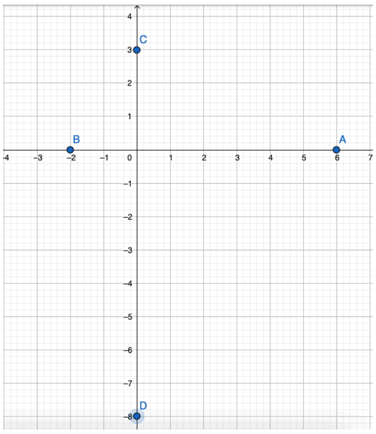
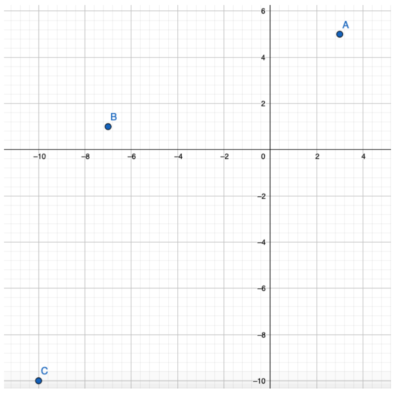
EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

2. Localice los siguientes números en el plano complejo:

(a) $+6$ **(b)** -2 **(c)** $+j3$ **(d)** $-j8$



***4.** Determine las coordenadas de cada punto que tenga igual magnitud pero esté localizado a 180° de cada uno de los puntos del problema 3.



Forma Polar:

$$a)\ 3, j5 = 5{,}83 < 59{,}03°$$
$$b)\ -7, j1 = 7{,}07 < 171{,}86°$$
$$c)\ -10, -10j = 14{,}14 < -135°$$

Aumentamos los 180° decimos que:

$$a)\ 5{,}83 < 59{,}03° + 180° = 5{,}83 < 239{,}03° = -3 - 5j$$
$$b)\ 7{,}07 < 171{,}86° + 180° = 7{,}07 < 351{,}86° = 7 - 1j$$
$$c)\ 14{,}14 < -135° + 180° = 14{,}14 < 45° = 10 + 10j$$

6. A continuación se describen puntos localizados en el plano complejo. Exprese cada punto como un número complejo en forma rectangular:

(a) 3 unidades a la derecha del origen sobre el eje real, y 5 unidades hacia arriba sobre el eje j.

(b) 2 unidades a la izquierda del origen sobre el eje real, y 1.5 unidades hacia arriba sobre el eje j.

(c) 10 unidades a la izquierda del origen sobre el eje real, y 14 unidades hacia abajo sobre el eje $-j$.

$$a)\ 3 + j5$$
$$b)\ -2 + j1.5$$
$$c)\ -10 - j14$$

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

8. Convierta cada uno de los siguientes números rectangulares a forma polar:
(a) $40 - j40$ **(b)** $50 - j200$ **(c)** $35 - j20$ **(d)** $98 + j45$

$$a)\ C = \sqrt{40^2 + 40^2} = 56.57 \quad \theta = \tan^{-1}\left(\frac{-40}{40}\right) = -45 \rightarrow 56.57 < -45°$$

$$b)\ C = \sqrt{50^2 + 200^2} = 206.15 \theta = \tan^{-1}\left(\frac{-200}{50}\right) = -75.96 \rightarrow 206.15 < -75.96°$$

$$c)\ C = \sqrt{35^2 + 20^2} = 40.31 \quad \theta = \tan^{-1}\left(\frac{-20}{35}\right) = -29.74 \rightarrow 40.31 < -29.74°$$

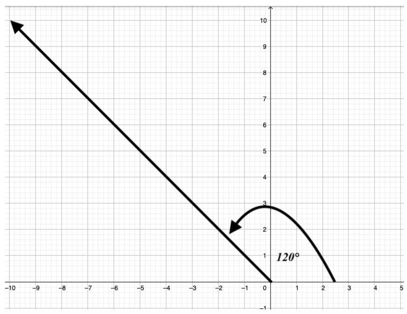
$$d)\ C = \sqrt{98^2 + 45^2} = 107.84 \quad \theta = \tan^{-1}\left(\frac{45}{98}\right) = 24.66 \rightarrow 107.84 < 24.66°$$

10. Exprese cada uno de los siguientes números polares utilizando un ángulo negativo para reemplazar al positivo.
(a) $10\angle 120°$ **(b)** $32\angle 85°$ **(c)** $5\angle 310°$

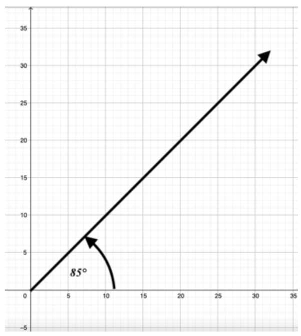
$a)\ 10 < -240,\quad b) 32 < -275,\quad c) 5 < -50$

12. Identifique el cuadrante en el cual se localiza cada uno de los puntos del problema 10.

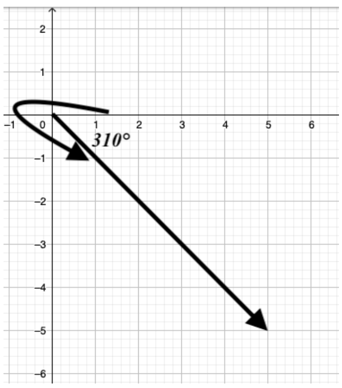
a) Segundo Cuadrante.



b) Primer Cuadrante



c) Cuarto Cuadrante



EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

14. Sume los siguientes conjuntos de números complejos:

(a) $9 + j3$ y $5 + j8$ **(b)** $3.5 - j4$ y $2.2 + j6$
(c) $-18 + j23$ y $30 - j15$ **(d)** $12\angle 45°$ y $20\angle 32°$
(e) $3.8\angle 75°$ y $1 + j1.8$ **(f)** $50 - j39$ y $60\angle -30°$

$$a)\ (9+5)+j(3+8)=14+j11$$
$$b)\ (3.5+2.2)+j(4+6)=5.7+j10$$
$$c)\ (-18+30)+j(23-15)=12+j8$$
$$d)\ (12+20)+<(45°+32°)=22<77°$$
$$e)\ (3.8+1)+<(75°+1.8°)=4.8<76.8°$$
$$f)\ (50+60)-j30+<-30°=123.11<-34.08°$$

