CHAPTER

1.3

METHODS OF ANALYSIS

1. $v_1 = ?$

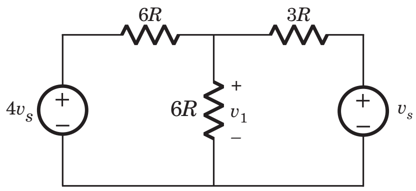

Fig. P1.3.1

(A) $0.4v_s$ (B) $1.5v_s$

(C) $0.67v_s$ (D) $2.5v_s$

2. $v_a = ?$

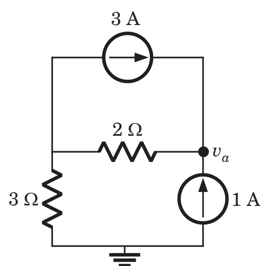

Fig. P1.3.2

(A) –11 V (B) 11 V

(C) 3 V (D) –3 V

3. $v_1 = ?$

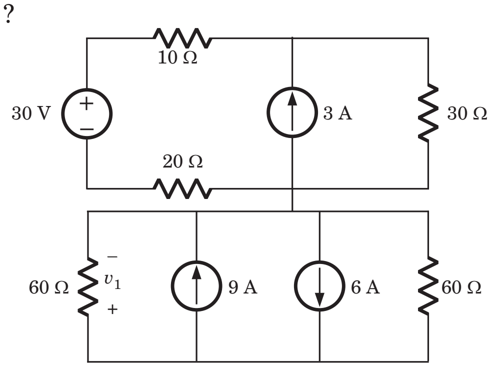

Fig. P1.3.3

(A) 120 V (B) –120 V

(C) 90 V (D) –90 V

4. $v_a = ?$

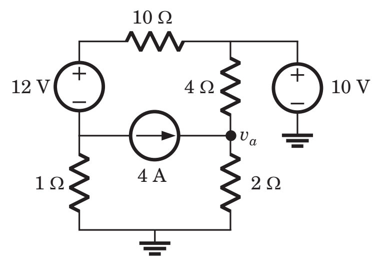

Fig. P1.3.4

(A) 4.33 V (B) 4.09 V

(C) 8.67 V (D) 8.18 V

5. $v_2 = ?$

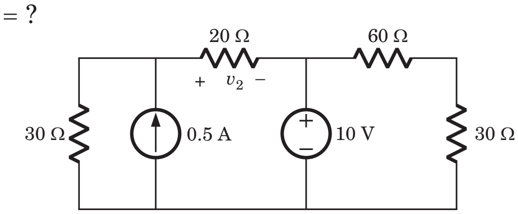

Fig. P1.3.5

(A) 0.5 V (B) 1.0 V

(C) 1.5 V (D) 2.0 V

6. $i_b = ?$

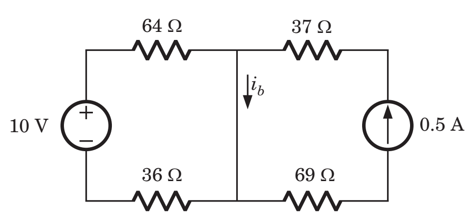

Fig. P1.3.6

(A) 0.6 A (B) 0.5 A

(C) 0.4 A (D) 0.3 A

7. $i_1 = ?$

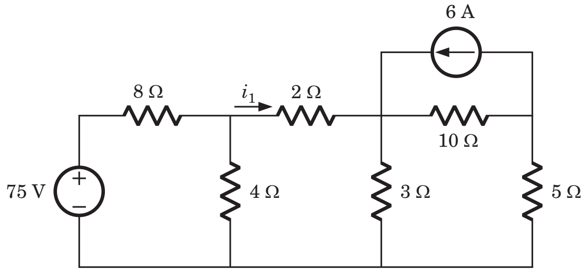

Fig. P1.3.7

(A) 3.3 A (B) 2.1 A

(C) 1.7 A (D) 1.1 A

8. $i_1 = ?$

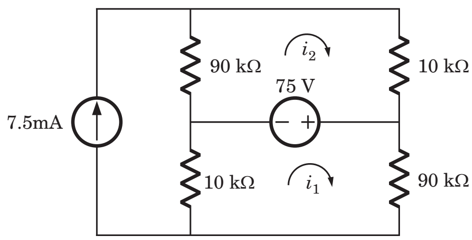

