

4)  $x_1$  = <sup>cent</sup>selección  
 $x_2$  = <sup>cent</sup>fines

	Licor	Nuez	Frutas	Precio
$x_1$	0,3 gr	0,5 gr	0,2 gr	120
$x_2$	0,4 gr	0,2 gr	0,4 gr	90
Total	100 kg	120 kg	100 kg	

Ecuación:

$$\frac{3}{10}x_1 + \frac{4}{10}x_2 + x_3 = 100$$

$$\frac{5}{10}x_1 + \frac{2}{10}x_2 + x_4 = 120$$

$$\frac{2}{10}x_1 + \frac{4}{10}x_2 + x_5 = 100$$

Función objetivo:

$$Z = 120x_1 + 90x_2 + 0x_3 + 0x_4 + 0x_5 \text{ (maximizar)}$$

Inecuaciones:

$$r_1 \frac{3}{10}x_1 + \frac{4}{10}x_2 \leq 100$$

$$r_2 \frac{5}{10}x_1 + \frac{2}{10}x_2 \leq 120$$

$$r_3 \frac{2}{10}x_1 + \frac{4}{10}x_2 \leq 100$$

Método Simplex:		B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$\Phi$
0	$x_3$	700	$\frac{3}{70}$	$\frac{1}{70}$	1	0	0	$100 \frac{3}{70} = \frac{1000}{3}$
0	$x_4$	120	$\frac{5}{10}$	$\frac{2}{70}$	0	1	0	$120 \frac{5}{10} = 240$
0	$x_5$	100	$\frac{2}{70}$	$\frac{15}{70}$	0	0	1	$100 \frac{2}{70} = 500$
0		0	0	0	0	0	0	
0		120	90	0	0	0	0	
0		-120	-90	0	0	0	0	

C	X	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$\Phi$
0	$x_3$	28	0	$\frac{7}{25}$	1	$\frac{1}{5}$	0	$28 \frac{7}{25} = 100$
120	$x_1$	240	1	$\frac{2}{5}$	0	2	0	$240 \frac{2}{5} = 600$
0	$x_5$	52	0	$\frac{21}{50}$	0	$\frac{11}{5}$	1	$52 \frac{21}{50} = \frac{2600}{21}$
0		28.800	120	48	0	240	0	
0		120	0	0	0	0	0	
0		0	-42	0	240	0	0	

C	X	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$\Phi$
90	$x_2$	100	0	1	$\frac{5}{7}$	$\frac{15}{7}$	0	0
120	$x_1$	200	1	0	0	$\frac{10}{7}$	$\frac{9}{7}$	0
0	$x_5$	10	0	0	$\frac{3}{2}$	$\frac{15}{2}$	150	1000
0		33000	120	120	0	0	0	
0		120	0	0	150	150	150	
0		0	0	0	0	0	0	

Resultados:

$$\begin{aligned} x_1 &= 200 \\ x_2 &= 100 \end{aligned}$$

$$\underline{\underline{z = 33.000}}$$



5)  $x_1$  = cereales mayorista "A"  
 $x_2$  = cereales mayorista "B"

	PERAOS	PLÉTROS	MANZANAS	Precio
$x_1$	8	1	2	\$150
$x_2$	2	7	2	\$300
Total	16	5	20	

INECUACIONES:

$$\begin{aligned} r_1 & 8x_1 + 2x_2 \geq 16 \\ r_2 & x_1 + x_2 \geq 5 \\ r_3 & 2x_1 + 7x_2 \geq 20 \end{aligned}$$

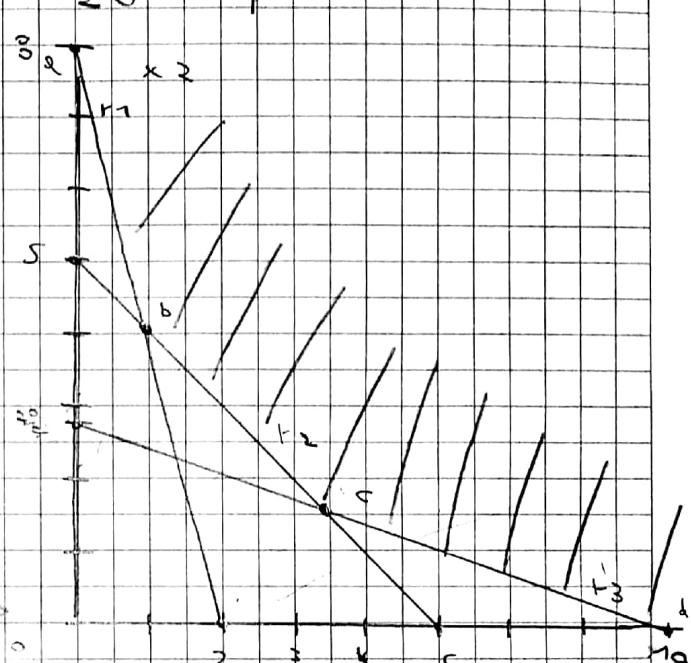
$$Z = 150x_1 + 300x_2 \text{ (minimizar)}$$

Punto O:

$$\begin{aligned} r_1: & x_1 = 2 \quad x_2 = 8 \\ r_2: & x_1 = 5 \quad x_2 = 5 \\ r_3: & x_1 = 10 \quad x_2 = 0 \end{aligned}$$

coordenadas:

$$\begin{aligned} a(0, 8) & Z_a = 150 \cdot 0 + 300 \cdot 8 = 2400 \\ b(1, 4) & Z_b = 150 \cdot 1 + 300 \cdot 4 = 1350 \\ c(3, 2) & Z_c = 150 \cdot 3 + 300 \cdot 2 = 1050 \\ d(10, 0) & Z_d = 150 \cdot 10 + 300 \cdot 0 = 1500 \end{aligned}$$



calculo "b":

$$\begin{aligned} r_1 \quad 8x_1 + 2x_2 &= 16 \rightarrow x_2 = -4x_1 + 8 \\ r_2 \quad x_1 + x_2 &= 5 \rightarrow x_2 = -x_1 + 5 \\ -4x_1 + 8 &= -x_1 + 5 \\ 8 - 5 &= -x_1 + 4x_1 \\ 3 &= 3x_1 \\ 1 &= x_1 \end{aligned}$$

$$\boxed{x_2 = 4}$$

calculo "c":

$$\begin{aligned} r_2 \quad x_1 + x_2 &= 5 \rightarrow x_2 = -x_1 + 5 \\ r_3 \quad 2x_1 + 7x_2 &= 20 \rightarrow x_2 = -\frac{2}{7}x_1 + \frac{20}{7} \\ -\frac{2}{7}x_1 + \frac{20}{7} &= -x_1 + 5 \\ \frac{5}{7}x_1 - \frac{20}{7} &= -x_1 + 5 \\ x_1 &= 3 \end{aligned}$$

