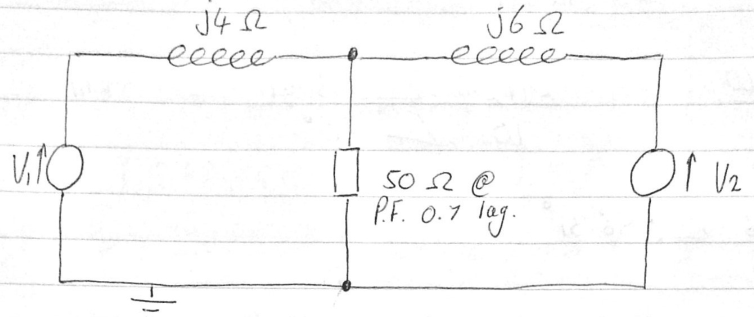
1a) FIND THE VALUE OF I BY MEANS OF THEVONINS THEORUM :



$V_1 = \sqrt{2} \times 415 \cos(100\pi t)$ V

$V_2 = \sqrt{2} \times 415 \sin(100\pi t)$ V

RMS VALUES = $V_1 = 415 \angle 90°$ OR $0 + 415$ V

$V_2 = 415 \angle 0°$ OR $415 + 0$ V

$R_L = 50(\cos^{-1} 0.7) = 50 \angle 45.57° \Omega$ OR $35 + j35.7 \Omega$

$R_{TH} = \dfrac{(j4 \times j6)}{(j4 + j6)} = \dfrac{24}{10} = j2.4\ \Omega$ OR $2.4 \angle 90° \Omega$

NODAL ANALYSIS TO FIND V_{TH} :

$I_{L1} = I_{L2}$

$$\frac{V_1 - V_{TH}}{j4} = \frac{V_{TH} - V_2}{j6}$$

$$\frac{0 + j415 - V_{TH}}{j4} = \frac{V_{TH} - 415 + j0}{j6}$$

$$(0 + j415 - V_{TH})(j4) = (V_{TH} - 415 + j0)(j6)$$

$j1660 - j4 V_{TH} = j6 V_{TH} - 2490$

$2490 + j1660 = j10 V_{TH}$

$$\frac{2490 + j1660}{j10} = \frac{2992.6 \angle 33.69^\circ}{10 \angle 90^\circ} = V_{TH}$$

$V_{TH} = 299.26 \angle -56.31^\circ$

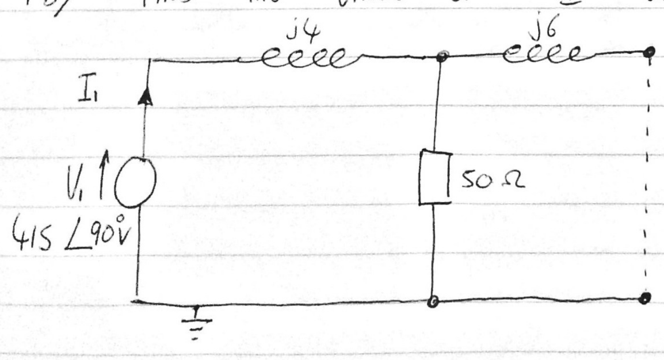
$$I = \frac{V_{TH}}{(R_{TH} + R_L)}$$

$$= \frac{299.26 \angle -56.31^\circ}{(0 + j2.4) + (35 + j35.7)} = \frac{299.26 \angle -56.31^\circ}{35 + j38.1^\circ}$$

$$= \frac{299.26 \angle -56.31^\circ}{51.73 \angle 47.42^\circ}$$

$I = 5.78 \angle -103.73^\circ \ A$

1b/ FIND THE VALUE OF I USING SUPERSITION THEOREM.



