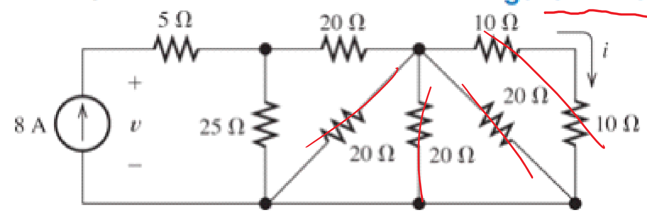
Homework 3

Monday, September 28, 2020   12:55 PM

"I pledge my honor I have abided by the Stevens Honor system."

-Alex Gaskins

***P2.25.** Find the values of v and i in **Figure P2.25**.

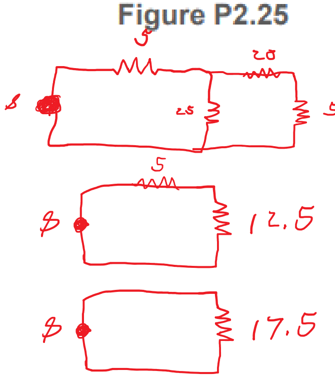


$= 20\,\Omega$ (in series)

In Parallel

$R = \dfrac{1}{4(1/20)} = 5\,\Omega$

Figure P2.25



$100 = i\,(25)$

$i = 4$

$V = iR$

$V = (8)(12.5)$

$V = 100\ V$

$V = IR$

$V = iR$

$V = 8\,(17.5)$

$\boxed{V = 140\ V}$

$i_{parallel}$ (4 parallel paths) $= \frac{4}{4} = \boxed{1\ A}$

P2.30. Consider the circuit shown in **Figure P2.30**. Find the values of v_1, v_2, and v_{ab}.

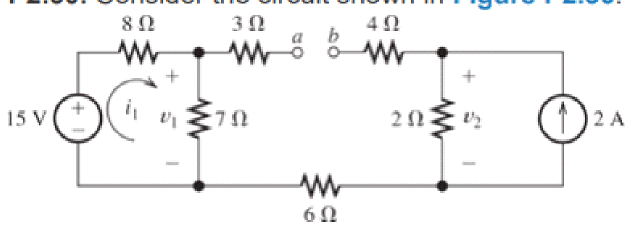


Figure P2.30

$V_1 = \dfrac{7\,\Omega}{8 + 7\,\Omega}(15\ V)$

$\boxed{V_1 = 7\ V}$

$V_{ab} = V_1 - V_2$

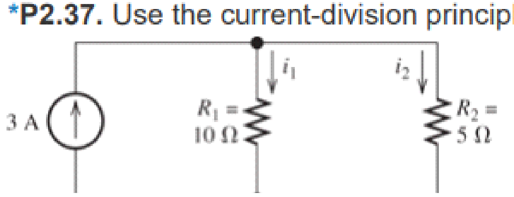
$V_{ab} = 7 - 4$

$\boxed{V_{ab} = 3\ V}$

$V_2 = 2\ A\,(2\,\Omega)$

$\boxed{V_2 = 4\ V}$

***P2.37.** Use the current-division principle to calculate i_1 and i_2 in **Figure P2.37**.



*__P2.37.__ Use the current-division principle to calculate i_1 and i_2 in **Figure P2.37**.

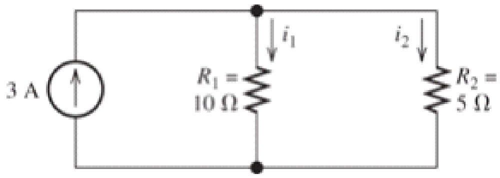


Figure P2.37

$$i_1 = \frac{R_2}{R_1 + R_2}(3\,A) \qquad i_2 = \frac{R_1}{R_2 + R_1}(3\,A)$$

$$i_1 = \frac{5}{15}(3) = 1\,A \qquad i_2 = \frac{10}{15}(3) = 2\,A$$

$$\boxed{i_1 = 1\,A \quad i_2 = 2\,A}$$

*__P2.38.__ Use the voltage-division principle to calculate *v* in **Figure P2.38**.