Paralelos:

$$\begin{aligned} x_1 &= 3 \\ x_2 &= 2 \\ Z &= 1050 \end{aligned}$$

## Método simplex:

ecuaciones:

$$\begin{array}{lcl} 8x_1 + 2x_2 - x_3 + M_1 & = 16 \\ x_1 + x_2 & = 5 \\ 2x_1 + 7x_2 & = 20 \end{array}$$

$$Z = 150x_1 + 300x_2 + 0x_3 + 0x_4 + 0x_5 + m.M_1 + m.M_2 + m.M_3 \text{ (minimizar)}$$

	$x$	$B$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$M_1$	$M_2$	$M_3$	$\phi$
3	$x$	3	$x_1$	2	-1	0	0	1	0	0	$16/8 = 2$
3	$M_1$	16	(8)	2	-1	0	0	0	1	0	
3	$M_2$	5	1	1	0	-1	0	0	1	0	$5/1 = 5$
3	$M_3$	20	2	7	0	0	-1	0	0	1	$20/2 = 10$
$c_j$		4	1m	11m	10m	-m	-m	m	m	m	
$c_j$		150	300	0	0	0	0	m	m	m	
$Z - c_j$		11m - 150	10m - 300	-m	-m	-m	0	0	0	0	

	$x$	$B$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$M_1$	$M_2$	$M_3$	$\phi$
150	$x_1$	2	1	$\frac{3}{4}$	$-\frac{1}{8}$	0	0	$\frac{1}{8}$	0	0	$21\frac{3}{4} = 8$
3	$M_2$	3	0	$\frac{3}{4}$	$\frac{1}{8}$	-1	0	$-\frac{1}{8}$	1	0	$3\frac{3}{4} = 4$
3	$M_3$	16	0	( $\frac{13}{2}$ )	$\frac{1}{10}$	0	-1	$-\frac{13}{80}$	0	1	$16\frac{13}{2} = \frac{32}{13}$
$Z - c_j$		19m + 300	150	$\frac{28}{4}m + \frac{75}{2}$	$\frac{3}{8}m - \frac{35}{4}$	-m	-m	$\frac{13}{8}m + \frac{95}{4}$	m	m	
$c_j$		150	300	0	0	0	0	m	m	m	
$Z - c_j$		0	$\frac{28}{4}m - \frac{225}{2}$	$\frac{3}{8}m - \frac{75}{4}$	-m	-m	$-\frac{11}{8}m + \frac{75}{4}$	0	0	0	

	$x$	$B$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$M_1$	$M_2$	$M_3$	$\phi$
150	$x_1$	$\frac{18}{13}$	1	0	$-\frac{3}{52}$	0	$\frac{1}{26}$	$\frac{3}{52}$	0	$-\frac{1}{26}$	$\frac{18}{13} / \frac{3}{52} = -\frac{22}{7}$
3	$M_2$	$\frac{15}{13}$	0	0	( $\frac{5}{52}$ )	-1	$\frac{5}{26}$	$-\frac{5}{52}$	1	$-\frac{3}{26}$	$\frac{15}{13} / \frac{5}{52} = 12$
300	$x_2$	$\frac{32}{13}$	0	1	$\frac{1}{26}$	0	$-\frac{2}{13}$	$-\frac{1}{26}$	0	$\frac{2}{13}$	$\frac{32}{13} / \frac{1}{26} = 64$
$Z - c_j$		$\frac{15}{13}m + \frac{12300}{13}$	150	300	$\frac{5}{26}m - \frac{225}{26}$	-m	$\frac{3}{26}m - \frac{525}{13}$	$-\frac{5}{26}m + \frac{225}{26}$	m	$-\frac{3}{26}m + \frac{525}{13}$	
$c_j$		150	300	0	0	0	0	m	m	m	
$Z - c_j$		0	0	$\frac{5}{26}m - \frac{225}{26}$	-m	$\frac{3}{26}m - \frac{525}{13}$	$-\frac{5}{26}m + \frac{225}{26}$	0	$-\frac{2}{26}m + \frac{525}{13}$		

continuación 5)

C	x	B	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	μ <sub>1</sub>	μ <sub>2</sub>	μ <sub>3</sub>	d
50	x <sub>1</sub>	3	1	0	0	- $\frac{3}{4}$	$\frac{5}{4}$	0	$\frac{7}{4}$	-1	5
0	x <sub>3</sub>	12	0	0	1	$-\frac{5}{2}$	$\frac{6}{5}$	-1	$\frac{2}{5}$	-6	5
300	x <sub>2</sub>	2	0	1	0	$-\frac{2}{5}$	$-\frac{1}{5}$	0	$-\frac{2}{5}$	1	5
z		1050	150	300	0	-90	-30	0	90	30	
c <sub>i</sub>		750	300	0	0	0	0	m	m	m	
z <sub>j-c_i</sub>		0	0	0	-90	-30	-m	90-m	30-m		

Resolución:

$$x_1 = 3$$

$$x_2 = 2$$

$$x_3 = 12.$$

$$z = 1050$$

	Alta	Media	Baja	Precio
A	1	2	4	150
B	2	2	2	200
Total	70	130	150	

inecuaciones:

$$\begin{array}{l} r_1 \quad x_1 + 2x_2 \geq 70 \\ r_2 \quad 2x_1 + 2x_2 \geq 130 \\ r_3 \quad 4x_1 + 2x_2 \geq 150 \end{array}$$

función obj:

$$z = 150x_1 + 200x_2$$

ecuación:

$$x_1 + 2x_2 - x_3 + M_1 = 70$$

$$2x_1 + 2x_2 - x_4 + M_2 = 130$$

$$(mínimo) 4x_1 + 2x_2 - x_5 + M_3 = 150$$

puntos:

$$\begin{array}{ll} r_1 \quad x_1 = 70 & x_2 = 35 \\ r_2 \quad x_1 = 65 & x_2 = 65 \\ r_3 \quad x_1 = 37,5 & x_2 = 7,5 \end{array}$$

coordenadas:

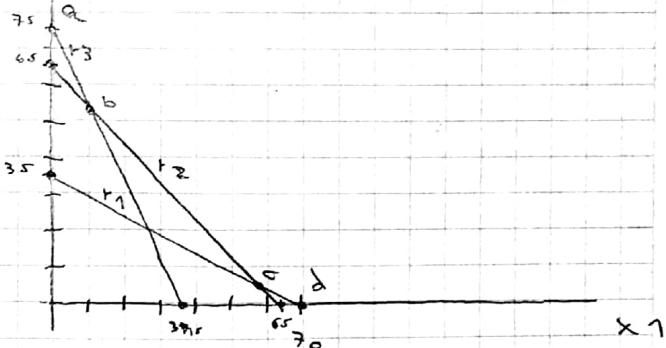
25:

$$\begin{array}{ll} a(0, 75) & z_0 = 150 \cdot 0 + 200 \cdot 75 = 15.000 \\ b(10, 55) & z_0 = 150 \cdot 10 + 200 \cdot 55 = 12.500 \\ c(60, 5) & z_0 = 150 \cdot 60 + 200 \cdot 5 = 10.000 \\ d(70, 0) & z_0 = 150 \cdot 70 + 200 \cdot 0 = 10.500 \end{array}$$

x2

obtengo "b":

$$\begin{aligned} 2x_1 + 2x_2 &= 130 \rightarrow x_2 = -x_1 + 65 \\ 4x_1 + 2x_2 &= 150 \rightarrow x_2 = -2x_1 + 75 \\ &\rightarrow x_2 = -2 \cdot 10 + 75 \\ -x_1 + 65 &= -2x_1 + 75 \quad \boxed{x_2 = 55} \\ -x_1 + 2x_1 &= 75 - 65 \\ \boxed{x_1 = 10} \end{aligned}$$



obtengo "c":

$$\begin{aligned} x_1 + 2x_2 &= 70 \rightarrow x_2 = \frac{1}{2}x_1 + 35 \\ 2x_1 + 2x_2 &= 130 \rightarrow x_2 = -x_1 + 65 \\ &\rightarrow x_2 = -60 + 65 \\ -\frac{1}{2}x_1 + 35 &= -x_1 + 65 \quad \boxed{x_2 = 5} \\ -\frac{1}{2}x_1 + x_1 &= 65 - 35 \\ \frac{1}{2}x_1 &= 30 \\ x_1 &= \frac{30}{\frac{1}{2}} \\ \boxed{x_1 = 60} \end{aligned}$$

resultados:

$$x_1 = 60$$

$$x_2 = 5$$

$$z = 150 \cdot 60 + 200 \cdot 5 = 10.000 \quad \checkmark$$

Método Simplex:  $Z = 150x_1 + 200x_2 + 0 \cdot x_3 + 0 \cdot x_4 + 0 \cdot x_5 + m \cdot M_1 + m \cdot M_2$

X	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$M_1$	$M_2$	$M_3$	$\phi$
$M_1$	70	1	2	-1	0	0	1	0	0	$\frac{1}{70}M_1 + \frac{1}{70}M_2 + \phi$
$M_2$	130	2	2	0	-1	0	0	1	0	$\frac{1}{130}M_2 + \phi$
$M_3$	150	(4)	2	0	0	-1	0	0	1	$\frac{1}{150}M_3 + \phi$
	350m	7m	6m	-3	-3	-3	3	3	3	
	150	200	0	0	0	0	3	3	3	
	$+m - 150$	$6m - 200$	-3	-3	-3	0	0	0	0	
	$\uparrow$									
$M_1$	$\frac{65}{2}$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$M_1$	$M_2$	$M_3$	$\frac{65}{2} - \frac{1}{2}m + \phi$
$M_2$	55	0	1	0	-1	$\frac{1}{2}$	0	1	$-\frac{1}{2}$	$55 - \frac{1}{2}m + \phi$
$x_1$	$\frac{75}{2}$	1	$\frac{1}{2}$	0	0	$-\frac{1}{2}$	0	0	$\frac{1}{4}$	$\frac{75}{2} + \frac{1}{2}m + \phi$
$\frac{125}{2}M_2 + 55\frac{1}{2}$	$150$	$\frac{5}{2}m + \frac{75}{2}$	-3	-3	$\frac{3}{4}m + \frac{75}{4}$	3	3	$-\frac{3}{4}m + \frac{75}{4}$	$\uparrow$	
	150	200	0	0	0	0	3	3	3	
	$\frac{100}{3} - \frac{125}{3}$	$\frac{5}{3}m - \frac{75}{3}$	-3	-3	$\frac{1}{3}m - \frac{75}{3}$	0	0	$-\frac{4}{3}m + \frac{75}{3}$		
	$\uparrow$									
$x_2$	$\frac{65}{3}$	$x_1$	$x_2$	$-x_3$	$x_4$	$x_5$	$M_1$	$M_2$	$M_3$	$\phi$
$M_2$	$\frac{100}{3}$	0	0	$\frac{1}{3}$	-1	$\frac{1}{3}$	0	$-\frac{1}{6}$	$\frac{65}{3} - \frac{2}{3}m + \phi$	
$x_1$	$\frac{50}{3}$	1	0	$\frac{1}{3}$	0	$-\frac{1}{3}$	$\frac{1}{3}$	0	$\frac{1}{3}$	$40 - \frac{1}{3}m + \phi$
$\frac{100}{3} + \frac{2500}{3}$	$150$	$200$	$\frac{2}{3}m - \frac{250}{3}$	-3	$\frac{1}{3}m - \frac{50}{3}$	$\frac{2}{3} + \frac{250}{3}$	3	$-\frac{1}{3}m + \frac{50}{3}$	$\uparrow$	
	150	200	0	0	0	0	3	3	3	
	$\frac{100}{3} - \frac{2500}{3}$	$\frac{5}{3}m - \frac{50}{3}$	-3	-3	$\frac{1}{3}m - \frac{50}{3}$	$\frac{2}{3} + \frac{250}{3}$	0	$-\frac{4}{3}m + \frac{50}{3}$		
	$\uparrow$									
$x_2$	$\frac{55}{3}$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$M_1$	$M_2$	$M_3$	$\phi$
$x_3$	50	0	0	1	$-\frac{1}{6}$	$\frac{1}{2}$	0	1	$\frac{1}{2}$	$55 - \frac{1}{2}m + \phi$
$x_1$	70	1	0	0	$\frac{1}{2}$	$-\frac{1}{2}$	0	$-\frac{1}{2}$	$\frac{1}{2}$	$10 - \frac{1}{2}m + \phi$
$12500$	$150$	$200$	0	-125	-175	0	0	125	175	
	150	200	0	0	0	0	3	3	3	
	$\uparrow$			-125	-175	125 - 3	175 - 3			

hisares

continuation 8)