Fig. P1.3.8

(A) 1 mA (B) 1.5 mA

(C) 2 mA (D) 2.5 mA

9. $i_1 = ?$

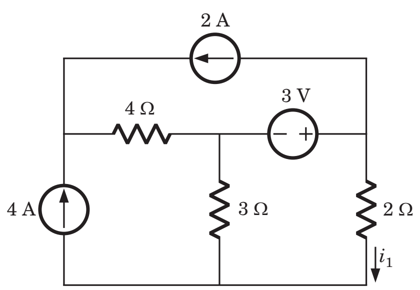

Fig. P1.3.9

(A) 4 A (B) 3 A

(C) 6 A (D) 5 A

10. $i_1 = ?$

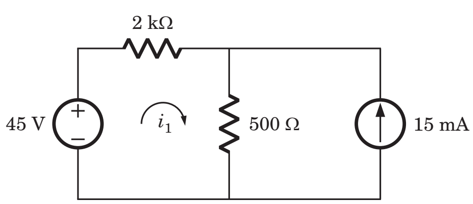

Fig. P1.3.10

(A) 20 mA (B) 15 mA

(C) 10 mA (D) 5 mA

11. $i_1 = ?$

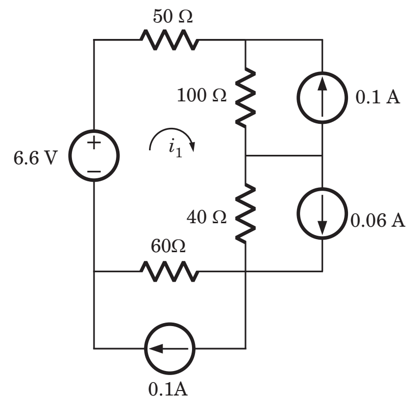

Fig. P1.3.11

(A) 0.01 A (B) –0.01 A

(C) 0.03 A (D) 0.02 A

12. The value of the current measured by the ammeter in Fig. P1.3.12 is

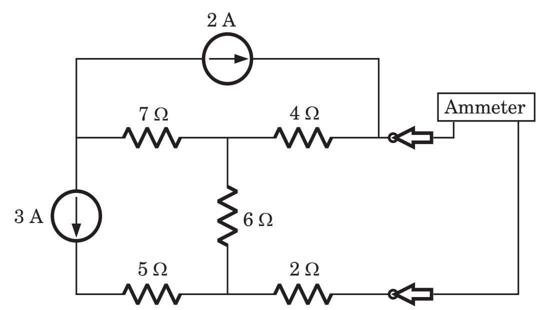

Fig. P1.3.12

(A) $\frac{2}{3}$ A (B) $\frac{5}{3}$ A

(C) $-\frac{5}{6}$ A (D) $\frac{2}{9}$ A

13. $i_1 = ?$

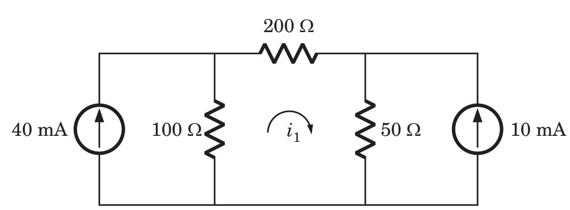

Fig. 1.3.13

(A) 10 mA (B) –10 mA

(C) 0.4 mA (D) –0.4 mA

14. The values of node voltage are $v_a = 12$ V, $v_b = 9.88$ V and $v_c = 5.29$ V. The power supplied by the voltage source is

