1) Maximizar $f(x,y) = 3x + y$

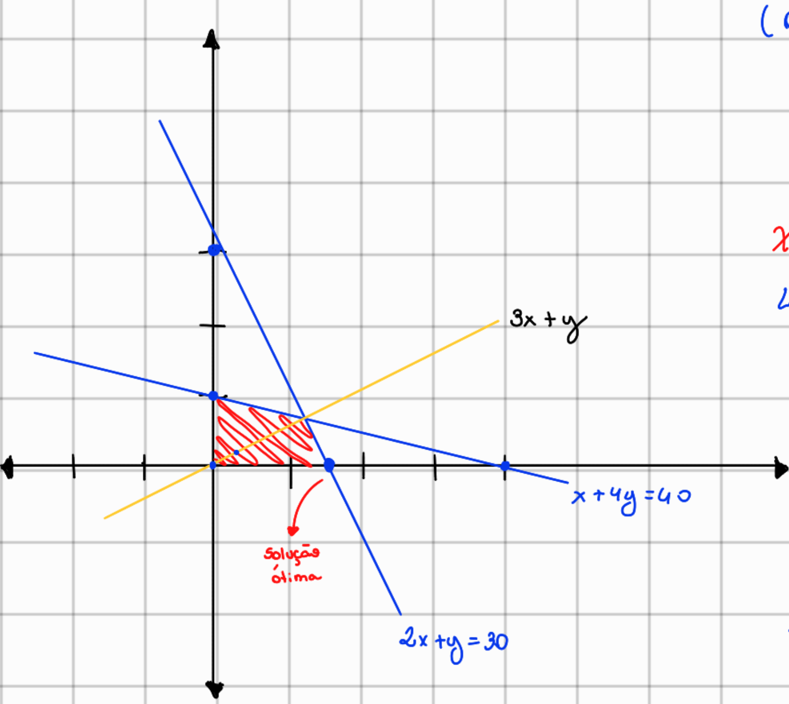
$$2x + y \leq 30$$
$$x + 4y \leq 40$$
$$x \geq 0,\ y \geq 0$$

$2x + y \leq 30$

$x = 0$ | $y = 0$
$y = 30$ | $2x = 30$
$(0,30)$ | $x = 15$ $(15,0)$

$x + 4y \leq 40$

$x = 0$ | $y = 0$
$4y = 40$ | $x = 40$
$y = 10$ | $(40,0)$
$(0,10)$



$$\begin{cases} 2x + y = 30 \\ x + 4y = 40 \quad .(-2) \end{cases}$$

$$\begin{cases} 2x + y = 30 \\ -2x - 8y = -80 \end{cases}$$

$-7y = -50$

$y = \frac{50}{7}$

$2x + \frac{50}{7} = 30$

$2x = \frac{210}{7} - \frac{50}{7}$

$2x = \frac{160}{7}$

$x = \frac{80}{7}$

$f(x,y) = 3x + y$

$f(x,y) = 3.15 + 0$

$f(x,y) = 45$

---

2) $\max z = 3x_1 + 5x_2$

s.a: $x_1 \leq 4$

$2x_2 \leq 12$

$3x_1 + 2x_2 \leq 18$

$x_1, x_2 \geq 0$

$x_1 \leq 4$ | $2x_2 \leq 12$ | $3x_1 + 2x_2 = 18$
$x_1 = 4$ | $x_2 = 6$ | $x_1 = 0$ $x_2 = 0$
$x_2 = 9$ $x_1 = 6$
$(6,9)$

