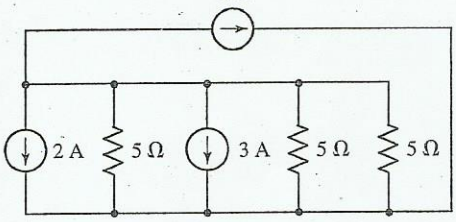


FIGURE 3.75

43. Referring to Table 2.4, how many miles of 28 AWG solid copper wire is required for the labelled wire segment of Fig. 3.76 to obtain $i_1 = 5$ A?

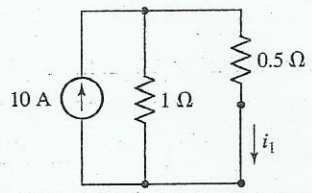


FIGURE 3.76

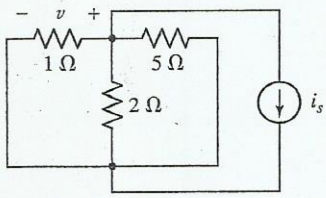


FIGURE 3.77

44. In the circuit of Fig. 3.77, if $v = 6$ V, find i_s.

3.6 Series and Parallel Connected Sources

45. Using combinations of sources, compute i for both circuits in Fig. 3.78.

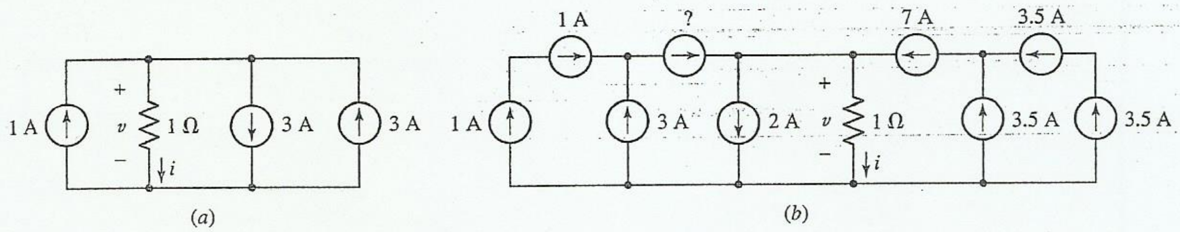


FIGURE 3.78

46. Compute v for each of the circuits in Fig. 3.78 by first combining sources.
47. Compute the current labeled i in each of the circuits in Fig. 3.79.

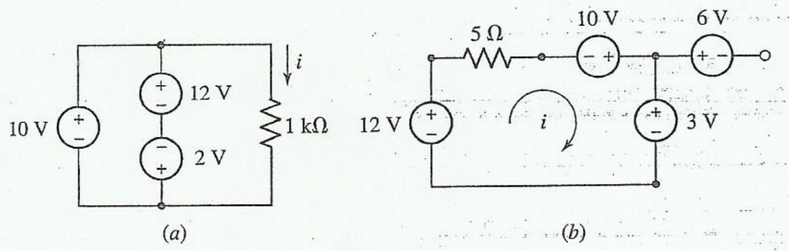


FIGURE 3.79

48. Compute the power absorbed by each element of the circuit shown in Fig. 3.80, and verify that their sum is zero.

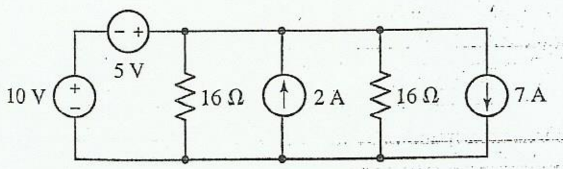


FIGURE 3.80

49. For the circuit in Fig. 3.81, compute i if:
   (a) $v_1 = v_2 = 10$ V and $v_3 = v_4 = 6$ V.
   (b) $v_1 = v_3 = 3$ V and $v_2 = v_4 = 2.5$ V.
   (c) $v_1 = -3$ V, $v_2 = 1.5$ V, $v_3 = -0.5$ V, and $v_4 = 0$ V.

