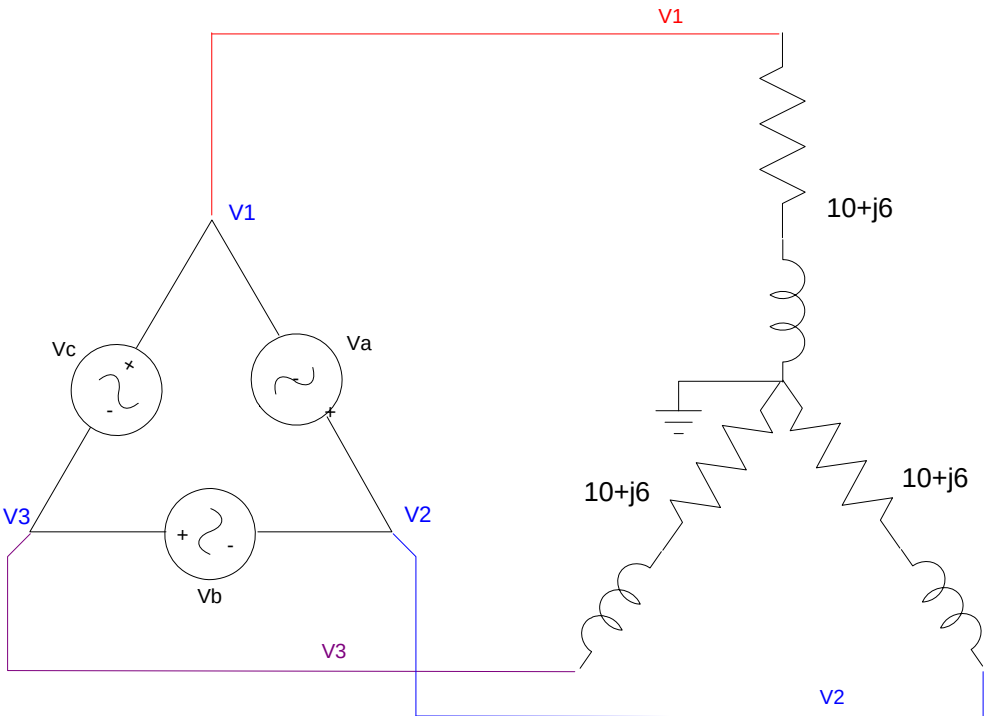
ECE 311 - Homework #6

Balanced 3-Phase Circuits

For each problem, let

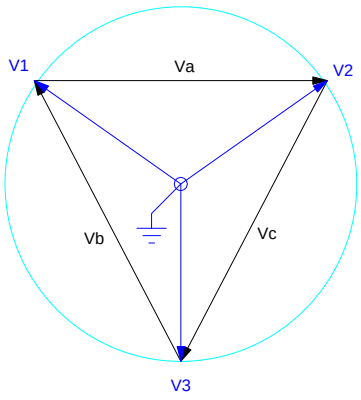
- $V_a = 120\angle 0^0$
- $V_b = 120\angle -120^0$
- $V_c = 120\angle -240^0$

1) Find V1, V2, V3, and the power delivered to each resistor



Problem 1: Y-Delta Connection

Start with a Y-Delta conversion



$$V_1 = \frac{120}{\sqrt{3}}\angle 150^0 \qquad V_2 = \frac{120}{\sqrt{3}}\angle 30^0 \qquad V_3 = \frac{120}{\sqrt{3}}\angle -90^0$$

Power is the same for all three phases:

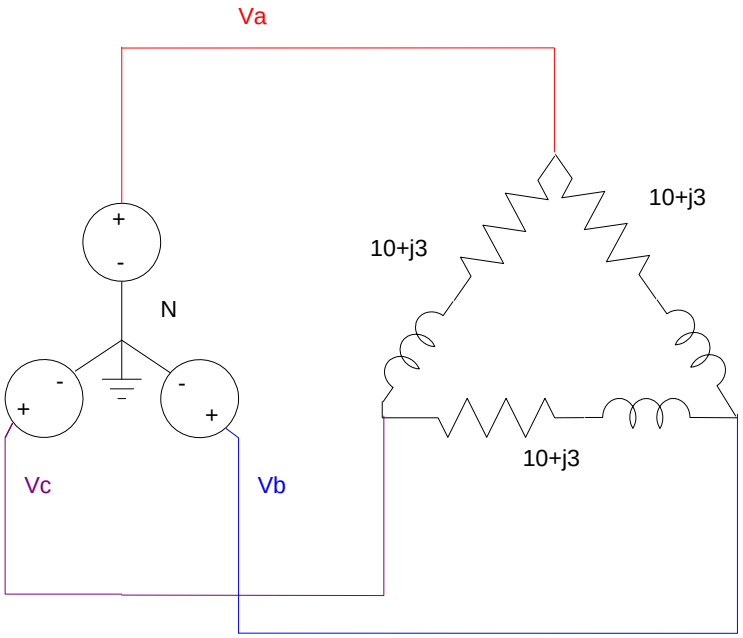
$$V = I \cdot Z$$

$$P = V \cdot I^* = \frac{|V|^2}{Z^*} = |I|^2 \cdot Z$$

$$P = \frac{\left(\frac{120}{\sqrt{3}}\right)^2}{10 - j3}$$

$$\boxed{P = 440 + j132}$$

2) Find the power delivered to each resistor



Y-Delta Connection

$$V_{ab} = V_a - V_b = (120\angle 0^0) - (120\angle -120^0) = 120\sqrt{3}\angle 30^0$$

$$P = \frac{|V|^2}{Z^*} = \frac{\left(120\sqrt{3}\right)^2}{10 - j3}$$

$$\boxed{P = 3963 + j1189}$$