C	$x_1$	$B$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$\mu_1$	$-\frac{\mu_2}{2}$	$M_3$	$\emptyset$
200	$x_2$	5	0	1	-1	$\frac{7}{2}$	0	1	$-\frac{1}{2}$	0	
0	$x_5$	100	0	6	2	-3	1	-2	3	-7	
150	$x_1$	60	1	0	7	-7	0	-1	7	0	
25		70,000	150	200	-50	-50	0	50	50	0	
0			150	200	0	0	0	m	m	m	3
25-0			0	0	-50	-50	0	50-m	50-m	-m	

variables:

$$x_1 = 60$$

$$x_2 = 5$$

$$z = 10,000$$



## Método simplex

## Ecuaciones

$$\begin{array}{rcl}
 x_1 - 2x_2 + x_3 & = & 0 \\
 -x_1 + x_2 & = & 2 \\
 x_1 + x_2 & = & 5 \\
 x_2 & & \\
 x_1 & &
 \end{array}$$

$$Z = 5x_1 + 4x_2 + 0x_3 + 0x_4 + 0x_5 + 0x_6 + 0x_7 - m \cdot M_1 - m \cdot M_2$$

$$\begin{array}{cccc}
 & \downarrow & \downarrow & \\
 \begin{matrix} 0 & 2 & 4 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 2 & 5 \end{matrix} & \begin{matrix} 0 & 2 & 4 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 2 & 5 \end{matrix} & \begin{matrix} 0 & 2 & 4 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 2 & 5 \end{matrix} & \begin{matrix} 0 & 2 & 4 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 2 & 5 \end{matrix} \\
 \begin{matrix} 0 & 0 & 0 & 0 & 1 & 3 & 6 & 0 \\ , & & & & & & & \\ 1 & 0 & 0 & 0 & 1 & 3 & 6 & 0 \end{matrix} & \begin{matrix} 0 & 2 & 4 & 1 & 0 & 5 & 8 & 5 \\ , & & & & & & & \\ 1 & 0 & 0 & 0 & 1 & 3 & 6 & 0 \end{matrix} & \begin{matrix} 0 & 2 & 4 & 1 & 0 & 5 & 8 & 5 \\ , & & & & & & & \\ 1 & 0 & 0 & 0 & 1 & 3 & 6 & 0 \end{matrix} & \begin{matrix} 0 & 2 & 4 & 1 & 0 & 5 & 8 & 5 \\ , & & & & & & & \\ 1 & 0 & 0 & 0 & 1 & 3 & 6 & 0 \end{matrix} \\
 \end{array}$$

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$$5 \times 10^5 \text{ or } 000\ 000 \quad 5 \times 10^5 \text{ or } 000\ 000 \quad 5 \times 10^5 \text{ or } 000\ 000$$

$\overline{x}_0 \approx 000000$     $\overline{x}_0 \approx 000009$     $\overline{x}_0 \approx 000000$

$$x_1^3 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \quad x_1^3 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \quad x_1^3 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0$$

$x_1^n < r < 0, \exists x \in X_1^n, r \in (r_0, \varepsilon) \subset X^0$

B O N S I R R A  
B R M S I R R A

$$x_3 \quad x_4 \quad x_5 \quad x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_1 \quad x_2$$

100033 - 100034 = 1

10)	$x = \text{tiempo}$
16 mb	2 min
32 mb	3 min

$$x = 16 \text{ min}$$

$$y = 32 \text{ min}$$

Función objetivo:  
 $45x + 60y$  (maximizar)

$$r_1: x \leq 90$$

$$r_2: y \leq 80$$

$$r_3: x + y \leq 125$$

$$r_4: 2x + 3y \leq 300$$

$$y = 100 \quad x = 150$$

$$\rightarrow y \leq -x + 125$$

$$\rightarrow y \leq -\frac{2}{3}x + 100$$

Puntos:

$$a(0, 100)$$

$$b(75, 50)$$

$$c(125, 0)$$

$$d(0, 80)$$

$$e(90, 0)$$

Calculo b:

z:

$$z_a: 45 \cdot 0 + 60 \cdot 100 = 6000$$

$$z_b: 45 \cdot 75 + 60 \cdot 50 = 6375$$

$$z_c: 45 \cdot 125 + 60 \cdot 0 = 5625$$

$$z_d: 45 \cdot 0 + 60 \cdot 80 = 4800$$

$$z_e: 45 \cdot 90 + 60 \cdot 0 = 4050$$

r3

$$y = -x + 125 \rightarrow y = 50 + 125$$

$$r4 \quad y = -\frac{2}{3}x + 100$$

$$-x + 125 = -\frac{2}{3}x + 100$$

$$125 - 100 = -\frac{2}{3}x + x$$

$$25 = \frac{1}{3}x$$

$$\frac{25}{\frac{1}{3}} = x$$

$$75 = x$$

resultados:

$$x = 75$$

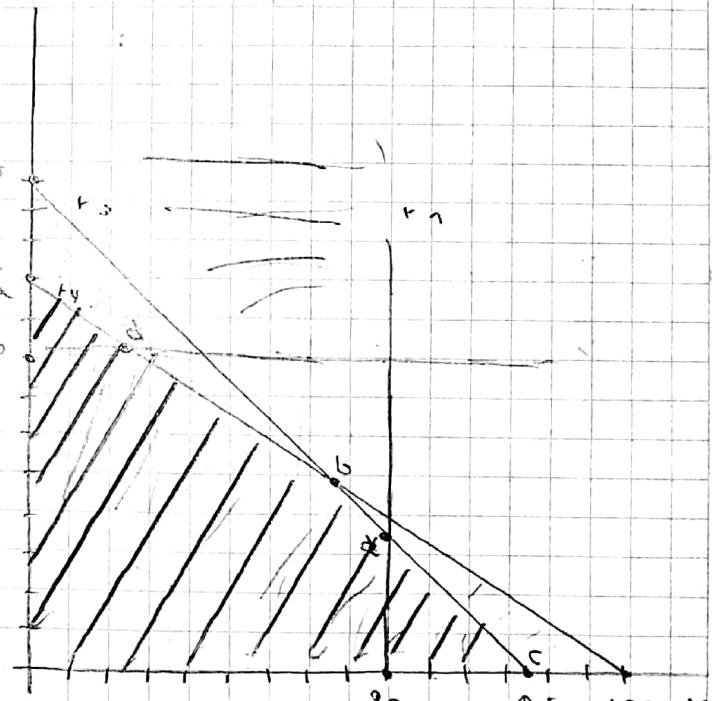
$$y = 50$$

$$z = 6375$$

Punto c:

$$r_2: y \leq 80$$

$$r_4: y \leq -\frac{2}{3}x + 100 \quad x = 0$$



Método simplex

Ecuaciones:

$$\begin{aligned} x_1 &= 0 \\ x_2 &= 0 \\ x_1 + x_2 + x_3 &= 125 \\ 2x_1 + 3x_2 + x_4 &= 300 \end{aligned}$$

	x	B	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>6</sub>	Φ
0	x <sub>3</sub>	0	1	0	0	0	0	0	0
0	x <sub>2</sub>	80	0	1	0	1	0	0	80/1 = 80 ↗
0	x <sub>5</sub>	125	1	1	0	0	1	0	125/1 = 125
0	x <sub>6</sub>	300	2	3	0	0	0	1	300/3 = 100
z <sub>j</sub>		0	0	0	0	0	0	0	
c <sub>j</sub>		45	60	0	0	0	0	0	
z <sub>j</sub> - c <sub>j</sub>		-45	-60	0	0	0	0	0	

