

Responda cada pregunta sin omitir detalles, no olvide poner su nombre y número de carné en su documento digital. **Trabaje ordenadamente, si una respuesta no se comprende NO se puede revisar.**

**Entregar un pdf con las fotos de su examen. Trabajar a mano, NO utilizar editores de texto ni herramientas de graficación. Se puede realizar en parejas. Si trabajan dos personas, coloca el nombre de ambos en el documento. Solo un estudiante de la pareja sube el examen.**

Consulta martes y miércoles.

**Integrantes:**

- Dayana Xie Li, 2022097967
- Jeison Fonseca Brenes, 2020001815

### Ejercicio #1 (Gran M)

Valor 25 ptos

$$\text{Min } z = -x - 2y$$

Sujeto a:

$$x + y \geq 2$$

$$-x + y \geq 1$$

$$y \leq 3$$

$$x, y \geq 0$$

- Debe venir completo todo el desarrollo, Gran M
- Tabla inicial
- Penalización
- Tipo de Caso

## Ejercicio #1: Gran M

$$\text{Min } z = -x - 2y$$

Sujeto a:

$$x + y \geq 2 \quad A_1 - E_1$$

$$-x + y \geq 1 \quad A_2 - E_2$$

$$y \leq 3 \quad H_1$$

$$x, y \geq 0$$

$$x + y + A_1 - E_1 = 2$$

$$-x + y + A_2 - E_2 = 1$$

$$y + H_1 = 3$$

$$\text{Min } z = -x - 2y + MA_1 + MA_2 + OH_1 + OE_1 + OE_2$$

$$\text{Min } z = 0 \Rightarrow x + 2y - MA_1 - MA_2 + OH_1 + OE_1 + OE_2$$

Base	v0		variables					VS
	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>	
A <sub>1</sub>	1	1	1	0	0	-1	0	2
A <sub>2</sub>	-1	1	0	1	0	0	-1	1
H <sub>1</sub>	0	1	0	0	1	0	0	3
z	1	2	-M	-M	0	0	0	0

## Generalización

Base	v0		variables					VS
	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>	
z viejo	1	2	-M	-M	0	0	0	0
+MA <sub>1</sub>	M	M	M	0	0	-M	0	2M
+MA <sub>2</sub>	-M	M	0	M	0	0	-M	M
Nuevo z	1	2+2M	0	0	0	-M	-M	3M

Base	X	Y	variables						VS
			A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>		
A <sub>1</sub>	1	1	1	0	0	-1	0	2	
A <sub>2</sub>	-1	1	0	1	0	0	-1	1	Pivot
H <sub>1</sub>	0	1	0	0	1	0	0	3	
Z	1	2+2M	0	0	0	-M	-M	3M	

$$VE: Y \quad RM = \underline{Z}_1 = 2, \underline{Y}_1 = 1, \underline{3}_1 = 3$$

VS: A<sub>2</sub>

	V0			VA0					VS
	X	Y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>		
Pivot A <sub>2</sub> =Y	-1	1	0	1	0	0	-1	1	//

	A <sub>1</sub>	H <sub>1</sub>	2
X	$1 - (1 \cdot 1) = 2$	$0 - (1 \cdot -1) = 1$	$1 - ((2+2M) \cdot -1) = 3+2M$
Y	$1 - (1 \cdot 1) = 0$	$1 - (1 \cdot 1) = 0$	$2+2M - ((2+2M) \cdot 1) = 0$
A <sub>1</sub>	$1 - (1 \cdot 0) = 1$	$0 - (1 \cdot 0) = 0$	$0 - ((2+2M) \cdot 0) = 0$
A <sub>2</sub>	$0 - (1 \cdot 1) = -1$	$0 - (1 \cdot 1) = -1$	$0 - ((2+2M) \cdot 1) = -2-2M$
H <sub>1</sub>	$0 - (1 \cdot 0) = 0$	$1 - (1 \cdot 0) = 1$	$0 - ((2+2M) \cdot 0) = 0$
E <sub>1</sub>	$-1 - (1 \cdot 0) = -1$	$0 - (1 \cdot 0) = 0$	$-M - ((2+2M) \cdot 0) = -M$
E <sub>2</sub>	$0 - (1 \cdot -1) = 1$	$0 - (1 \cdot -1) = 1$	$-M - ((2+2M) \cdot -1) = 2M+M$
VS	$2 - (1 \cdot 1) = 1$	$3 - (1 \cdot 1) = 2$	$3M - ((2+2M) \cdot 1) = M-2$

Base	X	Y	variables						VS
			A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>		
A <sub>1</sub>	2	0	1	-1	0	-1	1	1	Pivot
Y	-1	1	0	1	0	0	-1	1	
H <sub>1</sub>	1	0	0	-1	1	0	1	2	
Z	3+2M	0	0	-2-2M	0	-M	2M+M	M-2	

$$VE = X$$

$$VS = A_1$$

$$RM = \underline{Y}_2 = 0, \underline{S} , \underline{Y}_1 = X, \underline{Z}_1 = 2$$

	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>	VS
Pivot A <sub>1</sub> $\Rightarrow x = \frac{z}{2} = 1$	0	$\frac{1}{2}$	0	$-\frac{1}{2}$	0	$-\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

	Y	H <sub>1</sub>	Z
X	$-1 - (-1 \cdot 1) = 0$	$1 - (1 \cdot 1) = 0$	$3 + 2M - ((3 + 2M) \cdot 1) = 0$
Y	$1 - (-1 \cdot 0) = 1$	$0 - (1 \cdot 0) = 0$	$0 - ((3 + 2M) \cdot 0) = 0$
A <sub>1</sub>	$0 - (-1 \cdot \frac{1}{2}) = \frac{1}{2}$	$0 - (1 \cdot \frac{1}{2}) = -\frac{1}{2}$	$0 - ((3 + 2M) \cdot \frac{1}{2}) = -\frac{3}{2} - M$
A <sub>2</sub>	$1 - (-1 \cdot -\frac{1}{2}) = \frac{1}{2}$	$-1 - (1 \cdot -\frac{1}{2}) = -\frac{1}{2}$	$-2 - 2M - ((3 + 2M) \cdot -\frac{1}{2}) = -\frac{1}{2} - M$
H <sub>1</sub>	$0 - (-1 \cdot 0) = 0$	$1 - (1 \cdot 0) = 1$	$0 - ((3 + 2M) \cdot 0) = 0$
E <sub>1</sub>	$0 - (-1 \cdot -\frac{1}{2}) = -\frac{1}{2}$	$0 - (1 \cdot -\frac{1}{2}) = \frac{1}{2}$	$-M - ((3 + 2M) \cdot -\frac{1}{2}) = \frac{3}{2}$
E <sub>2</sub>	$-1 - (-1 \cdot \frac{1}{2}) = -\frac{1}{2}$	$1 - (1 \cdot \frac{1}{2}) = \frac{1}{2}$	$2 + M - ((3 + 2M) \cdot \frac{1}{2}) = \frac{1}{2}$
VS	$1 - (-1 \cdot \frac{1}{2}) = \frac{3}{2}$	$2 - (1 \cdot \frac{1}{2}) = \frac{3}{2}$	$M - 2 - ((3 + 2M) \cdot \frac{1}{2}) = -\frac{7}{2}$

