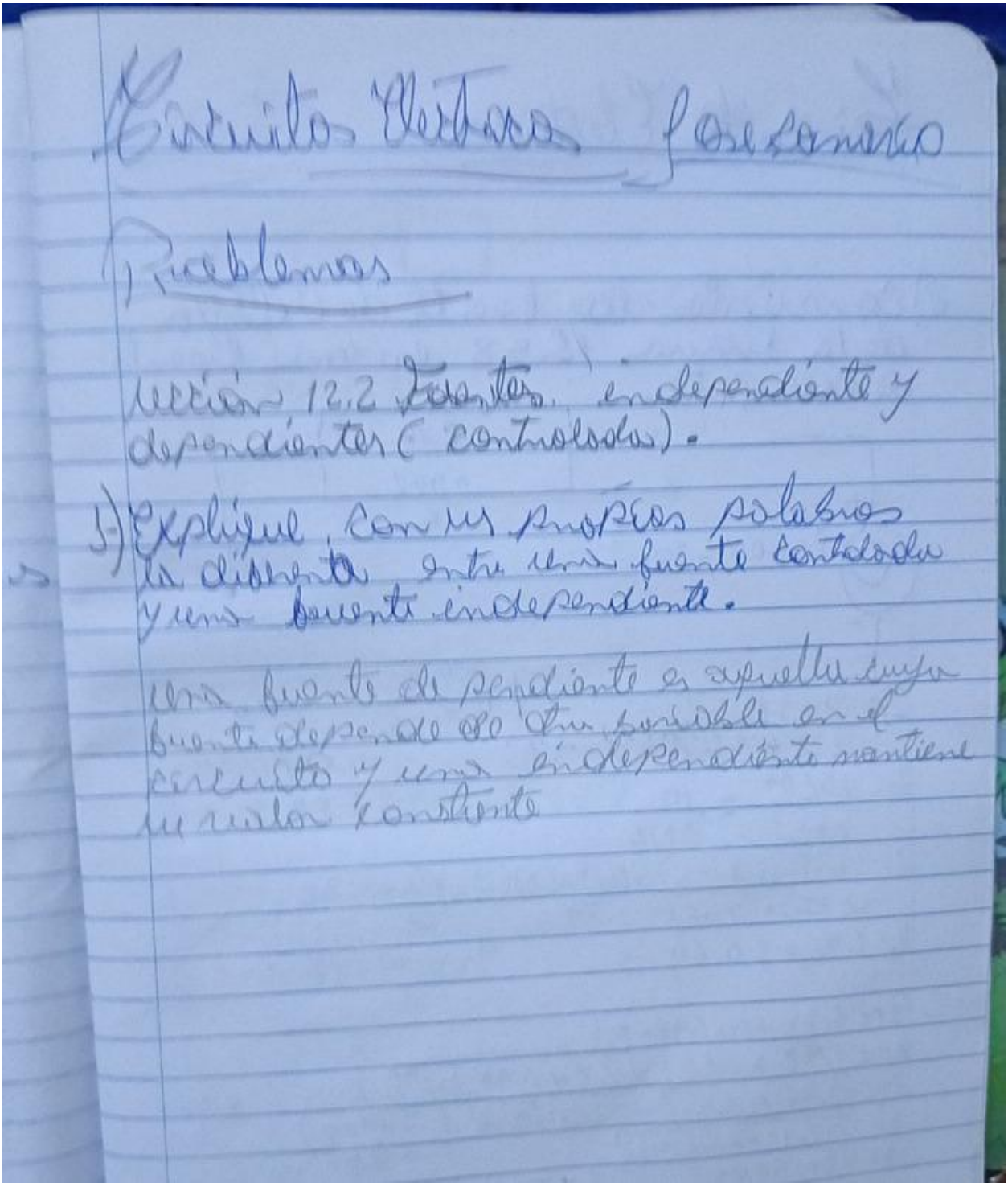
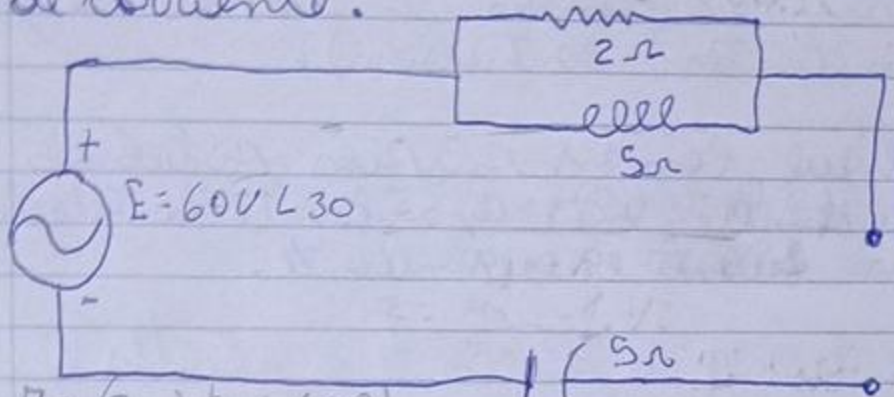
Capitulo 12