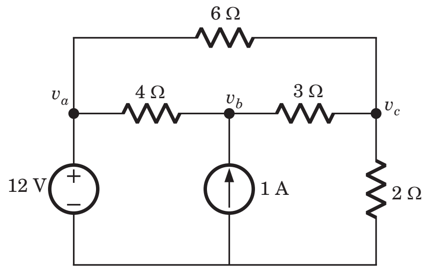

Fig. 1.3.14

(A) 19.8 W (B) 27.3 W

(C) 46.9 W (D) 54.6 W

15. $i_1, i_2, i_3 = ?$

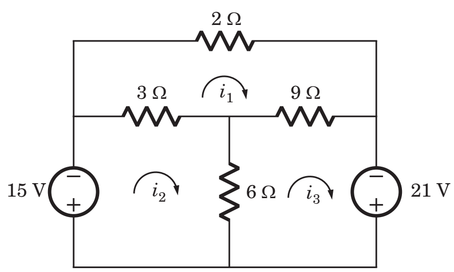

Fig. P1.3.15

(A) 3 A, 2 A, and 4 A (B) 3 A, 3 A, and 8 A

(C) 1 A, 3 A, and 4 A (D) 1 A, 2 A, and 8 A

16. $v_o = ?$

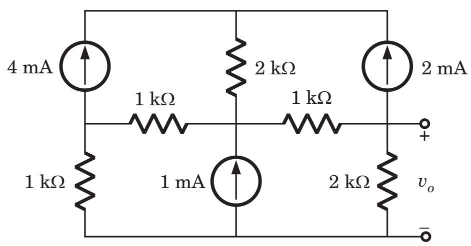

Fig. P1.3.16

(A) $\frac{6}{5}$ V (B) $\frac{8}{5}$ V

(C) $\frac{6}{7}$ V (D) $\frac{5}{7}$ V

17. The mesh current equation for the circuit in Fig. P1.3.17 are

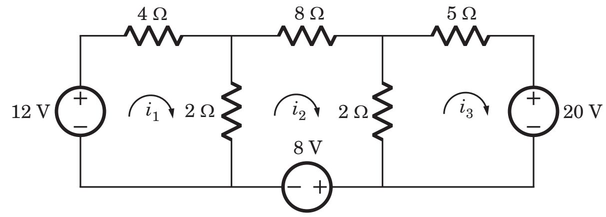

Fig. 1.3.17

(A) $\begin{bmatrix} 4 & -2 & 0 \\ -2 & 8 & -2 \\ 0 & -2 & 5 \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 12 \\ -8 \\ 20 \end{bmatrix}$

(B) $\begin{bmatrix} 6 & -2 & 0 \\ 2 & -12 & 2 \\ 0 & 2 & -7 \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 8 \\ 20 \end{bmatrix}$

(C) $\begin{bmatrix} 6 & -2 & 0 \\ -2 & 12 & -2 \\ 0 & -2 & 7 \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 8 \\ 20 \end{bmatrix}$

(D) $\begin{bmatrix} 4 & -2 & 0 \\ 2 & -8 & 2 \\ 0 & 2 & -5 \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 8 \\ 20 \end{bmatrix}$

18. For the circuit shown in Fig. P1.3.18 the mesh equation are

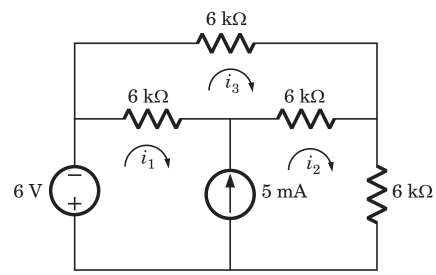

Fig. 1.3.18

(A) $\begin{bmatrix} 6k & -12k & -12k \\ -6k & 6k & -18k \\ -1k & -1k & 0k \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -6 \\ 0 \\ 5 \end{bmatrix}$

(B) $\begin{bmatrix} 6k & 12k & -12k \\ -6k & -6k & 18k \\ -1k & 1k & 0k \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -6 \\ 0 \\ 5 \end{bmatrix}$

(C) $\begin{bmatrix} -6k & -12k & 12k \\ 6k & -6k & 18k \\ 1k & 1k & 0k \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -6 \\ 0 \\ 5 \end{bmatrix}$

(D) $\begin{bmatrix} -6k & 12k & -12k \\ -6k & 6k & -18k \\ -1k & 1k & 0k \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -6 \\ 0 \\ 5 \end{bmatrix}$

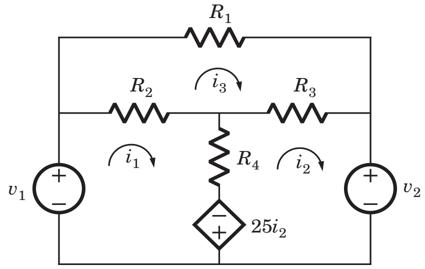

Fig. P1.3.25

The value of R_4 is

(A) 40 (B) 15

(C) 5 (D) 20

26. v_a = ?