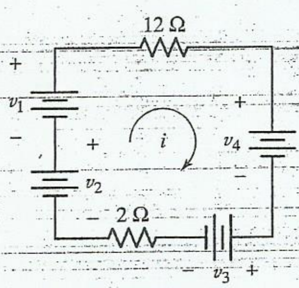


FIGURE 3.81

50. In the circuit of Fig. 3.82, choose v_1 to obtain a current i_x of 2 A.

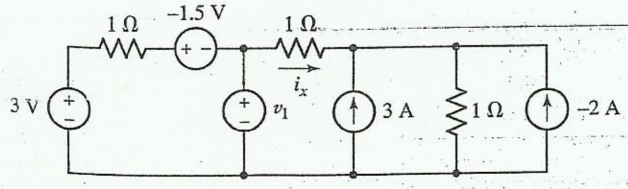


FIGURE 3.82

57. Compute the equivalent resistance of the circuit in Fig. 3.88.

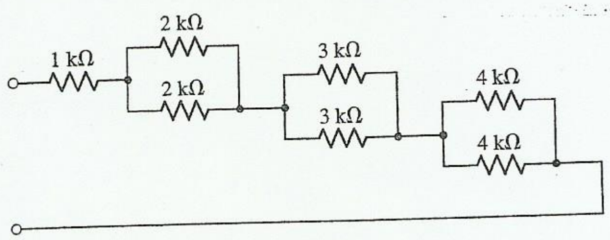


FIGURE 3.88

58. Find R_{eq} for each of the resistive networks shown in Fig. 3.89.

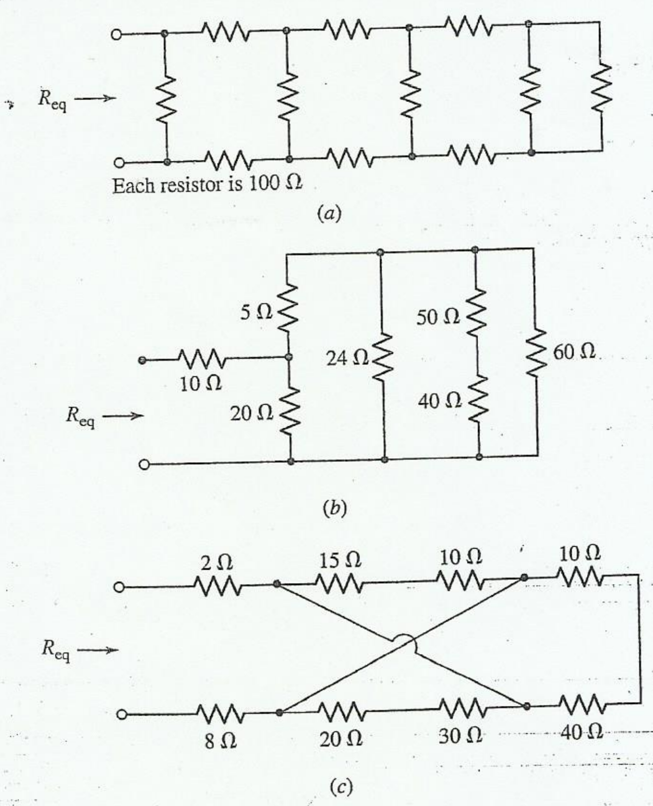


FIGURE 3.89

59. In the network shown in Fig. 3.90: (*a*) let $R = 80\ \Omega$ and find R_{eq}; (*b*) find R if $R_{eq} = 80\ \Omega$; (*c*) find R if $R = R_{eq}$.

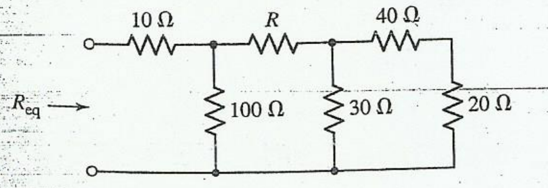
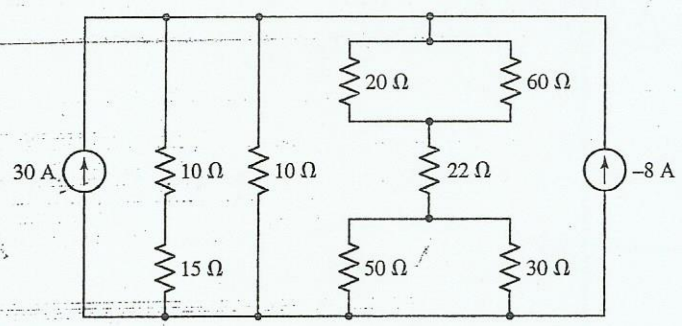


FIGURE 3.90

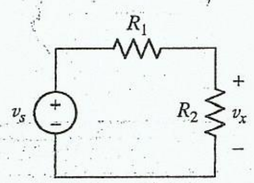
60. Show how to combine four 100 Ω resistors to obtain an equivalent resistance of (*a*) 25 Ω; (*b*) 60 Ω; (*c*) 40 Ω.

69. It appears that despite the large number of components in the circuit of Fig. 3.99, only the voltage across the 15 Ω resistor is of interest. Use current division to assist in calculating the correct value.

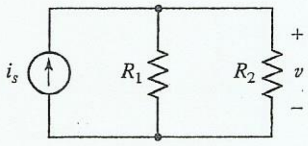


■ **FIGURE 3.99**

70. Choosing from the following resistor values (they may be used more than once), set v_s, R_1, and R_2 in Fig. 3.100 to obtain $v_x = 5.5$ V. [1 kΩ, 3.3 kΩ, 4.7 kΩ, 10 kΩ]