1-2-3-4-5-6-7-8



Circuito Eléctrico

2) Convierta la fuente de voltaje de la figura 12.58 en una fuente de corriente.



$$Z_1 = \frac{(2\Omega)(5\Omega \angle 90^\circ)}{2\angle 0^\circ + 5\Omega \angle 4^\circ}$$

$$Z_1 = \frac{10\angle 90^\circ}{2+5j} = \frac{10}{2+j5}$$

$$Z_1 = \frac{(10)\cdot(2-j5)}{(2+j5)\cdot(2-j5)} = \frac{(10)+(2)(5)}{29} = \frac{20+10}{29}$$

$$Z_1 = 1.72 + j\,0.69$$

$$Z_T = 1.72 + 0.69 - 5j$$

$$Z_T = 1.72 + 4.31 = \boxed{4.64 \angle -68.24^\circ}$$

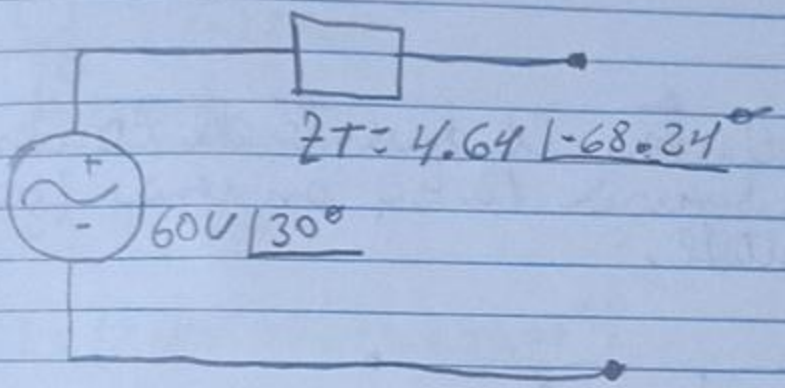
$$Z_T = \sqrt{(1.72)^2 + (4.31)^2} \qquad \theta = \tan^{-1}\left(\frac{4.31}{1.72}\right)$$

$$Z = \sqrt{12.4564 + 18.576}$$

$$Z = \sqrt{21.5345} \qquad \theta = \tan^{-1}(2.505)$$

$$Z = 4.6 \qquad \theta = -68.24$$

Cont:



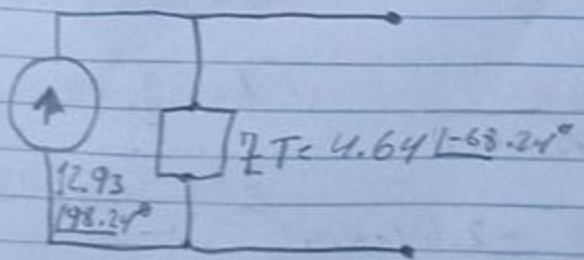
$$I = \frac{V}{R} = \frac{E}{Z}$$

$$I = \frac{60 \angle 30^\circ}{4.64 \angle -68.24^\circ}$$

$$I = 12.93 \angle 30^\circ - (-68.24^\circ)$$

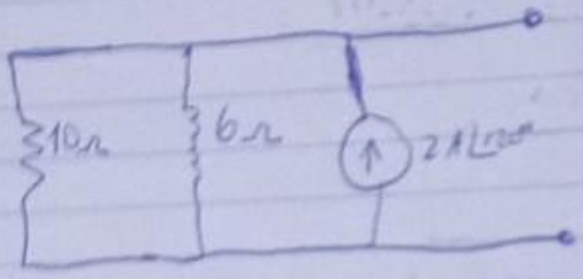
$$I = 12.93 \angle 30^\circ + 68.24^\circ$$

$$I = 12.93 \angle 98.24^\circ$$



Circuitos Eléctricos

3) Convierta la fuente de corriente de la figura 12.54 en una fuente de voltaje.



$$Z_T = \frac{(10\Omega \angle 0) \cdot (6\Omega \angle 90°)}{10\Omega \angle 0° + 6\Omega \angle 90°}$$

$$Z_T = \frac{60\angle 90°}{10+6j} = \frac{60j}{10+6j}$$

$$Z_T = \frac{60j \cdot (10-16)}{(10+16)\cdot(10-16)}$$

$$Z_T = \frac{600j - 360}{100 - 36 + 36 - 36(-1)}$$

$$Z_T = \frac{600j - 360}{136} = 2.64 + 4.41$$

$$Z = \sqrt{(2.64)^2 + (4.41)^2}$$

$$Z = \sqrt{26.4177}$$

$$Z = 5.15$$

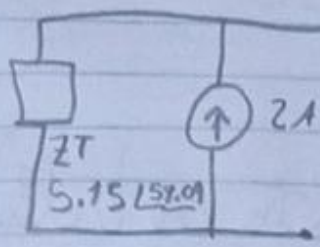
$$\theta = \tan^{-1}\left(\frac{4.41}{2.64}\right)$$

$$\theta = \tan^{-1}\{1.67\ldots\}$$

$$\theta = 59.09$$

$$Z_T = 5.15\angle 59.09°$$

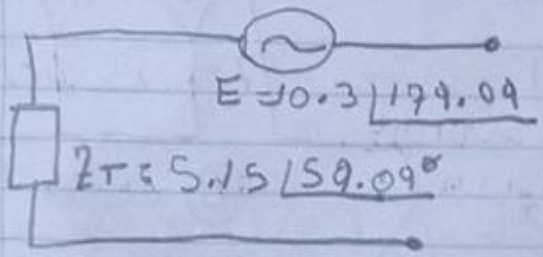
Cont:



$E = I \cdot Z_T$

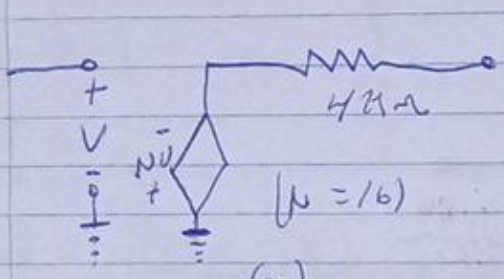
$E = (2 \angle 120^\circ)(5.15 \angle 59.09^\circ)$

$E = 10.3 \angle 179.09^\circ$

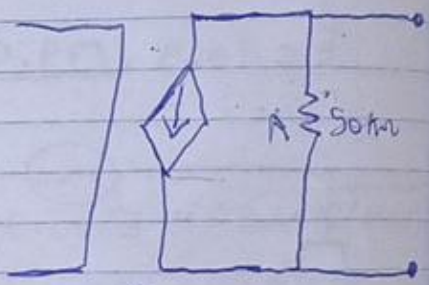


Circuitos Eléctricos

4) Convierta la fuente de voltaje de la figura 12.60(a) en una fuente de corriente y la fuente de corriente de la figura 12.60(b) en una fuente de voltaje.