	x	B	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>6</sub>	Φ
0	x <sub>3</sub>	0	1	0	0	0	0	0	0/1 = 0
60	x <sub>2</sub>	80	0	1	0	1	0	0	80/0 = 1
0	x <sub>5</sub>	45	1	0	0	-1	1	0	45/1 = 45
0	x <sub>6</sub>	60	0	0	0	-3	0	1	60/2 = 30 ↗
z <sub>j</sub>		4800	0	60	0	60	0	0	
c <sub>j</sub>		45	60	0	0	60	0	0	
z <sub>j</sub> - c <sub>j</sub>		-45	0	0	60	0	0	0	

	x	B	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>6</sub>	Φ
0	x <sub>3</sub>	60	0	0	1	0	0	0	60/1 = 60
60	x <sub>2</sub>	80	0	1	0	1	0	0	80/1 = 80
0	x <sub>5</sub>	15	0	0	0	1/2	1	-1/2	15/1/2 = 30 ↗
45	x <sub>1</sub>	30	1	0	0	-1/2	0	1/2	30/1 - 3/2 = -20
z <sub>j</sub>		6150	45	60	0	-1/2	0	1/2	
c <sub>j</sub>		45	60	0	0	0	0	0	
z <sub>j</sub> - c <sub>j</sub>		0	0	0	0	-1/2	0	1/2	

continuation (b)

$$\begin{array}{ccccccccc|c} & & & & & & & & & \\ & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & x_6 \\ & 6 & 0 & 0 & x_3 & x_2 & x_1 & 0 & 0 & -1 \\ & 0 & 0 & x_4 & 30 & 50 & 75 & 15 & 1 & x_7 \\ & 45 & x_1 & +5 & 1 & 50 & 75 & 15 & 1 & 1 \\ z_j & & 6375 & 45 & 45 & 60 & 10 & 0 & 2 \\ c_j & & & 45 & 60 & 0 & 1 & 0 & -1 \\ z_j - c_j & & & 6 & 0 & 0 & 0 & 0 & 0 \end{array}$$

Results:

$$x_1 = 45$$

$$x_2 = 60$$

$$z = 6375$$

11) Resolver método simplex

$$x_1 + x_3 + 2x_4 \geq 8$$

$$x_2 + 3x_3 + x_4 \geq 3$$

$$Z = 16x_1 + 8x_2 + 20x_3 + 24x_4 \text{ (minimizar)}$$

Ecuaciones:

$$x_1 + x_3 + 2x_4 - x_5 + M_1 = 8$$

$$x_2 + 3x_3 + x_4 - x_6 + M_2 = 3$$

$$Z = 16x_1 + 8x_2 + 20x_3 + 24x_4 + 0x_5 + 0x_6 \text{ m. } M_1 \text{ m. } M_2$$

	x	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$M_1$	$M_2$	
3	$x_1$	8	(1)	0	1	2	-1	0	1	0	$8/1 = 8$
3	$M_2$	3	0	-1	3	1	0	-1	0	1	$3/1 = 3$
$Z_j$			11m	m	3m	4m	3m	-m	-m	m	m
$c_j$			16	0	20	24	0	0	m	m	m
$Z_j - c_j$			$m - 16$	$m - 8$	$3m - 20$	$3m - 24$	$-m$	$-m$	0	0	

	x	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$M_1$	$M_2$	
16	$x_1$	8	1	0	1	2	-1	0	1	0	$8/1 = 8$
3	$M_2$	3	0	1	(3)	1	0	-1	0	1	$3/1 = 3$
$Z_j$			$3m + 128$	16	m	$3m + 16$	$m + 32$	$-16$	$-m$	16	m
$c_j$			16	0	20	24	0	0	m	m	m
$Z_j - c_j$			0	$m - 8$	$3m - 4$	$m + 8$	$-16$	$-m$	$16 - m$	0	

	x	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$M_1$	$M_2$	
16	$x_1$	7	1	$-\frac{1}{3}$	0	$\frac{5}{3}$	$-\frac{1}{3}$	$\frac{1}{3}$	1	$-\frac{1}{3}$	$-\frac{1}{3} = \frac{1}{3}$
20	$x_3$	1	0	$-\frac{1}{3}$	1	( $\frac{1}{3}$ )	0	$-\frac{1}{3}$	0	$\frac{1}{3}$	$1/3 = 3$
$Z_j$			132	16	$-\frac{4}{3}$	20	$\frac{100}{3}$	$-16$	$-\frac{4}{3}$	16	
$c_j$			16	0	20	24	0	0	m	m	m
$Z_j - c_j$			0	$-\frac{12}{3}$	0	$\frac{28}{3}$	$-16$	$-\frac{4}{3}$	$16 - m$	$\frac{4}{3} - m$	

C	X	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$M_1$	$M_2$	Φ
16	$x_1$	2	1	-2	-5	0	-1	(2)	1	-2	$\frac{2}{2} = 1$
24	$x_4$	3	0	7	3	1	0	-1	0	1	$\frac{3}{1} - 1 = -3$
$\underline{z_j}$		704	16	-8	-8	24	-16	0	16	-8	
$\underline{c_j}$		76	8	20	24	0	0	0	m	3	
$\underline{z_j - c_j}$		0	-16	-28	0	-16	8		$16-m$	$-8-m$	
								↑			
C	X	B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$M_1$	$M_2$	Φ
0	$x_6$	1	$\frac{1}{2}$	-1	$-\frac{5}{2}$	0	$-\frac{1}{2}$	1	$\frac{1}{2}$	-1	
24	$x_4$	4	$\frac{1}{2}$	0	$-\frac{1}{2}$	1	$-\frac{1}{2}$	0	$\frac{1}{2}$	0	
$\underline{z_j}$		76	12	0	72	24	-12	0	12	0	
$\underline{c_j}$		76	8	20	24	0	0	0	m	3	
$\underline{z_j - c_j}$		-4	-8	-8	0	-12	0		$12-m$	-m	

Resultados:

$$x_6 = 9$$

$$x_4 = -4$$

$$\boxed{x_3 = 96}$$

12) Resolver método simplex.

$$\begin{array}{l} 4x_1 - x_2 \leq 8 \\ 2x_1 + x_2 \leq 10 \\ 4x_1 + 3x_2 \leq 24 \end{array}$$

$$Z = 8x_1 + 6x_2 \text{ (maximizar)}$$

Ecuación:

$$\begin{array}{l} 4x_1 - x_2 + x_3 = 8 \\ 2x_1 + x_2 + x_4 = 10 \\ 4x_1 + 3x_2 + x_5 = 24 \end{array}$$

	x	B	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	Z <sub>14</sub> = Z ↗
0	x <sub>3</sub>	8	(4)	-1	1	0	0	
0	x <sub>4</sub>	10	2	1	0	1	0	10/2 = 5
0	x <sub>5</sub>	24	4	3	0	0	1	24/4 = 6
		0	0	0	0	0	0	
		8	6	0	0	0	0	
		-8	-6	0	0	0	0	
								↑

	x	B	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	Z <sub>14</sub> = Z ↗
0	x <sub>1</sub>	2	1	- $\frac{1}{4}$	$\frac{1}{4}$	0	0	z <sub>14</sub> = -8
0	x <sub>4</sub>	6	0	$\frac{3}{2}$	- $\frac{1}{2}$	1	0	6/ $\frac{3}{2}$ = 4 ↗
0	x <sub>5</sub>	16	0	(4)	-1	0	1	16/4 = 4 ↗
		16	8	-2	2	0	0	
		8	6	0	0	0	0	
		0	-8	2	0	0	0	↑

