Section 3-2: Mesh-Current Method

Problem 3.21  Apply mesh analysis to find the mesh currents in the circuit of Fig. P3.21. Use the information to determine the voltage $V$.

![Figure P3.21: Circuit for Problem 3.21.](image)

Solution: Application of KVL to the two loops gives:

- Mesh 1: $-16 + 2I_1 + 3(I_1 - I_2) = 0$,
- Mesh 2: $3(I_2 - I_1) + (2 + 4)I_2 + 12 = 0$,

which can be simplified to

$$
5I_1 - 3I_2 = 16 \quad (1) \\
-3I_1 + 9I_2 = -12 \quad (2)
$$

Simultaneous solution of (1) and (2) leads to

$I_1 = 3 \text{ A}, \quad I_2 = -\frac{1}{3} \text{ A}.$

Hence,

$$
V = 3(I_1 - I_2) = 3 \left( 3 + \frac{1}{3} \right) = 10 \text{ V}.
$$