16. Multiplique los siguientes números:

(a) $4.5\angle 48°$ y $3.2\angle 90°$ **(b)** $120\angle -220°$ y $95\angle 200°$
(c) $-3\angle 150°$ y $4 - j3$ **(d)** $67 + j84$ y $102\angle 40°$
(e) $15 - j10$ y $-25 - j30$ **(f)** $0.8 + j0.5$ y $1.2 - j1.5$

$$a)\ (4.5*3.2)<(48°+90°)=14.4<138°$$
$$b)\ (120*95)<(-220°+200°)=11400<20°$$
$$c)\ (-3*5)<(150°-36.86°)=15<113.14°$$

$$d)\ (107.44*102)<(51.42°+40°)=10958.88<91.42°$$
$$e)\ (15*-15)+15(-j30)+(-15)(-j10)+(-j10)(-j30)=-525-j300$$
$$g)\ (0.8)(1.2)+(0.8)(-j1.5)+(1.2)(j0.5)+(0.5)(-j15)=1.71-j0.6$$

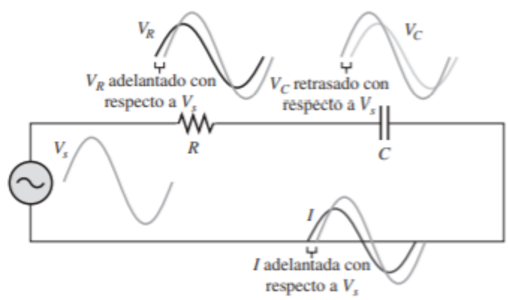
18. Realice las siguientes operaciones:

(a) $\dfrac{2.5\angle 65° - 1.8\angle -23°}{1.2\angle 37°}$ **(b)** $\dfrac{(100\angle 15°)(85 - j150)}{25 + j45}$

(c) $\dfrac{(250\angle 90° + 175\angle 75°)(50 - j100)}{(125 + j90)(35\angle 50°)}$ **(d)** $\dfrac{(1.5)^2(3.8)}{1.1} + j\left(\dfrac{8}{4} - j\dfrac{4}{2}\right)$

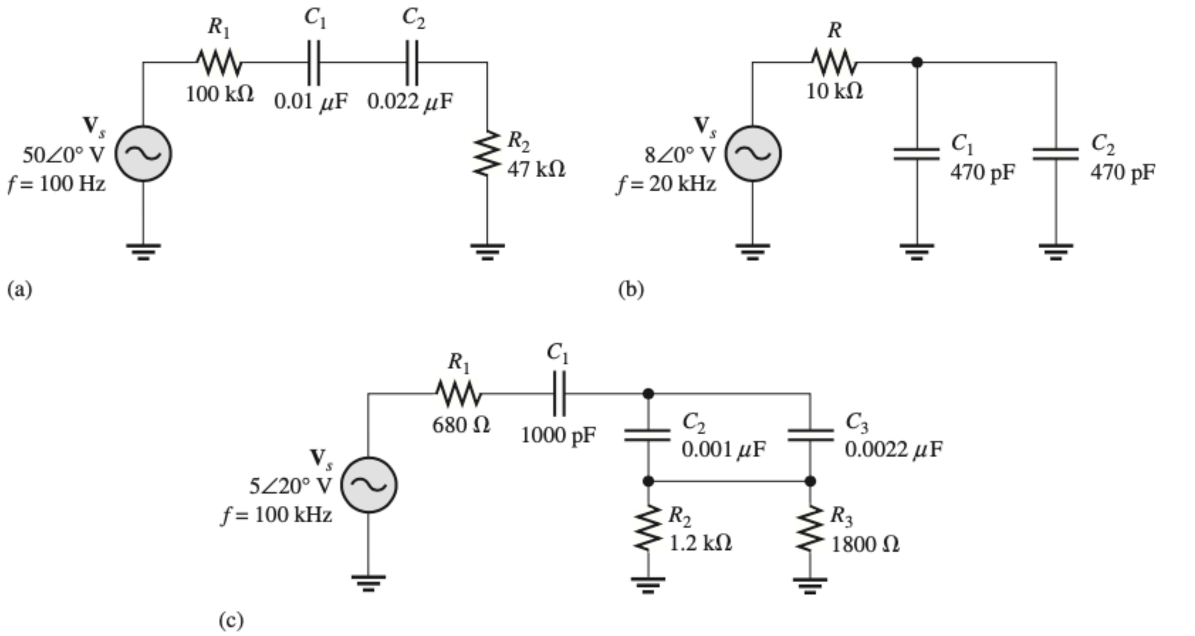
$$a)\ 2{,}52<64.43°$$
$$b)\ 334.92<106.41°$$
$$c) 6.67<62.59°$$
$$d) 9.97<11.56°$$

20. ¿Cuál es la forma de onda de la corriente en el circuito del problema 19?

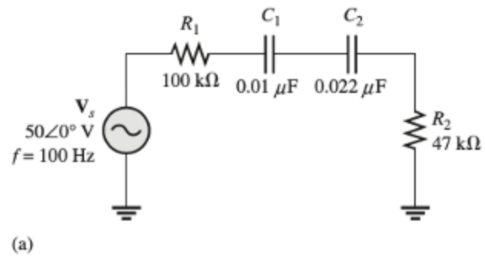


EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

22. Determine la magnitud de la impedancia y el ángulo de fase en cada circuito de la figura 15-85.



a)



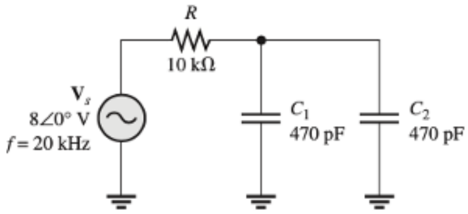
$$X_{C1} = \frac{1}{2\pi f C} = \frac{1}{2\pi(0.1)(0.01)} = 159.15k\Omega$$

$$X_{C2} = \frac{1}{2\pi f C} = \frac{1}{2\pi(0.1)(0.022)} = 72.34k\Omega$$

$$Z = R_1 - jX_{C1} - jX_{C2} + R_2$$
$$Z = 100k\Omega - \mathrm{j}59.15k\Omega - \mathrm{j}72.34k\Omega + 47k\Omega$$
$$Z = 147k\Omega - \mathrm{j}231.49k\Omega$$
$$Z = \sqrt{R^2 + X^2c} < -\tan\left(\frac{Xc}{R}\right)$$
$$Z = \sqrt{(147)^2 + 231.49^2} < -\tan\left(\frac{231.49}{147}\right)$$
$$Z = 274.22 < -57.58k\Omega$$

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

b)



(b)

$$X_{C1} = \frac{1}{2\pi fC} = \frac{1}{2\pi(20kHz)(4{,}7x10^{-7}\mu F)} = 16931{,}37k\Omega$$

$$X_{C1} = \frac{1}{2\pi fC} = \frac{1}{2\pi(20kHz)(4{,}7x10^{-7}\mu F)} = 16931{,}37k\Omega$$

