PS #29 Solutions

Chapter 12, Solution 22.

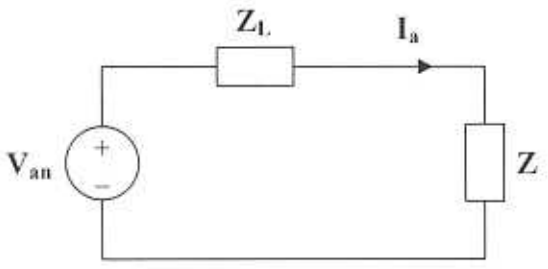
Convert the Δ-connected source to a Y-connected source.

$$\mathbf{V}_{an} = \frac{V_p}{\sqrt{3}}\angle -30° = \frac{208}{\sqrt{3}}\angle -30° = 120\angle -30°$$

Convert the Δ-connected load to a Y-connected load.

$$\mathbf{Z} = \mathbf{Z}_Y \parallel \frac{\mathbf{Z}_\Delta}{3} = (4+j6) \parallel (4-j5) = \frac{(4+j6)(4-j5)}{8+j}$$

$$\mathbf{Z} = 5.723 - j0.2153$$



$$\mathbf{I}_a = \frac{\mathbf{V}_{an}}{\mathbf{Z}_L + \mathbf{Z}} = \frac{120\angle -30°}{7.723 - j0.2153} = \underline{\mathbf{15.53\angle -28.4°\ A}}$$

$$\mathbf{I}_b = \mathbf{I}_a\angle -120° = \underline{\mathbf{15.53\angle -148.4°\ A}}$$

$$\mathbf{I}_c = \mathbf{I}_a\angle 120° = \underline{\mathbf{15.53\angle 91.6°\ A}}$$

Chapter 12, Solution 27.

Since Z_L and Z_ℓ are in series, we can lump them together so that

$$Z_Y = 2 + j + 6 + j4 = 8 + j5$$

$$I_a = \frac{\frac{V_p}{\sqrt{3}} < -30°}{Z_Y} = \frac{208 < -30°}{\sqrt{3}(8+j5)}$$

$$V_{L_N} = (6+j4)I_a = \frac{208(0.866 - j0.5)(6+j4)}{\sqrt{3}(8+j5)} = 80.81 - j43.54$$

$$|V_{L_N}| = \underline{\mathbf{91.79\ V}}$$

$V_L = \sqrt{3}\, V_{LN} = 158.98\,V$