(a)



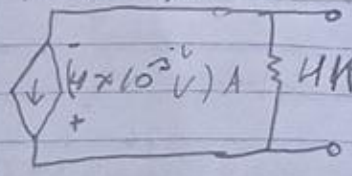
(B)

$R = 4000\,\Omega = 4 \times 10^3\,\Omega$

$V = 16\,\mu V = 16 \times 10^{-6}\,V$

$I = \frac{V}{R} = \frac{16 \times 10^{-6}\,V}{4 \times 10^3\,\Omega} =$

$= (4 \times 10^{-3}\,V)\,A$

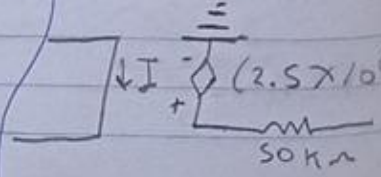


$I = 50h\,I$

$R = 50R\,\Omega$

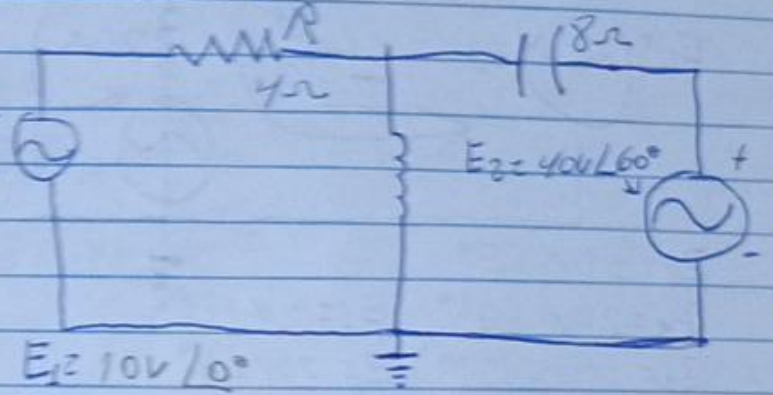
$V = I(R) = 50h\,I(50k\Omega)$

$V = (2.5 \times 10^6\,I)\,V$



Circuitos Eléctricos

9) Escriba las ecuaciones de mallas para la red de la figura 12.61. Determinar la corriente que fluye a través del resistor A.



$Z_1 = 4\Omega \angle 0°$
$Z_2 = 6\Omega \angle 90°$
$Z_3 = 8\Omega \angle -90°$

$E_1 = 10V \angle 0°$
$E_2 = 40V \angle 60°$

malla #1

$-E_1 + (I_1)(Z_1) + (Z_2)(I_1 - I_2) = 0$

$-(10V \angle 0°) + (4\Omega \angle 0°)(I_1) + (6\Omega \angle 90°)(I_1) - (6\Omega \angle 90°)(I_2) = 0$

$(7.21\Omega \angle 56.31)(I_1) + (6 \angle 90)(I_2) = 10 \angle 0°$

malla #2

$(40 \angle 60°) + (6 \angle 90°)(I_2) - (6 \angle 90)(I_1) + (8 \angle 90°)(I_2) = 0$

$(6 \angle 90°)(I_1) + (2 \angle 90°)(I_2) = -40 \angle 60°$

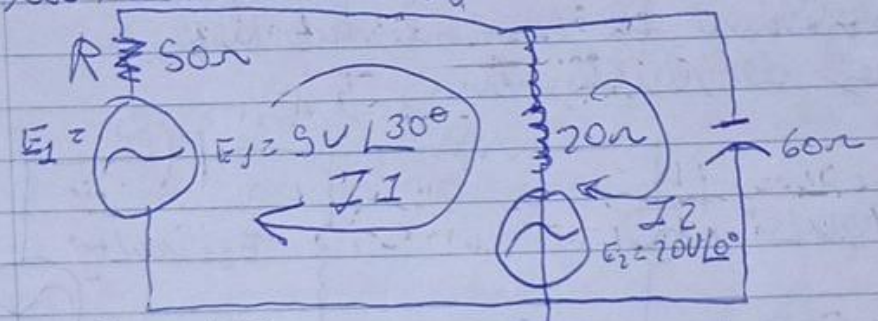
Conclusión:

$(43.66 \angle 9.46)\, I_1 = (250.60 \angle 33.96°)$

$I_1 = 5.15 \angle -29.5°$

Circuito Electrico

6) Escriba las ecuaciones de malla para la red de la figura 12.62.