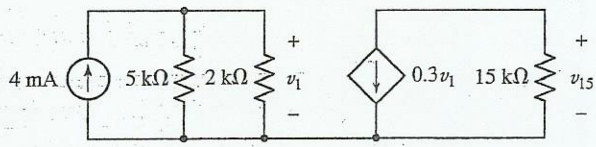
■ **FIGURE 3.100**



■ **FIGURE 3.101**

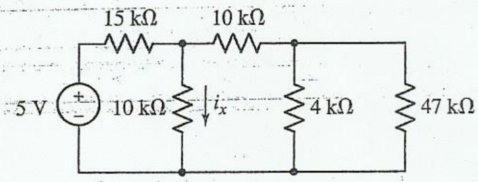
71. Choosing from the following resistor values (they may be used more than once), set i_s, R_1, and R_2 in Fig. 3.101 to obtain $v = 5.5$ V. [1 kΩ, 3.3 kΩ, 4.7 kΩ, 10 kΩ]

72. Determine the power dissipated by (absorbed by) the 15 kΩ resistor in Fig. 3.102.



■ **FIGURE 3.102**

73. For the circuit in Fig. 3.103, determine i_x, and compute the power dissipated by (absorbed by) the 15 kΩ resistor.



■ **FIGURE 3.103**

74. For the circuit in Fig. 3.104, find i_x, i_y, and the power dissipated by (absorbed by) the 3 Ω resistor.

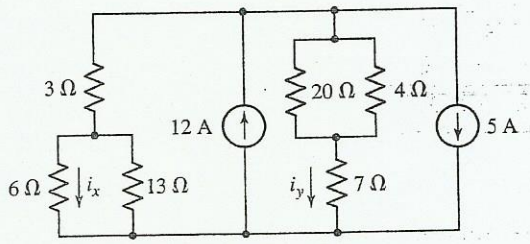


FIGURE 3.104

75. What is the power dissipated by (absorbed by) the 47 kΩ resistor in Fig. 3.105?

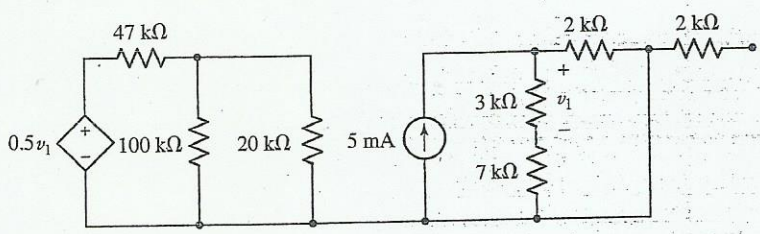


FIGURE 3.105

76. Explain why voltage division cannot be used to determine v_1 in Fig. 3.106.

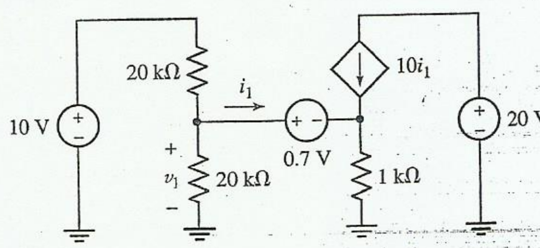


FIGURE 3.106

77. Use current and voltage division on the circuit of Fig. 3.107 to find an expression for (*a*) v_2; (*b*) v_1; (*c*) i_4.

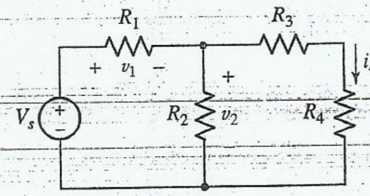


FIGURE 3.107

78. With reference to the circuit shown in Fig. 3.108: (*a*) let $v_s = 40$ V, $i_s = 0$, and find v_1; (*b*) let $v_s = 0$, $i_s = 3$ mA, and find i_2 and i_3.

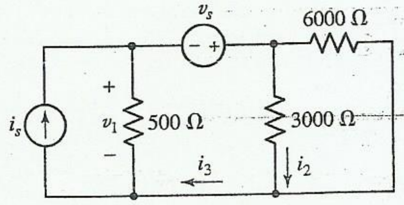


FIGURE 3.108

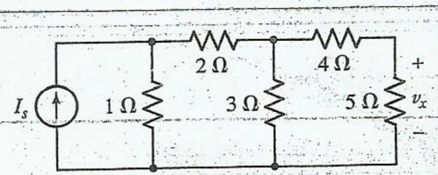
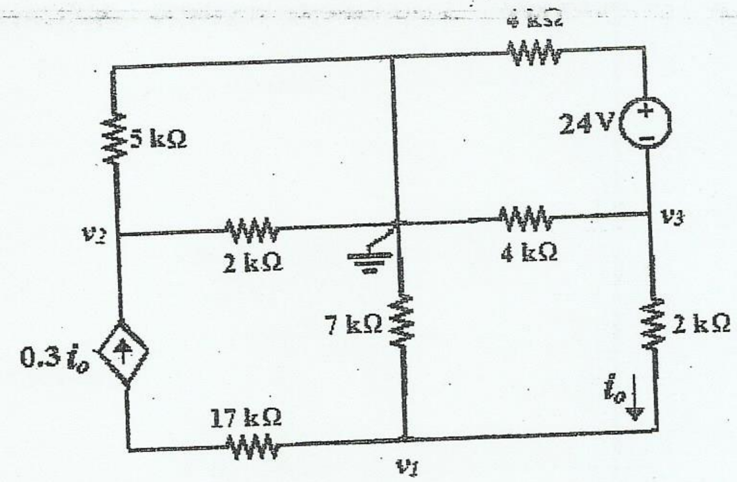


