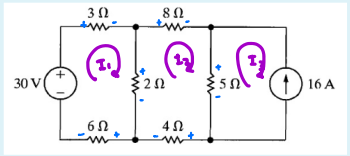
1.



AP4.10_9ed

Use the mesh-current method to find the power dissipated in the 2 Ω (Ohm) resistor in the circuit shown

$P_{2\Omega}$ = 72 ✔ W

I_1 : $30V - 3I_1 - 2(I_1 - I_2) - 6I_1 = 0$

$11I_1 - 2I_2 = 30$

I_2 : $2(I_1 - I_2) - 8I_2 - 5(I_2 - I_3) - 4I_2 = 0$

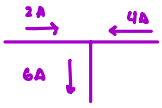
$2I_1 - 19I_2 + 5I_3 = 0$

I_3 : $I_3 = -16A$

$2I_1 - 19I_2 = -5(-16)$

$2I_1 - 19I_2 = 80$] $I_1 = 2A$

$11I_1 - 2I_2 = 30$] $I_2 = -4A$

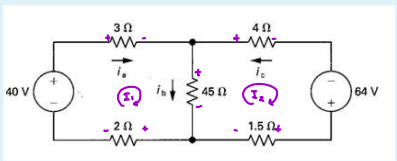


$V_2 = IR_2 = (6)(2)$

$= 12\ V$

$P = iV = 72\ W$

2.



P4.30_6ed

Use the mesh-current method.

Find the currents ia, ib and ic.

i_a = 9.8 ✔ A

i_b = -0.2 ✔ A

i_c = -10 ✔ A

I_1 : $40 - 3I_1 - 45(I_1 - I_2) - 2I_1 = 0$

$50I_1 - 45I_2 = 40$

I_2 : $45(I_1 - I_2) - 4I_2 + 64 - 1.5I_2 = 0$

$45I_1 - 50.5I_2 + 64 = 0$

$-45I_1 + 50.5I_2 = 64$] $I_1 = 9.8\ A$

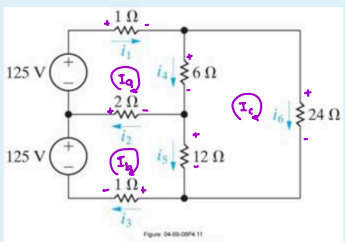
$50I_1 - 45I_2 = 40$] $I_2 = 10\ A$

$i_a = 9.8A$

$i_b = -0.2\ A$

$i_c = -10A$

3.



P4-11b_8ed

This circuit is a dc model of a residential power distribution circuit.

Use the mesh-current method to find the branch currents i_1 to i_6.

i_1 = 23.76 ✔ A

i_2 = 5.33 ✔ A

i_3 = 18.43 ✔ A

i_4 = 15.1 ✔ A

i_5 = 9.77 ✔ A

i_6 = 8.66 ✔ A

$125 - 5I_a - 6(I_a - I_c) + 2(I_a - I_b) = 0$

$125 - 9I_a - 2I_b + 6I_c = 0$

$9I_a + 2I_b - 6I_c = 125$

$125 - 2(I_b - I_a) - 12(I_b - I_c) - I_b = 0$

$125 + 2I_a - 15I_b + 12I_c = 0$

$-2I_a + 15I_b - 12I_c = 125$

$12(I_b - I_c) + 6(I_a - I_c) - 24I_c = 0$

$6I_a + 12I_b - 42I_c = 0$

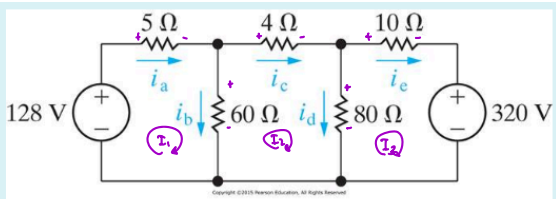
$I_a + 2I_b - 7I_c = 0$

$19I_a - 2I_b - 6I_c = 125$

$-2I_a + 15I_b - 12I_c = 125$

$I_a + 2I_b - 7I_c = 0$

4.



P4.33_10ed

Use the mesh-current method.

Find the power absorbed/delivered by the 60Ω (Ohm), and the 80Ω (Ohm) resistors.

$P_{60\Omega}$ = 437.4 ✔ W

$P_{80\Omega}$ = 500 ✔ W

$128 - 5I_1 - 60(I_1 - I_2) = 0$

$65I_1 - 60I_2 = 128$

$60(I_1 - I_2) - 4I_2 - 80(I_2 - I_3) = 0$

$60I_1 - 144I_2 + 80I_3 = 0$

$80(I_2 - I_3) - 10I_3 - 320 = 0$

$80I_2 - 90I_3 = 320$

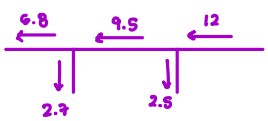
$8I_2 - 9I_3 = 32$

$I_1 = 6.8\ A$

$I_2 = -9.5\ A$

$I_3 = -12\ A$

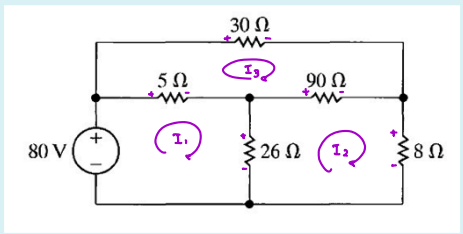
$i_a - i_b - i_c = 0$



$P_{60\Omega} = i^2R = (2.7)^2(60) = 437.4$

$P_{80\Omega} = (2.5)^2(80) = 500$

5.