$$\begin{cases} x_1 = 4 \\ 2x_2 = 12 \\ 3x_1 + 2x_2 = 18 \end{cases}$$

$x_2 = 6$

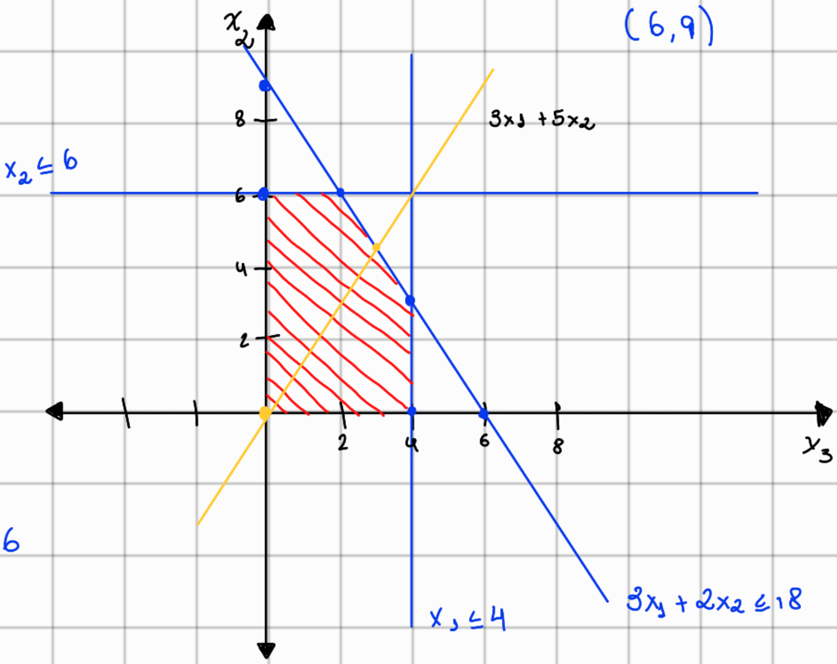
$3x_1 + 12 = 18$

$3x_1 = 6$

$x_1 = 2$

$\max z = 3.2 + 5.6$

$= 36$



3) $\min Z = -4x_1 - 2x_2$

s.a: $x_1 + x_2 \leq 8$

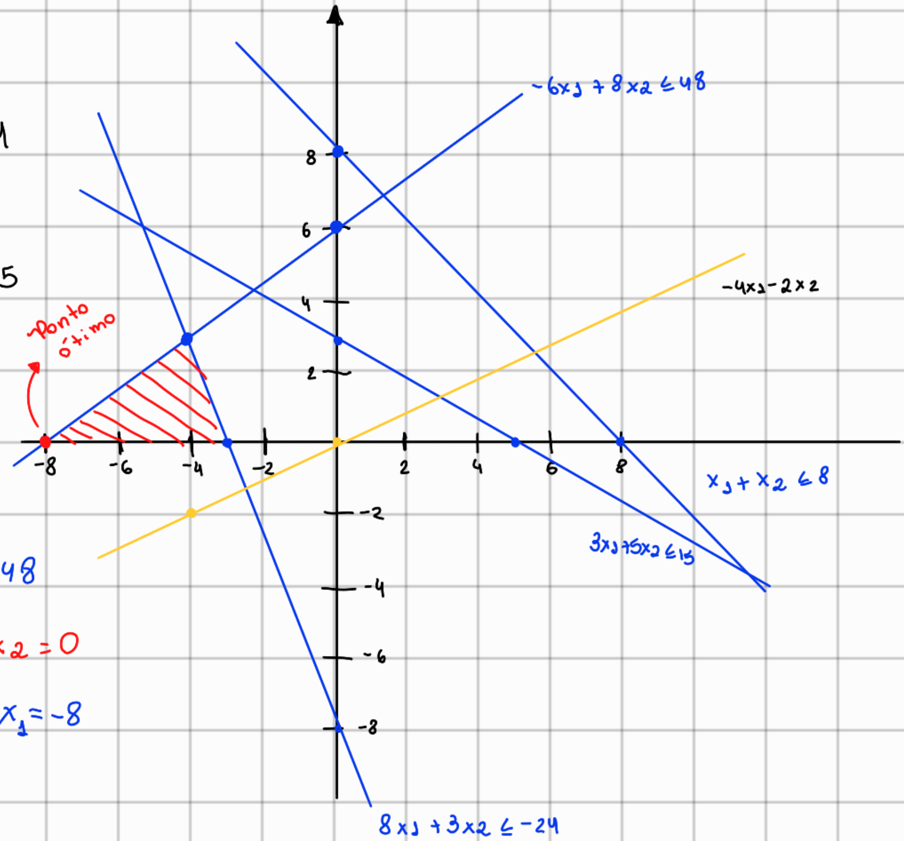
$8x_1 + 3x_2 \leq -24$

$-6x_1 + 8x_2 \leq 48$

$3x_1 + 5x_2 \leq 15$

$x_1 \leq 3$

$x_2 \geq 0$



$x_1 + x_2 \leq 8$

$x_1 = 0$ $\quad$ $x_2 = 0$

$x_2 = 8$ $\quad$ $x_2 = 8$

$(0, 8)$ $\quad$ $(8, 0)$

$-6x_1 + 8x_2 \leq 48$

$x_1 = 0$ $\quad$ $x_2 = 0$

$x_2 = 6$ $\quad$ $x_1 = -8$

$8x_1 + 3x_2 \leq -24$

$x_1 = 0$ $\quad$ $x_2 = 0$

$x_2 = -8$ $\quad$ $x_1 = -3$

$3x_1 + 5x_2 \leq 15$

$x_1 = 0$ $\quad$ $x_2 = 0$

$x_2 = 3$ $\quad$ $x_1 = 5$

Vértices = $(-4, 3)$; $(-8, 0)$; $(-3, 0)$

Solução Ótima: $(-8, 0)$

