Problem 3.42  Use the by-inspection method to establish a node-voltage matrix equation for the circuit in Fig. P3.42. Solve the matrix equation by MATLAB® or MathScript software to find $V_1$ to $V_4$.

![Circuit for Problem 3.42.](image)

**Solution:**

\[
G_{11} = \frac{1}{2+1} + \frac{1}{3+4} = 0.476
\]

\[
G_{12} = G_{21} = -\frac{1}{2+1} = -0.333
\]

\[
G_{13} = G_{31} = 0
\]

\[
G_{14} = G_{41} = -\frac{1}{3+4} = -0.143
\]

\[
G_{22} = \frac{1}{1+2} + \frac{1}{7} + \frac{1}{6} = 0.643
\]

\[
G_{23} = G_{32} = -\frac{1}{6} = -0.167
\]

\[
G_{24} = G_{42} = 0
\]

\[
G_{33} = \frac{1}{5} + \frac{1}{6} + \frac{1}{9} = 0.478
\]

\[
G_{34} = G_{43} = -\frac{1}{5} = -0.2
\]

\[
G_{44} = \frac{1}{3+4} + \frac{1}{5} = 0.343
\]

Application of Eq. (3.26) gives:

\[
\begin{bmatrix}
0.476 & -0.333 & 0 & -0.143 \\
-0.333 & 0.643 & -0.167 & 0 \\
0 & -0.167 & 0.478 & -0.2 \\
-0.143 & 0 & -0.2 & 0.343
\end{bmatrix}
\begin{bmatrix}
V_1 \\
V_2 \\
V_3 \\
V_4
\end{bmatrix}
= 
\begin{bmatrix}
2 \\
0 \\
-2 \\
-3
\end{bmatrix}
\]

Matrix inversion gives:

\[
V_1 = -8.1689 \text{ V}, \quad V_2 = -8.4235 \text{ V}, \quad V_3 = -16.155 \text{ V}, \quad V_4 = -21.5748 \text{ V}.
\]