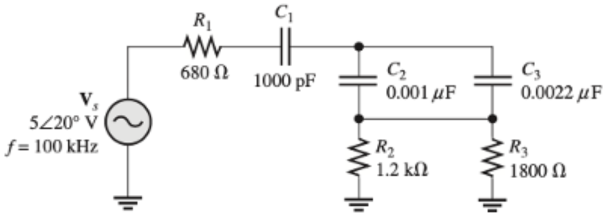
$$X_C = \frac{16931{,}37}{2} = 8465{,}68k\Omega$$

$$\mathrm{Z} = \mathrm{R1} - \mathrm{jXc} = 10k\Omega - \mathrm{j}8465{,}68k\Omega$$

$$\mathrm{Z} = \sqrt{10^2 + 18465{,}68^2} < -\tan\left(\frac{8645{,}68}{10}\right)$$

$$Z = 8645{,}68 < \; -89{,}93k\Omega$$

c)



(c)

$$1000pf = 0{,}001\mu F$$

$$X_{C1} = \frac{1}{2\pi fC} = \frac{1}{2\pi(100kHz)(0{,}001\mu F)} = 1{,}59k\Omega$$

$$X_{C2} = \frac{1}{2\pi fC} = \frac{1}{2\pi(100kHz)(0{,}001\mu F)} = 1{,}59k\Omega$$

$$X_{C3} = \frac{1}{2\pi fC} = \frac{1}{2\pi(100kHz)(0{,}0022\mu F)} = 0{,}72k\Omega$$

$$Z = R1 - jXc1 - jXc2||Xc3 + R2||R3$$

$$Z = 0{,}68k\Omega - \mathrm{j}1{,}59k\Omega - \mathrm{j}\frac{(1{,}59)(0{,}72)k\Omega}{1{,}59 + 0{,}72} + \frac{(1{,}2)(1{,}8)}{1{,}2 + 1{,}8}k\Omega$$

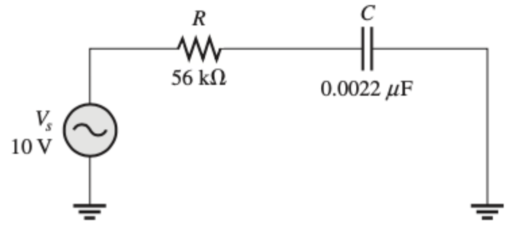
$$Z = 1{,}4k\Omega - \mathrm{j}2{,}05k\Omega$$

$$Z = \sqrt{1{,}4^2 + 2{,}05^2} < -\tan^{-1}\left(\frac{2{,}05}{1{,}4}\right)$$

$$Z = 2{,}48 < -55{,}56k\Omega$$

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

24. Repita el problema 23 con $C = 0.0047\ \mu F$.



▲ **FIGURA 15–86**

a)

$$F = 100Hz = 0,1kHz$$
$$Xc = \frac{1}{2\pi(0,1kHz)(0,0047)} = 338,62k\Omega$$
$$Z = R - jXc = 56k\Omega - \mathrm{j}338,62k\Omega$$

b)

$$F = 500Hz = 0,5kHz$$
$$Xc = \frac{1}{2\pi(0,5kHz)(0,0047)} = 67,72k\Omega$$
$$Z = R - jXc = 56k\Omega - \mathrm{j}67,72k\Omega$$

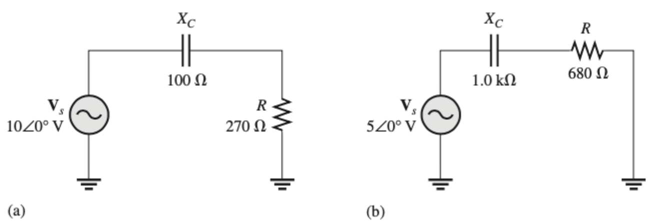
c)

$$F = 1kHz$$
$$Xc = \frac{1}{2\pi(1kHz)(0,0047)} = 33,86k\Omega$$
$$Z = R - jXc = 56k\Omega - \mathrm{j}33,86k\Omega$$

d)

$$F = 2,5kHz$$
$$Xc = \frac{1}{2\pi(2,5kHz)(0,0047)} = 13,54k\Omega$$
$$Z = R - jXc = 56k\Omega - \mathrm{j}13,54k\Omega$$

26. Exprese la corriente en forma polar para cada circuito de la figura 15-84.



a)

$$Z = R - jXc = 0,27k\Omega - \mathrm{j}0,1k\Omega$$

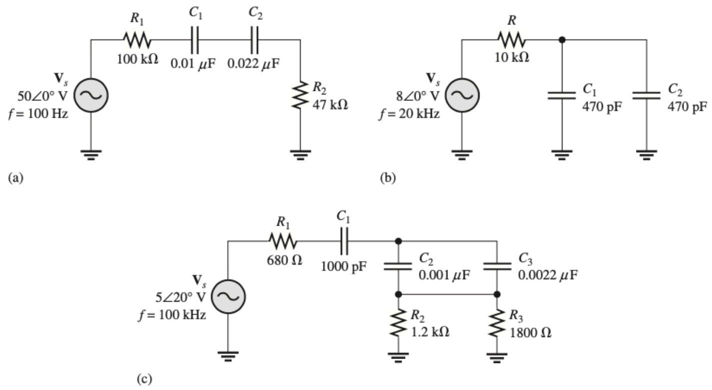
EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

$$Z = \sqrt{0{,}27^2 + 0{,}1^2} < -\tan^{-1}\left(\frac{0{,}1}{0{,}27}\right)$$
$$Z = 0{,}28 < -20{,}32°$$
$$I = \frac{V}{Z} = \frac{10 < 0°}{0{,}28 < -20{,}32°} = 35{,}71 < 20{,}32°\ mA$$

b)

$$Z = R - jXc = 0{,}68k\Omega - \mathrm{j}1k\Omega$$
$$Z = \sqrt{0{,}68^2 + 1^2} < -\tan^{-1}\left(\frac{1}{0{,}68}\right)$$
$$Z = 1{,}21 < -55{,}78°$$
$$I = \frac{V}{Z} = \frac{5 < 0°}{1{,}21 < -55{,}78°} = 4{,}13 < 55{,}78°\ mA$$