	$x$	$B$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	
0	$x_1$	3	1	0	$\frac{3}{16}$	0	$\frac{3}{16}$	$\frac{3}{16} = 16 \leftarrow$
0	$x_4$	0	0	0	$-\frac{1}{8}$	1	$-\frac{3}{8}$	0
6	$x_2$	4	0	1	$-\frac{1}{4}$	0	$\frac{1}{4}$	$41 - 1 = 40$
2		48	0	6	0	0	0	2
0			8	6	0	0	0	0
0			0	0	0	0	0	2

$\Rightarrow$  solución alternativa

	$x$	$B$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	
0	$x_3$	$\frac{1}{16}$	0	0	1	0	$\frac{1}{2}$	$\emptyset$
0	$x_4$	2	$\frac{1}{2}$	0	0	1	$-\frac{1}{2}$	
6	$x_2$	8	$\frac{1}{2}$	1	0	0	$\frac{1}{3}$	
2		40	0	6	0	0	0	2
0			0	6	0	0	0	0
0			0	0	0	0	0	2

$\Rightarrow$  se obtiene  $x_4 = 2$  y  $x_5 = 0$

se establece que  $x_1 = 0$ ,  $x_2 = 8$  y  $x_3 = 16$

Resultados:

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} (1-4) \\ 3 \\ 4 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 16 \\ 2 \end{bmatrix}$$

continuación

72)

inecuaciones:

$$\begin{array}{l} r_1 4x_1 - x_2 \leq 8 \\ r_2 2x_1 + x_2 \leq 10 \\ r_3 4x_1 + 3x_2 \leq 12 \end{array}$$

$$Z = 8x_1 + 6x_2 \text{ (maximizar)}$$

puntos:

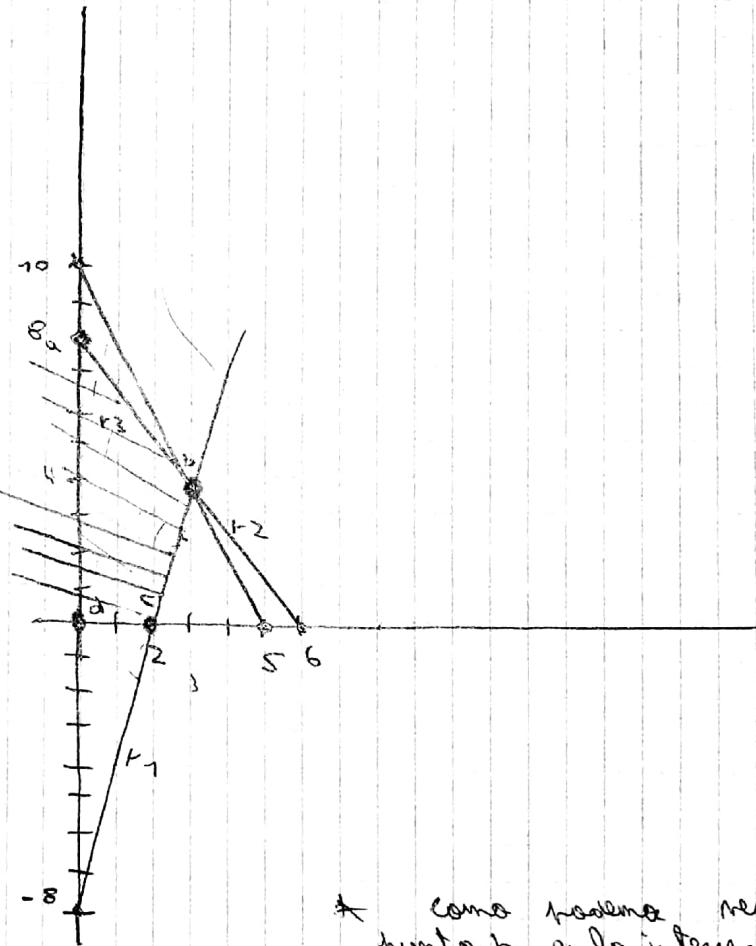
$$\begin{array}{ll} r_1 x_1 = 2 & x_2 = -8 \\ r_2 x_1 = 5 & x_2 = 10 \\ r_3 x_1 = 6 & x_2 = 0 \end{array}$$

coordenadas:

$$\begin{array}{ll} P(0, 8) & Z_P = 8.0 + 6.8 = 48 \\ Q(2, 4) & Z_Q = 8.2 + 6.4 = 43 \\ R(2, 0) & Z_R = 8.2 + 6.0 = 16 \end{array}$$

\* obtengo b:

$$\begin{array}{l} r_1 4x_1 - x_2 = 8 \Rightarrow x_2 = 4x_1 - 8 \\ r_2 2x_1 + x_2 = 10 \Rightarrow x_2 = -2x_1 + 10 \\ \therefore x_2 = -2x_1 + 10 \\ 4x_1 - 8 = -2x_1 + 10 \quad |x_2 = 4 \\ 4x_1 + 2x_1 = 10 + 8 \\ 6x_1 = 18 \\ x_1 = 3 \\ \boxed{x_1 = 3} \end{array}$$



$$\begin{array}{l} r_2 x_1 + x_2 = 10 \quad x_2 = -2x_1 + 10 \\ r_3 4x_1 + 3x_2 = 24 \quad x_2 = -\frac{4}{3}x_1 + 8 \\ \therefore x_2 = -\frac{4}{3}x_1 + 8 \\ -2x_1 + 10 = -\frac{4}{3}x_1 + 8 \quad |x_2 = 4 \\ 10 - 8 = -\frac{4}{3}x_1 + 8 \\ 2 = -\frac{4}{3}x_1 + 8 \\ 2 = \frac{4}{3}x_1 + 8 \\ 2 = x_1 \\ \boxed{3 = x_1} \end{array}$$

$$\begin{array}{l} r_1 4x_1 - x_2 = 8 \Rightarrow x_2 = 4x_1 - 8 \\ r_3 4x_1 + 3x_2 = 24 \Rightarrow x_2 = -\frac{4}{3}x_1 + 8 \\ 4x_1 - 8 = -\frac{4}{3}x_1 + 8 \\ 4x_1 + \frac{4}{3}x_1 = 8 + 8 \\ \frac{16}{3}x_1 = 16 \\ x_1 = \frac{16}{16} \\ \boxed{x_1 = 3} \end{array}$$

\* Como resultado del punto b es la intersección entre 3 rectas, el resultado x e y de los puntos podemos obtener los de las 3 variables y calcular así los resultados.