$\min z \quad -4x_1 - 2x_2$

$-32 - 0$

$= -32$

---

4) $\max z \; f(x_1, x_2) = x_1 + x_2$

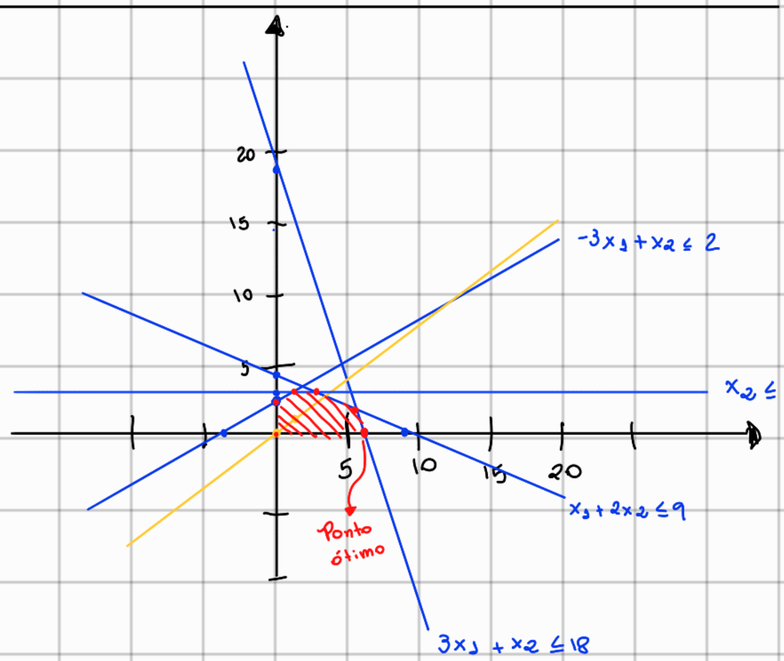
$-3x_1 + x_2 \leq 2$

$x_1 + 2x_2 \leq 9$

$3x_1 + x_2 \leq 18$

$x_2 \leq 3$

$x_1 \geq 0, x_2 \geq 0$



$-3x_1 + x_2 \leq 2$

$(0, 2)$; $(-\frac{2}{3}, 0)$

$x_1 + 2x_2 \leq 9$

$(0, \frac{9}{2})$; $(9, 0)$

$3x_1 + x_2 \leq 18$

$(0, 18)$; $(6, 0)$

Ponto Ótimo = $(6, 0)$

Solução ótima: $x_1 + x_2 = 6 + 0 = 6$

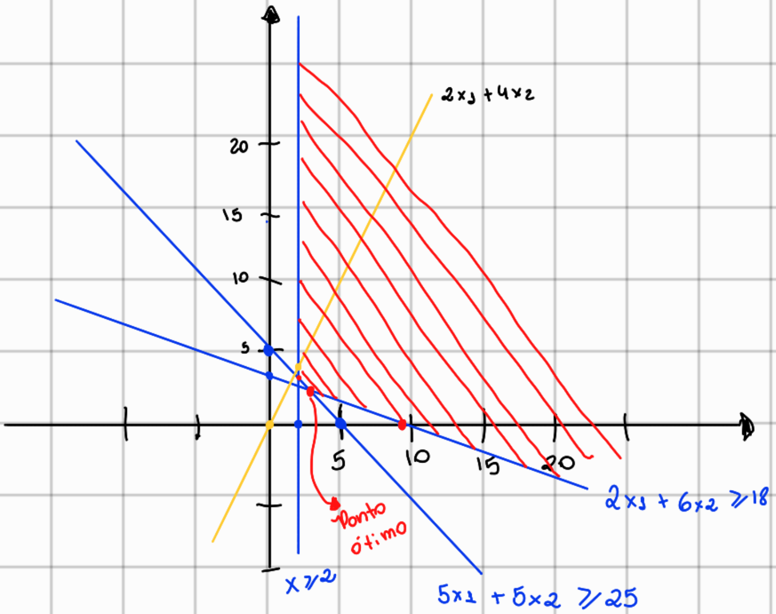
5) $\min f(x_1, x_2) = 2x_1 + 4x_2$

$5x_1 + 5x_2 \geq 25$

$2x_1 + 6x_2 \geq 18$

$x_1 \geq 2$

$x_1, x_2 \geq 0$



$5x_1 + 5x_2 \geq 25$ $2x_1 + 6x_2 \geq 18$

$(0,5) ; (5,0)$ $(0,3) ; (9,0)$

$$\begin{cases} 5x_1 + 5x_2 = 25 \quad \cdots (1) \\ 2x_1 + 6x_2 = 18 \quad \cdots (2) \end{cases}$$