28. Determine el ángulo de fase entre el voltaje aplicado y la corriente para cada circuito de la figura 15-85.



A.-

$$C = \frac{1}{\frac{1}{0{,}01} + \frac{1}{0{,}022}} = 0{,}006875\mu f$$
$$R_{fq} = 100\mathrm{K\Omega} + 47\mathrm{K\Omega} = 147\mathrm{K\Omega}$$
$$X_c = \frac{1}{2\pi(100Hz)(0{,}006875\mu f)} = 231{,}49\mathrm{K\Omega}$$

$$Z = \sqrt{(147\mathrm{K\Omega})^2 + (231{,}49)^2} < -\tan^{-1}\left(\frac{231{,}49\mathrm{K\Omega}}{147\mathrm{K\Omega}}\right)$$

$$Z = 247{,}22 < -63{,}98\mathrm{K\Omega}$$

$$I = \frac{V}{Z} = \frac{50 < 0°V}{274{,}22 < -63{,}98\mathrm{K\Omega}} = 0.188 < 63{,}98mA$$

B.-

$$C_{eq} = 0{,}00047\mu f + 0{,}00047\mu f$$

$$C_{eq} = 0{,}00094\mu f$$

$$X_c = \frac{1}{2\pi(20\mathrm{K}Hz)(0{,}00094\mu f)} = 8{,}46\mathrm{K\Omega}$$

$$Z = \sqrt{(10\mathrm{K\Omega})^2 + (8{,}46\mathrm{K\Omega})^2} < -\tan^{-1}\left(\frac{8{,}46\mathrm{K\Omega}}{10\mathrm{K\Omega}}\right)$$

$$Z = 13{,}098 < -44{,}70°\text{K}\Omega$$

$$I = \frac{V}{Z} = \frac{8 < 0°V}{13{,}098 < -44{,}70°\text{K}\Omega} = 0{,}61 < 44{,}70°mA$$

C.-

$$C_{eq1} = 0{,}001\mu f + 0{,}0022\mu f = 0{,}0032\mu f$$

$$C_{eq2} = \frac{1}{\frac{1}{0{,}0032} + \frac{1}{0{,}001}} = 0{,}000762\mu f$$

$$R_{eq1} = \frac{1}{\frac{1}{1{,}2} + \frac{1}{1{,}6}} = 0{,}72\text{K}\Omega$$

$$R_{eq2} = 0{,}72 + 0{,}66 = 1{,}4\text{K}\Omega$$

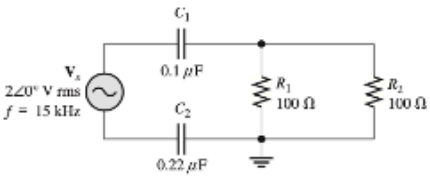
$$X_c = \frac{1}{2\pi(100\text{K}Hz)(0{,}000762\mu f)} = 2{,}08\text{K}\Omega$$

$$Z = \sqrt{(1{,}4\text{K}\Omega)^2 + (2{,}08\text{K}\Omega)^2} < -\tan^{-1}\left(\frac{2{,}08\text{K}\Omega}{1{,}4\text{K}\Omega}\right)$$

$$Z = 2{,}50 < -62{,}28°$$

$$I = \frac{V}{Z} = \frac{5 < 20°}{2{,}50 < -62{,}28°} = 2 < 82{,}28°mA$$

30. Para el circuito de la figura 15-87, trace el diagrama fasorial que muestre todos los voltajes y la corriente total. Indique los ángulos de fase.



▲ FIGURA 15–87

- Determinamos la resistencia equivalente y la capacitancia equivalente

$$Req = \frac{(100)(100)}{200} = 50\Omega$$

$$Ceq = 0.07\ uF$$

- Determinamos la reactancia capacitiva

$$Xc = \frac{1}{2\pi(15)(0.07)} = 0.15k\Omega$$

- La impedancia es

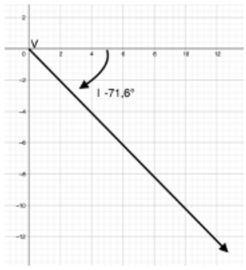
$$Z = \sqrt{(0.05)^2 + (0.15)^2} < tan^{-1}\left(\frac{0.15}{0.05}\right) = 0.15 < -71.6º$$

$$V = 2V$$

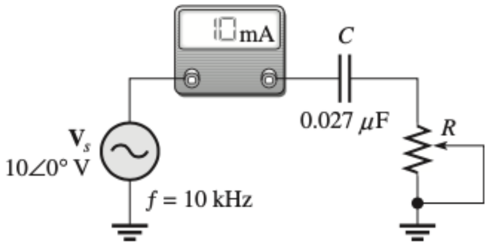
$$i = \frac{2 < 0ºV}{0.16 < -71.6ºk\Omega} = 12.5 < 71.6ºmA$$

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

- Diagrama Fasorial:



*32. ¿A qué valor se debe ajustar el reóstato de la figura 15-89 para hacer que la corriente total sea de 10 mA? ¿Cuál es el ángulo resultante?



▲ FIGURA 15–89

$$X_c = \frac{1}{2\pi(10)(0{,}027)} = 0.58\text{K}\Omega$$

$$Z = \frac{V}{I} = \frac{10}{10} = 1$$

$$Z = \sqrt{(R\text{K}\Omega)^2 + (Xc\text{K}\Omega)^2}$$

$$1 - Xc^2 = R^2$$

$$R^2 = 1 - 0.58^2$$

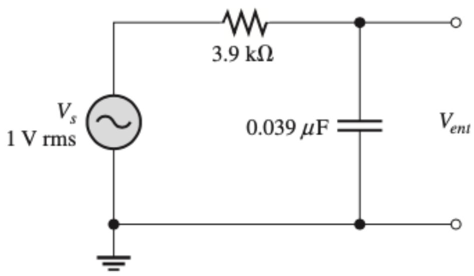
$$R = 0.81K\Omega$$

$$\theta = -\tan^{-1}\left(\frac{0.58\text{K}\Omega}{0.81K\Omega}\right)$$

Θ= -39.56=39.56

34. Para el circuito de retraso de la figura 15-91, determine el desplazamiento de fase entre el voltaje de entrada y el voltaje de salida para cada una de las siguientes frecuencias:

(a) 1 Hz **(b)** 100 Hz **(c)** 1 kHz **(d)** 10 kHz



EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

$$X_c = \frac{1}{2\pi(0{,}001)(0{,}039)} = 4060{,}62\text{K}\Omega$$
$$\theta = -\tan^{-1}\left(\frac{39\text{K}\Omega}{4060{,}62}\right) = -0{,}06°$$

B)

$X_c = 40{,}60\text{K}\Omega$

$\theta = -6.066°$

C)

$X_c = 4{,}08\text{K}\Omega$

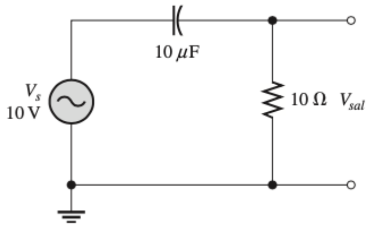
$\theta = -48{,}56°$

D)