15) Resolución:

inecuaciones:

$$+1 \quad x_1 + x_2 \leq 3$$

$$+2 \quad 4x_1 + 6x_2 \leq 24$$

$$+3 \quad 2x_1 + 2x_2 \leq 12$$

punto s:

$$r_1 \quad x_1 = 0 \quad x_2 = 3$$

$$r_2 \quad x_1 = 6 \quad x_2 = 4$$

$$r_3 \quad x_1 = 6 \quad x_2 = 6$$

coordenadas:

$$a(0, 3)$$

$$b\left(\frac{3}{2}, 3\right)$$

$$c(6, 0)$$

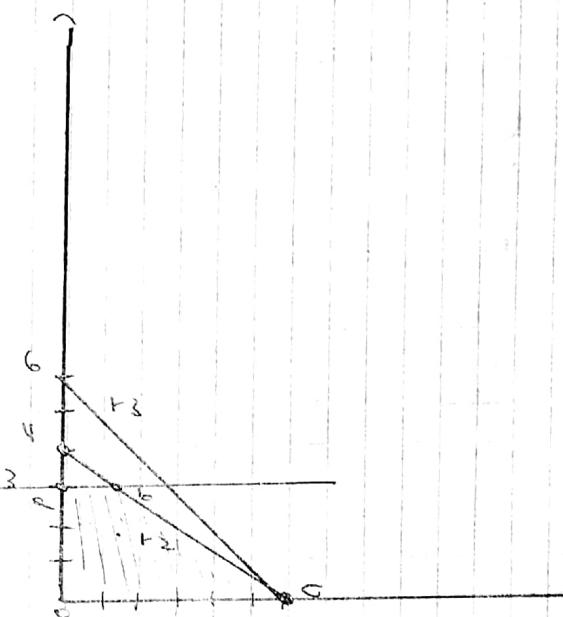
$$z = 5$$

$$z_a = -2 \cdot 0 + 4 \cdot 3 = 12$$

$$z_b = -2 \cdot \frac{3}{2} + 4 \cdot 3 = 7$$

$$z_c = -2 \cdot 6 + 4 \cdot 0 = -12$$

r1



Ejemplo B:

$$r_1 \quad x_1 + x_2 \leq 3$$

$$r_2 \quad 4x_1 + 6x_2 = 24 \quad \rightarrow x_2 = -\frac{2}{3}x_1 + 4$$

$$\rightarrow x_2 = -\frac{2}{3}x_1 + 4$$

$$3 = -\frac{2}{3}x_1 + 4$$
$$\frac{3}{3}x_1 = 4 - 3$$

$$x_1 = \frac{3}{2}$$

$$x_1 = \frac{3}{2}$$

soltado:

$$x_1 = \frac{3}{2}$$

$$x_2 = 0$$

$$z = -12$$

ecuaciones:

$$x_1 + x_2 = 3$$

$$4x_1 + 6x_2 = 24$$

$$2x_1 + 2x_2 = 12$$

Método Simplex:

		B	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	
0	$x_1$	0	3	0	1	0	0	$\rightarrow$
0	$x_3$	0	24	4	0	0	0	$\rightarrow$
0	$x_4$	0	12	0	0	0	0	$\rightarrow$
0	$x_5$	0	0	0	0	0	0	
$c_j - c_0$			2	6	0	0	0	
			-2	4	0	0	0	
			-4	-4	0	0	0	
			-12	-12	0	0	0	
$c_j - c_0$			0	0	0	0	0	
0	$x_1$	0	3	1	0	0	0	$\rightarrow$
0	$x_3$	0	0	2	0	0	0	$\rightarrow$
-2	$x_1$	6	1	1	0	0	0	$\rightarrow$
-2	$x_2$	-12	-2	-2	0	0	0	$\rightarrow$
-2			-2	4	0	0	0	$\rightarrow$
-2			0	-6	0	0	0	$\rightarrow$
$c_j - c_0$			0	0	0	0	0	
			0	0	1	0	0	
			0	0	0	1	0	
			0	0	0	0	1	
			0	0	0	0	0	

Resultados:

$$x_1 = 6$$

$$x_3 = 3$$

$$x_4 = 0$$

$$z = -12$$

16) Randow:

$$4x_1 + 3x_2 \leq 12$$

$$2x_1 - 5x_2 \geq 3$$

$$-2x_1 + x_2 \leq 0$$

$$z = 4x_1 + 5x_2 \text{ (minimizer)}$$

grenzen:

$$x_1 = 3$$

$$x_1 = 5$$

$$x_1 = 0$$

$$x_2 = 4$$

$$x_2 = 1 - \frac{3}{5}$$

$$x_2 = 0$$

coordinates:

$$e = \left( \frac{3}{2}, 0 \right)$$

$$b = \left( \frac{6}{5}, \frac{6}{13} \right)$$

$$c = \left( 3, 0 \right)$$

$$\left( 2, 5 \right)$$

$$ze = 4 \cdot \frac{3}{2} + 5 \cdot 0 = 6$$

$$zb = 4 \cdot \frac{6}{5} + 5 \cdot \frac{6}{13} = \frac{168}{13}$$

$$zc = 4 \cdot 3 + 5 \cdot 0 = 12$$

Optimal:

$$r_1: 4x_1 + 3x_2 = 12 \rightarrow x_2 = -\frac{4}{3}x_1 + 4$$

$$r_2: 2x_1 - 5x_2 = 3 \rightarrow x_2 = \frac{2}{5}x_1 - \frac{3}{5}$$

$$x_2 = \frac{2}{5} \cdot \frac{6}{5} = \frac{3}{5}$$

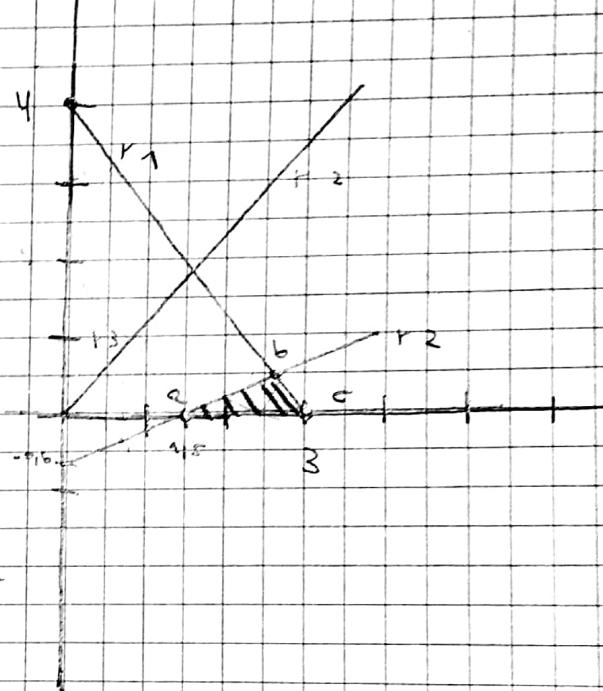
$$-\frac{4}{3}x_1 + 4 = \frac{2}{5}x_1 - \frac{3}{5}$$