AP4.07_9ed

Use the mesh-current method.

a) Find the power absorbed/delivered by the 80 V source to the circuit shown.

P_{80V} = -400 ✔ W

b) Find the power absorbed/delivered in the 8 Ω resistor.

$P_{8\Omega}$ = 50 ✔ W

$80 - 5(I_1 - I_3) - 26(I_1 - I_2) = 0$

$31I_1 - 26I_2 - 5I_3 = 80$

$26(I_1 - I_2) - 90(I_2 - I_3) - 8I_2 = 0$

$26I_1 - 124I_2 + 90I_3 = 0$

$-30I_3 + 90(I_2 - I_3) + 5(I_1 - I_3) = 0$

$5I_1 + 90I_2 - 125 = 0$

$I_1 = 5\ A$

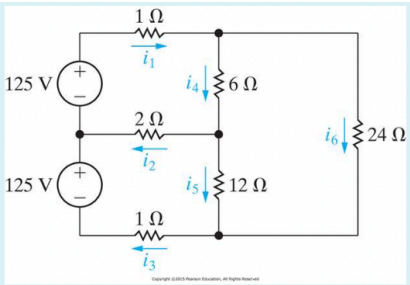
$I_2 = 2.5A$

$I_3 = 2\ A$

$P_{80V} = I_1 V = (5)(80) = 400\ W\ (-)$

$P_{8\Omega} = I_2^2(8\Omega) = (2.5)^2(8) = 50\ W\ (+)$

6.



P4.34_10ed

Use the mesh-current method.

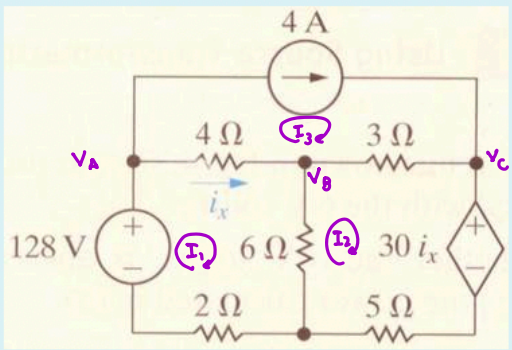
Find the power absorbed/delivered by the 24Ω (Ohm) resistor.

$P_{24\Omega}$ = 1799.89 ✔ W

SOLUTION QUESTION #3

$P = i_6^2 R_6 = (8.66)^2(24) = 1799.89\ W\ (+)$

7.



AP4.14_9ed

Find the power absorbed/delivered by the 4 A current source in the circuit shown

P_{4A} = -40 ✔ W

"+" = absorbed "-" = delivered

I_1: $128 - 4(I_1 - I_3) - 6(I_1 - I_2) - 2I_1 = 0$

$-12I_1 + 6I_2 + 4I_3 + 128 = 0$

$6I_1 - 3I_2 - 2I_3 = 64$

$6I_1 - 3I_2 = 72$

I_2: $6(I_1 - I_2) - 3(I_2 - I_3) - 30i_x - 5I_2 = 0$

$6I_1 - 14I_2 + 3I_3 - 30i_x = 0$

$6I_1 - 14I_2 + 12 - 30(I_1 - 4) = 0$

$-24I_1 - 14I_2 = -132$

$12I_1 + 7I_2 = 66$

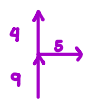
$I_3 = 4A$

$i_x = i_1 - i_3$

$= I_1 - 4$

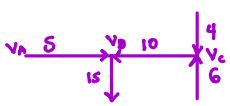
$6I_1 - 3I_2 = 72$] $I_1 = 9A$

$12I_1 + 7I_2 = 66$] $I_2 = -6A$



$i_x = 5$

$V_B = i_{6\Omega} R_{6\Omega} = (15)(6) = 90\ V$



$V_C - V_B = (10)(3)$

$V_C = 30 + 90 = 120\ V$

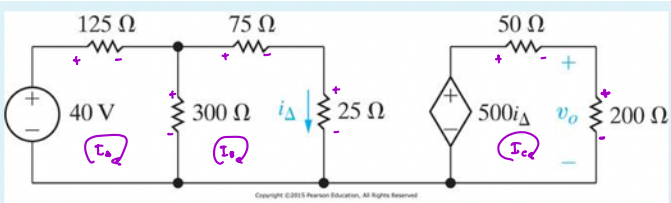
$V_A - V_B = (5)(4) = 20$

$V_A = 20 + 90 = 110\ V$

$V_{4A} = V_C - V_A = 10\ V$

$P_{4A} = iV = (4)(10) = 40\ V\ (-)$

8.