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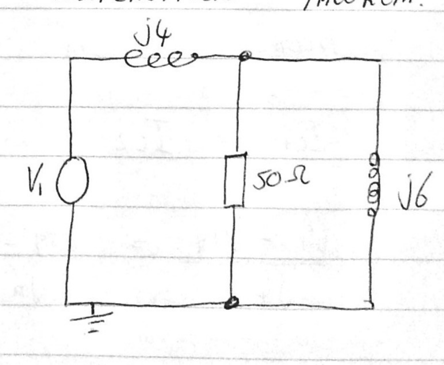


$$I_1 = \frac{V_{1TOTAL}}{R_{1TOTAL}}$$

$$R_1 = \frac{(50 \angle 45.57)(6 \angle 90)}{(35 + j35.7) + (0 + j6)} = \frac{300 \angle 135.57}{35. + j41.7}$$

$$= \frac{300 \angle 135.57}{54.44 \angle 49.9} = 5.51 \angle 85.58^\circ \Omega \text{ OR } 0.42 + j5.49$$

$$R_{1\,TOTAL} = (0.42 + j5.49) + (0 + j4) = 0.42 + j9.49 \text{ OR } 9.5 \angle 87.43^\circ \Omega$$

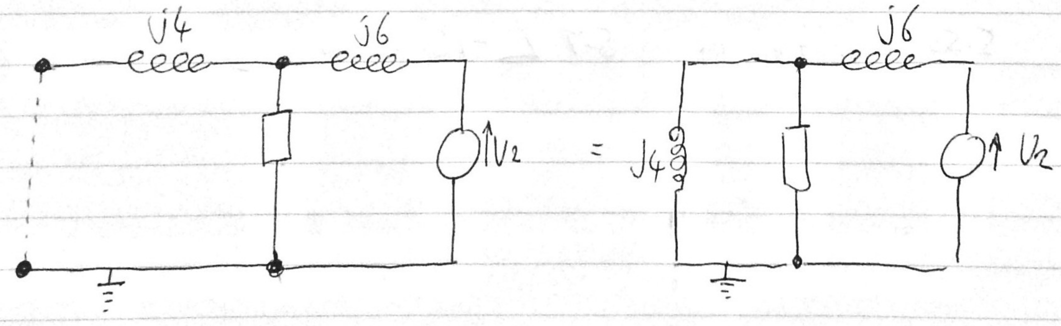
$$I_1 = \frac{415 \angle 90^\circ}{9.5 \angle 87.43^\circ} = 43.68 \angle 2.57^\circ A \text{ OR } 43.68 + j1.95 A$$

CURRENT DIVIDER RULE: $\frac{4 \angle 90^\circ}{(35 + 35.7) + (0 + j6)} \times I_1$

$$= \frac{4 \angle 90}{35 + j41.7} = \frac{4 \angle 90}{54.44 \angle 49.9} \times 43.68 \angle 2.57^\circ$$

$$= (0.07 \angle 40.1^\circ)(43.68 \angle 2.57^\circ)$$

$$I_{1\,TOTAL} = 3.05 \angle 42.58 \text{ OR } 2.24 + j2.06$$



$$R_2 = \frac{(50 \angle 45.57^\circ)(4 \angle 90^\circ)}{(35 + j35.7) + (0 + j4)} = \frac{200 \angle 135.57^\circ}{35 + j39.7}$$

$$= \frac{200 \angle 135.57^\circ}{52.92 \angle 48.6^\circ} = 3.77 \angle 86.97 \Omega \text{ OR } 0.19 + j3.7 \Omega$$

R_2 TOTAL $= (0.19 + j3.7) + (0 + j6) = 0.19 + j9.7$ OR $9.76 \angle 88.83° \Omega$

$$I_2 = \frac{415 \angle 0}{9.76} = 42.52 \angle -88.83 \text{ OR } 0.86 - j42.41 \text{ A}$$

CURRENT DIVIDER TO FIND I_2 TOTAL :

$$I_2 \text{ TOTAL} = \frac{6 \angle 90°}{(35. + j35.7) + (0 + j6)} \times I_2$$

$$= \frac{6 \angle 90°}{35. + j39.7} = \frac{6 \angle 90°}{52.92 \angle 48.6°} \times 42.52 \angle -88.83° \text{ A}$$

$$= (0.11 \angle 41.4°)(42.52 \angle -88.83°)$$

$$= 4.67 \angle -47.43° \text{ A} \text{ OR } 3.15 - j3.4 \text{ A}$$

$$I = I_1 \text{ TOTAL} + I_2 \text{ TOTAL}$$

$$= (3.15 - j3.4) + (2.24 + j2.06)$$

$$I = 5.55 - j1.34 \text{ A} \text{ OR } 5.7 \angle -13.57 \text{ A}$$