Base	variables						VS
	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	
X	1	0	$\frac{1}{2}$	$-\frac{1}{2}$	0	$-\frac{1}{2}$	$\frac{1}{2}$
Y	0	1	$\frac{1}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$\frac{3}{2}$
H <sub>1</sub>	0	0	$-\frac{1}{2}$	$-\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{3}{2}$
Z	0	0	$-\frac{3}{2} - M$	$-\frac{1}{2} - M$	0	$\frac{3}{2}$	$-\frac{7}{2}$

$$\text{VE} = E_1 \quad RM = \frac{1}{2} / -\frac{1}{2} = X, \quad \frac{3}{2} / -\frac{1}{2} = X, \quad \frac{3}{2} / \frac{1}{2} = 3 //$$

$\text{VS} = H_1$

	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>	VS
Pivot H <sub>1</sub> $\Rightarrow E_1$	0	0	$-\frac{1}{2} / \frac{1}{2} = -1$	$-\frac{1}{2} / \frac{1}{2} = -1$	$\frac{1}{2} / \frac{1}{2} = 2$	$\frac{1}{2} / \frac{1}{2} = 1$	$\frac{1}{2} / \frac{1}{2} = 1$	$\frac{3}{2} / \frac{1}{2} = 3 //$

	X	Y	Z
X	$1 - (-\frac{1}{2} \cdot 0) = 1$	$0 - (-\frac{1}{2} \cdot 0) = 0$	$0 - (\frac{3}{2} \cdot 0) = 0$
Y	$0 - (-\frac{1}{2} \cdot 0) = 0$	$1 - (-\frac{1}{2} \cdot 0) = 1$	$0 - (\frac{3}{2} \cdot 0) = 0$
A <sub>1</sub>	$\frac{1}{2} - (-\frac{1}{2} \cdot -1) = 0$	$\frac{1}{2} - (-\frac{1}{2} \cdot -1) = 0$	$-\frac{3}{2} - M - (\frac{3}{2} \cdot -1) = -M$
A <sub>2</sub>	$-\frac{1}{2} - (-\frac{1}{2} \cdot -1) = -1$	$\frac{1}{2} - (-\frac{1}{2} \cdot -1) = 0$	$-\frac{1}{2} - M - (\frac{3}{2} \cdot -1) = 1 - M$
H <sub>1</sub>	$0 - (-\frac{1}{2} \cdot 2) = 1$	$0 - (-\frac{1}{2} \cdot 2) = 1$	$0 - (\frac{3}{2} \cdot 2) = -3$
E <sub>1</sub>	$-\frac{1}{2} - (-\frac{1}{2} \cdot 1) = 0$	$-\frac{1}{2} - (-\frac{1}{2} \cdot 1) = 0$	$\frac{3}{2} - (\frac{3}{2} \cdot 1) = 0$
E <sub>2</sub>	$\frac{1}{2} - (-\frac{1}{2} \cdot 1) = 1$	$-\frac{1}{2} - (-\frac{1}{2} \cdot 1) = 0$	$\frac{1}{2} - (\frac{3}{2} \cdot 1) = -1$
VS	$\frac{1}{2} - (-\frac{1}{2} \cdot 3) = 2$	$\frac{3}{2} - (-\frac{1}{2} \cdot 3) = 3$	$-\frac{7}{2} - (\frac{3}{2} \cdot 3) = -8$

Base	vo		variables						VS
	X	Y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	E <sub>2</sub>		
X	1	0	0	-1	1	0	1	2	
Y	0	1	0	0	1	0	0	3	
E <sub>1</sub>	0	0	-1	-1	2	1	1	3	
Z	0	0	-M	1-M	-3	0	-1	-8	

Punto (2,3)

R/Tipo de cajón: solución única.

$$\text{Min } z = -x - 2y$$

$$= -2 - 2 \cdot 3$$

$$= -8$$

**Ejercicio #2****Valor 25 ptos (2 Fases)**Min  $z = 8x + 2y$ 

Sujeto a:

$$6x + 2y = 6$$

$$8x + 6y \geq 12$$

$$2x + 4y \leq 8$$

$$x, y \geq 0$$

- Debe venir completo todo el desarrollo, 2 Fases
- Tabla inicial
- Penalización
- Cambio del FO
- Gauss Jordan
- Tipo de Caso
- Fase 1 y Fase 2

## Ejercicio #2: 2 fases

$$\text{Min } z = 8x + 2y$$

Sujeto a:

$$6x + 2y = 6 \quad (A_1)$$

$$8x + 6y \geq 12 \quad (A_2 - E_1)$$

$$2x + 4y \leq 8 \quad (H_1)$$

$$x, y \geq 0$$

### Fase 1:

$$\text{Min } r = A_1 + A_2 \quad \text{Iguald a } 0 \Rightarrow -A_1 - A_2$$

Sujeto:

$$6x + 2y + A_1 = 6$$

$$8x + 6y + A_2 - E_1 = 12$$

$$2x + 4y + H_1 = 8$$

### Tabla inicial:

Base	v0		variables					VS
	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>		
A <sub>1</sub>	6	2	1	0	0	0		6
A <sub>2</sub>	8	6	0	1	0	-1		12
H <sub>1</sub>	2	4	0	0	1	0		8
r	0	0	-1	-1	0	0		0

## Penalización:

Base	X	Y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	VS
Antiguo r	0	0	-1	-1	0	0	0
+fila A <sub>1</sub>	6	2	1	0	0	0	6
+fila A <sub>2</sub>	8	6	0	1	0	-1	12
Nuevo r	14	8	0	0	0	-1	18

## Tabla nuevo r:

Base	X	Y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	variables	VS
A <sub>1</sub>	6	2	1	0	0	0		6
A <sub>2</sub>	8	6	0	1	0	-1		12
H <sub>1</sub>	2	4	0	0	1	0		8
r	14	8	0	0	0	-1		18

$$VE = X$$

$$RM = \frac{6}{6} = 1, \frac{12}{8} = 1,5, \frac{8}{2} = 4$$

$$VS = A_1$$

Pivote A <sub>1</sub> = x	VD		VAO					VS
	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>		
	$\frac{6}{6} = 1$	$\frac{2}{6} = \frac{1}{3}$	$\frac{1}{6}$	0	0	0	$\frac{6}{6} = 1$	