$Z_1 = 50\Omega \angle 0°$
$Z_2 = 20\Omega \angle 90°$ $E_1 = 5V \angle 30°$
$Z_3 = 60\Omega \angle -90°$ $E_2 = 20V \angle 0°$

malla #1

$-E_1 + (Z_1)(I_1) + (Z_2)(I_1 - I_2) + E_2 = 0$

$-(5V \angle 30°) + (50\Omega \angle 0°)(I_1) + (20\Omega \angle 90°)(I_1) - (20\Omega \angle 90°) + 20 =$

$-(5V \angle 30°) + 53.85 \angle 21.80°(I_1) - 20\Omega \angle 90° + 20V \angle 0° = 0$

malla #2

$-E_2 \cdot Z_2 (I_1 - I_2) + (Z_3)(I_2) = 0$

$-(20V \angle 0°) - (20\Omega \angle 90°)(I_2) + (20\Omega \angle 90°)(I_2) + 60\Omega \angle -90°(I_2) = 0$

$(20V \angle 0°) + (20\Omega \angle 90°)(I_1) + (80\Omega \angle -90°)(I_2) = 0$

Cont:

Conclusion:

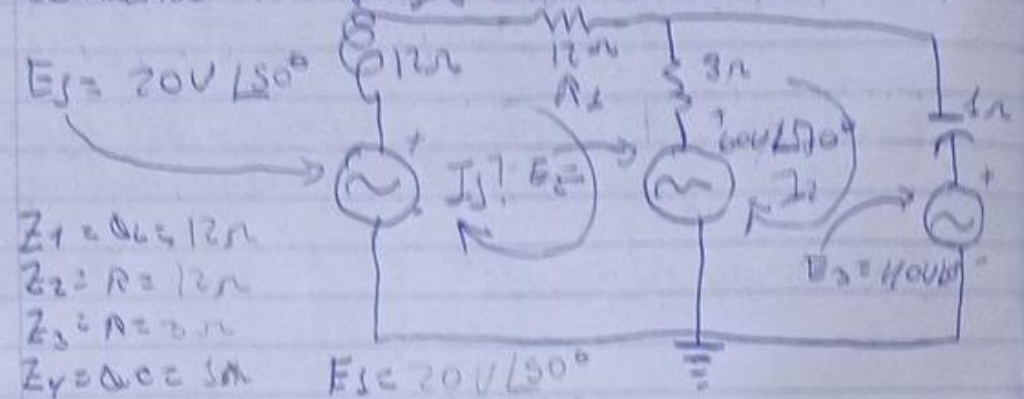
$$I_R = I_2 \quad \frac{[Z_3 + Z_2]\,E_1 - Z_3 E_2}{(Z_1)(Z_3) + (Z_1)(Z_2) + (Z_3)(Z_2)}$$

$$I_R = \frac{[60\Omega \angle -90° + 20\Omega \angle 90° + 20\Omega \angle 90°]\ 5V \angle 20° - (60\Omega \angle -90°)\ 20V}{(50\Omega \angle 0°)(60\Omega \angle -90°) + (50\Omega \angle 0°)(20\Omega \angle 90°) + (60\Omega \angle -90°)(20\Omega \angle 90°)}$$

$$I_R = 0.44A \angle 143.48°$$

Circuitos Eléctricos

7) Escriba las ecuaciones de malla para la red de la figura 17.63. Determine la corriente que fluye a través del resistor R_1



$Z_1 = 0 + j12\Omega$
$Z_2 = R = 12\Omega$
$Z_3 = R = 3\Omega$
$Z_4 = 0 - j1 = 1\Omega$
$E_2 = 60V \angle 70°$

