

Chapter 10, Solution 39.

For mesh 1,

$$(28 - j15)I_1 - 8I_2 + j15I_3 = 12\angle 64^\circ \quad (1)$$

For mesh 2,

$$-8I_1 + (8 - j9)I_2 - j16I_3 = 0 \quad (2)$$

For mesh 3,

$$j15I_1 - j16I_2 + (10 + j)I_3 = 0 \quad (3)$$

In matrix form, (1) to (3) can be cast as

$$\begin{pmatrix} (28 - j15) & -8 & j15 \\ -8 & (8 - j9) & -j16 \\ j15 & -j16 & (10 + j) \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \\ I_3 \end{pmatrix} = \begin{pmatrix} 12\angle 64^\circ \\ 0 \\ 0 \end{pmatrix} \quad \text{or} \quad \mathbf{AI} = \mathbf{B}$$

Using MATLAB,

$$\mathbf{I} = \text{inv}(\mathbf{A}) * \mathbf{B}$$

$$I_1 = -0.128 + j0.3593 = \mathbf{381.4\angle 109.6^\circ \text{ mA}}$$

$$I_2 = -0.1946 + j0.2841 = \mathbf{344.3\angle 124.4^\circ \text{ mA}}$$

$$I_3 = 0.0718 - j0.1265 = \mathbf{145.5\angle -60.42^\circ \text{ mA}}$$

$$I_x = I_1 - I_2 = 0.0666 + j0.0752 = \mathbf{100.5\angle 48.5^\circ \text{ mA}}$$

$$\mathbf{381.4\angle 109.6^\circ \text{ mA}, 344.3\angle 124.4^\circ \text{ mA}, 145.5\angle -60.42^\circ \text{ mA}, 100.5\angle 48.5^\circ \text{ mA}}$$