P4.41_10ed

Find the current through the 200Ω (Ohm) resistor.

$i_{200\Omega}$ = 0.3 ✔ A

$40 - 125I_A - 300(I_A - I_B) = 0$

$425I_A - 300I_B = 40$

$300(I_A - I_B) - 75I_B - 25I_B = 0$

$300I_A - 400I_B = 0$] $I_A = 0.2A$

$425I_A - 300I_B = 40$] $I_B = 0.150A$

$500i_\Delta - 50I_C - 200I_C$

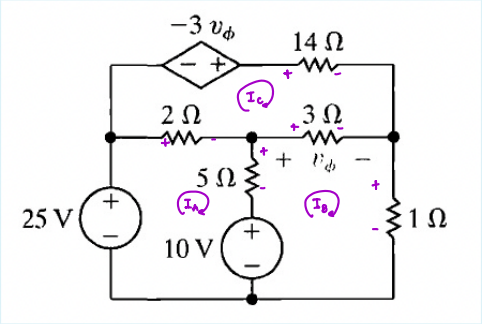
$500I_B - 250I_C = 0$

$I_C = \frac{(0.150)(500)}{250} = 0.3A$

$i_\Delta = I_B$

$i_{200} = I_C = 0.3\ A$

9.



AP4.08_9ed

Use the mesh-current method to find how much power is being absorbed/delivered by the dependent voltage source

P_{dep} = -36 ✔ W

$25 - 2(I_A - I_C) - 5(I_A - I_B) - 10 = 0$

$-7A + 5I_B + 2I_C + 15 = 0$

$7A - 5I_B - 2I_C = 15$

$10 + 5(I_B - I_A) - 3(I_B - I_C) - I_B = 0$

$5I_A - 9I_B + 3I_C + 10 = 0$

$-5I_A + 9I_B - 3I_C = 10$

$-3V_\phi - 14I_C + 3(I_B - I_C) + 2(I_A - I_C) = 0$

$-3V_\phi + 2I_A + 3I_B - 19I_C = 0$

$-3[3(I_B - I_C)] + 2I_A + 3I_B - 19I_C = 0$

$2I_A - 6I_B - 10I_C = 0$

$7A - 5I_B - 2I_C = 15$

$-5I_A + 9I_B - 3I_C = 10$

$2I_A - 6I_B - 10I_C = 0$

$I_A = 9A$

$I_B = 3A$

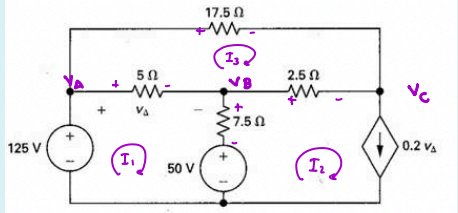
$I_C = -1A$

$V = -3V_\phi = -3[3(3-(-1))] = -36$

$P_{dep} = iV = (-1)(-36) = 36\ W$

$V_\phi = 3(I_B - I_C)$

10.



P4.34_6ed

a) Find the current through the dependent current source 0.2 v_Δ.

0.2 v_Δ = 9.6 ✔ A

b) Find the power absorbed/delivered by the dependent current source.

$P_{0.2V\Delta}$ = 595.2 ✔ W

$125 - 5(I_1 - I_3) - 7.5(I_1 - I_2) - 50 = 0$

$-12.5I_1 + 7.5I_2 + 5I_3 + 75 = 0$

$12.5I_1 - 7.5I_2 - 5I_3 = 75$

$12.5I_1 - 7.5(I_1 - I_2) - 5I_3 = 75$

$5I_1 + 2.5I_3 = 75$

$-17.5I_3 + 2.5(I_2 - I_3) + 5(I_1 - I_3) = 0$

$5I_1 + 2.5I_2 - 25I_3 = 0$

$5I_1 + 2.5(I_1 - I_3) - 25I_3 = 0$

$7.5I_1 - 27.5I_3 = 0$

$I_2 = 0.2V_A$ $\quad V_\Delta = 5(I_1 - I_3)$

$I_2 = I_1 - I_3 = 13.2 - 3.6 = 9.6A$

$5I_1 + 2.5I_3 = 75$

$7.5I_1 - 27.5I_3 = 0$

$I_1 = 13.2\ A$

$I_3 = 3.6\ A$

$i_{2.5} = 13.2 - 9.6 = 3.6A$

$V_A - V_B = V_\Delta = 5I_2 = 5(9.6)$

$V_B = 77V$ $\quad V_A = 125$

$i_{2.5} = 9.6 - 3.6 = 6A$

$77 - V_C = (6)(2.5)$

$V_C = 62V$

$V_B - 50 = 7.5(3.6)$

$V_B = 77\ V$

$P_{0.2V_\Delta} = (9.6)(62) = 595.2\ W$