

Método SIMPLEX

LUANA ALMEIDA
Ph.D.



No capítulo de hoje...

**Champions
League**

**Método
Gráfico –
Minimização**

**Método
SIMPLEX**

**Nos próximos
capítulos...**

No capítulo de hoje...

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Champions League



Kahoot!

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Minimização

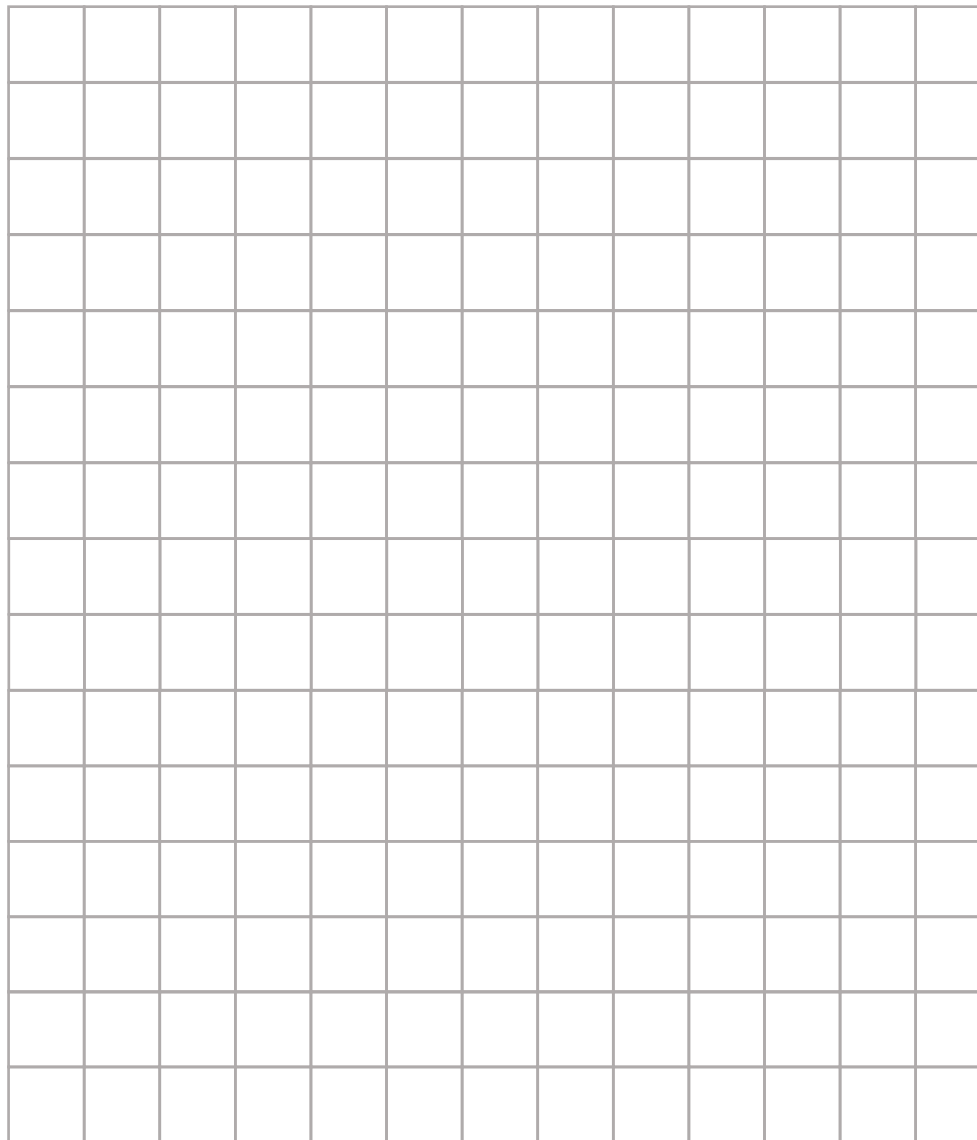
$$\text{Minimizar } W = 15x_1 + 20x_2$$

$$x_1 + 2x_2 \geq 10$$

$$2x_1 - 3x_2 \leq 6$$

$$x_1 + x_2 \geq 6$$

$$x_1, x_2 \geq 0$$



Minimização

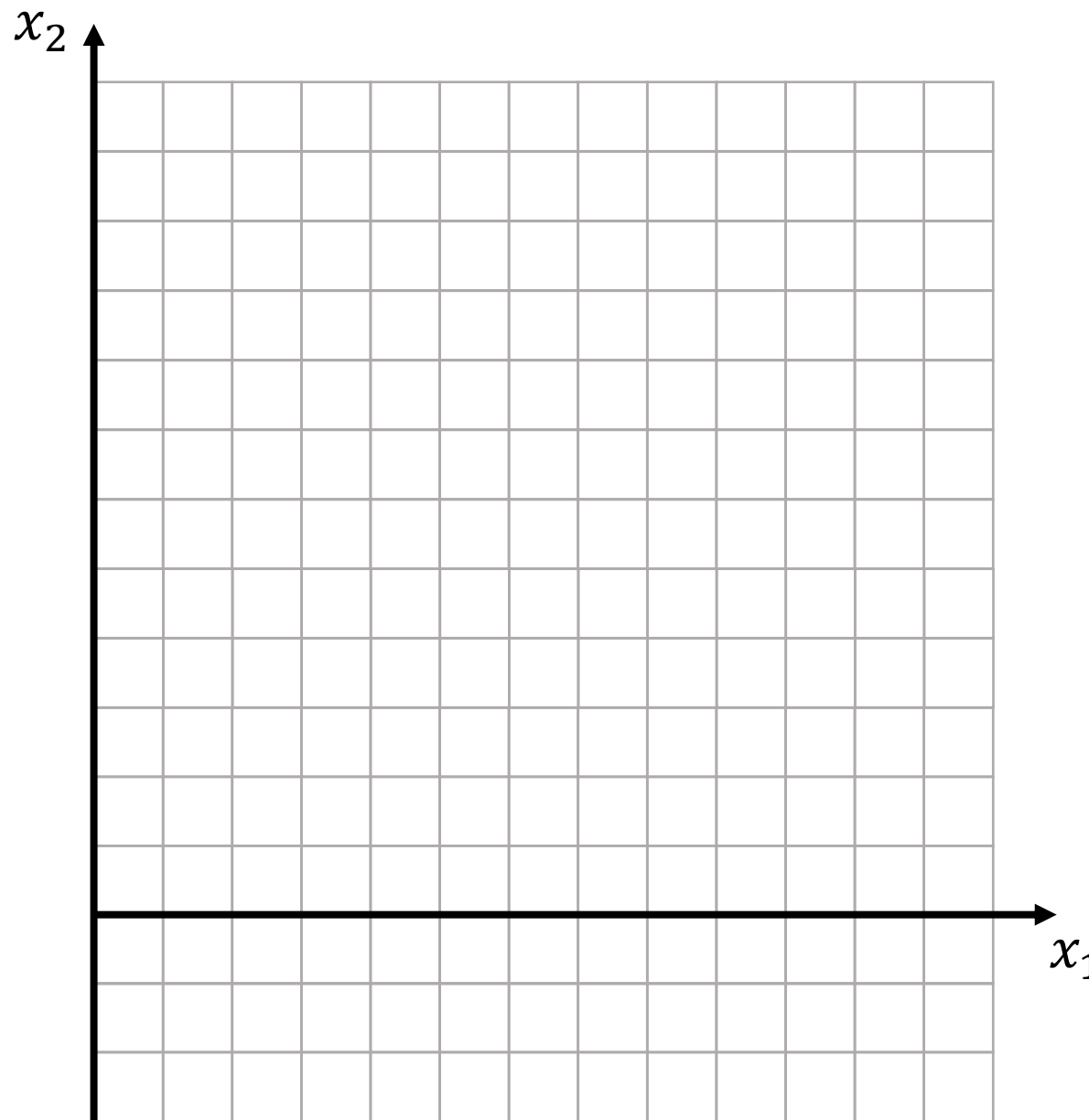
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Minimização

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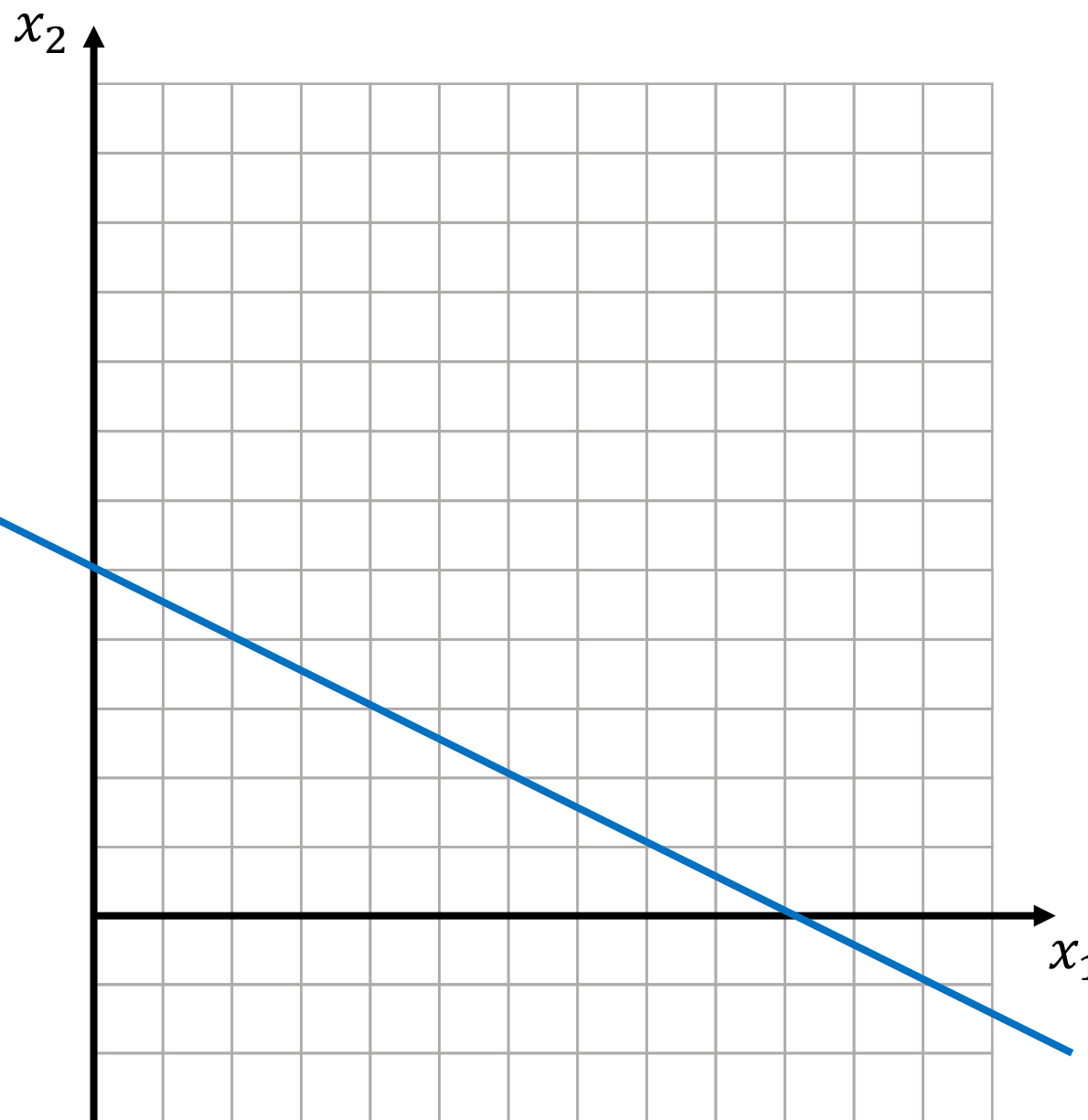
$$x_1 + 2x_2 \geq 10 \quad (I)$$

$$2x_1 - 3x_2 \leq 6$$

$$x_1 + x_2 \geq 6$$

$$x_1, x_2 \geq 0$$

(II)