FIGURE 3.109

79. In Fig. 3.109: (*a*) let $v_x = 10$ V and find I_s; (*b*) let $I_s = 50$ A and find v_x; (*c*) calculate the ratio v_x/I_s.

points)
Use **node-voltage method** to write three independent equations in terms of the node voltages v_1, v_2 and v_3. **Do not** use any other variables in your equations. **Do not** simplify your equations.



$$-0.3\left[\frac{V_3-V_1}{2k}\right]+\frac{V_2}{2k}+\frac{V_2}{5k}=0$$

$$0.3\left[\frac{V_3-V_1}{2k}\right]+\frac{V_1}{7k}+\frac{V_1-V_3}{2k}=0$$

$$\frac{V_3}{4k}+\frac{V_3-V_1}{2k}+\frac{24+V_3}{4k}=0$$

b) In terms of the proper node voltage(s), express i_o

$$i_\alpha = \frac{V_3 - V_1}{2k}$$ 1

c) In terms of the proper node voltage(s), express the absorbed power by the 24 V soure.

$$P_{24} = \left[\frac{-V_3 - 24}{4k}\right] \cdot 24$$ 1

d). In terms of the proper node voltage(s), express the absorbed power by the dependent source.

$$P_d = \left(\left(-17k\right)\left(0.3 i_\alpha\right) + V_2 - V_2\right)\left(0.3 i_\alpha\right)$$ 1

Good luck

٢ مم/

م. ريم الاديبي

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سيركت (١)

```
>>
>> a = sove(e e2 e3, 'v1', v2, 'v3')
```

7. Identify the obvious errors in the following complete set of nodal equations if the last equation is known to be correct:

$$7 = \frac{v_1}{4} - \frac{v_2 - v}{1} + \frac{v_1 - v_3}{9}$$

$$0 = \frac{v_2 - v_1}{2} + \frac{v_2 - v_3}{2}$$

$$4 = \frac{v_3}{7} + \frac{v_3 - v_1}{19} + \frac{v_3 - v_2}{2}$$

8. In the circuit of Fig. 4.34, determine the current labeled i with the assistance of nodal analysis techniques.

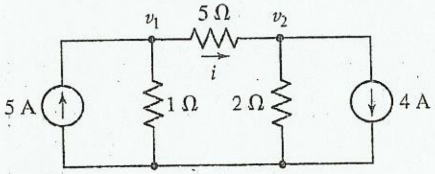


FIGURE 4.34

9. Calculate the power dissipated in the 1 Ω resistor of Fig. 4.35.

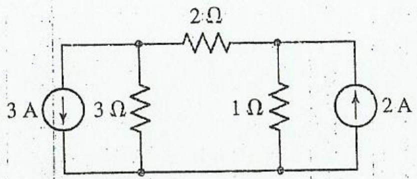


FIGURE 4.35

10. With the assistance of nodal analysis, determine $v_1 - v_2$ in the circuit shown in Fig. 4.36.

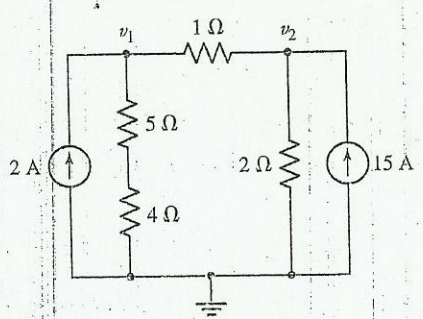


FIGURE 4.36

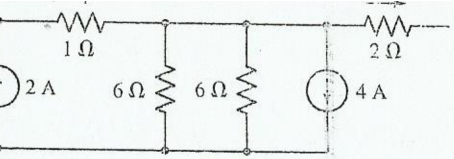


FIGURE 4.37

12. Use nodal analysis to find v_P in the circuit shown in Fig. 4.38.

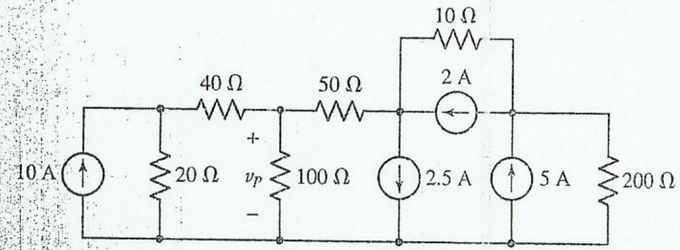


FIGURE 4.38

13. Using the bottom node as reference, determine the voltage across the 5 Ω resistor in the circuit of Fig. 4.39, and calculate the power dissipated by the 7 Ω resistor.