	A <sub>2</sub>	H <sub>1</sub>	r
x	$8 - (8 \cdot 1) = 0$	$2 - (2 \cdot 1) = 0$	$14 - (14 \cdot 1) = 0$
y	$6 - (8 \cdot \frac{1}{3}) = \frac{10}{3}$	$4 - (2 \cdot \frac{1}{3}) = \frac{10}{3}$	$8 - (14 \cdot \frac{1}{3}) = \frac{10}{3}$
A <sub>1</sub>	$0 - (8 \cdot \frac{1}{6}) = -\frac{4}{3}$	$0 - (2 \cdot \frac{1}{6}) = -\frac{1}{3}$	$0 - (14 \cdot \frac{1}{6}) = -\frac{7}{3}$
A <sub>2</sub>	$1 - (8 \cdot 0) = 1$	$0 - (2 \cdot 0) = 0$	$0 - (14 \cdot 0) = 0$
H <sub>1</sub>	$0 - (8 \cdot 0) = 0$	$1 - (2 \cdot 0) = 1$	$0 - (14 \cdot 0) = 0$
E <sub>1</sub>	$-1 - (8 \cdot 0) = -1$	$0 - (2 \cdot 0) = 0$	$-1 - (14 \cdot 0) = -1$
VS	$12 - (8 \cdot 1) = 4$	$8 - (2 \cdot 1) = 6$	$18 - (14 \cdot 1) = 4$

Base	X	Y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	VS
X	1	1/3	1/6	0	0	0	1
A <sub>2</sub>	0	10/3	-4/3	1	0	-1	4
H <sub>1</sub>	0	10/3	-1/3	0	1	0	6
r	0	10/3	-7/3	0	0	-1	4

No se puede evaluar ya que  $r \neq r_{\text{initial}}$

$$VE = y \\ VS = A_2$$

$$RM = 1/3 = 3, \quad 4/10/3 = \underline{\underline{1,2}}, \quad 6/10/3 = 1,8$$

Pivote A <sub>2</sub> $\Rightarrow$ y	x	y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	VS
	0	10/3/10/3 = 1	-4/3/10/3 = -2/5	10/3/10/3 = 3/10	0	-4/10/3 = -3/10	4/10/3 = 6/5 = 1,2

Cálculos:

	x	H <sub>1</sub>	r
X	$1 - (1/3 \cdot 0) = 1$	$0 - (10/3 \cdot 0) = 0$	$0 - (10/3 \cdot 0) = 0$
y	$1/3 - (1/3 \cdot 1) = 0$	$10/3 - (10/3 \cdot 1) = 0$	$10/3 - (10/3 \cdot 1) = 0$
A <sub>1</sub>	$1/6 - (1/3 \cdot -2/5) = 3/10$	$-1/3 - (10/3 \cdot -2/5) = 1$	$-7/3 - (10/3 \cdot -2/5) = -1$
A <sub>2</sub>	$0 - (1/3 \cdot 3/10) = -1/10$	$0 - (10/3 \cdot 3/10) = -1$	$0 - (10/3 \cdot 3/10) = -1$
H <sub>1</sub>	$0 - (1/3 \cdot 0) = 0$	$1 - (10/3 \cdot 0) = 1$	$0 - (10/3 \cdot 0) = 0$
E <sub>1</sub>	$0 - (1/3 \cdot -3/10) = 1/10$	$0 - (10/3 \cdot -3/10) = 1$	$-1 - (10/3 \cdot -3/10) = 0$
VS	$1 - (1/3 \cdot 6/5) = 3/5$	$6 - (10/3 \cdot 6/5) = 2$	$4 - (10/3 \cdot 6/5) = 0$

Tabla final

Base	X	Y	A <sub>1</sub>	A <sub>2</sub>	H <sub>1</sub>	E <sub>1</sub>	VS	Como r tabla inicial
X	1	0	3/10	-4/10	0	1/10	3/5	= r tabla final, además,
y	0	1	-2/5	3/10	0	3/10	6/5	se cumplen las demás
H <sub>1</sub>	0	0	1	-1	1	1	2	condiciones, se puede
r	0	0	-1	-1	0	0	0	pasar a fase 2.

Fase 2:

$$\text{Min } z = 8x + 2y \quad \text{Igualar a } 0: -8x - 2y$$

Basé	x	y	$H_1$	$E_1$	VS
x	1	0	0	$\frac{1}{10}$	$\frac{3}{5}$
y	0	1	0	$-\frac{3}{10}$	$\frac{6}{5}$
$H_1$	0	0	1	1	2
z	-8	-2	0	0	0

$$\begin{aligned} \text{Min } z &= 8(x) + 2(y) \\ &= 8\left(\frac{3}{5}\right) + 2\left(\frac{6}{5}\right) \\ &= \underline{\underline{36/5}} \end{aligned}$$

Gauss Jordan  $\rightarrow$  Obtener solución básica factible

Fila x · 8 + z

Basé	x	y	$H_1$	$E_1$	VS
Fila x · 8	$1 \cdot 8 = 8$	$0 \cdot 8 = 0$	$0 \cdot 8 = 0$	$\frac{1}{10} \cdot 8 = \frac{4}{5}$	$\frac{3}{5} \cdot 8 = \frac{24}{5}$
z	-8	-2	0	0	0
z nuevo	0	-2	0	$\frac{4}{5}$	$\frac{24}{5}$

Basé	x	y	$H_1$	$E_1$	VS
x	1	0	0	$\frac{1}{10}$	$\frac{3}{5}$
y	0	1	0	$-\frac{3}{10}$	$\frac{6}{5}$
$H_1$	0	0	1	1	2
z	0	-2	0	$\frac{4}{5}$	$\frac{24}{5}$

Fila  $y \cdot 2 + z$

Bare	$x$	$y$	$H_1$	$E_1$	VS
Fila $y \cdot 2$	$0 \cdot 2 = 0$	$1 \cdot 2 = 2$	$0 \cdot 2 = 0$	$-3/10 \cdot 2 = -3/5$	$6/5 \cdot 2 = 12/5$
$z$	0	-2	0	$4/5$	$24/5$
$z_{\text{nuevo}}$	0	0	0	$1/5$	$36/5$

Bare	$x$	$y$	$H_1$	$E_1$	VS
$x$	1	0	0	$1/10$	$3/5$
$y$	0	1	0	$-3/10$	$6/5$
$H_1$	0	0	1	1	2
$z$	0	0	0	$1/5$	$36/5$

$$VE = E_1 \quad RM = \frac{3/5}{1/10} = 6, \quad \frac{6/5}{-3/10} = X, \quad \frac{2}{1} = 2, \\ VS = H_1$$