Minimização

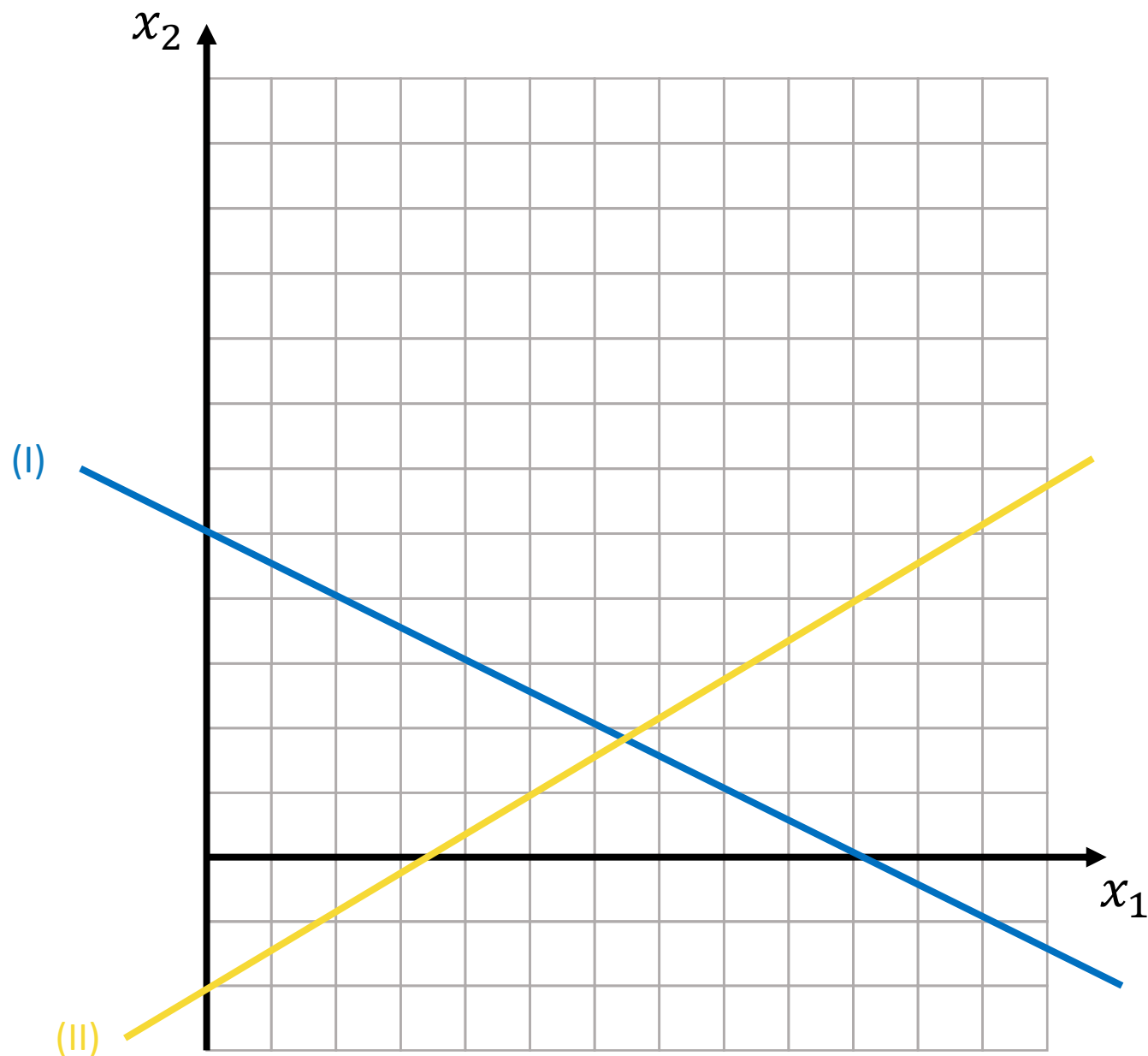
$$\text{Minimizar } W = 15x_1 + 20x_2$$

$$x_1 + 2x_2 \geq 10 \quad (\text{I})$$

$$2x_1 - 3x_2 \leq 6 \quad (\text{II})$$

$$x_1 + x_2 \geq 6$$

$$x_1, x_2 \geq 0$$



Minimização

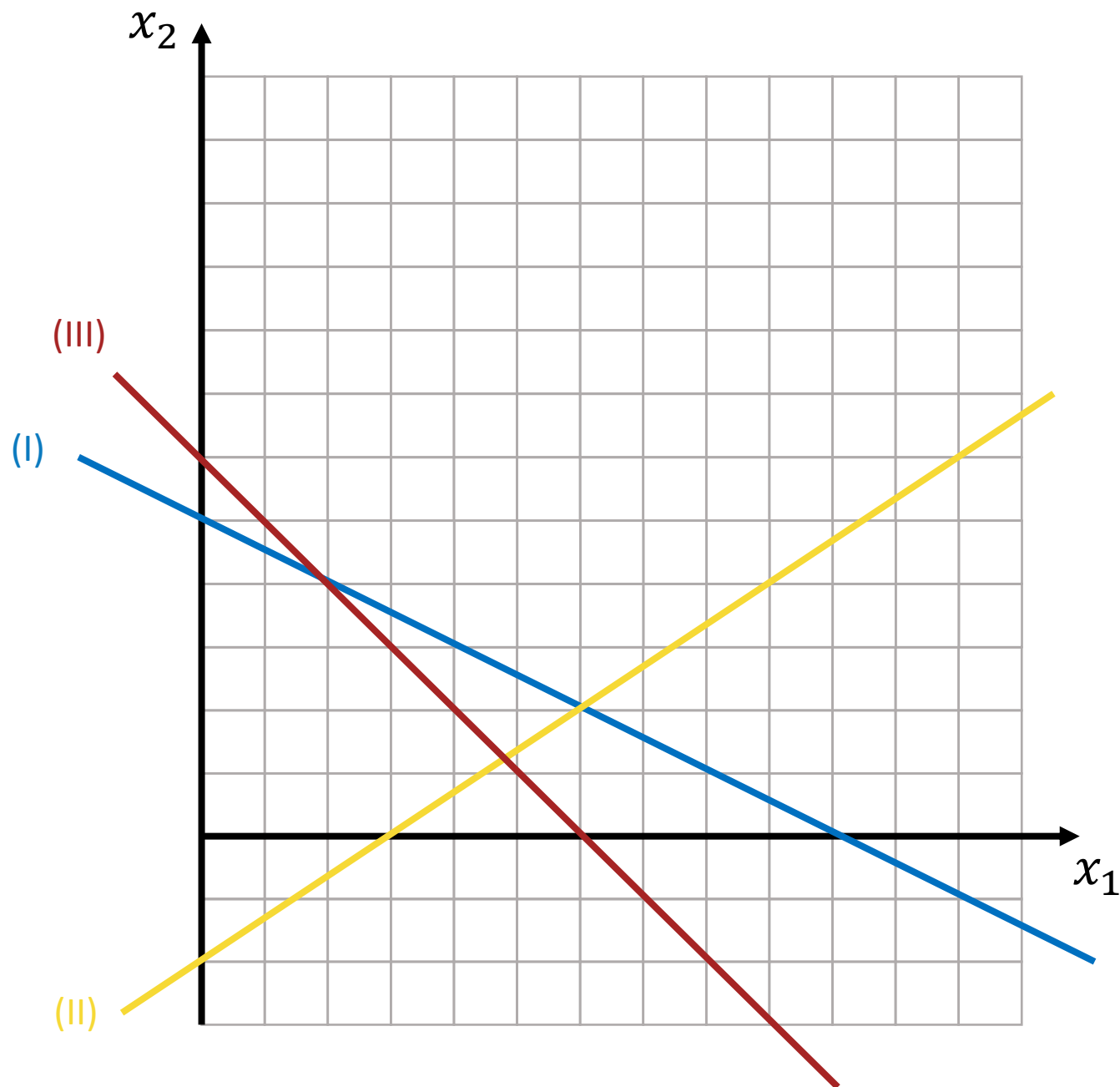
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$$x_1, x_2 \geq 0$$



Minimização

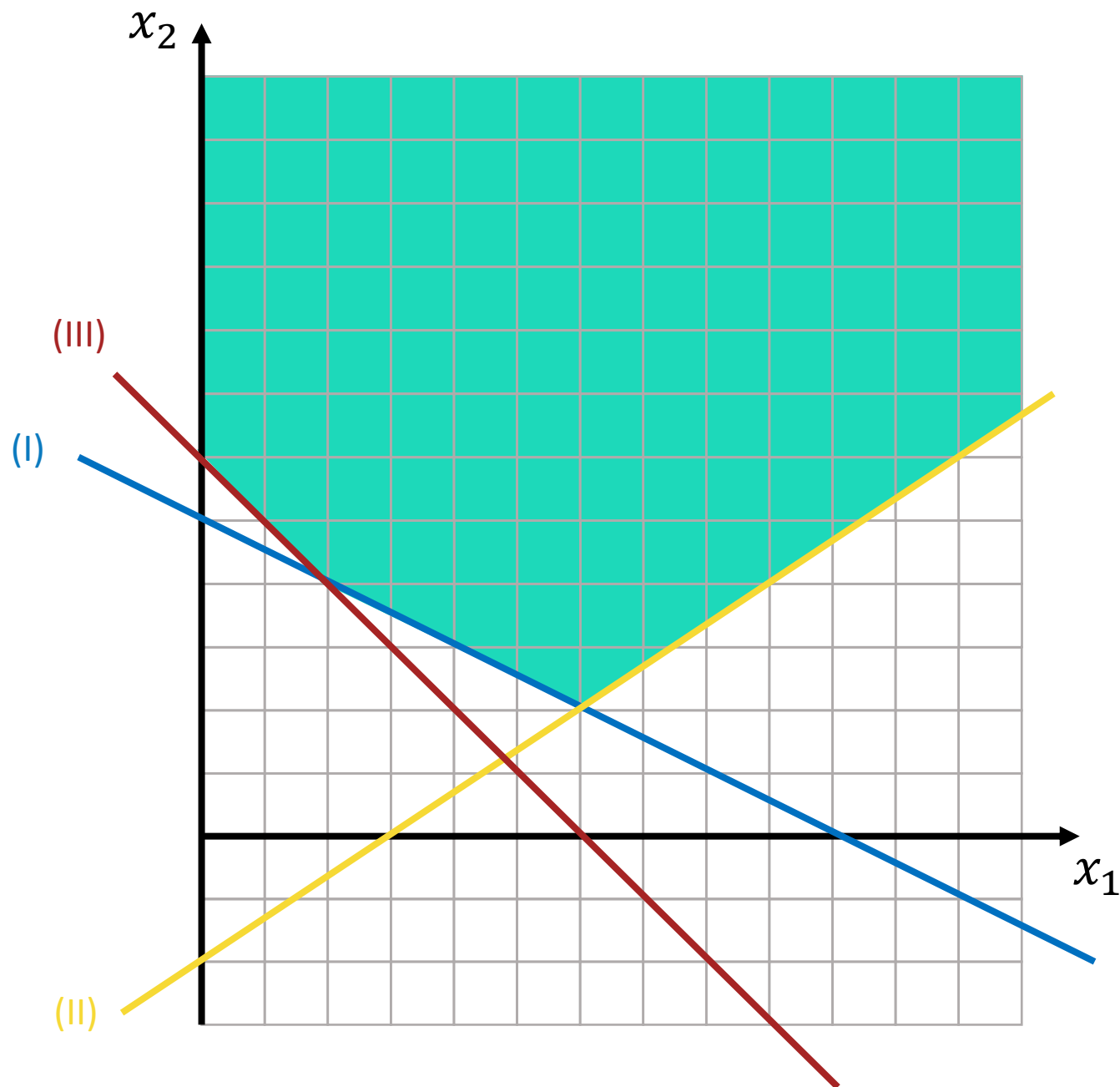
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Minimização