$X_c = 0{,}40\text{K}\Omega$

$\theta = -93{,}49°$

36. Repita el problema 34 para el circuito de adelanto de la figura 15-92.



$$X_c = \frac{1}{2\pi(0{,}001)(10)} = 15.91\text{K}\Omega$$
$$\theta = -\tan^{-1}\left(\frac{15.91\text{K}\Omega}{0.01K\Omega}\right) = -99.85°$$

B)

$X_c = 0.15\text{K}\Omega$

$\theta = -95.78°$

C)

$X_c = 0.0159\text{K}\Omega$

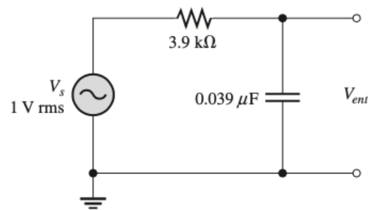
$\theta = -64.26°$

D)

$X_c = 0{,}0015\text{K}\Omega$

$\theta = -9.47°$

38. Trace el diagrama fasorial de voltaje para el circuito de la figura 15-91 para una frecuencia de 5 kHz con $V_s = 1$ V rms.

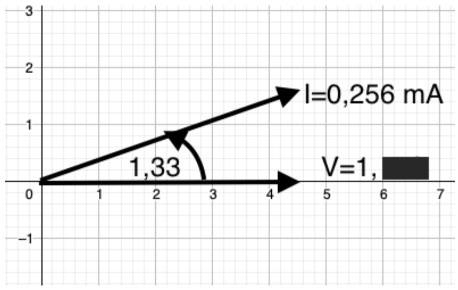


$$X_c = \frac{1}{2\pi(5KHz)(0{,}39\mu f)} = 0.0816\text{K}\Omega$$

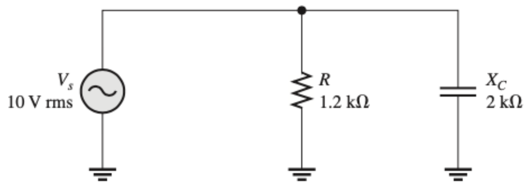
$$Z = \sqrt{(3.9\text{K}\Omega)^2 + (0.0816\text{K}\Omega)^2} < -\tan^{-1}\left(\frac{0.0816\text{K}\Omega}{3.9\text{K}\Omega}\right)$$

$$Z = 3.90 < -1.33°$$
$$I = \frac{V}{Z} = \frac{1 < 0°}{3.9 < -1.33°} = 0.256 < 1{,}33° mA$$

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)



40. Determine la impedancia y exprésela en forma polar para el circuito de la figura 15-93.

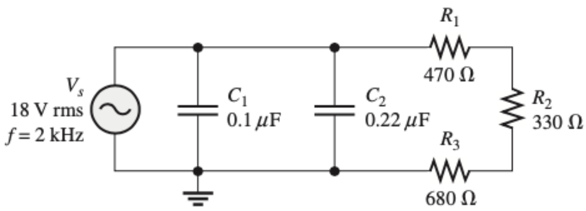


$$Z = \frac{(1{,}2 < 0°)(2K\Omega < 0°)}{\sqrt{(1{,}2)^2 + (2)^2}} < -\tan^{-1}\left(\frac{1{,}2}{2}\right)$$

$$Z = \frac{2{,}4}{2{,}33} < -\tan^{-1}\left(\frac{3}{5}\right)$$

$$Z = 1{,}03 < -34{,}40°$$

42. Repita el problema 41 para las siguientes frecuencias:
(a) 1.5 kHz **(b)** 3 kHz **(c)** 5 kHz **(d)** 10 kHz



$$\text{Ceq} = 0.32\ \text{uF}$$

$$Req = 1.48K\Omega$$

A)

$$Xc = \frac{1}{2\pi * 1.5 * 0.032\text{uF}} = 0.33\text{K}\Omega$$

$$Z = \frac{0.488}{1.51} < -\tan^{-1}\left(\frac{1.48\text{K}\Omega}{0.33\text{K}\Omega}\right)$$

$$Z = 0.323 < -86{,}03\text{K}\Omega$$

B)

$$Xc = \frac{1}{2\pi * 3 * 0.032\text{uF}} = 0.16\text{K}\Omega$$

$$Z = \frac{0.236}{1.48} < -\tan^{-1}\left(\frac{1.48\text{K}\Omega}{0.16\text{K}\Omega}\right)$$

$$Z = 0.16 < -93{,}14\text{K}\Omega$$

C)

$$Xc = \frac{1}{2\pi * 5 * 0.032\text{uF}} = 0.099\text{K}\Omega$$

$$Z = \frac{0.146}{1.483} < -\tan^{-1}\left(\frac{1.48\text{K}\Omega}{0.99\text{K}\Omega}\right)$$

$$Z = 0.098 < -62{,}46\text{K}\Omega$$

D)

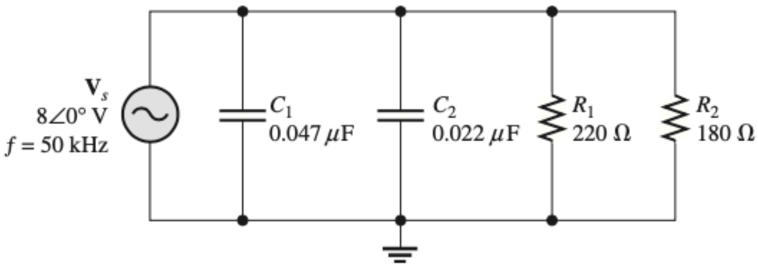
$$Xc = \frac{1}{2\pi * 10 * 0.032\text{uF}} = 0.049\text{K}\Omega$$

$$Z = \frac{0.072}{1.480} < -\tan^{-1}\left(\frac{1.48\text{K}\Omega}{0.049\text{K}\Omega}\right)$$

$$Z = 0.048 < -79{,}64\text{K}\Omega$$

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

44. Para el circuito en paralelo de la figura 15-96, encuentre la magnitud de cada corriente de rama y la corriente total. ¿Cuál es el ángulo de fase entre el voltaje aplicado y la corriente total?