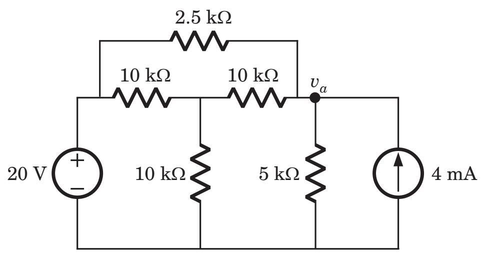

Fig. P1.3.26

(A) 26 V (B) 19 V

(C) 13 V (D) 18 V

27. v = ?

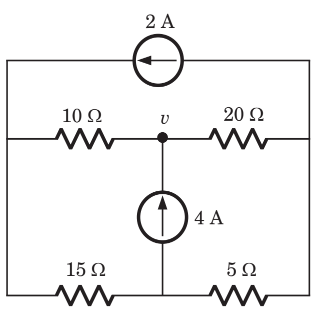

Fig. P.3.1.27

(A) 60 V (B) –60 V

(C) 30 V (D) –30 V

28. i_1 = ?

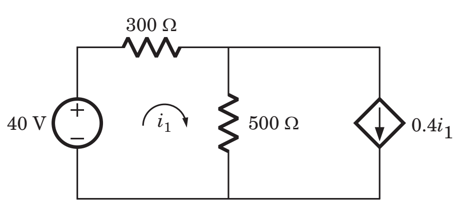

Fig. P1.3.28

(A) 66.67 mA (B) 46.24 mA

(C) 23.12 mA (D) 33.33 mA

29. v_a = ?

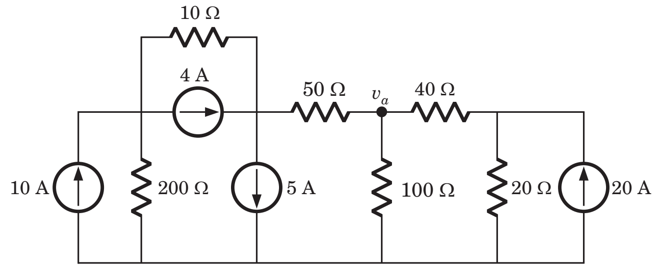

Fig. P1.3.29

(A) 342 V (B) 171 V

(C) 198 V (D) 396 V

30. i_a = ?

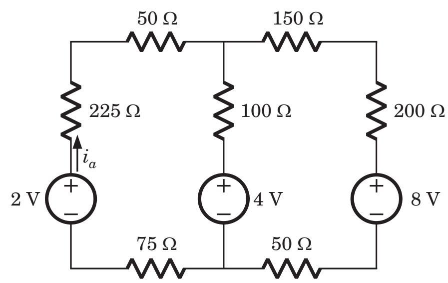

Fig. P1.3.30

(A) 14 mA (B) –6.5 mA

(C) 7 mA (D) –21 mA

31. v_2 = ?

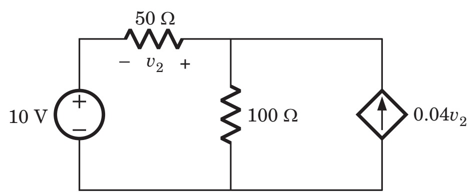

Fig. P1.3.31

(A) 5 V (B) 75 V

(C) 3 V (D) 10 V

32. i_1 = ?