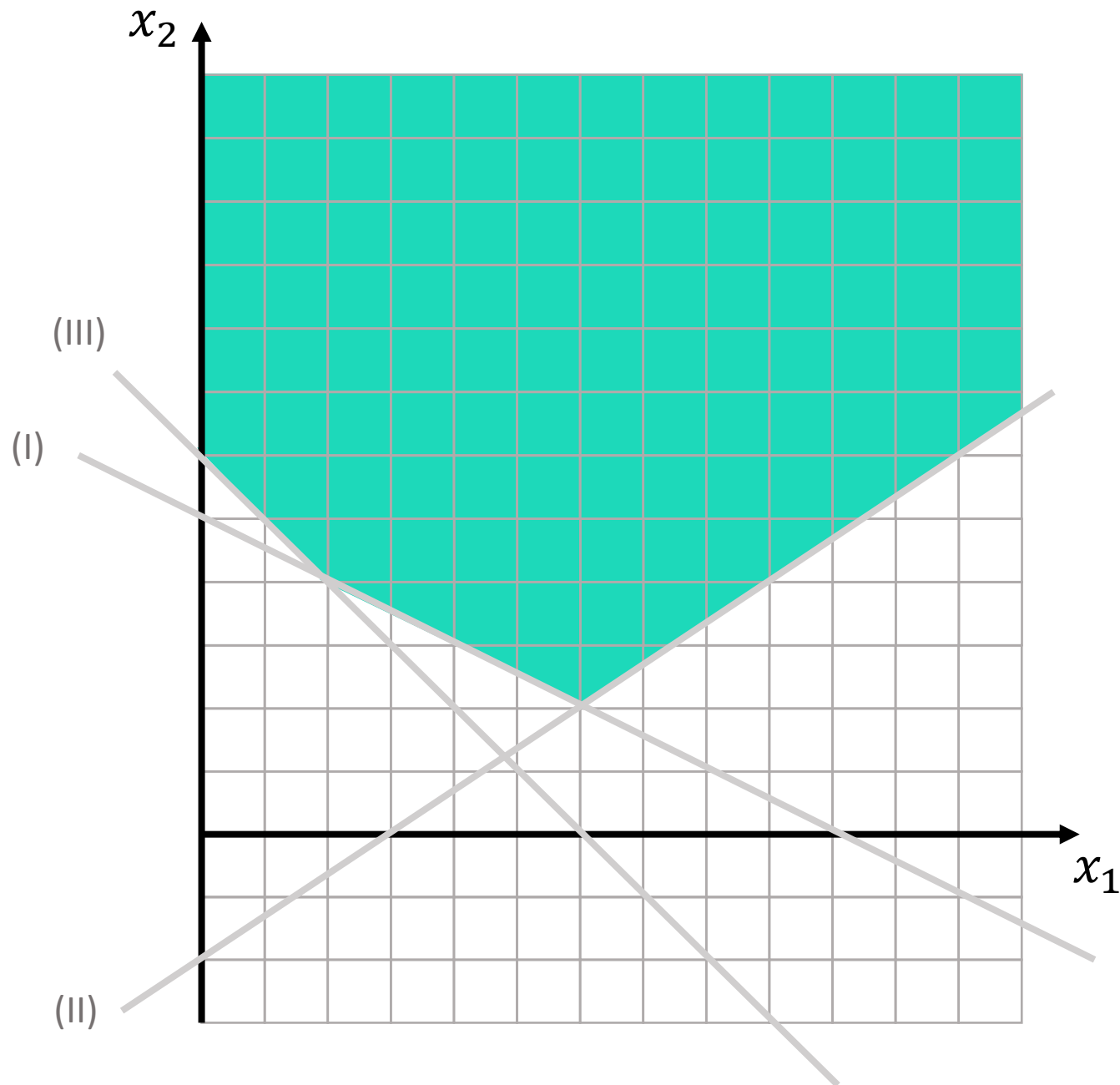
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Minimização

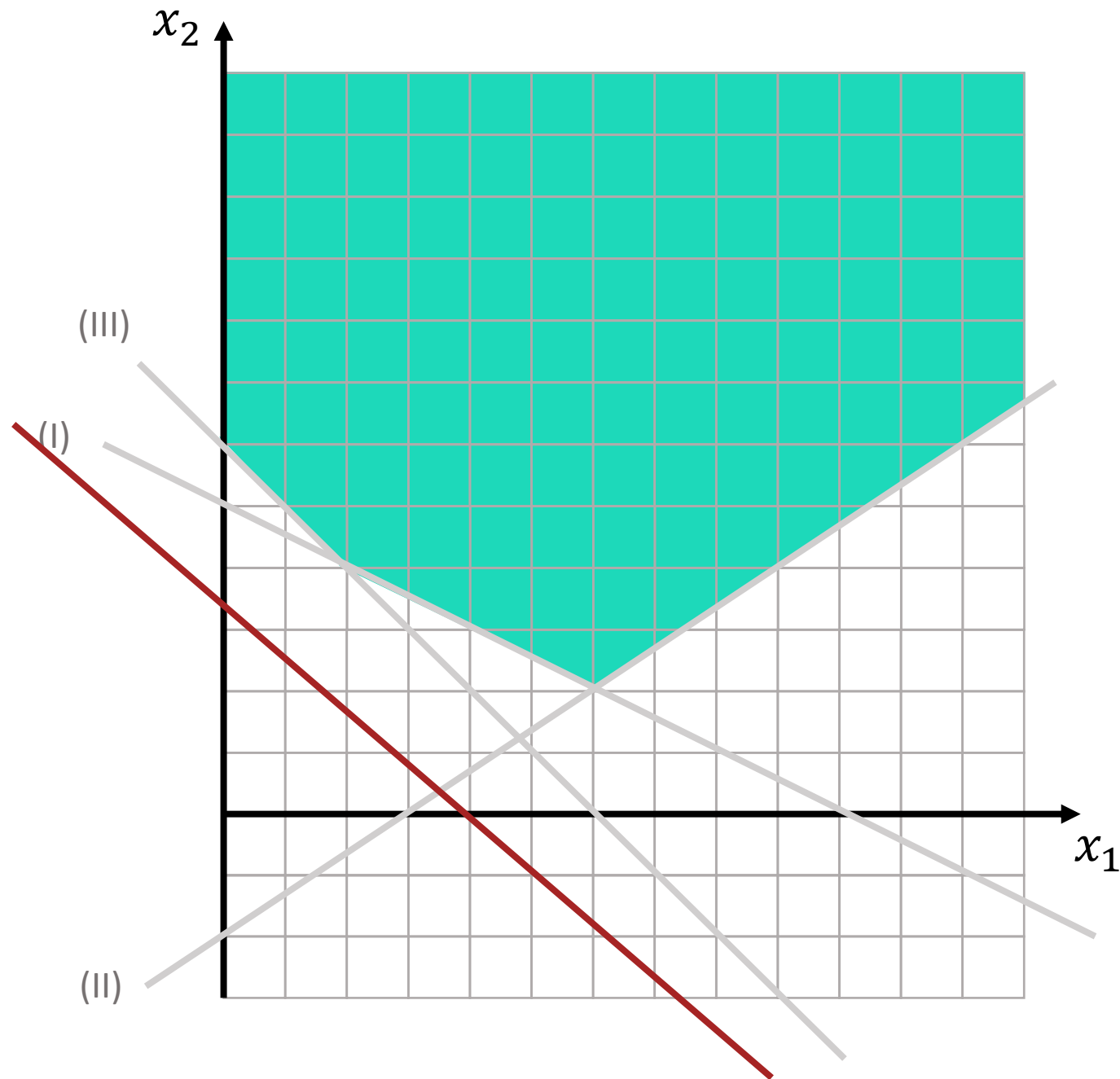
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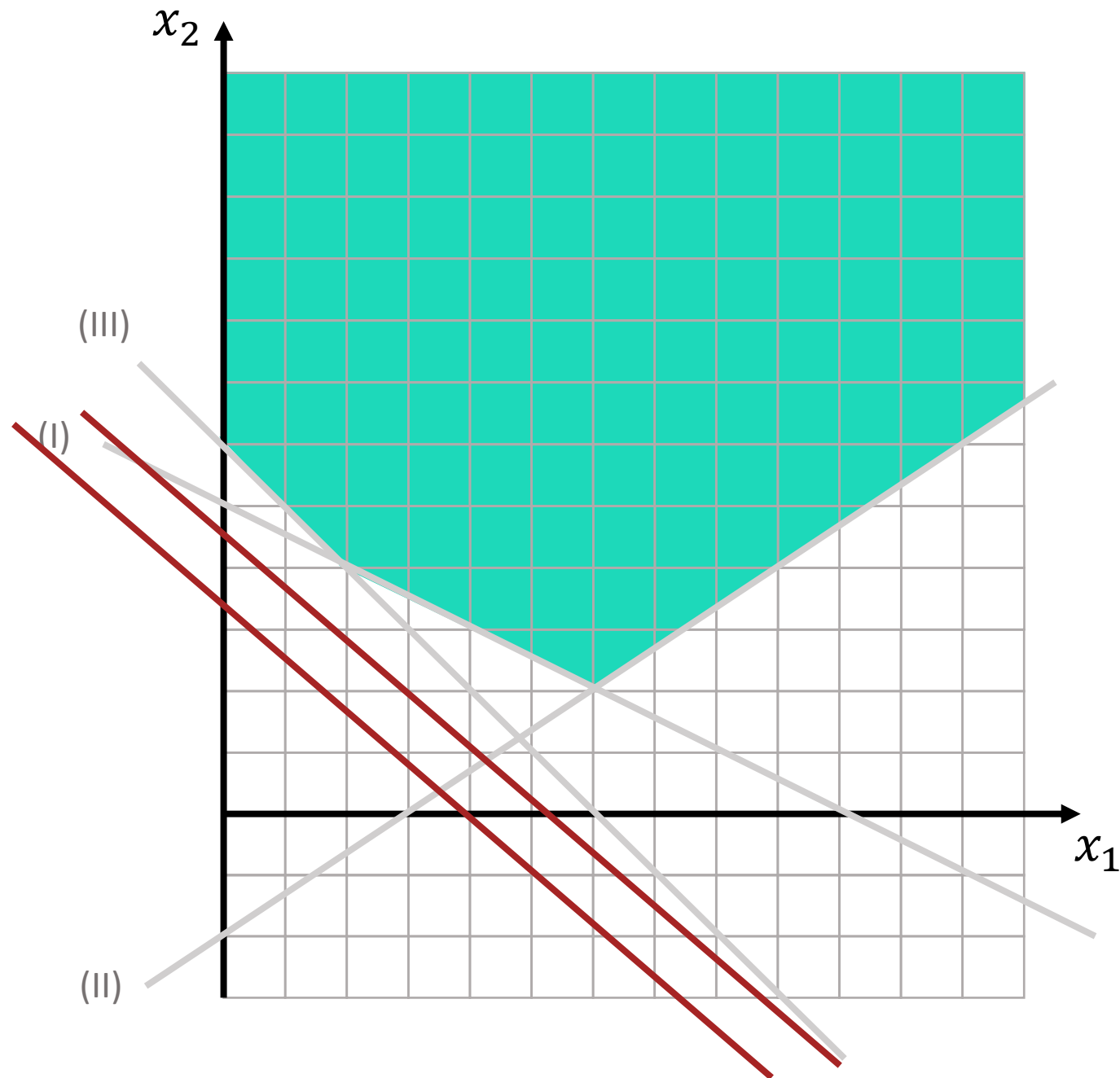
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Minimização

