3

3.31

✓ Answer

$$\begin{bmatrix} 7 & -3 & -2 \\ -3 & 9 & -6 \\ -2 & -6 & 12 \end{bmatrix} \begin{bmatrix} I_1 \\ -4 \\ I_3 \end{bmatrix} = \begin{bmatrix} -48 \\ V_2 \\ 48 \end{bmatrix}$$

$$I = \begin{bmatrix} -42/5 \\ -4 \\ 3/5 \end{bmatrix}$$

With I_1 as the left loop, I_2 as the top loop, and I_3 as the right loop, all clockwise.

$P = V(I_3 - I_1)$

$= -432\ W$

3.41

✓ Answer

$$\begin{bmatrix} 7 & -2 & -4 \\ -2 & 8 & -6 \\ -4 & -6 & 15 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ 2 \end{bmatrix} = \begin{bmatrix} 0 \\ -6 \\ V_3 \end{bmatrix}$$

$$I = \begin{bmatrix} 19/13 \\ 29/26 \\ 2 \end{bmatrix}$$

With I_1 as the outer loop, I_2 as the top loop, and I_3 as the right loop, all clockwise.

$V = IR = I_1 = 19/13\ V$

3.47

✓ Answer

$$\begin{bmatrix} 6 & 2 & 0 & 0 \\ 2 & 11 & -9 & -3 \\ 0 & -9 & 16 & 8 \\ 0 & -3 & 8 & 8 \end{bmatrix} \begin{bmatrix} I_x \\ 3I_x \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} v_x \\ v_x \\ 0 \\ -2 \end{bmatrix}$$

$$I = \begin{bmatrix} 6/49 \\ 18/49 \\ 103/196 \\ -125/196 \end{bmatrix}$$

With I_1 as the outer loop, I_2 as the left loop, and I_3 as the inner diamond loop, I_4 as the top of the inner diamond loop, all clockwise.

$I_3 = 103/196\ V$

3.63

a

✓ **Answer**

$$\begin{bmatrix} 12 & -12 & 0 \\ -12 & 12 & 0 \\ 0 & 0 & 30 \end{bmatrix} \begin{bmatrix} 1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} v_1 \\ 0 \\ 0 \end{bmatrix}$$

$$I = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

With clockwise loops, from left to right.

$V_x' = 0$

b

✓ **Answer**

$$\begin{bmatrix} 12 & 0 \\ 0 & 30 \end{bmatrix} \begin{bmatrix} I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} -10 \\ 10 \end{bmatrix}$$

$$I = \begin{bmatrix} -5/6 \\ 1/3 \end{bmatrix}$$

With clockwise loops, from left to right.

$V_x'' = 5\ V$

c

✓ **Answer**

$$\begin{bmatrix} 12 & 0 & 0 \\ 0 & 30 & -10 \\ 0 & -10 & 31 \end{bmatrix} \begin{bmatrix} I_2 \\ I_3 \\ -3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ v_2 \end{bmatrix}$$

$$I = \begin{bmatrix} 0 \\ -1 \\ -3 \end{bmatrix}$$

With clockwise loops, from left to right.

$V_x''' = -15\ V$

d

✓ **Answer**

$V_x = -10\ V$

3.68

✓ **Answer**

$$\begin{bmatrix} 8 & -2 & -2 \\ -2 & 8 & -2 \\ -2 & -2 & 8 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 6 \\ -8 \\ -12 \end{bmatrix}$$

$$I = \begin{bmatrix} -1/10 \\ -3/2 \\ -19/10 \end{bmatrix}$$

With I_1 as the left loop, I_2 as the top loop, and I_3 as the right loop, all clockwise.

$V_{Th} = 4I_3 = -\frac{38}{5}\ V$

$$\begin{bmatrix} 8 & -2 & -2 & 0 \\ -2 & 8 & -2 & 0 \\ -2 & -2 & 8 & -4 \\ 0 & 0 & -4 & 4 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} 6 \\ -8 \\ -12 \\ 0 \end{bmatrix}$$

$$I = \begin{bmatrix} -21/20 \\ -49/20 \\ -19/4 \\ -19/4 \end{bmatrix}$$

$R_{Th} = \frac{V_{Th}}{I_4} = \frac{8}{5}\ \Omega$

$V_{Th} = -\frac{38}{5}\ V$

$R_{Th} = \frac{8}{5}\ \Omega$