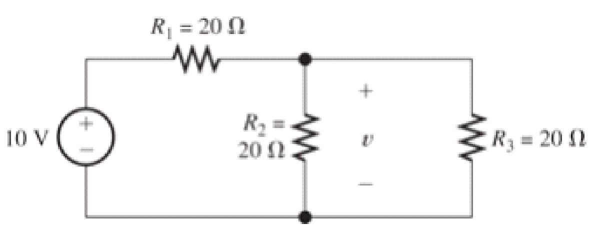


Figure P2.38

$$V = \frac{R_2}{R_2 + R_1}(10\,V)$$

$$V = \frac{20}{40}(10) = 5\,V$$

$$\boxed{V = 5\,V}$$

***P2.48.** Write equations and solve for the node voltages shown in **Figure P2.48**. Then, find the value of i1.

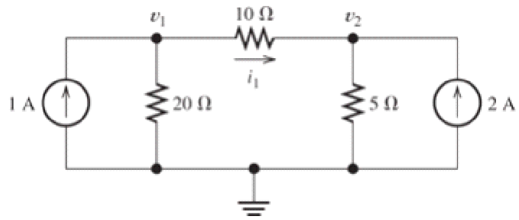


Figure P2.48

$$\frac{V_1}{20} + \frac{V_1 - V_2}{10} = 1$$

$$\frac{V_2}{5} + \frac{V_2 - V_1}{10} = 2$$

$$3V_2 - V_1 = 20$$

$$V_1 = 3V_2 - 20$$

$$\frac{(3V_2 - 20)}{20} + \frac{4V_2 - 40}{20} = 1$$

$$7V_2 - 60 = 20$$

$$7V_2 = 80$$

$$\boxed{\begin{array}{l} V_2 = 11.43\ V \\ V_1 = 14.29\ V \end{array}}$$

$$i_1 = \frac{V_2 - V_1}{10}$$

$$\boxed{i_1 = 286\ mA}$$

P2.51. Given R1=4 Ω,R2=5 Ω,R3=8 Ω,R4=10 Ω,R5=2 Ω, and Is=2 A, solve for the node voltages shown in **Figure P2.51**.

n - 1

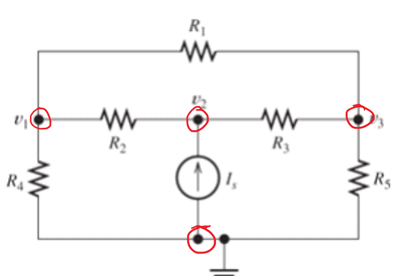


Figure P2.51

$$\frac{V_1 - V_3}{R_1} + \frac{V_1 - V_2}{R_2} + \frac{V_1}{R_4} = 0$$

$$\frac{V_2 - V_1}{R_2} + \frac{V_2 - V_3}{R_3} = I_s$$

$$\ldots - V_2 \ldots + \frac{V_3}{\ldots} = 0$$

$$\frac{V_3 - V_1}{R_1} + \frac{V_3 - V_2}{R_3} + \frac{V_3}{R_5} = 0$$

*P2.56. Solve for the values of the node voltages shown in **Figure P2.56**. Then, find the value of ix.

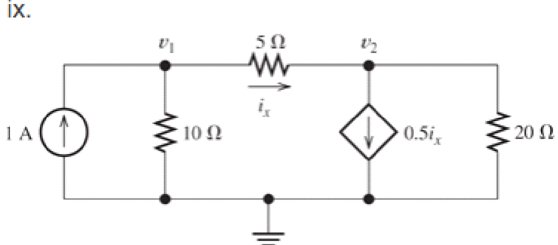


Figure P2.56

$$\frac{V_1 - V_2}{5} + \frac{V_1}{10} = 1$$

$$3V_1 - 2V_2 = 10$$

$$V_2 = \frac{3}{2}V_1 - 5$$

$$-i_x = \frac{V_2 - V_1}{5}$$

$$\frac{V_2 - V_1}{5} + \frac{V_2}{20} + \frac{i_x}{2} = 0$$

$$\frac{\left(\frac{3}{2}V_1 - 5\right) - V_1}{5} + \frac{\left(\frac{3}{2}V_1 - 5\right)}{20} - \frac{\left(\frac{3}{2}V_1 - 5\right) - V_1}{10} = 0$$

$$V_1 = \frac{20}{9}\,V \qquad V_2 = \frac{10}{3}\,V$$

$$i_x = \frac{10}{9}\left(\frac{1}{5}\right)$$

$$i_x = \frac{2}{9}\ A$$

***P2.65.** Solve for the power delivered to the 15-Ω resistor and for the mesh currents shown in **Figure P2.65**.

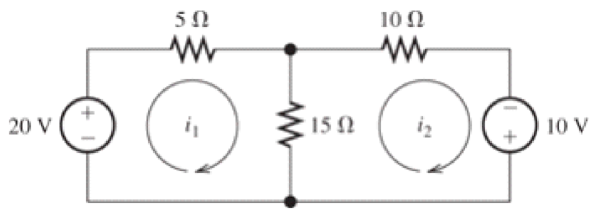


Figure P2.65

$$I_1(5+15) - I_2(15) = 20$$

$$20 I_1 = 15 I_2 + 20$$

$$I_1 = \frac{3}{4} I_2 + 1$$

$$I_2(15+10) - I_1(15) = 10$$

$$25 I_2 - 15\left(\frac{3}{4} I_2 + 1\right) = 10$$

$$I_2 = \frac{20}{11}\ A$$

$$I_1 = \frac{26}{11}\ A$$

$$P = I^2 R$$

$$P = (I_1 - I_2)^2 R$$

$$P = \left(\frac{26}{11} - \frac{20}{11}\right)^2 (15)$$

$$P = 4.46\ W$$

P2.68. Solve for the power delivered by the voltage source in **Figure P2.68**, using the mesh-current method.

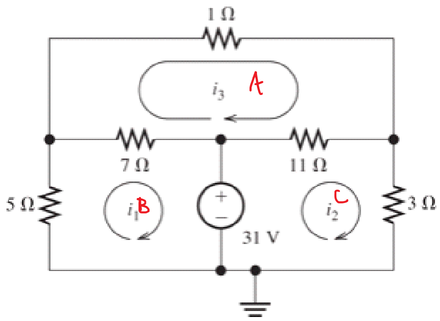


Figure P2.68

A:

$$i_3 + 11(i_3 - i_2) + 7(i_3 - i_1) = 0$$

B:

$$31 + (5+7)i - 7i_3 = 0$$

C:

$$11(i_2 - i_3) + 3i_2 = 31$$