(1): $x_1 = \dfrac{25 - 5x_2}{5} = 5 - x_2$

(2): $2 \cdot (5 - x_2) + 6x_2 = 18$

$10 - 2x_2 + 6x_2 = 18$

$4x_2 = 8$

$x_2 = 2$

$x_1 = 3$

Vértices: $(3,2) ; (2,3) ; (0,9)$

Solução Ótima: $\min 2x_1 + 4x_2$

$= 2 \cdot 3 + 4 \cdot 2$

$= 11$ //

---

6) a) $\max z = 2x + 30y$

$x + 2y \leq 8$

$2x + 2y \leq 12$

$x, y \geq 0$

b) $x + 2y \leq 8$

$x = 0$ $y = 0$

$(0,4)$ $(8,0)$

$2x + 2y \leq 12$

$x = 0$ $y = 0$

$(0,6)$ $(6,0)$

Vértices: $(0,4) ; (6,0) ;$

$$\begin{cases} x + 2y = 8 & \cdot(-2) \\ 2x + 2y = 12 \end{cases}$$

$$\begin{cases} \cancel{-2x} - 4y = 16 \\ \cancel{2x} + 2y = 12 \end{cases}$$

$2y = 4$

$y = 2$

$x + 2y = 8$

$x + 4 = 8$

$x = 4$

Vértices: $(0,4)$; $(6,0)$; $(4,2)$

Ponto ótimo $= (0,4)$

Solução Ótima $= 2 \cdot 0 + 30 \cdot 4 = 120$