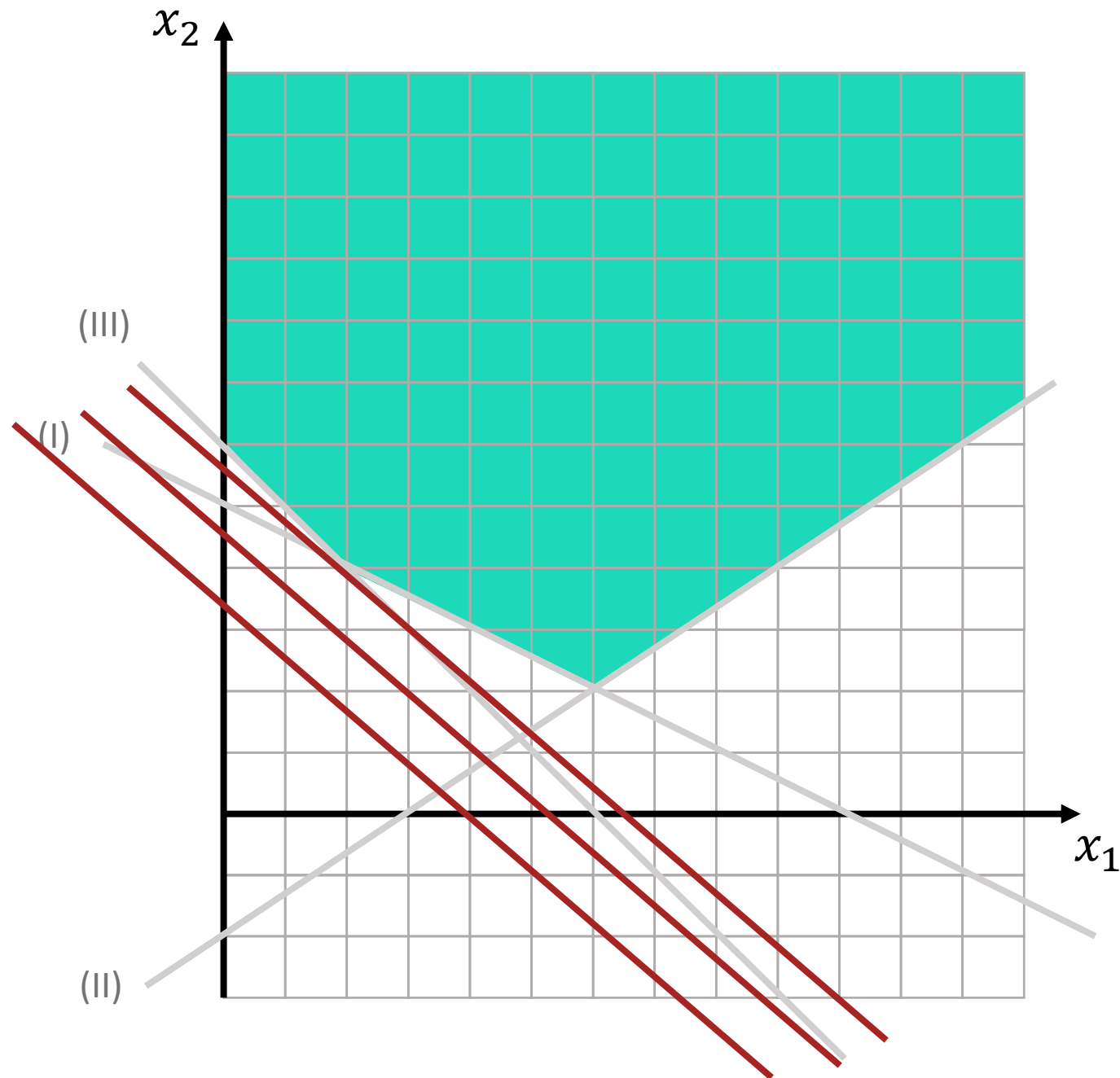
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$$x_1, x_2 \geq 0$$



Minimização

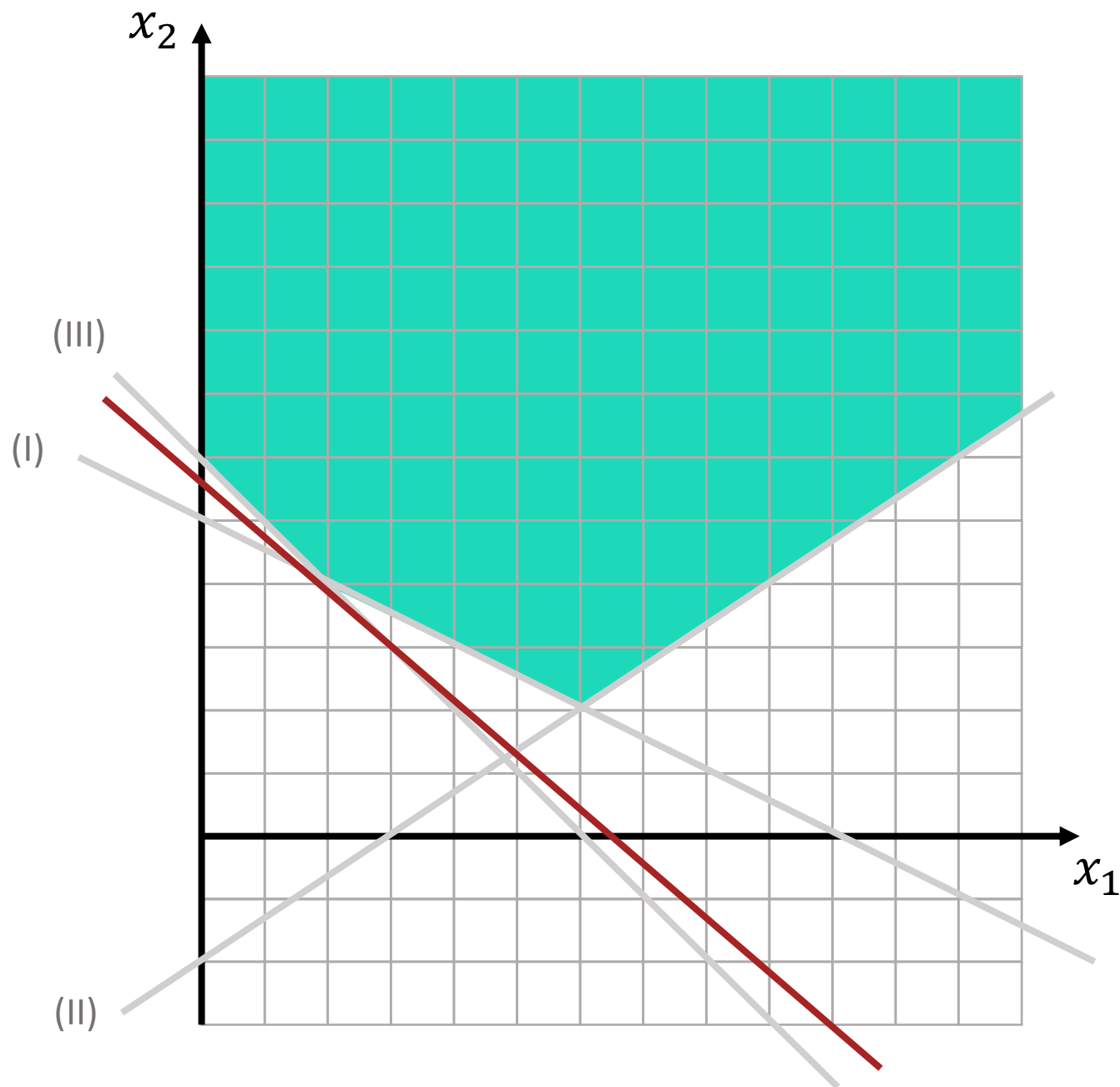
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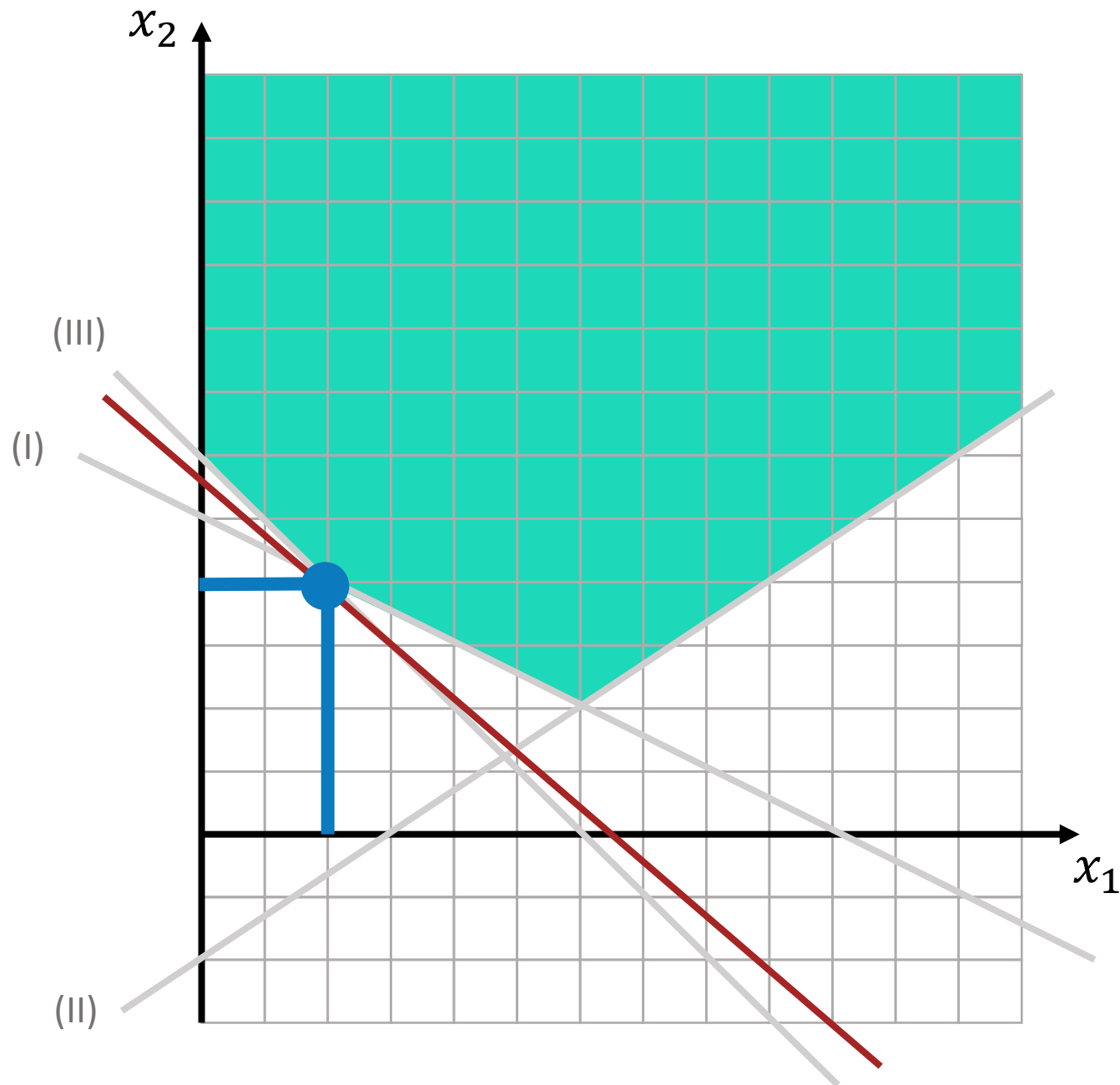
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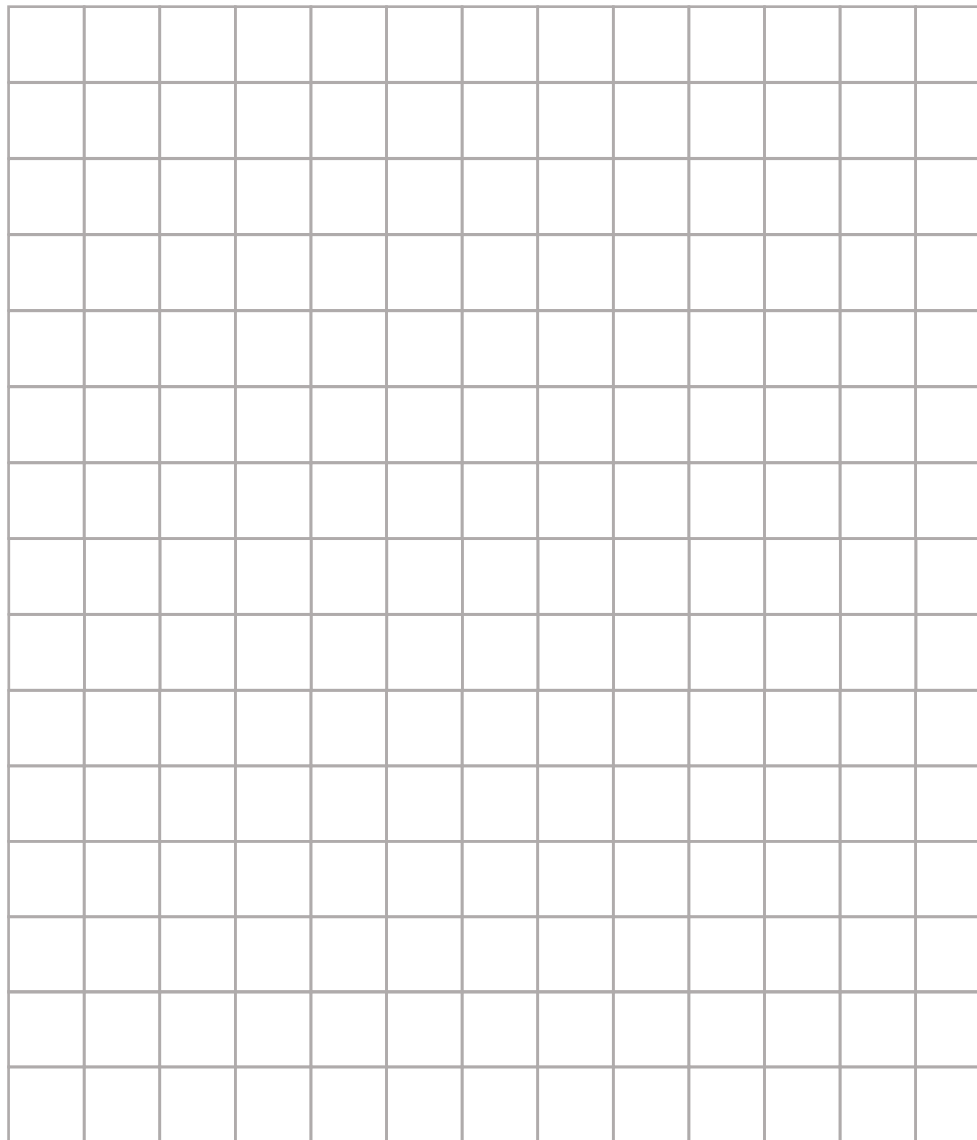
$$\text{Minimizar } W = 3x_1 + 2x_2$$

