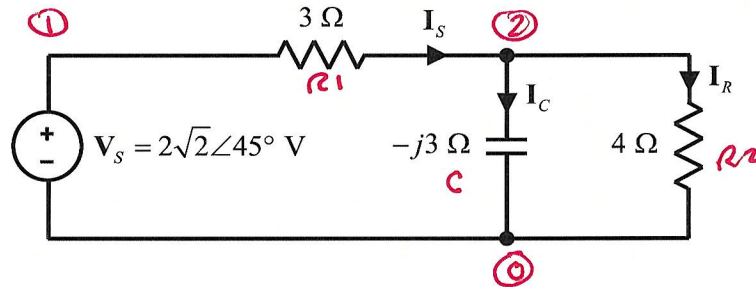


EE 3340  
**Homework Problem #044**

Assume  $\omega = 1 \text{ rad/sec}$

For the circuit shown:



$$-\frac{j}{\omega C} = -j3$$

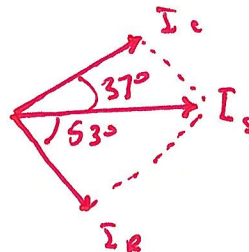
$$\Rightarrow C = \frac{1}{3} \text{ F}$$

(a) Apply current division to express  $I_C$  and  $I_R$  in terms of  $I_S$  (Not in terms of  $V_S$ ).

$$I_C = \frac{4}{4 - j3} I_S = \frac{4 \angle 0^\circ}{5 \angle -36.87^\circ} I_S = \frac{4 \angle 0^\circ}{5 \angle -36.87^\circ} I_S \approx .8 \angle 37^\circ I_S$$

$$I_R = \frac{-j3}{4 - j3} I_S = \frac{3 \angle -90^\circ}{5 \angle -37^\circ} I_S = .6 \angle -53^\circ I_S$$

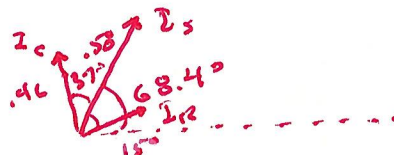
(b) Using  $I_S$  as reference, accurately sketch a **relative** phasor diagram showing  $I_C$ ,  $I_R$ , and  $I_S$  and verify that the vector sum  $I_R + I_C = I_S$  is satisfied.



(c) Now, fully analyze the circuit to determine  $I_S$  and then accurately sketch the **absolute** phasor diagram with  $I_C$ ,  $I_R$ , and  $I_S$  drawn according to their true phase angles.

$$I_S = \frac{2\sqrt{2} \angle 45^\circ}{3 + \frac{(-j3)(4)}{4 - j3}} = \frac{2\sqrt{2} \angle 45^\circ}{3 + \frac{12 \angle -90^\circ}{5 \angle -37^\circ}} = \frac{2\sqrt{2} \angle 45^\circ}{3 + 2.4 \angle -53^\circ}$$

$$= \frac{2\sqrt{2} \angle 45^\circ}{3 + 1.44 - j1.92} = \frac{2\sqrt{2} \angle 45^\circ}{4.84 \angle -23.4^\circ} = 0.58 \angle 68.4^\circ$$



Checking with LTSpice:  
 (see next page)

```

LTspice XVII - [Spring 2022 EE 3340 Homework Problem 044.cir]
File Edit View Simulate Tools Window Help
Spring 2022 EE 3340 Homework Problem 044.cir
* Q:\Websites\RES\EE 3340\homework problems\Spring 2022 EE 3340 Homework Problem 044.cir
Vs 1 0 AC {2*sqrt(2)} 45
R1 1 2 3
C 2 0 {1/3}
R2 2 0 4
.AC LIN 1 {1/(2*pi)} {1/(2*pi)}
.end
Ready

```

--- AC Analysis ---

| frequency: | 0.159155      | Hz               |                |  |
|------------|---------------|------------------|----------------|--|
| V(1):      | mag: 2.82843  | phase: 45°       | voltage        |  |
| V(2):      | mag: 1.40329  | phase: 15.2551°  | voltage        |  |
| I(C):      | mag: 0.467764 | phase: 105.255°  | device_current |  |
| I(R2):     | mag: 0.350823 | phase: 15.2551°  | device_current |  |
| I(R1):     | mag: 0.584705 | phase: 68.3852°  | device_current |  |
| I(Vs):     | mag: 0.584705 | phase: -111.615° | device_current |  |

$I_C$  →  
 $I_R$  →  
 $I_s$  →