$$-\frac{2}{3}x_1 = \frac{2}{5}x_1 + \frac{1}{5}$$

$$\frac{13}{15}x_1 = \frac{2}{5}$$

$$\boxed{\frac{10}{26} = x_1}$$

$$x_2 = \frac{6}{13}$$



Punkt:

$$x_1 = \frac{10}{26}$$

$$x_2 = 0$$

$$z = 6$$

Método simplex:

$$Z = 4x_1 + 5x_2 + 0x_3 + 2x_4 + 0x_5 + m \cdot M_1$$

Ecucciones:

$$4x_1 + 3x_2 + x_3 \leq 12$$

$$2x_1 - 5x_2 - x_4 + M_1 = 3$$

$$-2x_1 + x_2 + x_5 = 0$$

C	X	B	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	M <sub>1</sub>	Z
0	x <sub>3</sub>	12	4	3	1	0	0	0	$\frac{12}{4} = 3$
m	M <sub>1</sub>	3	(2)	-5	0	-1	0	1	$3   2 = \frac{3}{2} \leftarrow$
0	x <sub>5</sub>	0	-2	1	0	0	1	0	$0   -2 =$

$$z: 3m \quad 2m \quad -5m \quad 0 \quad -3 \quad 0 \quad 3 \quad 3$$

$$c_{ij} \quad 4 \quad 5 \quad 0 \quad 0 \quad 0 \quad 3 \quad 3$$

$$z_j - c_{ij} \quad 2m - 4 \quad -5m - 5 \quad 0 \quad -3 \quad 0 \quad 0$$

↑

C	X	B	y <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	M <sub>1</sub>	Z
0	x <sub>3</sub>	6	0	13	1	2	0	-2	
4	x <sub>1</sub>	$\frac{3}{2}$	1	$-\frac{5}{2}$	0	$-\frac{1}{2}$	0	$\frac{1}{2}$	
0	x <sub>5</sub>	3	0	-4	0	-1	1	7	

$$z: 6 \quad 4 \quad -10 \quad 0 \quad -2 \quad 0 \quad 2$$

$$c_{ij} \quad 4 \quad 5 \quad 0 \quad 0 \quad 0 \quad 0 \quad m$$

$$z_j - c_{ij} \quad 0 \quad -15 \quad 0 \quad -2 \quad 0 \quad 2 - m$$

Resultados:

$$x_1 = \frac{3}{2}$$

$$x_3 = 6$$

$$x_5 = 3$$

$$Z = 6$$

1)

$$\begin{cases} r_1: 4x_1 - x_2 \leq 8 \\ r_2: 2x_1 + x_2 \leq 10 \\ r_3: 4x_1 + 3x_2 \leq 24 \end{cases}$$

$$Z = 8x_1 + 6x_2 \quad (\text{maximizar}) \quad \left\{ \begin{array}{l} z = 8x_1 + 6x_2 + 0x_3 + 0x_4 + 0x_5 \end{array} \right.$$

Punto:

$$\begin{cases} r_1: x_1 = 2 \quad x_2 = -8 \\ r_2: x_1 = 5 \quad x_2 = 10 \\ r_3: x_1 = 6 \quad x_2 = 8 \end{cases}$$

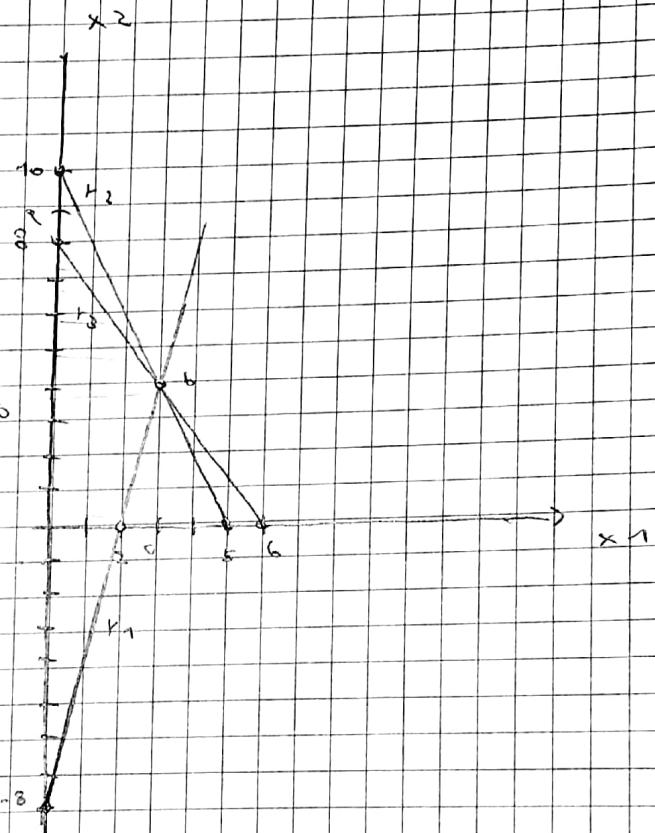
Coordinadas:

$$\begin{cases} A = (0; 8) \\ B = (3; 4) \\ C = (2; 0) \end{cases} \quad \begin{cases} Z_A = 8 \cdot 0 + 6 \cdot 8 = 48 \\ Z_B = 3 \cdot 3 + 6 \cdot 4 = 48 \\ Z_C = 2 \cdot 2 + 6 \cdot 0 = 16 \end{cases}$$

solución:

$$\begin{cases} r_1: 4x_1 - x_2 = 8 \rightarrow x_2 = 4x_1 - 8 \\ r_2: 2x_1 + x_2 = 10 \rightarrow x_2 = -2x_1 + 10 \\ \quad x_2 = -2x_1 + 10 \\ 4x_1 - 8 = -2x_1 + 10 \quad |+2x_1 \\ 6x_1 = 18 \\ x_1 = \frac{18}{6} \end{cases}$$

$$\boxed{x_1 = 3}$$



$$\begin{cases} r_2: 2x_1 + x_2 = 10 \rightarrow x_2 = -2x_1 + 10 \\ r_3: 4x_1 + 3x_2 = 24 \rightarrow x_2 = -\frac{4}{3}x_1 + 8 \\ -\frac{4}{3}x_1 + 8 = -2x_1 + 10 \quad |+2x_1 \\ \frac{2}{3}x_1 + 8 = 10 \quad |-8 \\ \frac{2}{3}x_1 = 2 \\ x_1 = \frac{2}{3} \cdot 3 \end{cases}$$

solución:

$$Z = 48$$

→ Existe infinitas soluciones (soluciones alternativas)  
Este ejercicio es igual al 1º solo que  
se representan graficamente