$$x_1 + 2x_2 \leq 12$$

$$2x_1 + 3x_2 = 12$$

$$2x_1 + x_2 \geq 8$$

$$x_1, x_2 \geq 0$$



Minimização

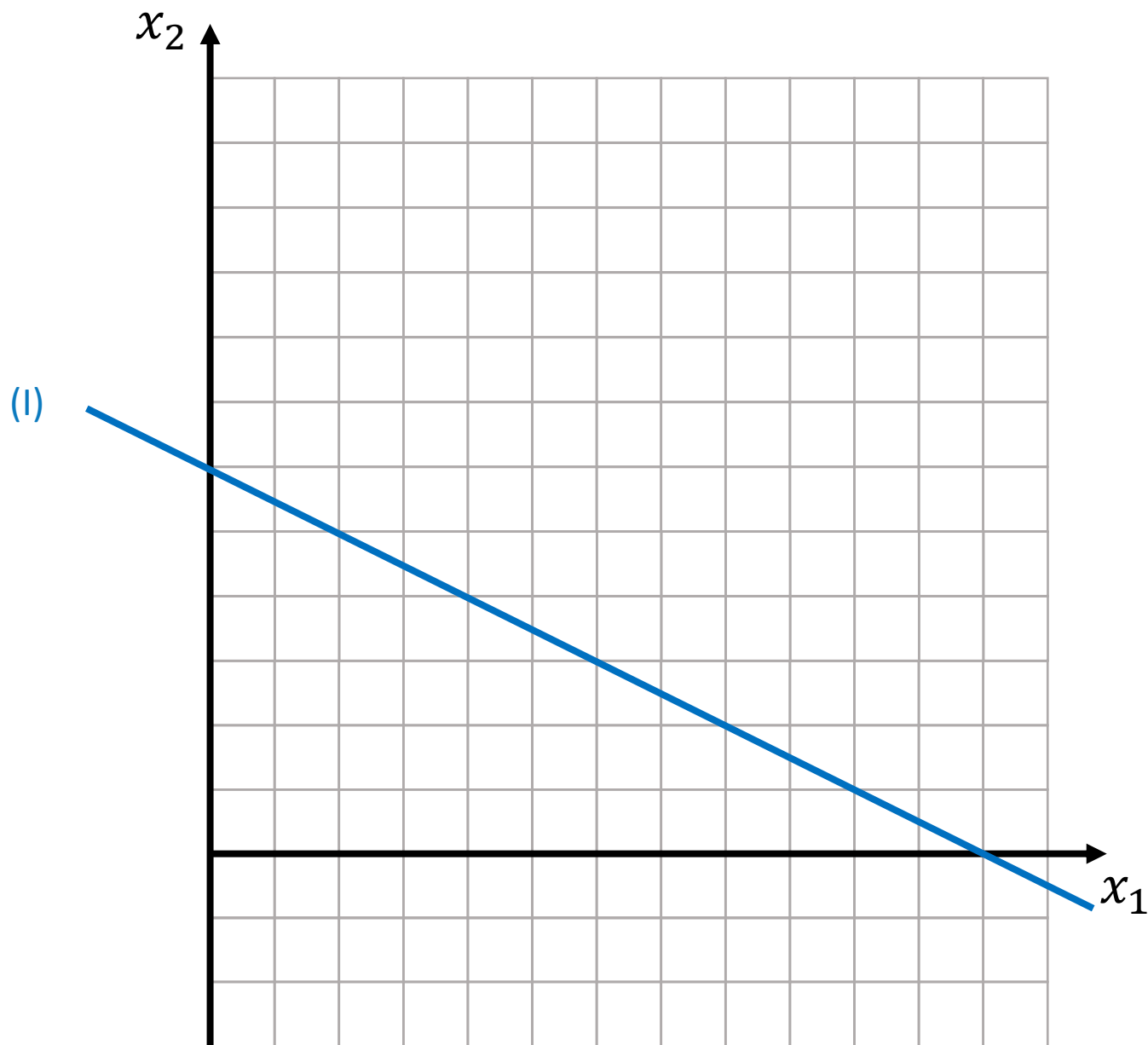
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$$x_1 + 2x_2 \leq 12 \quad (I)$$