$E_3 = 20V \angle 30°$
$E_4 = 110V \angle 0°$

malla #1

$-E_3 + (Z_1)(I_1) + (R_2)(I_1) + (R_3)(I_1 - I_2) + E_2 = 0$

$(-20 \angle 30°) + (12 \angle 90°)(I_1) + (12 \angle 0°)(I_1) + (3\angle 0°)(I_1) - (3\angle 0°)(I_2) + 60\angle 70°$

$(29.21 \angle 38.66)(I_1) - (3\angle 0)(I_2) = 41.77 \angle 29.43$

malla #2

$-E_2 + (R_3)(I_2 - I_1) + (1)(I_2) + E_3 = 0$

$-(3\angle 0\ I_2) + (3.16 \angle -18.43)(I_2) = 59.65 \angle 107.06°$

Cont.:

Conclusion:

$(60.70 \angle 20.20)(I_2) - (9.48 \angle -18.43) = 31.94 \angle -118$

$(9 \angle 0)(I) + (9.478 \angle -18.4)(I_2) = 178.85 \angle 104$

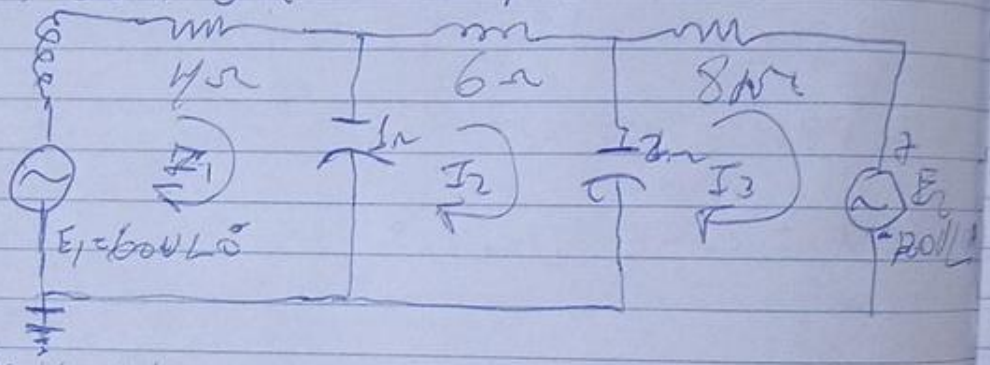
$(64.224 \angle 17.65)\, I_1 = 132.31 \angle 156.4$

$I_1 = 2.55 \angle 132.72°$

$I R_2 = 2.55 \angle 132.72°$

Circuitos Eléctricos

8) Escriba las ecuaciones de mallas para la red de la figura 12.64 Determine la corriente que fluye a través del resistor R_1



Z_1 $4\Omega + 3\Omega$

Z_2 $1\Omega + \angle -90°$

Z_3 $6\Omega \cdot \angle 90$

Z_4 $2\Omega \angle -90°$

Z_5 $8\Omega \cdot \angle 0°$

E_1 $60V \angle 0$

E_2 $170V \angle 120°$

malla 1

$E_1 = (I_1)(Z_2) - (I_1)(Z_2) + (I_2)(Z_2) = 0$

$60V \angle 0° (5 - 36.87)(I_1) + 1\Omega \angle -90° (I_1) + (4\Omega \angle -90°)$

malla 2

$(I_2)(Z_4) + (I_2)(Z_3) - (I_1)(Z_4) + (I_3)(Z_4) = 0$

$(2\angle -90°)(I_2) + (1\angle -90°)(6\angle 90°)(I_3) - (2\angle 90°)(I_1) = 0$

malla 3

$(I_3)(Z_4) + (I_2)(Z_4) - (I_1)(Z_1)(EB) = 0$

$(2\angle -90°)(I_3) + (2\angle -90°)(I_2) + (8\angle 0°)(I_3) - 170\angle 0° = 0$

conclusión:

$I_2 = 13.07\ A\ \angle -33.71°$

$I_{RD}\ I_B = 13.07\ A\ \angle -33.71°$