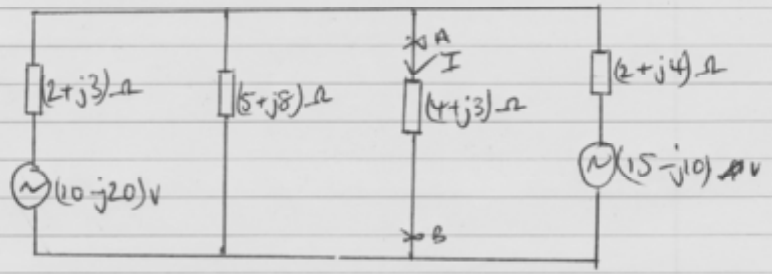
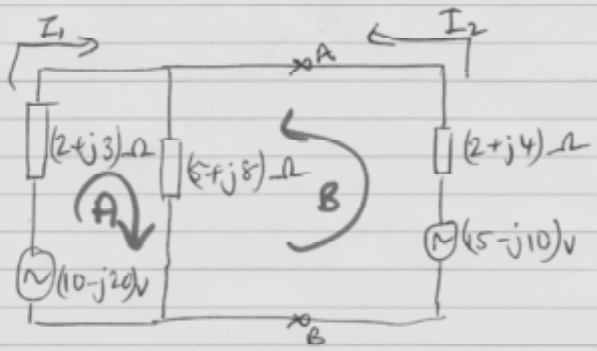
Electrical principles

2.



Removing AB and calculating V_{AB}



A. $(10-j20) - I_1(2+j3) - (5+j8)(I_1+I_2)$

$\therefore \quad (10-j20) = (7+j11)I_1 + (5+j8)I_2 \ldots ①$

B. $(15-j10) - (2+j4)I_2 - (5+j8)(I_1+I_2) = 0$

$(15-j10) = (7+j12)I_2 + (5+j8)I_1 \quad \ldots ②$

Print to PDF without this message by purchasing novaPDF (http://www.novapdf.com/)

$$\frac{(10-j20)}{(7-j11)} = I_1 + \frac{(5+j8)}{(7+j11)} I_2 \quad \ldots ①$$

$$\frac{(15-j10)}{(5+j8)} = \frac{(7+j12)}{(5+j8)} I_2 + I_1 \quad \ldots ②$$

① − ② $$\left[\frac{(10-j20)}{(7-j11)} - \frac{(15-j10)}{(5+j8)}\right] = \left[\frac{(5+j8)}{(7+j11)} - \frac{(7+j12)}{(5+j8)}\right] I_2$$

① − ② ∴ $$\left[\frac{22.4\angle 296.6^\circ}{13\angle 302.5^\circ} - \frac{18\angle 326.3^\circ}{9.4\angle 58^\circ}\right] = \left[\frac{9.4\angle 58^\circ}{13\angle 57.5} - \frac{13.9\angle 42.5}{9.4\angle 58}\right] I_2$$

$$\therefore \left[(1.72\angle -5.9^\circ) - (1.91\angle 268.3^\circ)\right] = \left[(0.723\angle 0.5^\circ) - (1.48\angle -15.5^\circ)\right] I_2$$

$$\therefore \left[(1.71 - j0.177) - (-0.057 - j1.91)\right] = \left[(0.72 + 0.005j) - (-1.43 - j0.41)\right] I_2$$

$$\therefore (1.227 + j0.12) = (2.153 + j0.406) I_2$$

$$\therefore I_2 = \frac{(1.227 - j0.12)}{(2.153 + j0.406)}$$

$$\therefore I_2 = \frac{1.23\angle -5.59^\circ}{2.190\angle 10.7^\circ} = 0.56\angle -16.29^\circ \text{ Amps}$$

Print to PDF without this message by purchasing novaPDF (http://www.novapdf.com/)