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Minimização

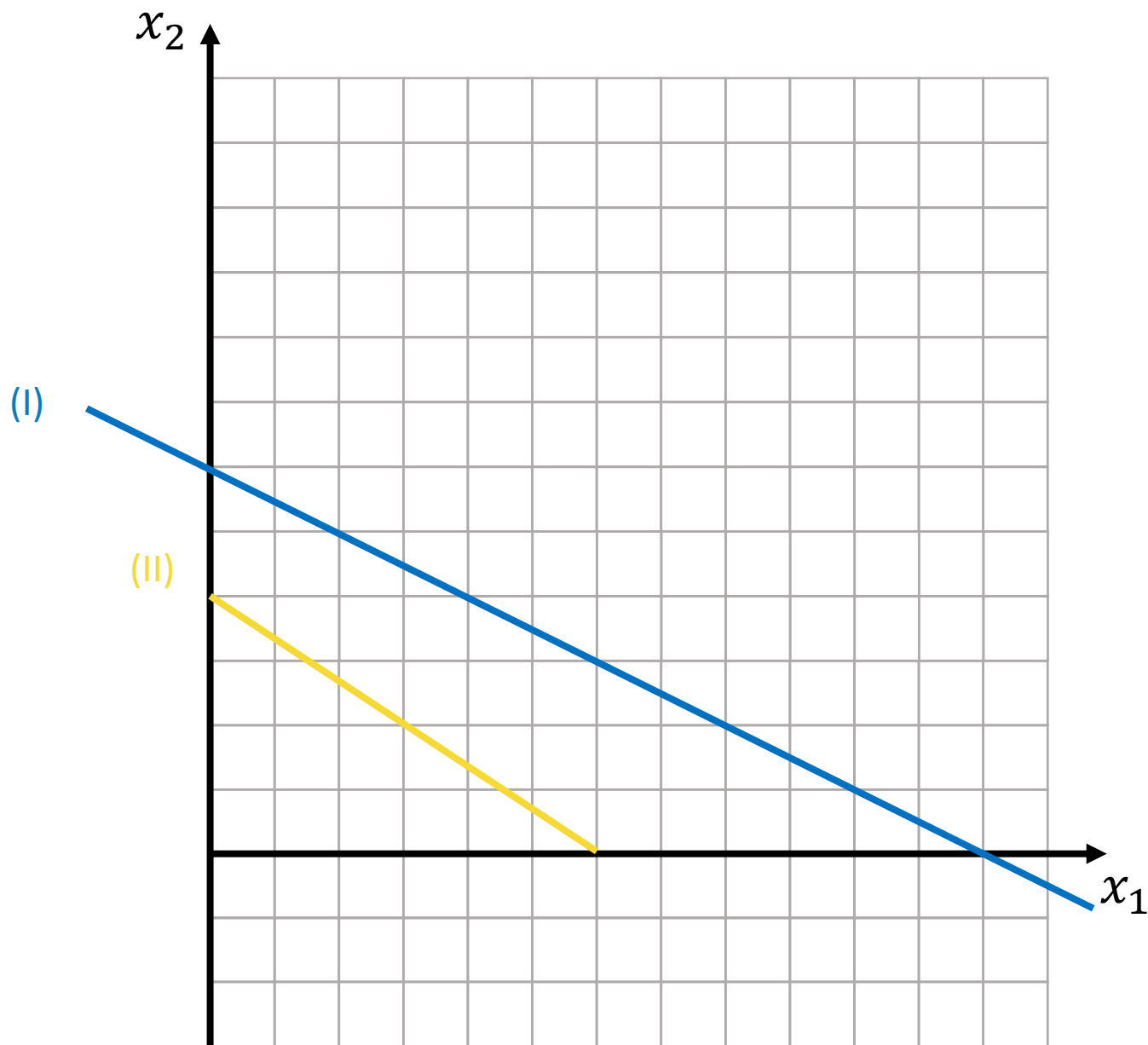
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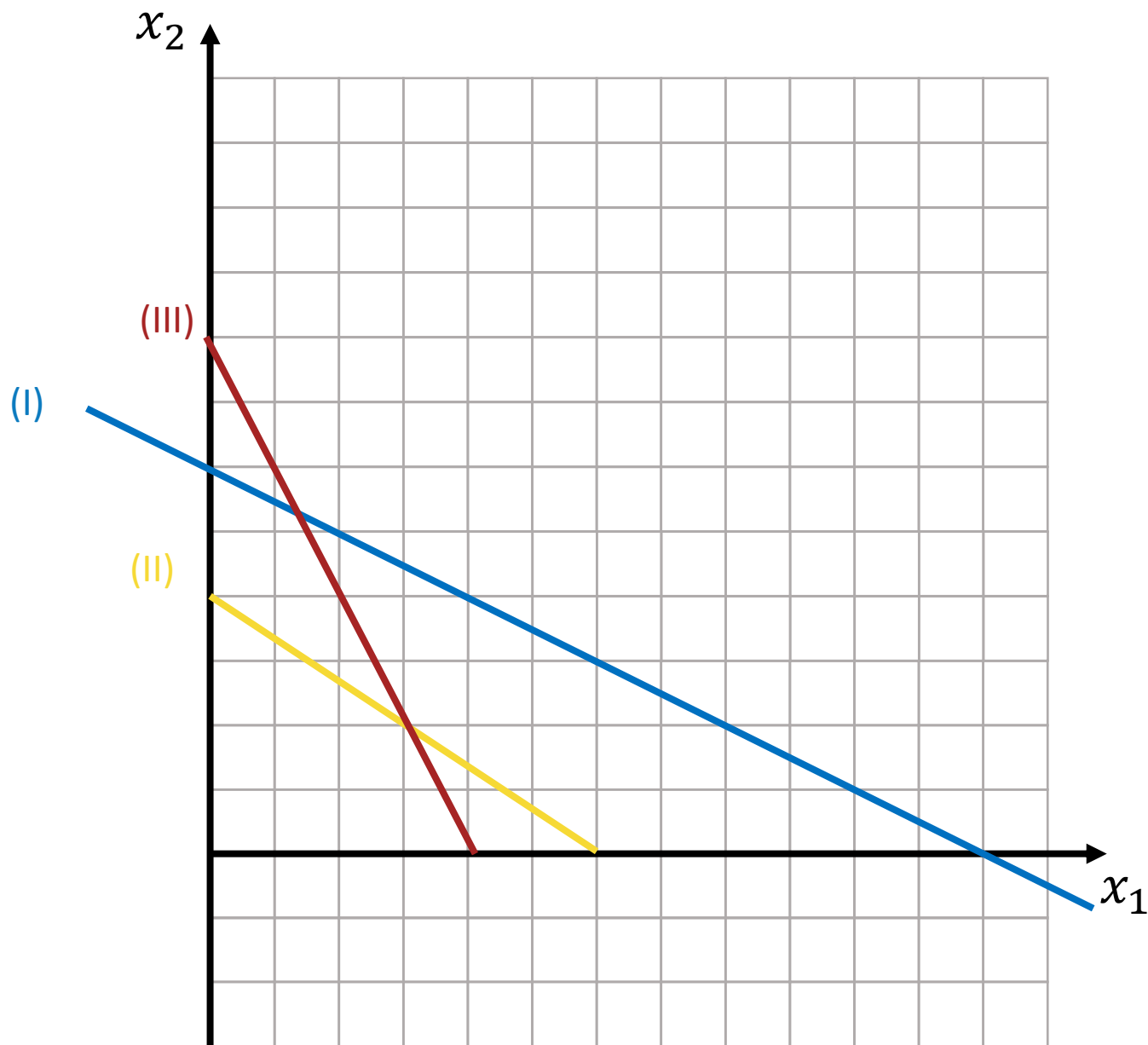
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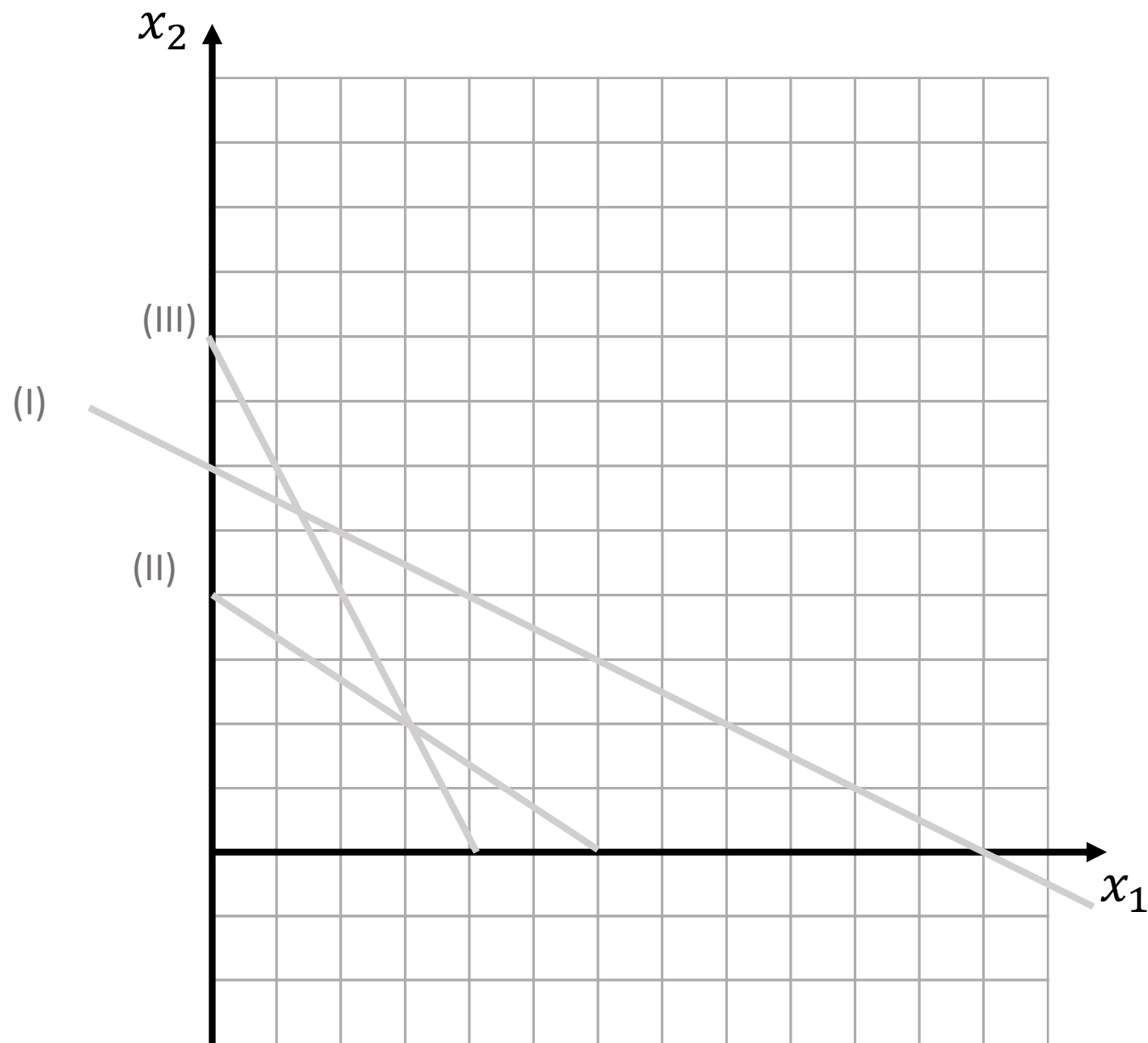
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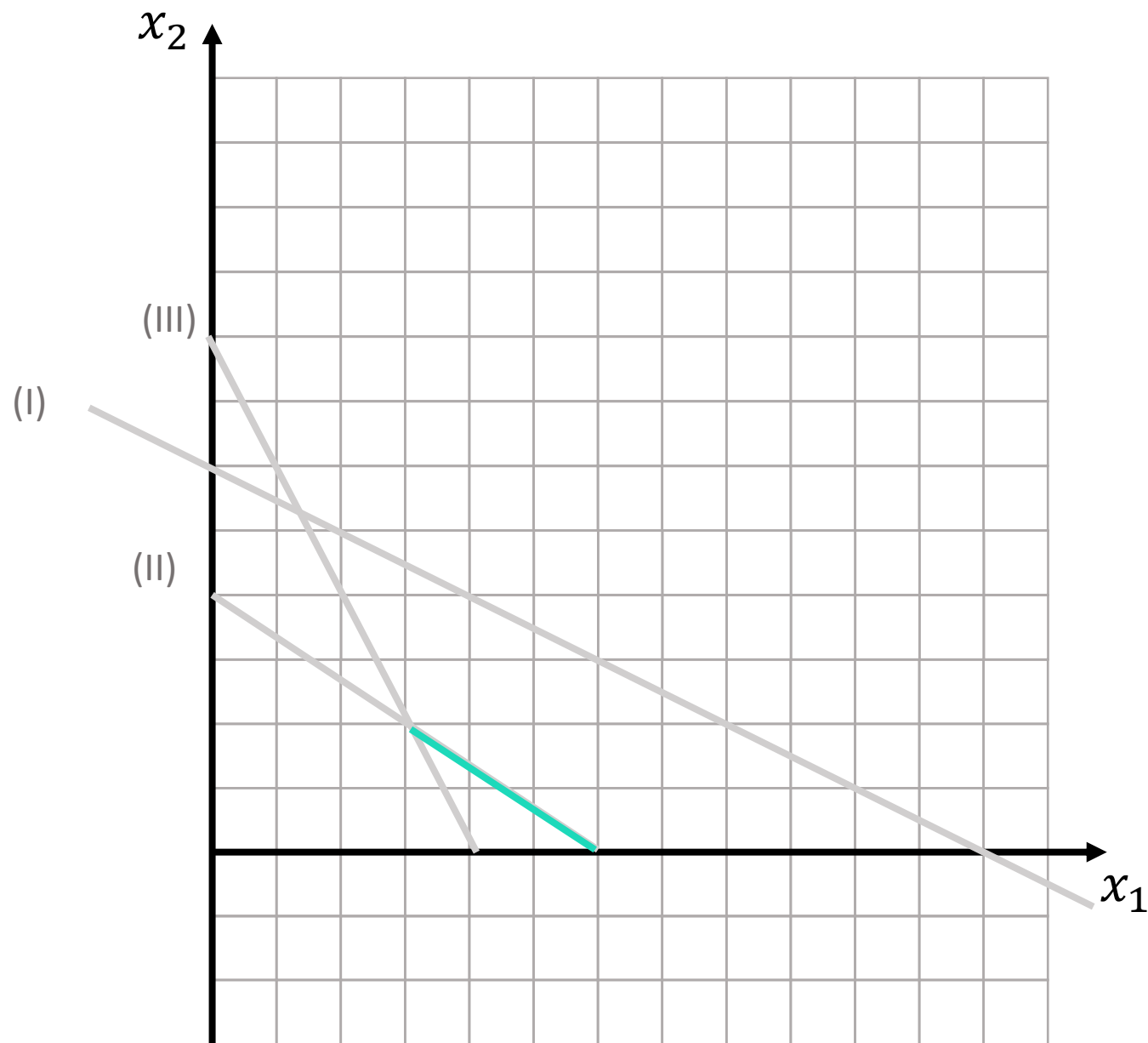