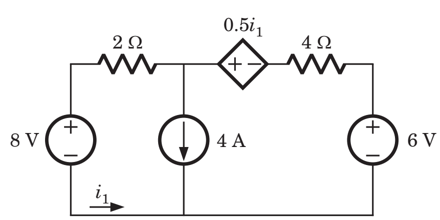

Fig. P1.3.32

(A) –1.636 A (B) –3.273 A

(C) –2.314 A (D) –4.628 A

33. $v_x = ?$

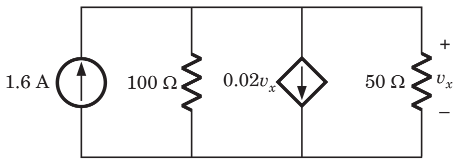

Fig. P1.3.33

(A) 32 V (B) –32 V

(C) 12 V (D) –12 V

34. $i_b = ?$

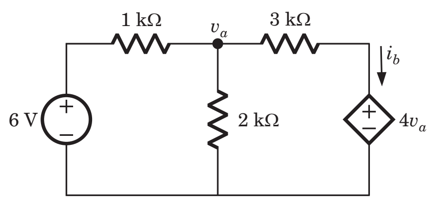

Fig. P1.3.34

(A) 4 mA (B) –4 mA

(C) 12 mA (D) –12 mA

35. $v_b = ?$

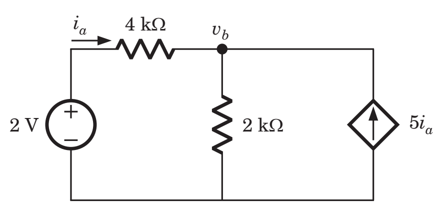

Fig. P1.3.35

(A) 1 V (B) 1.5 V

(C) 4 V (D) 6 V

36. $v_x = ?$

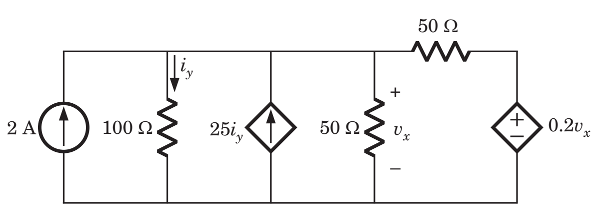

Fig. P1.3.36

(A) –3 V (B) 3 V

(C) 10 V (D) –10 V

37. $v_a = ?$

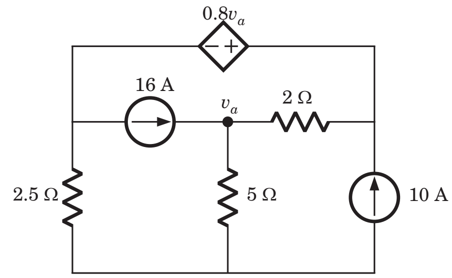

Fig. P1.3.37

(A) 25.91 V (B) –25.91 V

(C) 51.82 V (D) –51.82 V

38. For the circuit of Fig. P1.3.38 the value of v_s , that will result in $v_1 = 0$, is

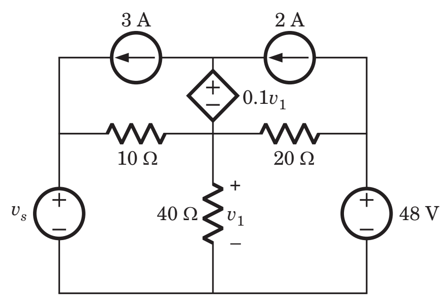

Fig. P1.3.38

(A) 28 V (B) –28 V

(C) 14 V (D) –14 V

39. i_1 , $i_2 = ?$

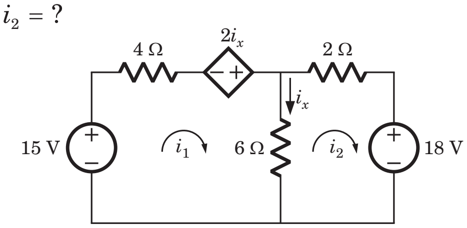

Fig. P1.3.39

(A) 2.6 A, 1.4 A (B) 2.6 A, –1.4 A

(C) 1.6 A, 1.35 A (D) 1.2 A, –1.35 A

40. $v_1 = ?$

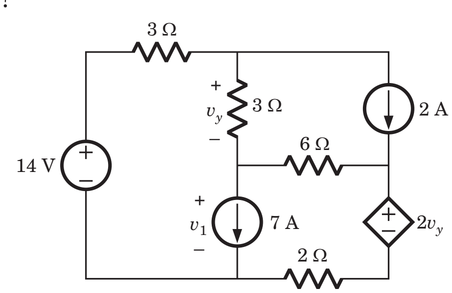

Fig. P1.3.40

(A) 10 V (B) –10 V

(C) 7 V (D) –7 V

41. $v_x = ?$

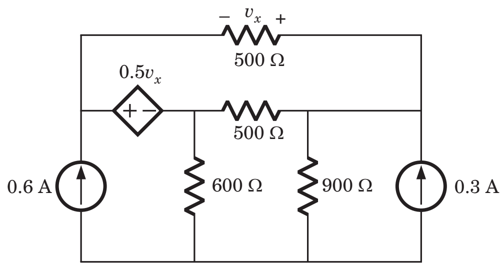

Fig. P1.3.41

(A) 9 V (B) –9 V

(C) 10 V (D) –10 V

42. The power being dissipated in the 2 Ω resistor in the circuit of Fig. P1.3.42 is

