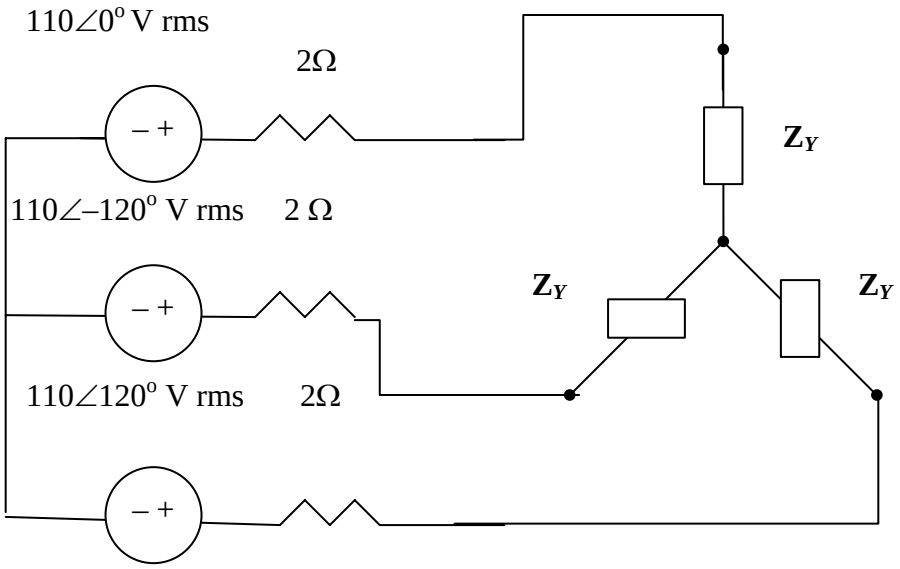
PROBLEM SET #28

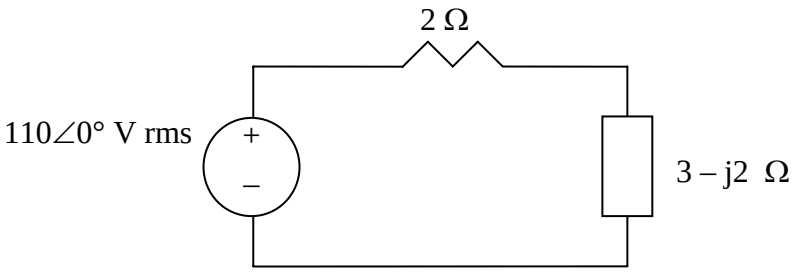
Chapter 12, Solution 13.

Convert the delta load to wye as shown below.



$$Z_Y = \frac{1}{3} Z_\Delta = 3 - j2\ \Omega$$

We consider the single phase equivalent shown below.



$$I_a = \frac{110}{2 + 3 - j2} = 20.4265 < 21.8^o$$

$$I_L = | I_a | = \underline{20.43\ \text{A}}$$

$$S = 3|I_a|^2 Z_Y = 3(20.43)^2(3–j2) = 4514\angle–33.96° = 3744 – j2522$$

$$P = \text{Re}(S) = \underline{\mathbf{3744\ W}}.$$

Chapter 12, Solution 19.

$$\mathbf{Z}_\Delta = 30 + j10 = 31.62\angle 18.43°$$

The phase currents are

$$\mathbf{I}_{AB} = \frac{\mathbf{V}_{ab}}{\mathbf{Z}_\Delta} = \frac{173\angle 0°}{31.62\angle 18.43°} = \underline{\mathbf{5.47\angle -18.43°\ A}}$$

$$\mathbf{I}_{BC} = \mathbf{I}_{AB}\angle -120° = \underline{\mathbf{5.47\angle -138.43°\ A}}$$

$$\mathbf{I}_{CA} = \mathbf{I}_{AB}\angle 120° = \underline{\mathbf{5.47\angle 101.57°\ A}}$$

The line currents are

$$\mathbf{I}_a = \mathbf{I}_{AB} - \mathbf{I}_{CA} = \mathbf{I}_{AB}\sqrt{3}\angle -30°$$

$$\mathbf{I}_a = 5.47\sqrt{3}\angle -48.43° = \underline{\mathbf{9.474\angle -48.43°\ A}}$$

$$\mathbf{I}_b = \mathbf{I}_a\angle -120° = \underline{\mathbf{9.474\angle -168.43°\ A}}$$

$$\mathbf{I}_c = \mathbf{I}_a\angle 120° = \underline{\mathbf{9.474\angle 71.57°\ A}}$$

Chapter 12, Solution 25.

Convert the delta-connected source to an equivalent wye-connected source and consider the single-phase equivalent.

$$\mathbf{I}_a = \frac{440\angle(10° - 30°)}{\sqrt{3}\,\mathbf{Z}_Y}$$

where $\mathbf{Z}_Y = 3 + j2 + 10 - j8 = 13 - j6 = 14.32\angle -24°.78°$

$$\mathbf{I}_a = \frac{440\angle -20°}{\sqrt{3}\,(14.32\angle -24.78°)} = \underline{\mathbf{17.74\angle 4.78°\ A}}$$

$$\mathbf{I}_b = \mathbf{I}_a\angle -120° = \underline{\mathbf{17.74\angle -115.22°\ A}}$$

$$\mathbf{I}_c = \mathbf{I}_a\angle 120° = \underline{\mathbf{17.74\angle 124.78°\ A}}$$