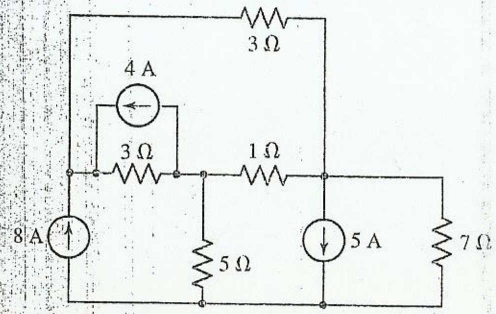


FIGURE 4.39

14. For the circuit of Fig. 4.40, use nodal analysis to determine the current i_5

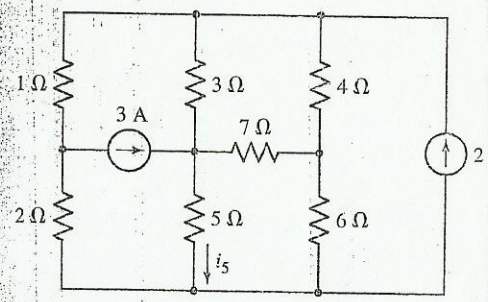


FIGURE 4.40

15. Determine a numerical value for each nodal voltage in the circuit of Fig. 4.41.

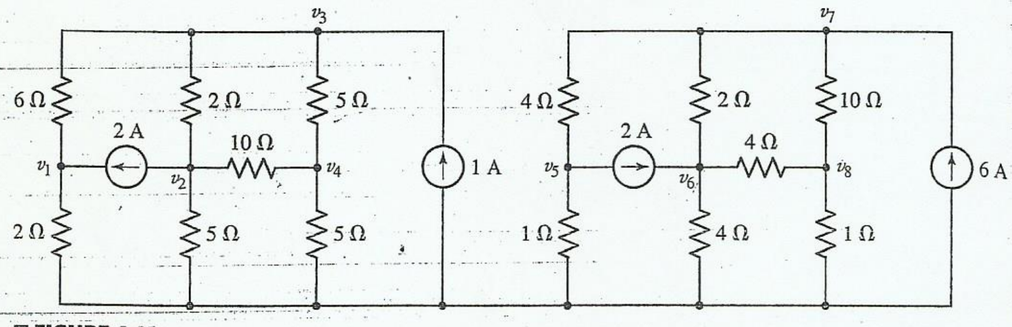


FIGURE 4.41

Determine the current i_2 as labeled in the circuit of Fig. 4.42, with the assistance of nodal analysis.

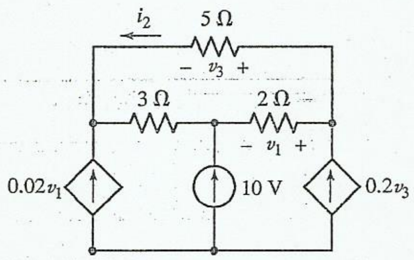


FIGURE 4.42

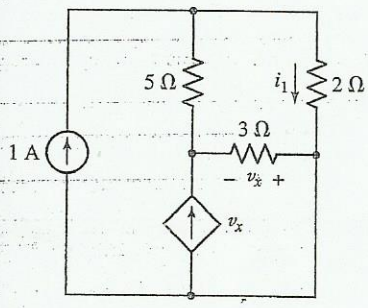


FIGURE 4.43

Using nodal analysis as appropriate, determine the current labeled i_1 in the circuit of Fig. 4.43.

4.2 The Supernode

Determine the nodal voltages as labeled in Fig. 4.44, making use of the supernode technique as appropriate.

For the circuit shown in Fig. 4.45, determine a numerical value for the voltage labeled v_1.

20. For the circuit of Fig. 4.46, determine all four nodal voltages.

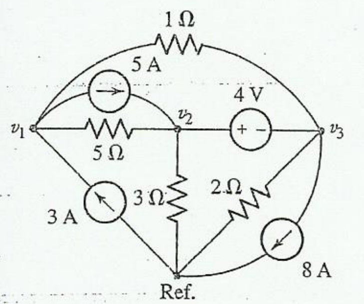


FIGURE 4.44

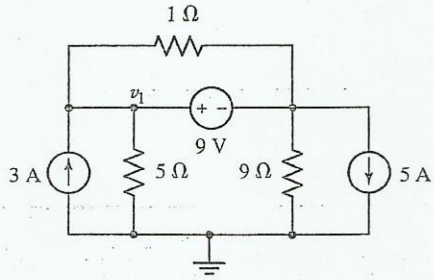


FIGURE 4.45

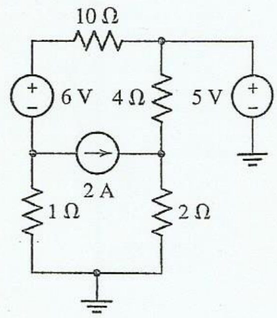
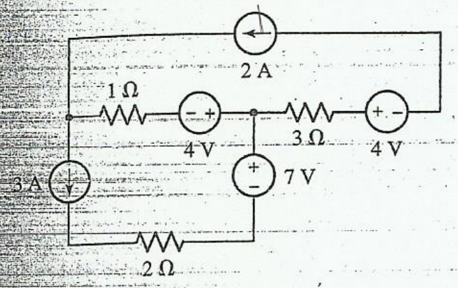