	$x$	$y$	$H_1$	$E_1$	VS
Pivote $H_1 = E_1$	0	0	1	1	2

Calculos:

	$x$	$y$	$z$
$x$	$1 - (1/10 \cdot 0) = 1$	$0 - (-3/10 \cdot 0) = 0$	$0(1/5 \cdot 0) = 0$
$y$	$0 - (1/10 \cdot 0) = 0$	$1 - (-3/10 \cdot 0) = 1$	$0(1/5 \cdot 0) = 0$
$H_1$	$0 - (1/10 \cdot 1) = -1/10$	$0 - (-3/10 \cdot 1) = 3/10$	$0(1/5 \cdot 1) = -1/5$
$E_1$	$1/10 - (1/10 \cdot 1) = 0$	$-3/10 - (-3/10 \cdot 1) = 0$	$1/5 - (1/5 \cdot 1) = 0$
VS	$3/5 - (1/10 \cdot 2) = 2/5$	$6/5 - (-3/10 \cdot 2) = 9/5$	$30/5 - (1/5 \cdot 2) = 34/5$

Base	X	Y	H <sub>i</sub>	E <sub>i</sub>	VS
X	1	0	-1/10	0	2/5
Y	0	1	3/10	0	9/5
H <sub>i</sub>	0	0	1	1	2
Z	0	0	-1/5	0	34/5

$$\begin{aligned}
 \text{Min } z &= 8x + 2y \\
 &= 8(2/5) + 2(9/5) \\
 &= 34/5 \quad \rightarrow z = 
 \end{aligned}$$

R/Tipo de caso: Solución única.

**Ejercicio #3**

**Valor 25 ptos (Gran M)**

Max  $z = 9x + 15y$

Sujeto a:

$$12x + 3y \geq 12$$

$$-3x + 6y \geq 24$$

$$3y \leq 6$$

$$x, y \geq 0$$

- Debe venir completo todo el desarrollo, Gran M
- Tabla inicial
- Penalización
- Tipo de Caso

### Ejercicio #3: Gran M

$$\text{Max } z = 9x + 15y - MA_1 - MA_2 \quad (\text{negativas al ser Max})$$

$$\text{Sujeto a: } 12x + 3y \geq 12 \quad (A_1 - E_1)$$

$$-3x + 6y \geq 24 \quad (A_2 - E_2)$$

$$3y \leq 6 \quad (H_1)$$

$$x, y \geq 0$$

Tabla inicial:

Bare	x	y	A <sub>1</sub>	E <sub>1</sub>	A <sub>2</sub>	E <sub>2</sub>	H <sub>1</sub>	VS
A <sub>1</sub>	12	3	1	-1	0	0	0	12
A <sub>2</sub>	-3	6	0	0	1	-1	0	24
H <sub>1</sub>	0	3	0	0	0	0	1	6
Z	-9	-15	M	0	M	0	0	0

Penalización:

	x	y	A <sub>1</sub>	E <sub>1</sub>	A <sub>2</sub>	E <sub>2</sub>	H <sub>1</sub>	VS
Antiguo z	-9	-15	M	0	M	0	0	0
-MA <sub>1</sub>	-12M	-3M	-M	M	0	0	0	-12M
-MA <sub>2</sub>	3M	-6M	0	0	-M	M	0	-24M
z nuevo	-9-9M	-15-9M	0	M	0	M	0	-36M

Nueva tabla:

Bare	x	y	A <sub>1</sub>	E <sub>1</sub>	A <sub>2</sub>	E <sub>2</sub>	H <sub>1</sub>	VS
A <sub>1</sub>	12	3	1	-1	0	0	0	12
A <sub>2</sub>	-3	6	0	0	1	-1	0	24
H <sub>1</sub>	0	3	0	0	0	0	1	6
Z	-9-9M	-15-9M	0	M	0	M	0	-36M

$$VE = \gamma$$

$$RM =$$

$$VS = H_1$$

$$-9 - 9 \cdot 1000 = -9009$$

$$12/3 = 4$$

$$-15 - 9 \cdot 1000 = -9015$$

$$24/6 = 4$$

$$6/3 = 2 \checkmark$$

Pivote a 1

	x	y	A <sub>1</sub>	E <sub>1</sub>	A <sub>2</sub>	E <sub>2</sub>	H <sub>1</sub>	VS
H <sub>1</sub> - γ y	0	3	0	0	0	0	1	6
		3/3						4/3
	0	1	0	0	0	0	1/3	2

## Calculos

	$A_1$	$A_2$	$Z$
$x$	$12 - (3 \cdot 0) = 12$	$-3 - (6 \cdot 0) = -3$	$-9 - 9M - ((-15 - 9M) \cdot 0) = -9 - 9M$
$y$	$3 - (3 \cdot 1) = 0$	$6 - (6 \cdot 1) = 0$	$-15 - 9M - ((-15 - 9M) \cdot 1) = 0$
$A_1$	$1 - (3 \cdot 0) = 1$	$0 - (6 \cdot 0) = 0$	$0 - ((-15 - 9M) \cdot 0) = 0$
$E_1$	$-1 - (3 \cdot 0) = -1$	$0 - (6 \cdot 0) = 0$	$M - ((-15 - 9M) \cdot 0) = M$
$A_2$	$0 - (3 \cdot 0) = 0$	$1 - (6 \cdot 0) = 1$	$0 - ((-15 - 9M) \cdot 0) = 0$
$E_2$	$0 - (3 \cdot 0) = 0$	$-1 - (6 \cdot 0) = -1$	$M - ((-15 - 9M) \cdot 0) = M$
$H_1$	$0 - (3 \cdot \frac{1}{3}) = -1$	$0 - (6 \cdot \frac{1}{3}) = -2$	$0 - ((-15 - 9M) \cdot \frac{1}{3}) = 5 + 3M$
$VS$	$12 - (3 \cdot 2) = 6$	$24 - (6 \cdot 2) = 12$	$-36M - ((-15 - 9M) \cdot 2) = 30 - 18M$

$$-(-15 - 9M \cdot \frac{1}{3})$$

$$-36M - (-15 - 9M \cdot 2)$$

$$= -\left(\frac{-15 - 9M}{3}\right)$$

$$-36M - (-30 - 18M)$$

$$-36M + 30 + 18M$$

$$30 - 18M$$

$$= -(-5 - 3M)$$

$$5 + 3M$$

Bate	$x$	$y$	$A_1$	$E_1$	$A_2$	$E_2$	$H_1$	$VS$
$A_1$	12	0	1	-1	0	0	-1	6
$A_2$	-3	0	0	0	1	-1	-2	12
$y$	0	1	0	0	0	0	$\frac{1}{3}$	2
$Z$	$-9 - 9M$	0	0	$M$	0	$M$	$5 + 3M$	$30 - 18M$

$$VE = X$$

$$RM =$$

$$VS = A_1$$

$$6/12 = \frac{1}{2} \checkmark$$

$$12/-3 = X$$

$$2/0 = X$$

Pivote a 1

	X	Y	A <sub>1</sub>	E <sub>1</sub>	A <sub>2</sub>	E <sub>2</sub>	H <sub>1</sub>	VS
A <sub>1</sub>	-7 X	12	0	1	-1	0	0	-1
		12/12						6 6/12
	1	0	1/12	-1/12	0	0	-1/12	1/2

