5)

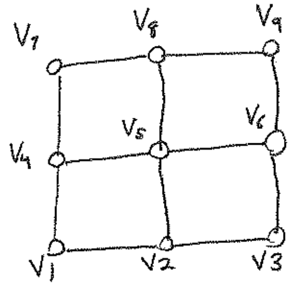
a) $$\left.\begin{aligned} V_1 &= 1 \\ V_5 &= 0 \end{aligned}\right\} \text{ imposed}$$

$$\frac{(V_{i-1} - V_i)}{R} + \frac{(V_{i+1} - V_i)}{R} = 0 \quad \text{for } i = 2, 3, 4 \quad (\text{no net current})$$

$$V_{i-1} - 2V_i + V_{i+1} = 0$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & -2 & 1 & 0 & 0 \\ 0 & 1 & -2 & 1 & 0 \\ 0 & 0 & 1 & -2 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

6) a)



$$\left.\begin{array}{l} V_1 = 1 \\ V_9 = 0 \end{array}\right\}\ \text{imposed}$$

For $i = 2 \cdots 8$

$$\left.\sum_{j \text{ a neighbor of } i} \frac{(V_j - V_i)}{R} = 0 \right\}\ \text{net current into any node is } 0$$

$$\begin{array}{ll}
i = 2: & (V_1 - V_2) + (V_5 - V_2) + (V_3 - V_2) = 0 \\
i = 3 & (V_2 - V_3) + (V_6 - V_3) = 0 \\
i = 4 & (V_1 - V_4) + (V_5 - V_4) + (V_7 - V_4) = 0 \\
i = 5 & (V_2 - V_5) + (V_4 - V_5) + (V_6 - V_5) + (V_8 - V_5) = 0 \\
i = 6 & (V_5 - V_6) + (V_9 - V_6) = 0 \\
i = 7 & (V_4 - V_7) + (V_8 - V_7) = 0 \\
i = 8 & (V_5 - V_8) + (V_7 - V_8) + (V_9 - V_8) = 0
\end{array}$$

In matrix form:

$$\begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & -3 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & -2 & 0 & 0 & 1 & 0 & 0 & 0 \\
1 & 0 & 0 & -3 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & -4 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & -3 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & -2 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & -3 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
\begin{pmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \\ V_7 \\ V_8 \\ V_9 \end{pmatrix}
=
\begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$