Circuit diagram showing: $12\angle 0°$ Vrms source, $4\,\Omega$, $\hat{I}_x$, $2\angle 0°$ Arms, $\hat{I}_3$, $j6\,\Omega$, $-j2\,\Omega$, $-\hat{V}_x+$, $2\,\Omega$, $-\hat{V}_y+$, $4\angle 0°$ Arms, $\hat{I}_1$, $\hat{I}_2$

Know

$$\hat{I}_2 = 4\angle 0° \text{ Arms}$$

$$\hat{I}_1 - \hat{I}_3 = 2\angle 0° \text{ Arms}$$

$$\hat{I}_x = \hat{I}_3$$

m1: $\quad \hat{V}_x - 2(\hat{I}_1 - \hat{I}_2) - (-j2)\hat{I}_1 = 0$

→ m2: $\quad$ don't need $\quad \boxed{\hat{V}_y - 2(\hat{I}_2 - \hat{I}_1) - j6(\hat{I}_2 - \hat{I}_3) = 0}$

$4\angle 0$

→ m3: $\quad 12\angle 0° - 4\hat{I}_3 - j6(\hat{I}_3 - \hat{I}_2) - \hat{V}_x = 0$

$$\hat{I}_1 - \hat{I}_3 = 2\angle 0°$$

$$\hat{I}_1(1+j0) + \hat{I}_3(-1+j0) = 2\angle 0°$$

$\boxed{\begin{array}{l} \hat{I}_1(-2+j2) + \hat{V}_x = 8\angle 180° \\ \hat{I}_3(-4-j6) - \hat{V}_x = 26.83\angle -116.56° \end{array}}$

m1:

$4\angle 0°$

$$\hat{I}_1(-2+j2) + \hat{I}_2(2) + \hat{V}_x = 0$$

$$\hat{I}_1(-2+j2) + \hat{V}_x = 8\angle 180$$

m3:

$$\hat{I}_3(-4-j6) - \hat{V}_x = 26.83\angle -116.56°$$

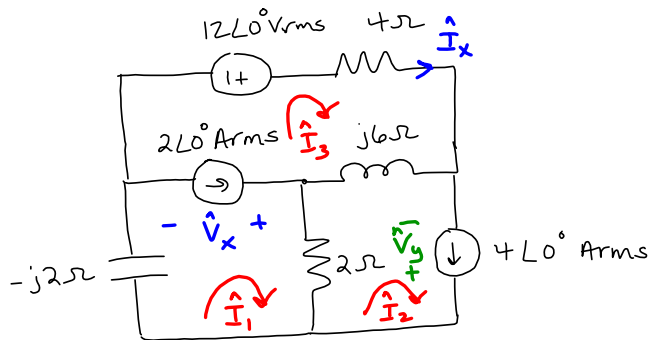$\boxed{\begin{array}{l} \hat{I}_1 = 6.32\angle 18.44° \text{ Arms} \\ \hat{I}_3 = 4.47\angle 26.57° \text{ Arms} \\ \hat{V}_x = 11.31\angle -45° \text{ Vrms} \end{array}}$

$\boxed{\hat{I}_x = 4.47\angle 26.57° \text{ Arms}}$

$\boxed{\hat{V}_y = 8.95\angle -26.53° \text{ Vrms}}$

$12\angle 0°\ Vrms \quad 4\Omega \quad \hat{I}_x$

$2\angle 0°\ Arms \quad \hat{I}_3 \quad j6\Omega$

$-j2\Omega \quad -\ \hat{V}_x\ + \quad 2\Omega \quad \hat{V}_y \quad 4\angle 0°\ Arms$

$\hat{I}_1 \qquad \hat{I}_2$

$P = V_{rms}\ I_{rms}\ \cos(\theta - \phi) \qquad \hat{S} = \hat{V}\cdot\hat{I}^*$

$Q = V_{rms}\ I_{rms}\ \sin(\theta - \phi)$

$\hat{I}_1 = 6.32\ \angle 18.44°\ Arms$

$\hat{I}_2 = 4\angle 0°\ Arms$

$\hat{I}_3 = 4.47\ \angle 26.57°\ Arms$

$\hat{V}_x = 11.31\ \angle -45°\ Vrms$

$\hat{I}_x = 4.47\ \angle 26.57°\ Arms$

$\hat{V}_y = 8.95\ \angle -26.53°\ Vrms$

$\hat{S} = (12\angle 0)(4.47\angle -26.57°)$
$\quad = 53.64\ \angle -26.57°\ VA$
$P = Re[\hat{S}] \qquad Q = Im[\hat{S}]$

$12\angle 0°\ Vrms$

$P = (12)(4.47)\cos(0 - 26.57°) = 47.97\ W,\ Del$

$Q = (12)(4.47)\sin(0 - 26.57°) = -23.99\ VAR,\ Del$

$2\angle 0°\ Arms$

$P = (11.31)(2)\cos(-45 - 0) = 16.00\ W,\ Del$

$Q = (11.31)(2)\sin(-45 - 0) = -16.00\ VAR,\ Del$

$4\angle 0°\ Arms$

$P = (8.95)(4)\cos(-26.53 - 0) = 32.03\ W,\ Del$

$Q = (8.95)(4)\sin(-26.53 - 0) = -16.00\ VAR,\ Del$

Impedances

$4\Omega: \quad Q = 0 \quad P = |\hat{I}_3|^2 \cdot 4 = 79.92\ W,\ Abs$
$\qquad\qquad\qquad = I_3^2 \cdot 4$

$2\Omega: \quad Q = 0 \quad P = |(\hat{I}_2 - \hat{I}_1)|^2 \cdot 2 = (2.82)^2(2)$
$\qquad\qquad\qquad = 15.96\ W,\ Abs$

$j6\Omega: \quad P = 0$
$\qquad Q = |\hat{I}_2 - \hat{I}_3|^2 \cdot 6$
$\qquad\quad = 23.99\ VAR,\ Abs$

$-j2\Omega: \quad P = 0$
$\qquad Q = -2(I_1^2)$
$\qquad\quad = -79.88\ VAR$

$\sum P_{del} = 96\ W$
$\sum P_{abs} = 95.88\ W$

$\sum Q_{del} = -55.98\ VAR$
$\sum Q_{abs} = -55.90\ VAR$

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