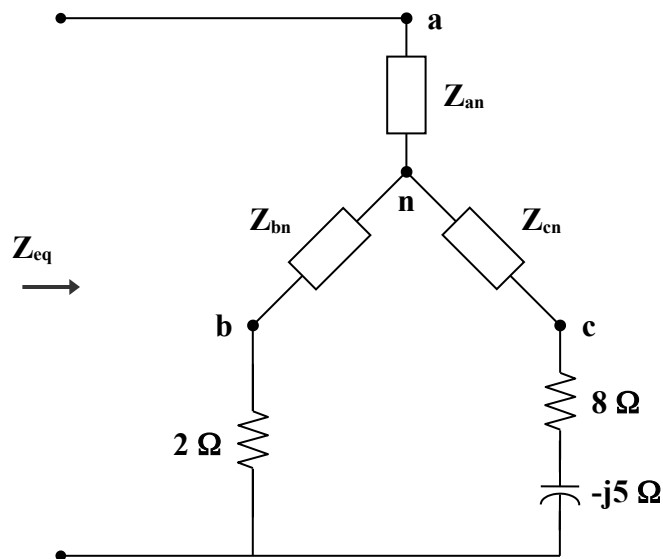


### Chapter 9, Solution 70.

Make a delta-to-wye transformation as shown in the figure below.



$$Z_{an} = \frac{(-j10)(10 + j15)}{5 - j10 + 10 + j15} = \frac{(10)(15 - j10)}{15 + j5} = 7 - j9$$

$$Z_{bn} = \frac{(5)(10 + j15)}{15 + j5} = 4.5 + j3.5$$

$$Z_{cn} = \frac{(5)(-j10)}{15 + j5} = -1 - j3$$

$$Z_{eq} = Z_{an} + (Z_{bn} + 2) \parallel (Z_{cn} + 8 - j5)$$

$$Z_{eq} = 7 - j9 + (6.5 + j3.5) \parallel (7 - j8)$$

$$Z_{eq} = 7 - j9 + \frac{(6.5 + j3.5)(7 - j8)}{13.5 - j4.5}$$

$$Z_{eq} = 7 - j9 + 5.511 - j0.2$$

$$Z_{eq} = 12.51 - j9.2 = \mathbf{15.53 \angle -36.33^\circ \Omega}$$