$$IR1 = \frac{Vs}{R1} = \frac{8V}{0.22uF} = 36.36mA$$

$$IR2 = \frac{Vs}{R2} = \frac{8V}{0.18uF} = 44.44mA$$

$$Ic1, c2 = I\ tot\ \ ; Req = 0.4K\Omega\ ; Ceq = 0.00103uf$$

$$G = \frac{I}{R} = \frac{1}{0.4} = 2.5$$

$$Xc = \frac{1}{2\pi * 50 * 0.00103\text{uF}} = 3.09\text{K}\Omega$$

$$Bc = \frac{1}{Xc} = \frac{1}{3.09}$$

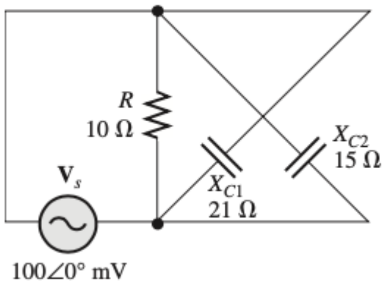
$$Y = \sqrt{2.5^2 + \frac{1}{3.09^2}} < \tan^{-1}\left(\frac{1}{7.72}\right)$$

$$Y = 2.52 < 8.20us$$

$$I = V * Y = (8 < 0)(2.52 < 8.20)$$

$$Itot = 20.16 < 8.20mA$$

▶ **FIGURA 15–97**



46. Repita el problema 45 con $R = 5.6\ \text{k}\Omega$, $C_1 = 0.047\ \mu\text{F}$, $C_2 = 0.022\ \mu\text{F}$, y $f = 500$ Hz.

$$C_{eq} = C1 \parallel C2 = 0{,}069\mu f$$

$$X_c = \frac{1}{2\pi(0{,}5)(0{,}069)} = 4{,}61\mathrm{K\Omega}$$

$$Z = \frac{25{,}81}{7{,}25} = 3{,}55\mathrm{K\Omega} < -\tan^{-1}\left(\frac{5{,}6}{4{,}61}\right)$$

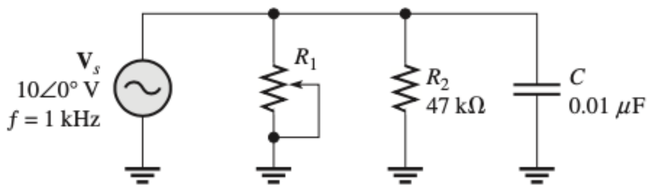
$$I_r = \frac{V_s}{R} = \frac{100}{5{,}6} = 17{,}85mA$$

$$I_c = \frac{V_s}{X_c} = \frac{100}{4{,}61} = 21{,}69mA$$

$$Z = \frac{1}{y} \quad Y = \frac{1}{z} \quad Y = \frac{1}{3{,}55 < -56{,}15°}$$

$$I_{tot} = V_o y = (100 < 0°)\left(\frac{1}{3{,}55 < -56{,}15}\right) = 28{,}16 < 56{,}15° mA$$

***48.** Determine el valor al cual R_1 debe ser ajustado para obtener un ángulo de fase de 30° entre el voltaje de fuente y la corriente total en la figura 15-99.



Para ángulos

$$I = V * Y$$

$$30 = 0 + \theta y$$

1. $\theta y = 30$

2. $\theta y = Tan^{-1}\frac{Bc}{G}$

$1\ y\ 2$

3. $Tan^{-1}\frac{Bc}{G} = 30$

$\frac{Bc}{G} = x; \quad Tan^{-1}(x) = 30$

$x = Tan(30) = 0.5$

4. $G = \frac{1}{Req} = \frac{1}{\frac{1}{R1} + \frac{1}{47}} = \frac{47 + R1}{47R1}$

5. $X_c = \frac{1}{2\pi(1)(0{,}01)} = 15{,}91\mathrm{K\Omega}; \quad \mathrm{Bc} = \frac{1}{15.91}$

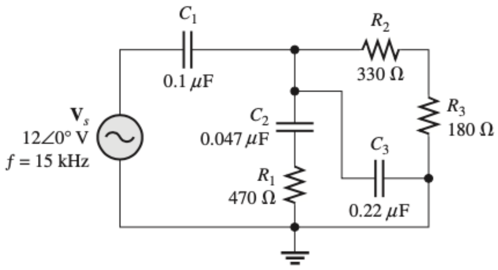
$$\frac{Bc}{G} = \frac{47R1}{747.77+15.91R1} = 0.50$$

$$4700\text{R1} = 37388.5 + 795.5\text{R1}$$

$$3904.5R1 = 37388.5$$

$$R1 = 9.57K\Omega$$

50. ¿Es el circuito de la figura 15-100 predominantemente resistivo o predominantemente capacitivo?



$$R1 = 330\Omega + 180\Omega = 510\Omega$$

$$Xc1 = \frac{1}{2\pi(15000Hz)(0.1) * 10 - 6} = -j106.103\Omega$$

$$Xc2 = \frac{1}{2\pi(15000Hz)(0.047) * 10 - 6} = -j225.751\Omega$$

$$Xc3 = \frac{1}{2\pi(15000Hz)(0.22) * 10 - 6} = -j48.228\Omega$$

$$Z1 = \frac{1}{\frac{1}{510} - \frac{1}{48.228j}} = 4.5202 - j47.80$$

$$Z2 = 470 - j225.751$$

$$Z3 = \frac{1}{\frac{1}{4.5202 - j47.80} + \frac{1}{470 - j225.751}} = 7.7078 - 45.051j$$

$$Zeq = 7.7078 - 45.051j - 106.103j = 7.70 - 151.15j$$

- Por lo tanto decimos que es un circuito RC

52. Para el circuito de la figura 15-101, determine lo siguiente:

(a) $\mathbf{I}_{tot}$ **(b)** θ **(c)** $\mathbf{V}_{R1}$ **(d)** $\mathbf{V}_{R2}$ **(e)** $\mathbf{V}_{R3}$ **(f)** $\mathbf{V}_{C}$

$$Ra = \frac{1}{\frac{1}{75\Omega} + \frac{1}{100\Omega}} = 42.8471\Omega$$

$$Xc1 = \frac{1}{2\pi(1000\text{Hz})(0.47) * 10 - 6} = -j338.627\Omega$$

$$z1 = 47 - j338.627 = 341.8731 < -82.098$$

$$\text{Zeq} = 42.841\Omega + 47 - j338.627 = 89.8471 - 338.27j = 350.3421 < -75.1411$$

$$\text{IT} = \frac{Vs}{Zeq} = \frac{15}{350.3421 < -75.1411} = 0.042815 < 75.1411(A)$$

$$Vz1 = \text{I} * \text{Z2} = 0.042815 < 75.1411 * 341.8731 < -82.098 = 14.63 < -6.95(v)$$

