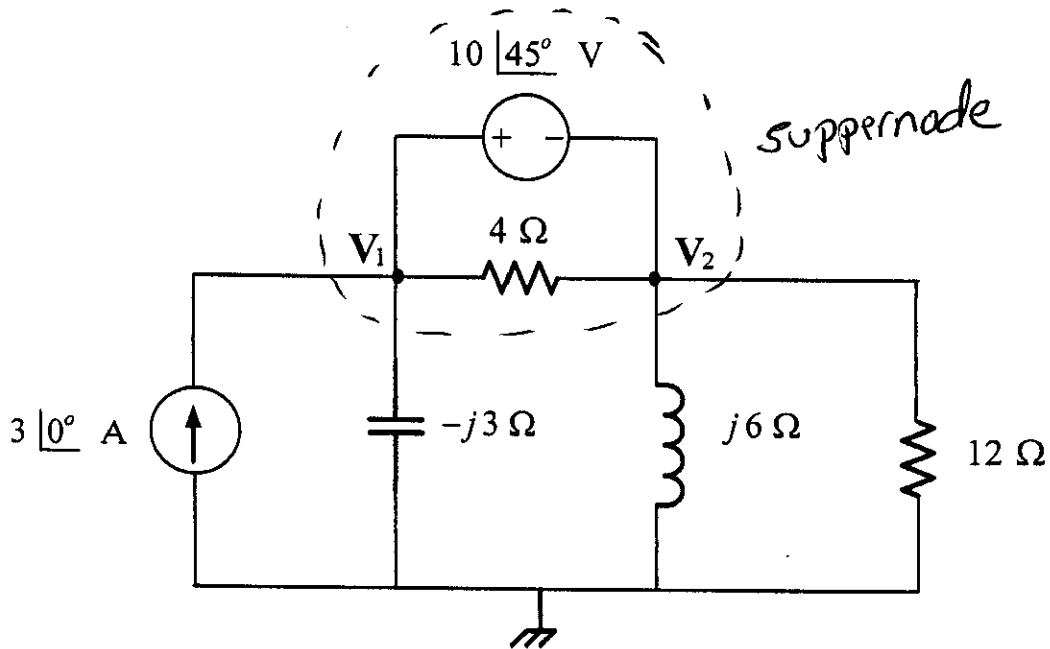


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Using Nodal analysis only :

(a) Find  $V_1$  ?

(b) If  $f=30$  HZ, find  $v_1(t)$  ?

Solution

(a) Node ① and ② form supernode,

$$\text{KCL} \quad -3\angle 0^\circ + \frac{\bar{V}_1}{-j3} + \frac{\bar{V}_2}{j6} + \frac{\bar{V}_2}{12} = 0$$

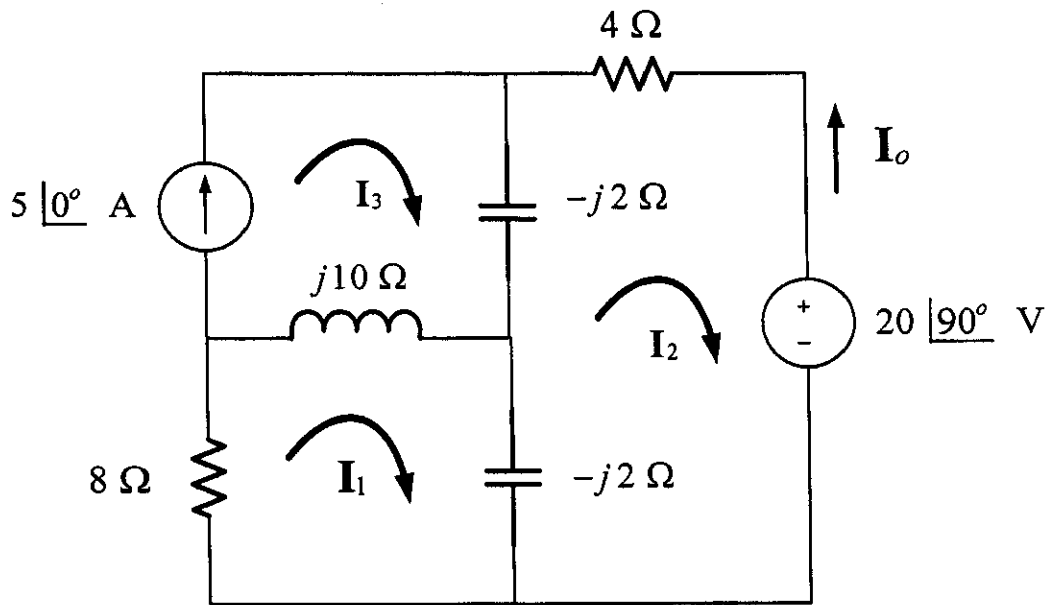
$$\Rightarrow j4\bar{V}_1 + (1-j2)\bar{V}_2 = 36 \quad \text{--- ①}$$

$$\bar{V}_1 - \bar{V}_2 = 10\angle 45^\circ \Rightarrow \bar{V}_2 = \bar{V}_1 - 10\angle 45^\circ \quad \text{--- ②}$$

$$\text{②} \Rightarrow \text{①} \quad \bar{V}_1 = 25.78 \angle -70.48^\circ \text{ V}$$

$$\text{(b)} \quad v_1(t) = 25.78 \cos(60\pi t - 70.48^\circ) \text{ V}$$

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Using Mesh analysis only :

$$(b) i_o(t) = 6.12 \cos(60\pi t + 144.7^\circ) \text{ A}$$

(a) Find  $I_o$  ?

(b) If  $f=30$  HZ, find  $i_o(t)$  ?

solution

$$(a) \bar{I}_3 = 5 \angle 0^\circ \text{ A}$$

KVL on mesh 1

$$8\bar{I}_1 + j10(\bar{I}_1 - \bar{I}_3) - j2(\bar{I}_1 - \bar{I}_2) = 0$$

$$\Rightarrow (8 + j8)\bar{I}_1 + j2\bar{I}_2 = j50 \quad \text{--- (1)}$$

KVL on mesh 2

$$4\bar{I}_2 + 20 \angle 90^\circ - j2(\bar{I}_2 - \bar{I}_1) - j2(\bar{I}_2 - \bar{I}_3) = 0$$

$$\Rightarrow j2\bar{I}_1 + (4 - j4)\bar{I}_2 = -j30 \quad \text{--- (2)}$$

$$\text{solving for } \bar{I}_2 \Rightarrow \bar{I}_2 = 6.12 \angle -35.22^\circ \text{ A}$$

$$\Rightarrow \bar{I}_o = -\bar{I}_2 = (1 \angle 180^\circ)(6.12 \angle -35.22^\circ) = 6.12 \angle 144.7^\circ \text{ A}$$