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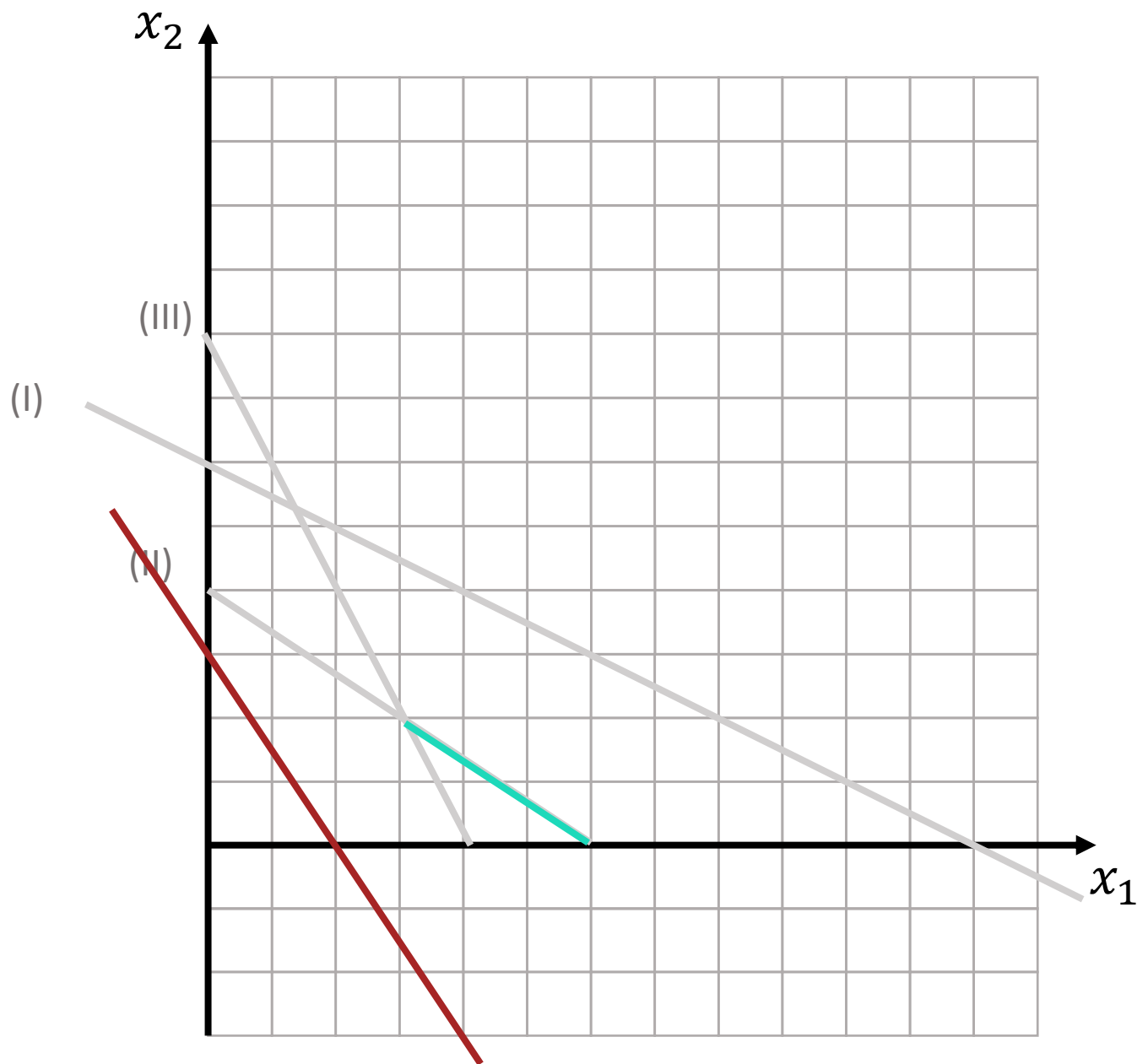
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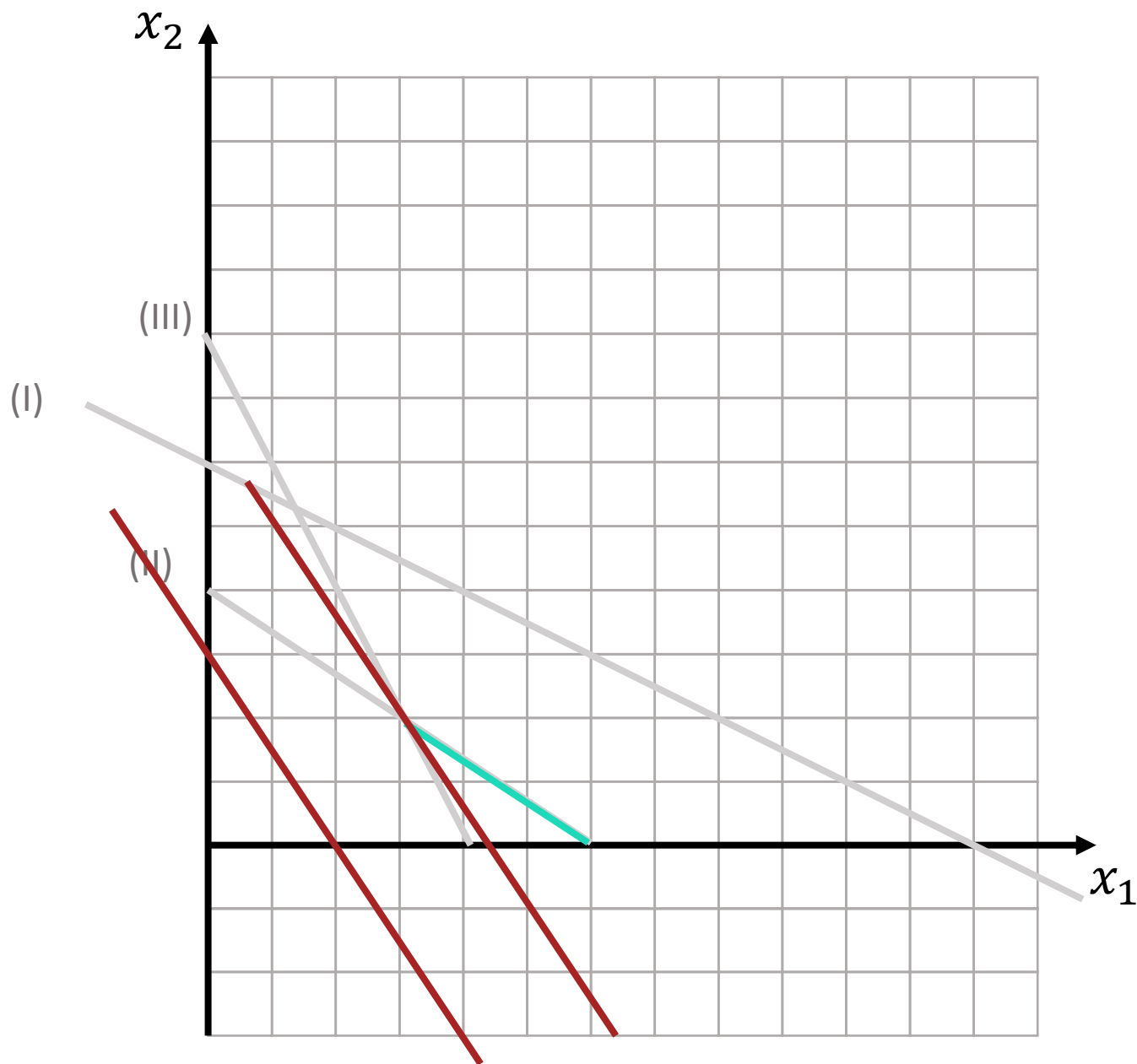
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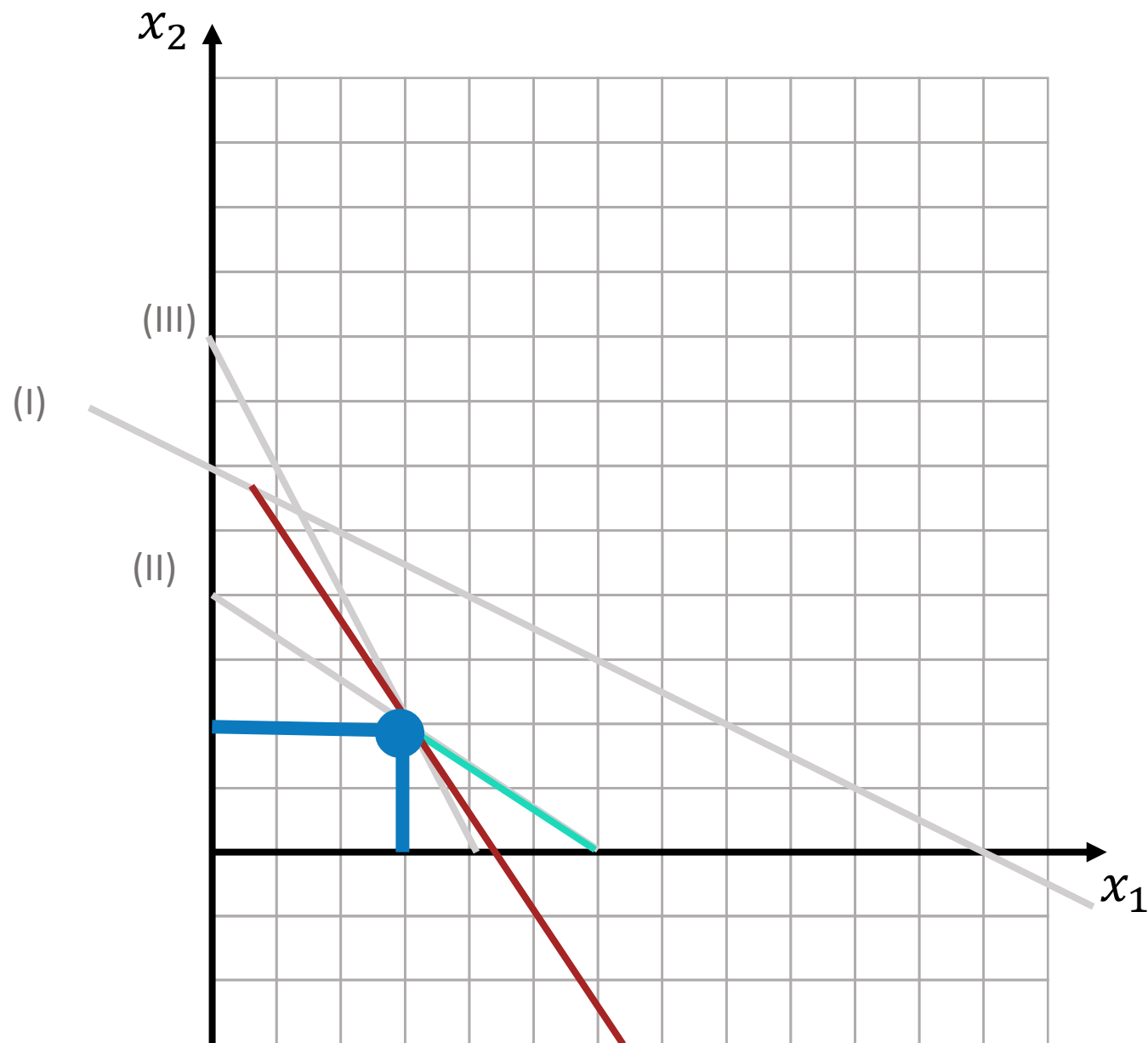
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LP Padrão