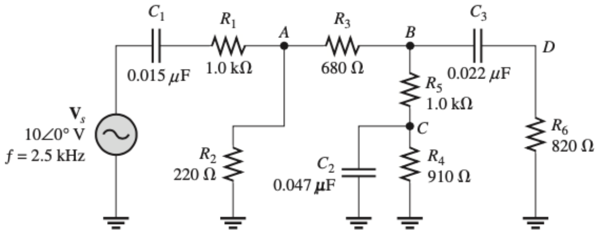
$$Vra = \text{I} * \text{Ra} = 0.042815 < 75.1411 * 42.8471\Omega = 1.8344 < 75.1411(v)$$

$$Vc1 = \text{I} * \text{C1} = 0.042815 < 75.1411 * 338.627 < -90 = 14.498 < -14.85(v)$$

$$Vr1 = \text{I} * \text{C1} = 0.042815 < 75.1411 * 47 = 2.01 < 75.14$$

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)

***54.** Determine el voltaje y su ángulo de fase en cada punto rotulado en la figura 15-103.



$$Xc1 = \frac{1}{2\pi(2500\text{Hz})(0.015)*10-6} = -j4244.1318\Omega = -j4.244k\Omega$$

$$Xc2 = \frac{1}{2\pi(2500\text{Hz})(0.047)*10-6} = -j1354.5101\Omega = -j1.3545k\Omega$$

$$Xc3 = \frac{1}{2\pi(2500\text{Hz})(0.022)*10-6} = -j2893.7262\Omega = -j2.8937k\Omega$$

$$z4 = 1.0 - 4.244j$$

$$z2 = \frac{1}{\frac{1}{0.91}+\frac{1}{-j1.3545}} = 0.626 - 0.4212j$$

$$z1 = 0.82 - 2.893j$$

$$z3 = z2 + 1.0k\Omega = 0.626 - 0.4212j + 1.0 = 1.626 - 0.4212j$$

$$z5 = \frac{1}{\frac{1}{1.626-0.4212j}+\frac{1}{0.82-2.893j}} = 1.0028 - 0.7055j$$

$$z6 = z5 + 0.68k\Omega = 1.6828 - 0.7055j$$

$$z7 = \frac{1}{\frac{1}{1.6828-0.7055j}+\frac{1}{0.22k\Omega}} = 0.1976 - 8.2911j*10-3$$

$$zeq = z7 + z4 = 0.1976 - 8.2911j*10-3 + 1.0 - 4.244j = 1.1976 - 4.2522j = 8.775 < -75.497$$

$$IT = IA = \frac{10<0}{8.775<-75.497} = 1.1394 < 75.4978\ (ma)$$

$$Vz7 = VA = IA*Z7 = 1.1394 < 75.4978 * 0.1977 < -2.4026 = 0.2253 < 73.095\ (v)$$

$$Iz6 = \frac{vz7}{z6} = \frac{0.2253<73.095}{1.8247<-22.745} = 0.1234 < 95.8404\ (ma)$$

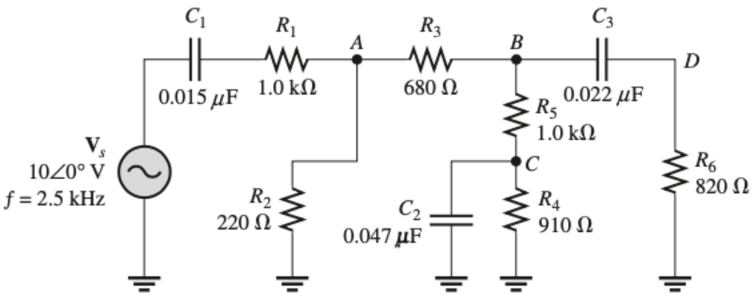
$$Vz5 = vB = VD = Iz6*Z5 = 0.1234 < 95.8404 * 1.2261 < -35.127 = 0.1513 < 60.71\ (v)$$

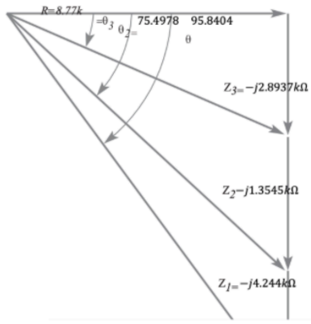
$$Iz3 = \frac{Vz5}{z3} = \frac{0.1513<60.71}{1.6796<-14.522} = 0.090 < 75.2327(ma)$$

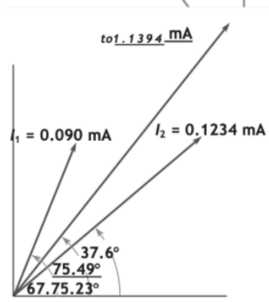
$$Vz2 = Vc = Iz3*Z2 = 0.090 < 75.2327 * 0.7545 < -33.934 = 0.0679 < 41.2983\ (v)$$

<u>***EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)***</u>

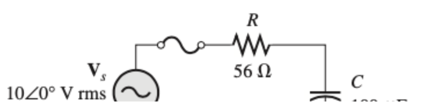
***56.** Trace el diagrama fasorial de voltaje y corriente para la figura 15-103.







58. En la figura 15-88, ¿cuáles son la potencia real y la potencia reactiva?



$$xc1 = \frac{-j}{\mathbf{2\pi(20Hz)(100) * 10 - 6}} = -j79.577\Omega$$

$$z1 = 56 - 79.577j = 137.392 < -35.394$$

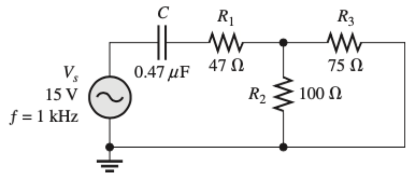
$$IT = \frac{V}{Z1} = \frac{10 < 0}{137.392 < -35.394} = 0.0727 < 35.394$$

$$Preal = It^2 * R = (0.0727 < 35.394)\text{^}2 * 56 = 0.2959 < 70.788\,W$$

$$Qc = It^2 * xc = (0.0727 < 35.394)^2 * 79.577 < -90 = 0.4205 < -19.212w$$

60. Determine P_{real}, P_r, P_a, y FP para el circuito de la figura 15-101. Trace el triángulo de potencia.

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)



$$\mathrm{IT} = \frac{Vs}{Zeq} = \frac{15}{350.3421 < -75.1411} = 0.042815 < 75.1411(A)$$