Cálculos

	A <sub>2</sub>	Y	Z
X	-3 - (-3 · 1) = 0	0 - (0 · 1) = 0	-9 - 9M - ((-9 - 9M) · 1) = 0
Y	0 - (-3 · 0) = 0	1 - (0 · 0) = 1	0 - ((-9 - 9M) · 0) = 0
A <sub>1</sub>	0 - (-3 · 1/12) = 1/4	0 - (0 · 1/12) = 0	0 - ((-9 - 9M) · 1/12) = 3 + 3M/4
E <sub>1</sub>	0 - (-3 · -1/12) = -1/4	0 - (0 · -1/12) = 0	M - ((-9 - 9M) · -1/12) = M/4 - 3/4
A <sub>2</sub>	1 - (-3 · 0) = 1	0 - (0 · 0) = 0	0 - ((-9 - 9M) · 0) = 0
E <sub>2</sub>	-1 - (-3 · 0) = -1	0 - (0 · 0) = 0	M - ((-9 - 9M) · 0) = M
H <sub>1</sub>	-2 - (-3 · -1/12) = -9/4	1/3 - (0 · -1/12) = 1/3	5 + 3M - ((-9 - 9M) · -1/12) = 17/4 + 9/4M
VS	12 - (-3 · 1/12) = 27/2	2 - (0 · 1/12) = 2	30 - 18M - ((-9 - 9M) · 1/12) = 69/2 - 27M/2

$$M - (-9 - 9M \cdot -1/12)$$

$$M - \frac{9+9M}{12}$$

$$12M - (9+9M)$$

$$12$$

$$\underline{12M - 9 - 9M}$$

$$12$$

$$5 + 3M - \left( \frac{9+9M}{12} \right)$$

$$5 + 3M - \left( \frac{3+3M}{4} \right)$$

$$5 + 3M - \frac{3}{4} - \frac{3M}{4}$$

$$\frac{17}{4} + \frac{9}{4}M$$

$$\frac{3M - 9}{12}$$

$$\frac{M}{4} - \frac{3}{4}$$

$$30 - 18M - ((-9 - 9M) \cdot \frac{1}{2})$$

$$30 - 18M + \frac{9}{2} + \frac{9M}{2}$$

$$\frac{69}{2} - \frac{27M}{2}$$

Bare	X	Y	A <sub>1</sub>	E <sub>1</sub>	A <sub>2</sub>	E <sub>2</sub>	H <sub>1</sub>	VS
X	1	0	$\frac{1}{12}$	$-\frac{1}{12}$	0	0	$-\frac{1}{12}$	$\frac{1}{2}$
A <sub>2</sub>	0	0	$\frac{1}{4}$	$-\frac{1}{4}$	1	-1	$-\frac{9}{4}$	$\frac{27}{2}$
Y	0	1	0	0	0	0	$\frac{1}{3}$	2
Z	0	0	$\frac{3+3M}{4}$	$\frac{M-3}{4}$	0	M	$\frac{M+9M}{4}$	$\frac{69-27M}{2}$

R / Sin solución, no deben quedar variables artificiales en la base y el valor en z está en términos de M.

**Ejercicio #4****Valor 25 ptos (2 Fases)**

$$\text{Max } z = 4x_1 + 2x_2 + 6x_3$$

Sujeto a:

$$6x_1 + 2x_2 + 4x_3 \leq 20$$

$$2x_1 - 4x_2 + 6x_3 \geq 12$$

$$4x_1 + 6x_2 - 2x_3 \leq 18$$

$$2x_1 + 2x_2 + 4x_3 = 14$$

$$x_i \geq 0, \forall i=1,2,..n$$

- Debe venir completo todo el desarrollo, 2 Fases
- Tabla inicial
- Penalización
- Cambio del FO
- Gauss Jordan
- Tipo de Caso
- Fase 1 y Fase 2

Ejercicio #4: 2 fases.

$$\text{Max } Z = 4x_1 + 2x_2 + 6x_3$$

$$\text{Sujeto a: } 2x_1 - 4x_2 + 6x_3 \geq 12 \quad (A_1 - E_1)$$

$$2x_1 + 2x_2 + 4x_3 = 14 \quad (A_2)$$

$$6x_1 + 2x_2 + 4x_3 \leq 20 \quad (H_1)$$

$$4x_1 + 6x_2 - 2x_3 \leq 18 \quad (H_2)$$

$$x_i \geq 0, \forall i = 1, 2, \dots, n$$

Reacomodo  
de las  
restricciones.

I fase: Min

$$\text{Min } r - A_1 - A_2 = 0 \quad (\text{Suma de las variables artificiales, FO igualado a 0})$$

$$\text{Sujeto a: } 2x_1 - 4x_2 + 6x_3 + A_1 - E_1 = 12$$

$$2x_1 + 2x_2 + 4x_3 + A_2 = 14$$

$$6x_1 + 2x_2 + 4x_3 + H_1 = 20$$

$$4x_1 + 6x_2 - 2x_3 + H_2 = 18$$

$$x_i \geq 0, \forall i = 1, 2, \dots, n$$

Tabla inicial:

Bare		$x_1$	$x_2$	$x_3$	$A_1$	$A_2$	$H_1$	$H_2$	$E_1$	VS
$A_1$		2	-4	6	1	0	0	0	-1	12
$A_2$		2	2	4	0	1	0	0	0	14
$H_1$		6	2	4	0	0	1	0	0	20
$H_2$		4	6	-2	0	0	0	1	0	18
$r$		0	0	0	-1	-1	0	0	0	0

Penalización:

Borde	$x_1$	$x_2$	$x_3$	$A_1$	$A_2$	$H_1$	$H_2$	$E_1$	VS
Antiguo r	0	0	0	-1	-1	0	0	0	0
+ Fila $A_1$	2	-4	6	1	0	0	0	-1	12
+ Fila $A_2$	2	2	4	0	1	0	0	0	14
Nuevo r	4	-2	10	0	0	0	0	-1	26