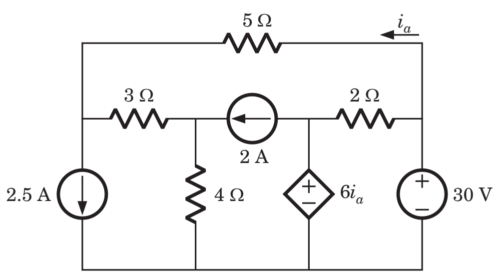

Fig. P1.3.42

(A) 76.4 W (B) 305.6 W

(C) 52.5 W (D) 210.0 W

43. $i_1 = ?$

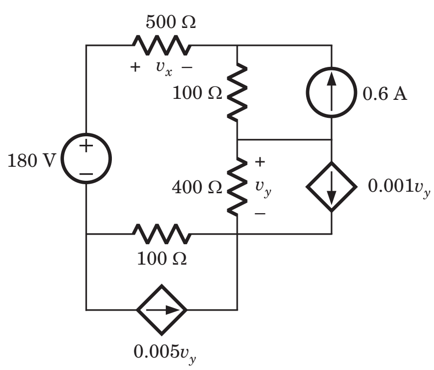

Fig. P1.3.43

(A) 0.12 A (B) 0.24 A

(C) 0.36 A (D) 0.48 A

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SOLUTIONS

1. (B) Applying the nodal analysis

$$v_1 = \frac{\frac{4v_s}{6R} + \frac{v_s}{3R}}{\frac{1}{6R} + \frac{1}{3R} + \frac{1}{6R}} = 1.5v_s$$

2. (C) $v_a = 2(3+1) + 3(1) = 11$ V

3. (D) $-\frac{v_1}{60} + \frac{-v_1}{60} + 6 = 9 \quad \Rightarrow \quad v_1 = -90$ V

4. (C) $\frac{v_a - 10}{4} + \frac{v_a}{2} = 4 \quad \Rightarrow \quad v_a = 8.67$ V

5. (D) $\frac{v_2}{20} + \frac{v_2 + 10}{30} = 0.5 \quad \Rightarrow \quad v_2 = 2$ V

6. (B) Using Thevenin equivalent and source transform

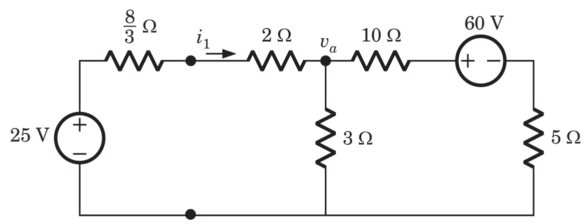

Fig. S.1.3.6

$$v_a = \frac{\frac{25}{\frac{8}{3}+2} + \frac{60}{15}}{\frac{3}{14} + \frac{1}{3} + \frac{1}{15}} = 15.23 \text{ V}$$

$$i_1 = \frac{25 - 15.23}{\frac{14}{3}} = 2.09 \text{ A}$$

7. (A) $i_b = \frac{10}{64 + 36} + 0.5 = 0.6$ A

8. (B) $75 = 90\text{k}i_1 + 10\text{k}(i_1 - 7.5\text{m})$

$150 = 100\text{k}i_1 \quad \Rightarrow \quad i_1 = 1.5$ mA

9. (B) $3 = 2i_1 + 3(i_1 - 4) \quad \Rightarrow \quad i_1 = 3$ A

10. (B) $45 = 2\text{k}i_1 + 500\,(i_1 + 15\text{m})$

$\Rightarrow \quad i_1 = 15$ mA

11. (D)

