[5.1]

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

$$V_{an} = \frac{V_{ph}}{\sqrt{3}}\angle -30^\circ = \frac{440}{\sqrt{3}}\angle -30^\circ = 254\angle -30^\circ$$

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

$$Z = Z_Y \parallel \frac{Z_\Delta}{3} = (4+j6) \parallel (4-j5) = \frac{(4+j6)(4-j5)}{8+j}$$

$$Z = 5.723 - j0.2153$$

$$I_a = \frac{V_{an}}{Z_L + Z} = \frac{254\angle -30^\circ}{7.723 - j0.2153} = 32.88\angle -28.4^\circ \text{ A}$$

$$I_b = I_a\angle -120^\circ = 32.88\angle -148.4^\circ \text{ A}$$

$$I_c = I_a\angle 120^\circ = 32.88\angle 91.6^\circ \text{ A}$$

[5.2]

Transform the delta-connected load to its wye equivalent:

$$Z_Y = \frac{Z_\Delta}{3} = 7 + j8$$

Using the per-phase equivalent circuit above:

$$I_a = \frac{100\angle 0^\circ}{(1+j0.5)+(7+j8)} = 8.567\angle -46.75^\circ$$

For a wye-connected load:

$$I_p = I_a = 8.567$$

The apparent power is:

$$S = 3I_p^2 Z_p = 3(8.567)^2(7+j8)$$

The average power (real part of S) is:

$$P = \mathrm{Re}(S) = 3(8.567)^2(7) = 1.541\,\mathrm{kW}$$

[5.3]

$$Z_Y = 4 + 4j$$

$$Z = 5 + 6j$$

$$I_a = \frac{100\angle 0^\circ}{5+6j} = 12.80\angle -50.19^\circ \text{ A}$$

$$I_b = 12.80\angle -170.19^\circ \text{ A}$$

$$I_c = 12.80\angle 69.81^\circ \text{ A}$$