---

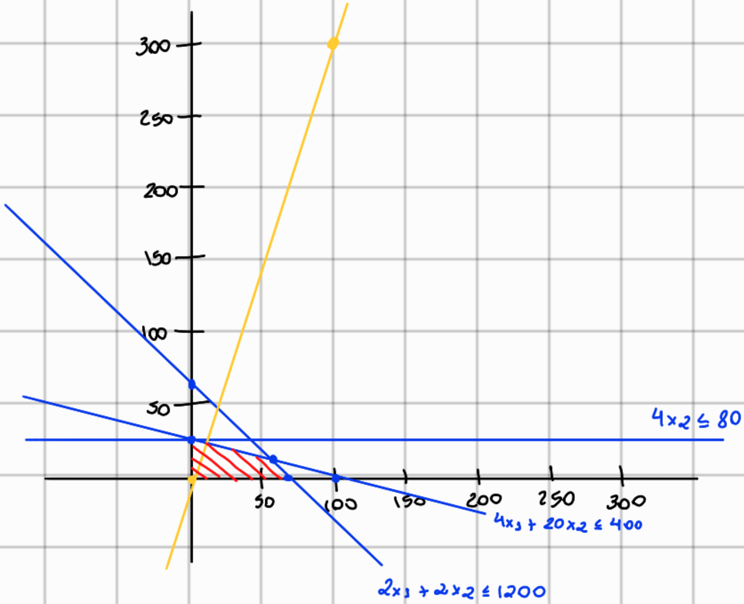
7) $\max z = 100x_1 + 300x_2$

$20x_1 + 20x_2 \leq 1200$

$4x_1 + 20x_2 \leq 400$

$4x_2 \leq 80$

$x, y \geq 0$



$20x_1 + 20x_2 \leq 1200$

$x_1 = 0$	$x_2 = 0$
$(0, 60)$	$(60, 0)$

$4x_2 \leq 80$

$x_2 = 20$

$4x_1 + 20x_2 \leq 400$

$x_1 = 0$	$x_2 = 0$
$(0, 20)$	$(100, 0)$

$$\begin{cases} 20x_1 + \cancel{20x_2} = 1200 \\ 4x_1 + \cancel{20x_2} = 400 \end{cases}$$

$16x_1 = 800$

$x_1 = 50$

$200 + 2x_2 = 400$

$x_2 = 100$

---

8) $\max z = 150x_1 + 50x_2$

S.a $x_1 \leq 30$

$2x_1 + 2x_2 \leq 80$

$x_1, x_2 \geq 0$

$2x_1 + 2x_2 = 80$

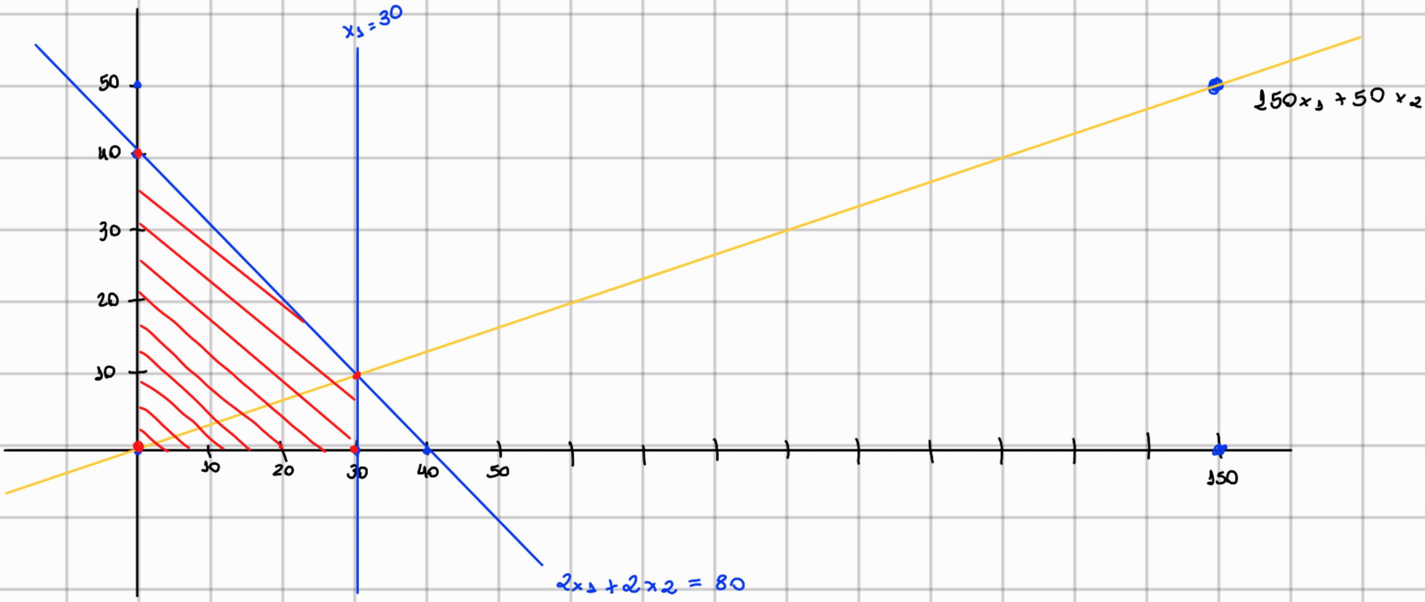
$x_1 = 0$

$0 + 2x_2 = 80$

$x_2 : 40$

$x_2 = 0$

$x_1 : 40$



Ponto ótimo

$150(30) + 50(10) = 5000$

Ponto = (30,10)