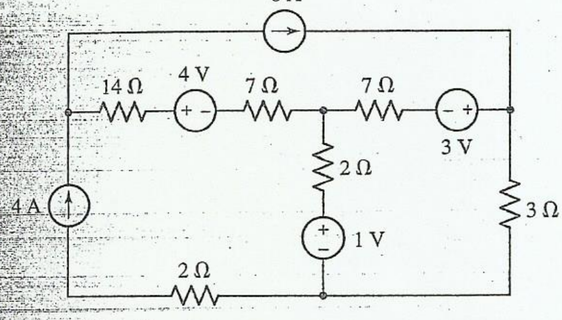
FIGURE 4.46

21. Employing supernode/nodal analysis techniques as appropriate, determine the power dissipated by the 1 Ω resistor in the circuit of Fig. 4.47.



■ FIGURE 4.47

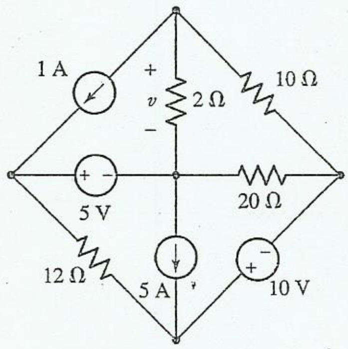
22. Referring to the circuit of Fig. 4.48, obtain a numerical value for the power supplied by the 1 V source.



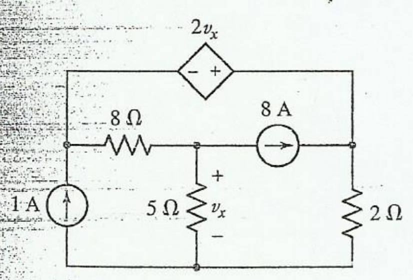
■ FIGURE 4.48

Determine the voltage labeled v in the circuit of Fig. 4.49.

Determine the voltage v_x in the circuit of Fig. 4.50, and the power supplied by the 1 A source.

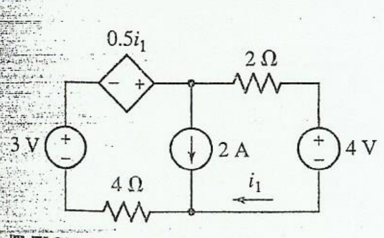


■ FIGURE 4.49

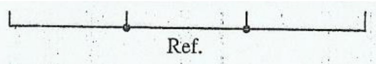


■ FIGURE 4.50

Consider the circuit of Fig. 4.51. Determine the current labeled i_1.

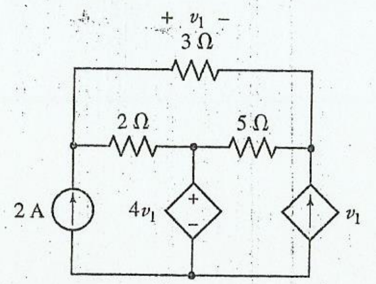


■ FIGURE 4.51



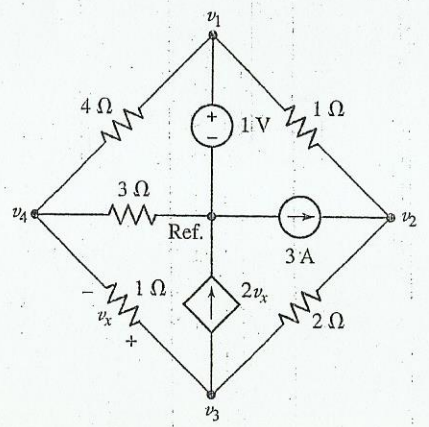
■ FIGURE 4.52

27. For the circuit depicted in Fig. 4.53, determine the voltage labeled v_1 across the 3 Ω resistor.



■ FIGURE 4.53

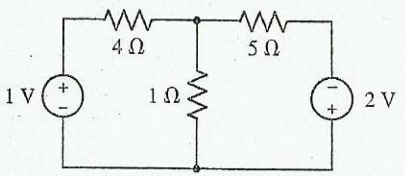
28. For the circuit of Fig. 4.54, determine all four nodal voltages.



■ FIGURE 4.54

4.3 Mesh Analysis

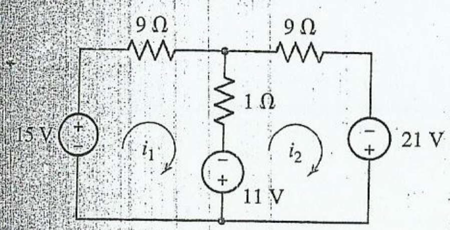
29. Determine the currents flowing out of the positive terminal of each voltage source in the circuit of Fig. 4.55.