Calculate V_A

$(15-10j)-(2+j4)I_2 = V_A$

$\therefore (15-j10)-(2+j4)(0.56\angle -16.29)$

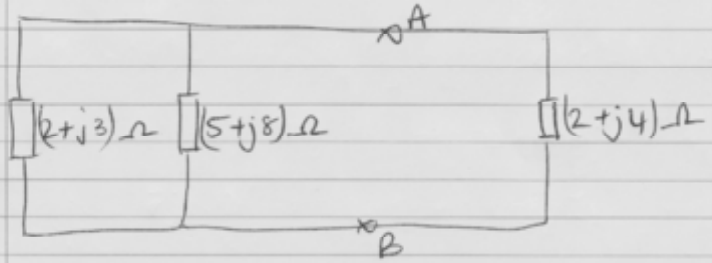
$\therefore (15-j10)-(4.5\angle 63.4)(0.56\angle -16.29)$

$\therefore (15-j10)-(2.03\angle 47.11)$

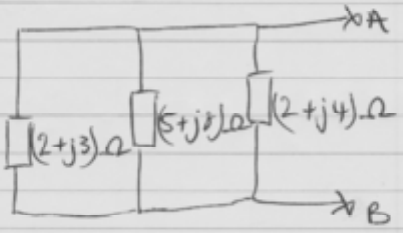
$\therefore (15-j10)-(1.38+j1.49)$

$\therefore (13.62-j8.51) = V_A$

Short circuit



Simplified



Print to PDF without this message by purchasing novaPDF (http://www.novapdf.com/)

All resistances are parrallel

$$\frac{1}{R_{AB}} = \frac{1}{2+j4} + \frac{1}{5+j5} + \frac{1}{2+3j}$$

$$\therefore \frac{1}{R_{AB}} = \frac{1\angle 0^\circ}{4.47\angle 63.4^\circ} + \frac{1\angle 0^\circ}{7.43\angle 58^\circ} + \frac{1\angle 0^\circ}{3.6\angle 56.3^\circ}$$

$$\therefore \frac{1}{R_{AB}} = (0.223\angle -63.4^\circ) + (0.106\angle -58^\circ) + (0.278\angle -56.3^\circ)$$

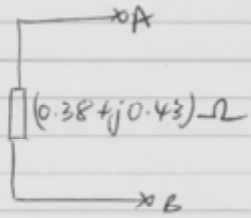
$$\therefore \frac{1}{R_{AB}} = (0.01 - j1.99) + (0.056 - j0.09) + (0.154 - j0.231)$$

$$\therefore \frac{1}{R_{AB}} = (0.22 - j2.311)$$

$$\therefore R_{AB} = \frac{1}{0.22 - j2.311} = \frac{1\angle 0^\circ}{2.32\angle 275.4^\circ}$$

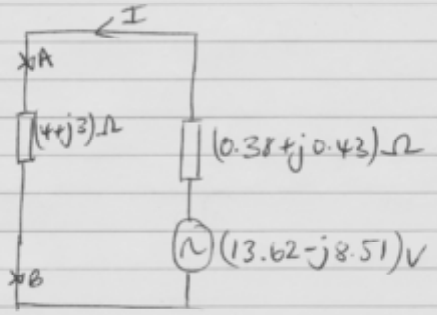
$$0.431\angle -275.4 = 0.0376 + j0.429$$

$$R_{AB} = (0.38 + j0.43)\,\Omega$$



Print to PDF without this message by purchasing novaPDF (http://www.novapdf.com/)

Equivalent thevenins circuit



Solving I for equiv circuit;

$$\text{Ex: } (13.62-j8.51) - (0.38+j0.43)I - (4+j3)I = 0$$

$$(13.62-j8.51) = (-3.62-j2.57)I$$

$$\frac{(13.62-j8.51)}{(3.62-j2.57)} = -I$$

$$\therefore \frac{16.1\angle -32^\circ}{4.44\angle 35.4^\circ} = -(3.63\angle 292.6^\circ) \text{ Amp}$$

$$\therefore -3.63\angle 67.4$$

$$(-1.39-j3.35)\ A$$

Print to PDF without this message by purchasing novaPDF (http://www.novapdf.com/)