Borde	$x_1$	$x_2$	$x_3$	$A_1$	$A_2$	$H_1$	$H_2$	$E_1$	VS
$A_1$	2	-4	6	1	0	0	0	-1	12
$A_2$	2	2	4	0	1	0	0	0	14
$H_1$	6	2	4	0	0	1	0	0	20
$H_2$	4	6	-2	0	0	0	1	0	18
r	4	-2	10	0	0	0	0	-1	26

VE:  $x_3$

RN:

$$12/6 = 2 \checkmark$$

VS:  $A_1$

$$14/4 = 3,5$$

$$20/4 = 5$$

$$18/-2 = X$$

Pivote a 1

	$x_1$	$x_2$	$x_3$	$A_1$	$A_2$	$H_1$	$H_2$	$E_1$	VS
$A_1 \rightarrow x_3$	2	-4	6	1	0	0	0	-1	12
	$2/6$	$-4/6$	$6/6$						$12/6$
	$1/3$	$-2/3$	1	$1/6$	0	0	0	$-1/6$	2

## Calculos:

	$A_2$	$H_1$	$H_2$	$r$
$X_1$	$2 - (4 \cdot 1/3) = 2/3$	$6 - (4 \cdot 1/3) = 14/3$	$4 - (-2 \cdot 1/3) = 14/3$	$4 - (10 \cdot 1/3) = 2/3$
$X_2$	$2 - (4 \cdot -2/3) = 14/3$	$2 - (4 \cdot -2/3) = 14/3$	$6 - (-2 \cdot -2/3) = 14/3$	$-2 - (10 \cdot -2/3) = 14/3$
$X_3$	$4 - (4 \cdot 1) = 0$	$4 - (4 \cdot 1) = 0$	$-2 - (-2 \cdot 1) = 0$	$10 - (10 \cdot 1) = 0$
$A_1$	$0 - (4 \cdot 1/6) = -2/3$	$0 - (4 \cdot 1/6) = -2/3$	$0 - (-2 \cdot 1/6) = 1/3$	$0 - (10 \cdot 1/6) = -5/3$
$A_2$	$1 - (4 \cdot 0) = 1$	$0 - (4 \cdot 0) = 0$	$0 - (-2 \cdot 0) = 0$	$0 - (10 \cdot 0) = 0$
$H_1$	$0 - (4 \cdot 0) = 0$	$1 - (4 \cdot 0) = 1$	$0 - (-2 \cdot 0) = 0$	$0 - (10 \cdot 0) = 0$
$H_2$	$0 - (4 \cdot 0) = 0$	$0 - (4 \cdot 0) = 0$	$1 - (-2 \cdot 0) = 1$	$0 - (10 \cdot 0) = 0$
$E_1$	$0 - (4 \cdot -1/6) = 2/3$	$0 - (4 \cdot -1/6) = 4/3$	$0 - (-2 \cdot -1/6) = -1/3$	$-1 - (10 \cdot -1/6) = 2/3$
VS	$14 - (4 \cdot 2) = 6$	$20 - (4 \cdot 2) = 12$	$18 - (-2 \cdot 2) = 22$	$26 - (10 \cdot 2) = 6$

Bare	VO			VA				VS	
	$x_1$	$x_2$	$x_3$	$A_1$	$A_2$	$H_1$	$H_2$		
$X_3$	$1/3$	$-2/3$	$1$	$1/6$	$0$	$0$	$0$	$-1/6$	$2$
$A_2$	$2/3$	$14/3$	$0$	$-2/3$	$1$	$0$	$0$	$2/3$	$6$
$H_1$	$14/3$	$14/3$	$0$	$-2/3$	$0$	$1$	$0$	$2/3$	$12$
$H_2$	$14/3$	$14/3$	$0$	$1/3$	$0$	$0$	$1$	$-1/3$	$22$
$r$	$2/3$	$14/3$	$0$	$-5/3$	$0$	$0$	$0$	$2/3$	$6$

VE:  $x_2$

$$2/-2/3 = X$$

$$6/14/3 = 1,28 \checkmark$$

$$12/14/3 = 2,57$$

$$22/14/3 = 4,71$$

VS:  $A_2$

Pivote a 1

	$x_1$	$x_2$	$x_3$	$A_1$	$A_2$	$H_1$	$H_2$	$E_1$	VS
$A_2 = 7 x_2$	$2/3$	$14/3$	$0$	$-2/3$	$1$	$0$	$0$	$2/3$	$6$
	$2/3 \cdot 3/14$	$14/3 \cdot 3/14$	$0$	$-2/3 \cdot 3/14$	$1 \cdot 3/14$	$0$	$0$	$2/3 \cdot 3/14$	$6 \cdot 3/14$
	$1/7$	$1$	$0$	$-1/7$	$3/14$	$0$	$0$	$1/7$	$9/14 = 1,28$

## Calculos:

	$X_3$	$H_1$	$H_2$	$r$
$X_1$	$\frac{1}{3} - (-\frac{2}{3} \cdot \frac{1}{7}) = \frac{3}{7}$	$\frac{14}{3} - (\frac{14}{3} \cdot \frac{1}{7}) = 4$	$\frac{14}{3} - (\frac{14}{3} \cdot \frac{1}{7}) = 4$	$\frac{2}{3} - (\frac{14}{3} \cdot \frac{1}{7}) = 0$
$X_2$	$-\frac{2}{3} - (-\frac{2}{3} \cdot 1) = 0$	$\frac{14}{3} - (\frac{14}{3} \cdot 1) = 0$	$\frac{14}{3} - (\frac{14}{3} \cdot 1) = 0$	$\frac{14}{3} - (\frac{14}{3} \cdot 1) = 0$
$X_3$	$1 - (-\frac{2}{3} \cdot 0) = 1$	$0 - (\frac{14}{3} \cdot 0) = 0$	$0 - (\frac{14}{3} \cdot 0) = 0$	$0 - (\frac{14}{3} \cdot 0) = 0$
$A_1$	$\frac{1}{6} - (-\frac{2}{3} \cdot -\frac{1}{7}) = \frac{1}{14}$	$-\frac{2}{3} - (\frac{14}{3} \cdot -\frac{1}{7}) = 0$	$\frac{1}{3} - (\frac{14}{3} \cdot -\frac{1}{7}) = 1$	$-\frac{5}{3} - (\frac{14}{3} \cdot -\frac{1}{7}) = -1$
$A_2$	$0 - (-\frac{2}{3} \cdot 3 \cdot \frac{1}{14}) = \frac{1}{7}$	$0 - (\frac{14}{3} \cdot 3 \cdot \frac{1}{14}) = -1$	$0 - (\frac{14}{3} \cdot 3 \cdot \frac{1}{14}) = -1$	$0 - (\frac{14}{3} \cdot 3 \cdot \frac{1}{14}) = -1$
$H_1$	$0 - (-\frac{2}{3} \cdot 6) = 0$	$1 - (\frac{14}{3} \cdot 0) = 1$	$0 - (\frac{14}{3} \cdot 0) = 0$	$0 - (\frac{14}{3} \cdot 0) = 0$
$H_2$	$0 - (-\frac{2}{3} \cdot 0) = 0$	$0 - (\frac{14}{3} \cdot 0) = 0$	$1 - (\frac{14}{3} \cdot 0) = 1$	$0 - (\frac{14}{3} \cdot 0) = 0$
$E_1$	$-\frac{1}{6} - (-\frac{2}{3} \cdot \frac{1}{7}) = -\frac{1}{14}$	$\frac{2}{3} - (\frac{14}{3} \cdot \frac{1}{7}) = 0$	$-\frac{1}{3} - (\frac{14}{3} \cdot \frac{1}{7}) = -1$	$\frac{2}{3} - (\frac{14}{3} \cdot \frac{1}{7}) = 0$
VS	$2 - (-\frac{2}{3} \cdot \frac{9}{7}) = \frac{20}{7}$	$12 - (\frac{14}{3} \cdot \frac{9}{7}) = 6$	$22 - (\frac{14}{3} \cdot \frac{9}{7}) = 16$	$6 - (\frac{14}{3} \cdot \frac{9}{7}) = 0$