■ FIGURE 4.55

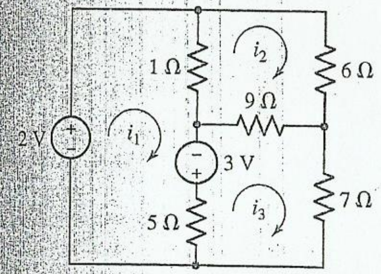
■ FIGURE 4.56

31. Use mesh analysis as appropriate to determine the two mesh currents labeled in Fig. 4.57.



■ FIGURE 4.57

32. Determine numerical values for each of the three mesh currents as labeled in the circuit diagram of Fig. 4.58.

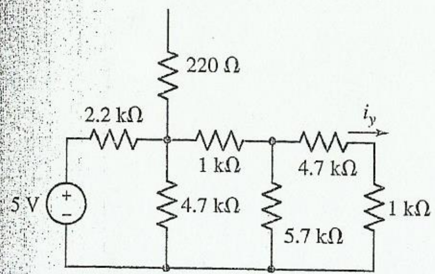


■ FIGURE 4.58

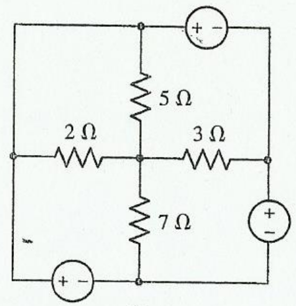
33. Calculate the power dissipated by each resistor in the circuit of Fig. 4.58.

34. Employing mesh analysis as appropriate, obtain (*a*) a value for the current i_y and (*b*) the power dissipated by the 220 Ω resistor in the circuit of Fig. 4.59.

35. Choose nonzero values for the three voltage sources of Fig. 4.60 so that no current flows through any resistor in the circuit.

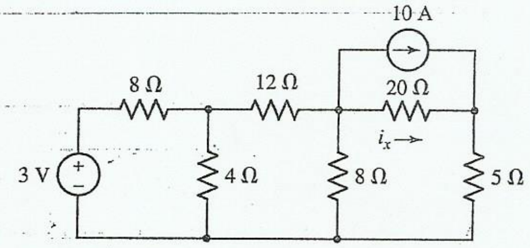


■ FIGURE 4.59



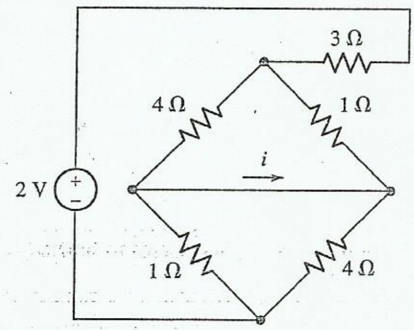
■ FIGURE 4.60

36. Calculate the current i_x in the circuit of Fig. 4.61.



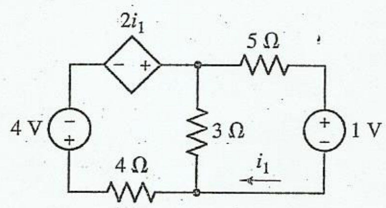
■ **FIGURE 4.61**

37. Employing mesh analysis procedures, obtain a value for the current labeled i in the circuit represented by Fig. 4.62.



■ **FIGURE 4.62**

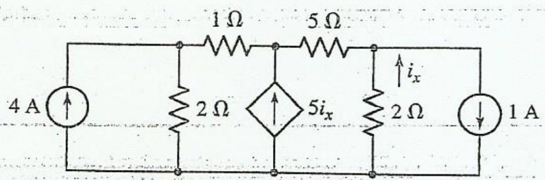
38. Determine the power dissipated in the 4 Ω resistor of the circuit shown in Fig. 4.63.



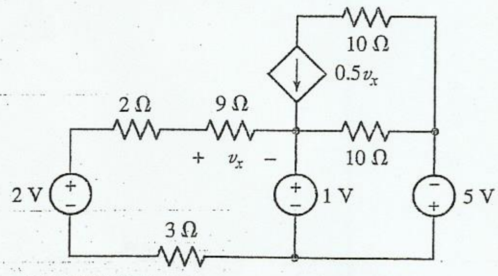
■ **FIGURE 4.63**

39. (*a*) Employ mesh analysis to determine the power dissipated by the 1 Ω resistor in the circuit represented schematically by Fig. 4.64. (*b*) Check your answer using nodal analysis.

40. Define three clockwise mesh currents for the circuit of Fig. 4.65, and employ mesh analysis to obtain a value for each.



■ **FIGURE 4.64**



■ **FIGURE 4.65**

Employ mesh analysis to obtain values for i_x and v_a in the circuit of Fig. 4.66.

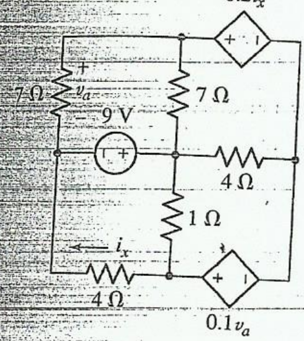


FIGURE 4.66

4.4 The Supermesh

42\. Determine values for the three mesh currents of Fig. 4.67.