$6.6 = 50i_1 + 100(i_1 + 0.1) + 40(i_1 - 0.06) + 60(i_1 - 0.1)$

$i_1 = 0.02$ A

38. (D) If $v_1 = 0$, the dependent source is a short circuit

$$\frac{v_1}{40} + \frac{v_1 - v_s}{10} + \frac{v_1 - 48}{20} = 2 - 3 \quad \Rightarrow \quad v_1 = 0$$

$$-\frac{v_s}{10} - \frac{48}{20} = -1 \quad \Rightarrow \quad v_s = -14 \text{ V}$$

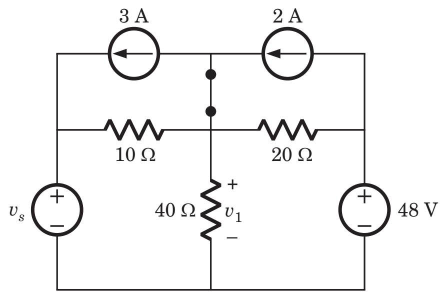

Fig. S1.3.38

39. (D) $i_x = i_1 - i_2$

$15 = 4i_1 - 2(i_1 - i_2) + 6(i_1 - i_2)$

$\Rightarrow \quad 8i_1 - 4i_2 = 15$ ...(i)

$-18 = 2i_2 + 6(i_2 - i_1)$

$\Rightarrow \quad 3i_1 - 4i_2 = 9$ ...(ii)

$i_1 = 1.2$ A, $i_2 = -1.35$ A

40. (B) $14 = 3i_1 + v_y + 6(i_1 - 2 - 7) + 2v_y + 2(i_1 - 7)$

$v_y = 3(i_1 - 2)$

$14 = 3i_1 + 9(i_1 - 2) + 6(i_1 - 9) + 2(i_1 - 7)$

$14 = 20i_1 - 18 - 54 - 14 \quad \Rightarrow \quad i_1 = 5$ A

$v_1 = 6(5 - 2 - 7) + 2 \times 3(5 - 2) + 2(5 - 7) = -10$ V

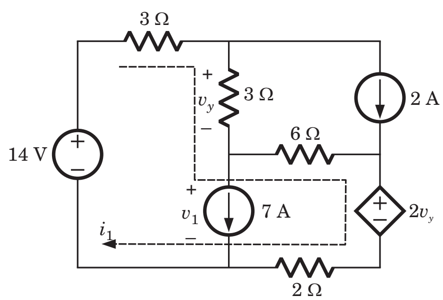

Fig. S1.3.40

41. (D) Let i_1 and i_2 be two loop current

$0.5v_x = 500i_1 + 500(i_1 - i_2)$,

$v_x = -500i_1$

$\Rightarrow \quad 5i_1 - 2i_2 = 0$ ...(i)

$500(i_2 - i_1) + 900(i_2 + 0.3) + 600(i_2 - 0.6) = 0$

$-5i_1 + 20i_2 = 0.9$ ...(ii)

$i_1 = 20$ mA, $v_x = -500 \times 20\text{m} = -10$ V

42. (C) $30 = 5i_a + 3(i_a - 2.5) + 4(i_a - 2.5 + 2)$

$$i_a = \frac{30 + 7.5 + 2}{12} = 3.29 \text{ A} \quad \Rightarrow \quad 6i_a = 19.75 \text{ V}$$

voltage across 2 Ω resistor

$30 - 19.75 = 10.25$ V,

$$P = \frac{(10.25)^2}{2} = 52.53 \text{ W}$$

43. (A) $v_x = 500i_1$

$v_y = 400(i_1 - 0.001v_x) = 400(i_1 - 0.5i_1) = 200i_1$

$180 = 500i_1 + 100(i_1 - 0.6) + 200i_1 + 100(i_1 + 0.005v_y)$

$180 = 900i_1 - 60 + 100 \times 0.005 \times 200i_1$

$i_1 = 0.12$ A

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