base	$x_1$	$x_2$	$x_3$	$A_1$	$A_2$	$H_1$	$H_2$	$E_1$	VS
$X_3$	$\frac{3}{7}$	0	1	$\frac{1}{14}$	$\frac{1}{7}$	0	0	$-\frac{1}{14}$	$\frac{20}{7}$
$X_2$	$\frac{1}{7}$	1	0	$-\frac{1}{7}$	$\frac{3}{14}$	0	0	$\frac{1}{7}$	$\frac{9}{7}$
$H_1$	4	0	0	0	-1	1	0	0	6
$H_2$	4	0	0	1	-1	0	1	-1	16
$r$	0	0	0	-1	-1	0	0	0	0

✓ En la base no quedan artificiales

✓ VS en z es cero

✓ En la fila r se obtienen los valores iguales antes de penalización

## II fase:

- Elimino las columnas de las variables artificiales.
  - Regreso al F.O original igualado a cero.  $\text{Max } z = 4x_1 + 2x_2 + 6x_3$
- $$\text{Max } z - 4x_1 - 2x_2 - 6x_3 = 0$$

Base	VO			VA			VS
	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	
$x_3$	$3/7$	0	1	0	0	$-1/14$	$20/7$
$x_2$	$1/7$	1	0	0	0	$1/7$	$9/7$
$H_1$	4	0	0	1	0	0	6
$H_2$	4	0	0	0	1	-1	16
$Z$	-4	-2	-6	0	0	0	0

Evaluar  $x_1 = 0$ ,  $x_2 = 9/7$ ,  $x_3 = 20/7$

$$\begin{aligned}\text{Max } z &= 4x_1 + 2x_2 + 6x_3 \\ &= 4 \cdot 0 + 2 \cdot \frac{9}{7} + 6 \cdot \frac{20}{7} \\ &= 138/7\end{aligned}$$

Gauss Jordan  $x_3$  a cero

Base	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	VS
Fila $x_3 \cdot 6$	$3/7 \cdot 6$	0 · 6	$1 \cdot 6$	0 · 6	0 · 6	$-1/14 \cdot 6$	$20/7 \cdot 6$
	$18/7$	0	6	0	0	$-3/7$	$120/7$
$Z$	-4	-2	-6	0	0	0	0
$Z$ nuevo	$-10/7$	-2	0	0	0	$-3/7$	$120/7$

Base	VO			VA			VS
	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	
$x_3$	$3/7$	0	1	0	0	$-1/14$	$20/7$
$x_2$	$1/7$	1	0	0	0	$1/7$	$9/7$
$H_1$	4	0	0	1	0	0	6
$H_2$	4	0	0	0	1	-1	16
$Z$	$-10/7$	-2	0	0	0	$-3/7$	$120/7$

## Gauss Jordan x2 a cero

Borde	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	VS
fila $x_2 \cdot 2$	$\frac{1}{7} \cdot 2$	$1 \cdot 2$	$0 \cdot 2$	$0 \cdot 2$	$0 \cdot 2$	$\frac{1}{7} \cdot 2$	$\frac{9}{7} \cdot 2$
	$\frac{2}{7}$	2	0	0	0	$\frac{2}{7}$	$\frac{18}{7}$
$z$	$-\frac{10}{7}$	-2	0	0	0	$-\frac{3}{7}$	$\frac{120}{7}$
$z$ nuevo	$-\frac{8}{7}$	0	0	0	0	$-\frac{1}{7}$	$\frac{138}{7}$

Borde	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	VS
$x_3$	$\frac{3}{7}$	0	1	0	0	$-\frac{1}{14}$	$\frac{20}{7}$
$x_2$	$\frac{1}{7}$	1	0	0	0	$\frac{1}{7}$	$\frac{9}{7}$
$H_1$	4	0	0	1	0	0	6
$H_2$	4	0	0	0	1	-1	16
$z$	$-\frac{8}{7}$	$0\sqrt{}$	$0\sqrt{}$	$0\sqrt{}$	$0\sqrt{}$	$-\frac{1}{7}$	$\frac{138}{7}$

$\rightarrow$  Hay negativo  
se cierra iterar.

$$\text{Evaluar } x_1 = 0, x_2 = \frac{9}{7}, x_3 = \frac{20}{7}$$

$$\begin{aligned} \text{Max } z &= 4x_1 + 2x_2 + 6x_3 \\ &= 4 \cdot 0 + 2 \cdot \frac{9}{7} + 6 \cdot \frac{20}{7} \\ &= \frac{138}{7} \checkmark \end{aligned}$$

VE:  $x_1$

$$\frac{20}{7} / \frac{3}{7} = 6,66$$

$$\frac{9}{7} / \frac{1}{7} = 9$$

$$\frac{6}{4} = 1,5 \checkmark$$

$$\frac{16}{4} = 4$$

VS:  $H_1$

Pivote a 1

Borde	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	VS
$H_1 \Rightarrow x_1$	4	0	0	1	0	0	6
	$\frac{4}{4}$						$\frac{6}{4}$
	1	0	0	$\frac{1}{4}$	0	0	$\frac{3}{2} = 1,5$