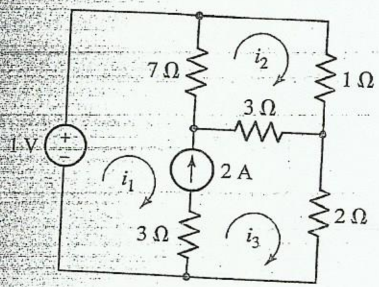


FIGURE 4.67

43\. Through appropriate application of the supermesh technique, obtain a numerical value for the mesh current i_3 in the circuit of Fig. 4.68, and calculate the power dissipated by the 1 Ω resistor.

44\. For the circuit of Fig. 4.69, determine the mesh current i_1 and the power dissipated by the 1 Ω resistor.

Calculate the three mesh currents labeled in the circuit diagram of Fig. 4.70.

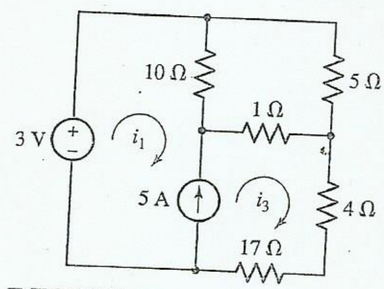


FIGURE 4.68

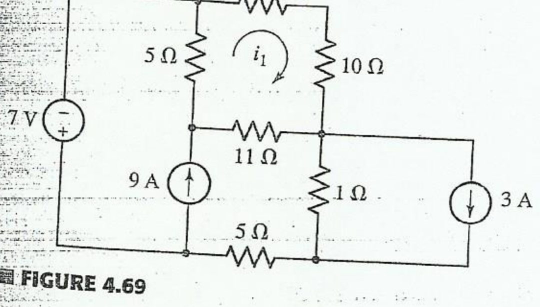


FIGURE 4.69

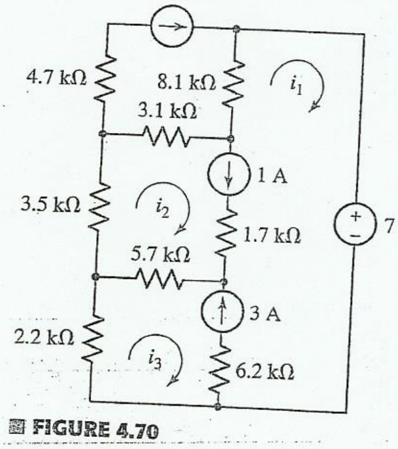


FIGURE 4.70

46. Employing the supermesh technique to best advantage, obtain numerical values for each of the mesh currents identified in the circuit depicted in Fig. 4.71.

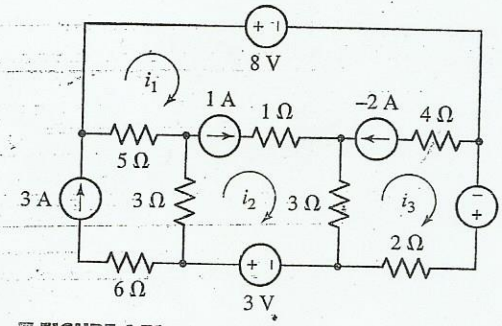


FIGURE 4.71

47. Through careful application of the supermesh technique, obtain values for all three mesh currents as labeled in Fig. 4.72.

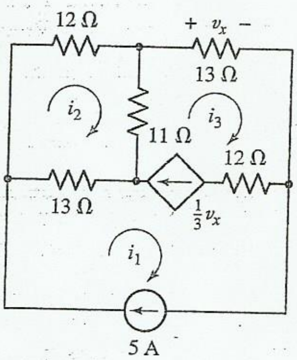


FIGURE 4.72

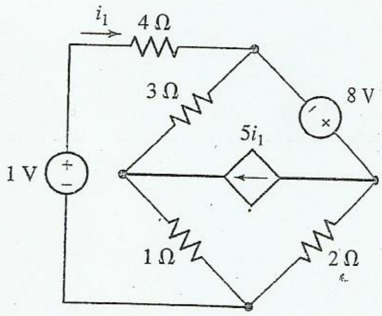


FIGURE 4.73

48. Determine the power supplied by the 1 V source in Fig. 4.73.

49. Define three clockwise mesh currents for the circuit of Fig. 4.74, and employ the supermesh technique to obtain a numerical value for each.

50. Determine the power absorbed by the 10 Ω resistor in Fig. 4.75.

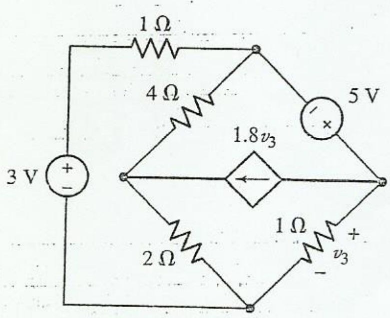


FIGURE 4.74

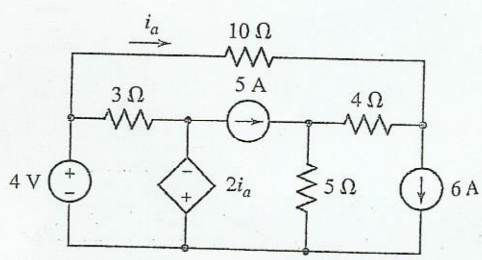


FIGURE 4.75