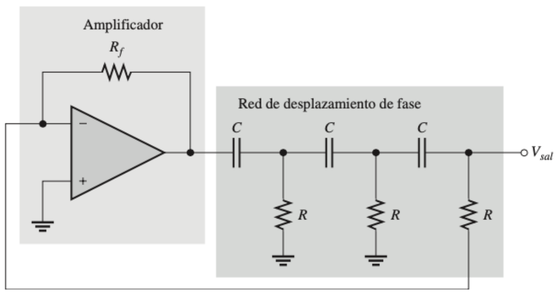
$$Pr = It^2 * R = (0.042815 < 75.1411)^2 * 89.8471 = 0.1647 < 150.28(\,W)$$

$$Qc = It^2 * xc = (0.042815 < 75.1411)^2 * (-338.27) = 0.620 < -29.7178(W)$$

$$Qc = IT * Vt = (0.042815 < 75.1411) * 15v = 0.6422 < 75.1411$$

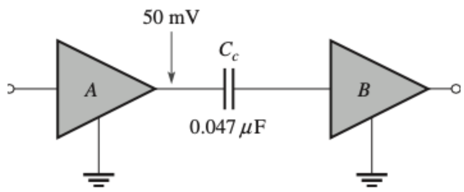
Fp=cos(75.1411)=0.2564

62. Calcule la frecuencia de oscilación para el circuito de la figura 15-62 si todos los capacitores son de 0.0022 μF y todos los resistores de 10 kΩ.



$$fr = \frac{1}{2\pi\sqrt{16} * RC} = \frac{1}{2\pi\sqrt{16} * 10k\Omega * 0.0022uf} = 1.80khz$$

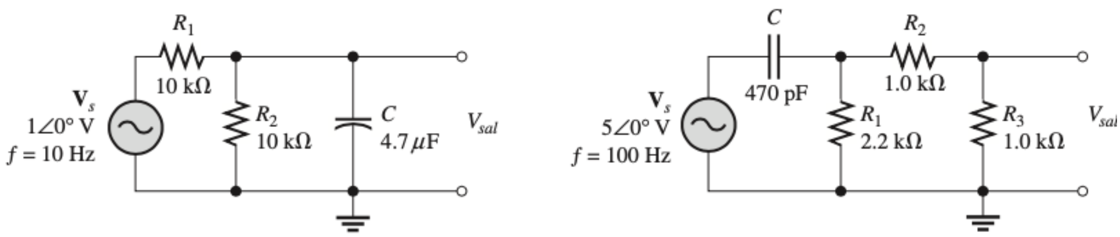
64. El valor rms del voltaje de señal que sale del amplificador *A* en la figura 15-105 es de 50 mV. Si la resistencia de entrada al amplificador *B* es de 10 kΩ, ¿qué tanto de la señal se pierde debido al capacitor de acoplamiento cuando la frecuencia es de 3 kHz?



$$fr = \frac{1}{2\pi\sqrt{16} * RC} = \frac{x}{2\pi\sqrt{16} * 10k\Omega * 0.0022uf} = 3khz$$

***66.** Los capacitores de la figura 15-107 han desarrollado un resistencia de fuga de 2 kΩ. Determine los voltajes de salida en esta condición para cada circuito.

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)



(a) (b)

$$xc1 = \frac{-j}{\mathbf{2\pi(10Hz)(4.7) * 10 - 6}} = -j3.38627k\Omega$$

$$z1 = \frac{1}{\frac{1}{-j3.38627k\Omega} + \frac{1}{10k\Omega}} = 1.0287 - 3.0379j = 3.20736 < -71.2925$$

$$Zeq = z1 + 10k = 3.20736 < -71.2925 + 10 = 11.4394 < -15.400$$

$$IT = \frac{V}{Z} = \frac{1 < 0}{11.4394 < -15.400} = 0.08741 < 15.400\ (ma)$$

$$Vsl = I * Z1 = 0.08741 < 15.400\ (ma) * 3.20736 < -71.2925 = 0.2803 < -55.8925(v)$$

$$xc1 = \frac{-j}{\mathbf{2\pi(100Hz)(470) * 10 - 10}} = -j33.8627k\Omega$$

$$Ra = 2.0k\Omega + 2.0k\Omega = 4.0k\Omega$$

$$Rb = \frac{1}{\frac{1}{4.0k\Omega} + \frac{1}{2k\Omega}} = 1.33k\Omega$$

$$z1 = 1.33k\Omega - j33.8627 = 33.88 < -87.750$$

$$IT = \frac{V}{Z1} = \frac{5 < 0}{33.88 < -87.750} = 0.1475 < 87.75(ma)$$

$$Vrb = It * rb = 0.1475 < 87.75(ma) * 1.33k\Omega = 0.1962 < 87.750(v$$

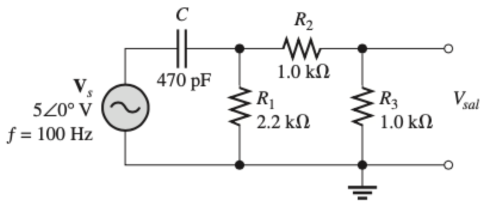
$$Ira = \frac{Vrb}{ra} = \frac{0.1962 < 87.750}{4} = 0.0490 < 87.750(ma)$$

$$Vr1 = Vsl = Ira * r1 = 0.0490 < 87.750 * 2.0k\Omega = 0.098114 < 87.750(v)$$

68. Determine el voltaje de salida para el circuito de la figura 15-107(b) para cada uno de los siguientes modos de falla, y compárelo con la salida correcta:

(a) *C* abierto **(b)** *C* en cortocircuito **(c)** R_1 abierto **(d)** R_2 abierto **(e)** R_3 abierto

EJERCICIOS TRABAJO DE INVESTIGACION 2 (PARES)



(b)

a) Nos da OV en la salida ya que no se energiza la fase.

b)

$$Ra = 1 + 1 = 2k\Omega$$

$$Rb = Req = \frac{1}{\frac{1}{2}+\frac{1}{2.2}} = 1.0476k\Omega$$

$$It = \frac{Vt}{Rt} = \frac{5}{1.0476} = 4.7728(ma)$$

$$I = \frac{V}{R} = \frac{5}{2} = 2.5(ma)$$

$$Vsalida = I * 1 = 2.5(v)$$

c)

$$xc1 = \frac{-j}{\mathbf{2\pi(100Hz)(470) * 10 - 10}} = -j33.8627k\Omega$$

$$Zeq = 2 - 33.8627j$$

$$It = \frac{Vt}{Rt} = \frac{5 < 0}{33.9217 < -86.6199} = 0.1473 < 86.61(ma)$$

$$Vsalida = I * 1 = 0.1473 < 86.61 * 1 = 0.1473(v)$$

d) Nos da OV en la salida ya que no se energiza la fase.

e)

$$xc1 = \frac{-j}{\mathbf{2\pi(100Hz)(470) * 10 - 10}} = -j33.8627k\Omega$$

$$Zeq = 3.2 - 33.8627j$$

$$It = \frac{Vt}{zt} = \frac{5 < 0}{3.2 - 33.8627j} = 0.1470 < 84.601(ma)$$

$$Vsl = 5(v)$$