## Calculos:

	$X_3$	$X_2$	$H_2$	$Z$
$X_1$	$\frac{3}{7} - (\frac{3}{7} \cdot 1) = 0$	$\frac{1}{7} - (\frac{1}{7} \cdot 1) = 0$	$4 - (4 \cdot 1) = 0$	$-\frac{8}{7} - (-\frac{8}{7} \cdot 1) = 0$
$X_2$	$0 - (\frac{3}{7} \cdot 0) = 0$	$1 - (\frac{1}{7} \cdot 0) = 1$	$0 - (4 \cdot 0) = 0$	$0 - (-\frac{8}{7} \cdot 0) = 0$
$X_3$	$1 - (\frac{3}{7} \cdot 0) = 1$	$0 - (\frac{1}{7} \cdot 0) = 0$	$0 - (4 \cdot 0) = 0$	$0 - (-\frac{8}{7} \cdot 0) = 0$
$H_1$	$0 - (\frac{3}{7} \cdot \frac{1}{4}) = -\frac{3}{28}$	$0 - (\frac{1}{7} \cdot \frac{1}{4}) = -\frac{1}{28}$	$0 - (4 \cdot \frac{1}{4}) = -1$	$0 - (-\frac{8}{7} \cdot \frac{1}{4}) = \frac{2}{7}$
$H_2$	$0 - (\frac{3}{7} \cdot 0) = 0$	$0 - (\frac{1}{7} \cdot 0) = 0$	$1 - (4 \cdot 0) = 1$	$0 - (-\frac{8}{7} \cdot 0) = 0$
$E_1$	$-\frac{1}{14} - (\frac{3}{7} \cdot 0) = -\frac{1}{14}$	$\frac{1}{7} - (\frac{1}{7} \cdot 0) = \frac{1}{7}$	$-1 - (4 \cdot 0) = -1$	$-\frac{1}{7} - (-\frac{8}{7} \cdot 0) = -\frac{1}{7}$
VS	$20/7 - (\frac{3}{7} \cdot \frac{3}{2}) = \frac{31}{14}$	$9/7 - (\frac{1}{7} \cdot \frac{3}{2}) = \frac{15}{14}$	$16 - (4 \cdot \frac{3}{2}) = 10$	$138/7 - (-\frac{8}{7} \cdot \frac{3}{2}) = \frac{150}{7}$

Bare	$v_0$	$v_A$					
	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	VS
$X_3$	0	0	1	$-\frac{3}{28}$	0	$-\frac{1}{14}$	$\frac{31}{14}$
$X_2$	0	1	0	$-\frac{1}{28}$	0	$\frac{1}{7}$	$\frac{15}{14}$
$X_1$	1	0	0	$\frac{1}{4}$	0	0	$\frac{3}{2}$
$H_2$	0	0	0	-1	1	-1	10
$Z$	0	0	0	$\frac{2}{7}$	0	$-\frac{1}{7}$	$\frac{150}{7}$

$\rightarrow$  Hay negativo,  
hay que iterar.

$$\text{Evaluar } x_1 = \frac{3}{2}, x_2 = \frac{15}{14}, x_3 = \frac{31}{14}$$

$$\begin{aligned}
 \text{Max } Z &= 4x_1 + 2x_2 + 6x_3 \\
 &= 4 \cdot \frac{3}{2} + 2 \cdot \frac{15}{14} + 6 \cdot \frac{31}{14} \\
 &= \frac{150}{7} \checkmark
 \end{aligned}$$

VE:  $E_1$

RM:

VS:  $X_2$

$$\frac{31}{14} / -\frac{1}{14} = X$$

$$\frac{15}{14} / \frac{1}{7} = \frac{15}{2}$$

$$\frac{3}{2} / 0 = X$$

$$10 / -1 = X$$

Pivote a 1

	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	VS
$x_2 \Rightarrow E_1$	0	1	0	$-1/28$	0	$1/4$	$15/4$
		$1 \cdot 7$		$-1/28 \cdot 7$		$1/4 \cdot 7$	$15/4 \cdot 7$
	0	7	0	$-1/4$	0	1	$15/2$

Cálculos:

	$X_3$	$X_1$	$H_2$	$Z$
$X_1$	$0 - (-1/14 \cdot 0) = 0$	$1 - (0 \cdot 0) = 1$	$0 - (-1 \cdot 0) = 0$	$0 - (-1/7 \cdot 0) = 0$
$X_2$	$0 - (-1/14 \cdot 7) = 1/2$	$0 - (0 \cdot 7) = 0$	$0 - (-1 \cdot 7) = 7$	$0 - (-1/7 \cdot 7) = 1$
$X_3$	$1 - (-1/14 \cdot 0) = 1$	$0 - (0 \cdot 0) = 0$	$0 - (-1 \cdot 0) = 0$	$0 - (-1/7 \cdot 0) = 0$
$H_1$	$-3/28 - (-1/14 \cdot 1/4) = -1/8$	$1/4 - (0 \cdot -1/4) = 1/4$	$-1 - (-1 \cdot -1/4) = -5/4$	$2/7 - (-1/7 \cdot -1/4) = 1/4$
$H_2$	$0 - (-1/14 \cdot 0) = 0$	$0 - (0 \cdot 0) = 0$	$1 - (-1 \cdot 0) = 1$	$0 - (-1/7 \cdot 0) = 0$
$E_1$	$-1/14 - (-1/14 \cdot 1) = 0$	$0 - (0 \cdot 1) = 0$	$-1 - (-1 \cdot 1) = 0$	$-1/7 - (-1/7 \cdot 1) = 0$
VS	$3/14 - (-1/14 \cdot 15/2) = 1/4$	$3/2 - (0 \cdot 15/2) = 3/2$	$10 - (-1 \cdot 15/2) = 35/2$	$150/7 - (-1/7 \cdot 15/2) = 45/2$

Borde	$x_1$	$x_2$	$x_3$	$H_1$	$H_2$	$E_1$	VS
$x_3$	0	$1/2$	1	$-1/8$	0	0	$11/4$
$E_1$	0	7	0	$-1/4$	0	1	$15/2$
$x_1$	1	0	0	$1/4$	0	0	$3/2$
$H_2$	0	7	0	$-5/4$	1	0	$35/2$
$Z$	$0^{\checkmark}$	1	$0^{\checkmark}$	$1/4$	$0^{\checkmark}$	$0^{\checkmark}$	$45/2 \rightarrow$ No hay más negativos, dejarlo)

Evaluar  $x_1 = 3/2$ ,  $x_2 = 0$ ,  $x_3 = 11/4$

de iterar.

$$\begin{aligned} \text{Max } Z &= 4x_1 + 2x_2 + 6x_3 \\ &= 4 \cdot 3/2 + 0 + 6 \cdot 11/4 \\ &= 45/2 \end{aligned}$$

R/Solución única con  $x_1 = 3/2$ ,  $x_2 = 0$  y  $x_3 = 11/4$ .