---

9) $\max z = 2x + y$

s.a $x + y = 4$

$x + y = 4$

$x = 0$ $y = 0$

$y = 4$ $x = 4$

Primeira solução : (0,4)

$\max z = 2 \cdot 0 + 4 = 4$

Última solução : (4,0)

$\max z = 2 \cdot 4 + 0 = 8$ } Solução ótima

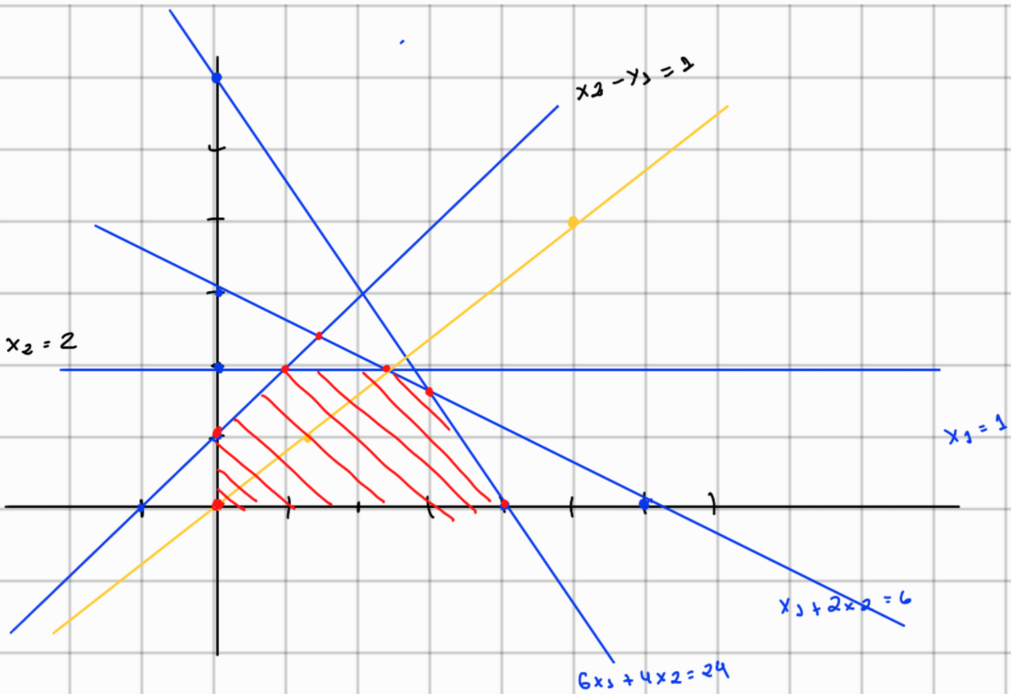
10) max $z = 5x_1 + 4x_2$

s.a $6x_1 + 4x_2 \leq 24$

$x_1 + 2x_2 \leq 6$

$x_2 - x_1 \leq 1$

$x_2 \leq 2$



Ponto ótimo:

max $z = 5 \cdot 3 + 4 \cdot 1{,}5 = 21$

$$\begin{cases} 6x_1 + 4x_2 = 24 \\ x_1 + 2x_2 = 6 \end{cases}$$

$x_1 = 6 - 2x_2$

$6 \cdot (6 - 2x_2) + 4x_2 = 24$

$36 - 12x_2 + 4x_2 = 24$

$-8x_2 = -12$

$x_2 = \frac{3}{2}$

$x_1 = 6 - 2 \cdot \left(\frac{3}{2}\right)$

$x_1 = 3$

$(3, 1{,}5)$