$$\text{Maximizar } Z = c_1x_1 + c_2x_2 + \cdots + c_nx_n$$

$$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n \leq b_1$$

$$a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n \leq b_2$$

$$a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n \leq m$$

$$x_1, x_2, \dots, x_n \geq 0$$

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$$a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n \leq m$$

$$x_1, x_2, \dots, x_n \geq 0$$

$$\text{Maximizar } Z = 3x_1 + 2x_2$$

$$2x_1 + x_2 \leq 100$$

$$x_1 + x_2 \leq 80$$

$$x_1 \leq 40$$

$$x_1, x_2 \geq 0$$

LP Padrão


$$\text{Maximizar } Z = c_1x_1 + c_2x_2 + \cdots + c_nx_n$$

$$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n \leq b_1$$

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$$x_1, x_2, \dots, x_n \geq 0$$


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$$x_1 \leq 40$$

$$x_1, x_2 \geq 0$$

$$\text{Minimizar } Z = 3x_1 + 2x_2$$

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$$x_1, x_2 \geq 0$$



$$\text{Minimizar } Z = 3x_1 + 2x_2$$

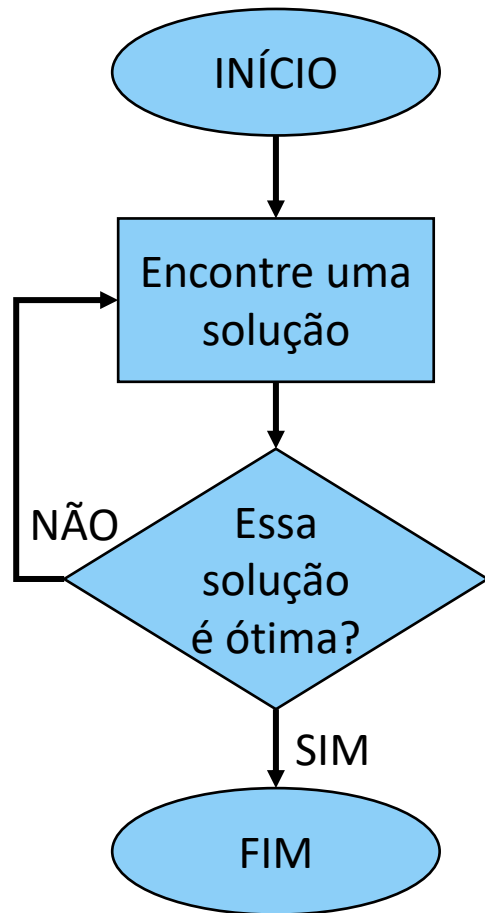
$$2x_1 + x_2 \leq 12$$

$$2x_1 + 3x_2 = 12$$

$$2x_1 + x_2 \geq 8$$

$$x_1, x_2 \geq 0$$

Algoritmo

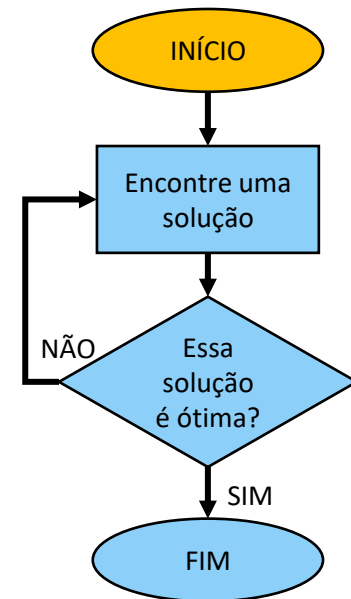


Tiozão

Cariani decidiu fazer uma nova dieta de preparo para o Mr. Olympia, e está na fase de “cutting”. Por isso, a sua dieta terá somente frango cozido e batata doce. Cada 100g de frango cozido tem cerca de 200 calorias, e cada 100g de batata doce tem aproximadamente 90 calorias. Ele pode consumir até 2000 calorias por dia. Além disso, como ele não quer perder massa magra, precisará consumir o máximo possível de proteínas. Cada 100g de frango e de batata doce tem, respectivamente, 27 e 2g de proteína. Como ele não curte muito frango, consome no máximo 200g. A sua nutricionista, Tati, permite que ele consuma no máximo 20g de gordura. Note que 100g de frango possui 14g de gordura, enquanto a batata doce tem 1g. Determine qual é a melhor combinação de frango e batata doce para a dieta de “cutting” do Cariani.

Passo 1

- Modelo Aumentado
- Adicionar variáveis de folga



$$\text{Maximizar } Z = 27x_1 + 2x_2$$

$$200x_1 + 90x_2 \leq 2000$$

$$x_1 \leq 2$$

$$14x_1 + x_2 \leq 20$$

$$x_1, x_2 \geq 0$$



$$\text{Maximizar } Z - 27x_1 + 2x_2 = 0$$

$$200x_1 + 90x_2 + \mathbf{x_3} = 2000$$

$$x_1 + \mathbf{x_4} = 2$$

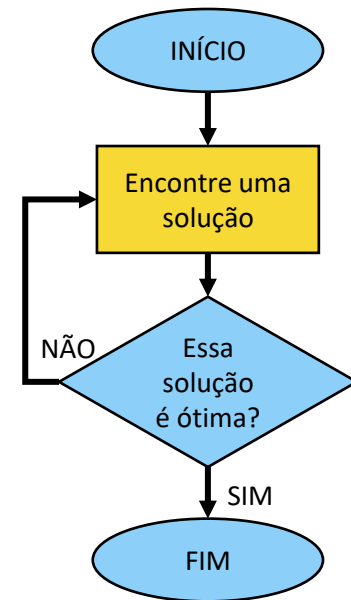
$$14x_1 + x_2 + \mathbf{x_5} = 20$$

$$x_1, x_2, x_3, x_4, x_5 \geq 0$$

Passo 2

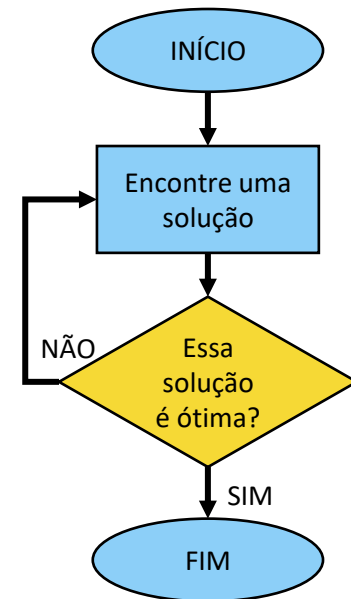
- Construir a tabela inicial

	Z	x1	x2	x3	x4	x5	RHS
Z	1	-27	-2	0	0	0	0
x3	0	200	90	1	0	0	2000
x4	0	1	0	0	1	0	2
x5	0	14	1	0	0	1	20



Passo 3

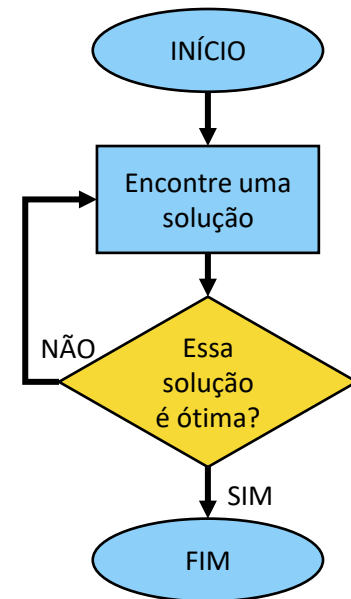
- Calcular o Ratio



	Z	x1	x2	x3	x4	x5	RHS	RATIO
Z	1	-27	-2	0	0	0	0	
x3	0	200	90	1	0	0	2000	2000/200
x4	0	1	0	0	1	0	2	2/1
x5	0	14	1	0	0	1	20	20/14

Passo 3

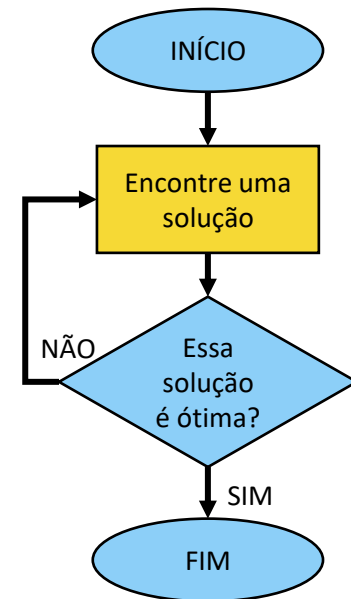
- Calcular o Ratio



	Z	x1	x2	x3	x4	x5	RHS	RATIO
Z	1	-27	-2	0	0	0	0	
x3	0	200	90	1	0	0	2000	2000/200
x4	0	1	0	0	1	0	2	2/1
x5	0	14	1	0	0	1	20	20/14

Passo 4

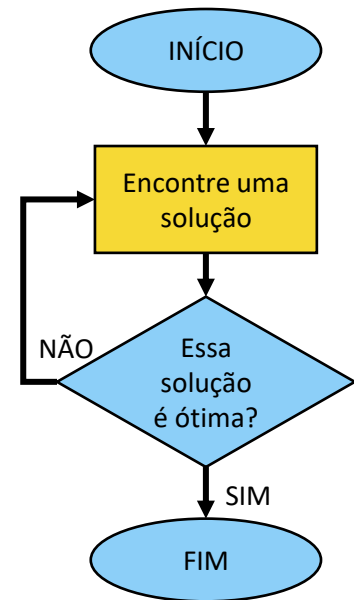
- Encontrar uma nova solução



	Z	x1	x2	x3	x4	x5	RHS	RATIO
Z	1	0	-1/14	0	0	27/14	270/7	
x3	0	0	530/7	1	0	-100/7	-100/7	
x4	0	0	-1/14	0	1	-1/14	-1/14	
x1	0	1	1/14	0	0	1/14	1/14	

Passo 4

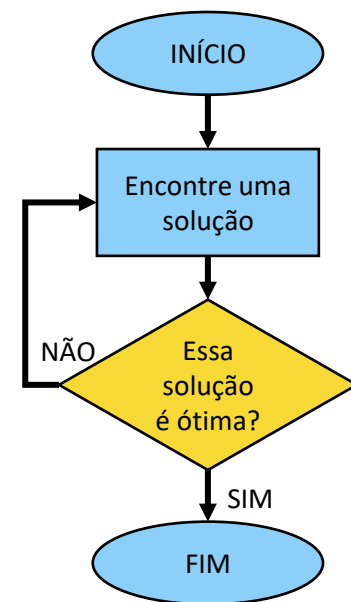
- Calcular o ratio



	Z	x1	x2	x3	x4	x5	RHS	RATIO
Z	1	0	-1/14	0	0	27/14	270/7	
x3	0	0	530/7	1	0	-100/7	1200/7	12000/530
x4	0	0	-1/14	0	1	-1/14	4/7	-
x1	0	1	1/14	0	0	1/14	20/14	20/1

Passo 4

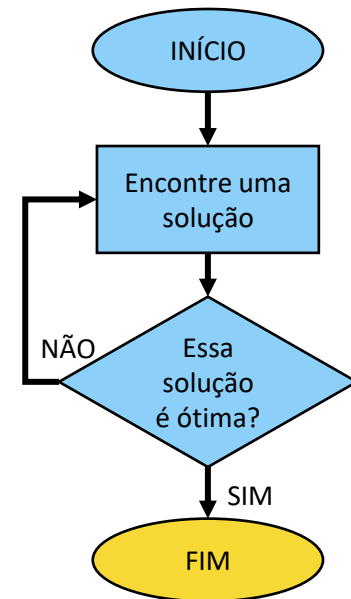
- Calcular o ratio



	Z	X1	X2	X3	x4	X5	RHS	RATIO
Z	1	1	0	0	0	2	40	
X3	0	-1060	0	1	1	430/7	200	
X4	0	1	0	0	1	0	2	
x1	0	14	1	0	0	1	20	

Passo 4

- Encontrar a solução ótima



	Z	X1	X2	X3	x4	X5	RHS	RATIO
Z	1	1	0	0	0	2	40	
X3	0	-1060	0	1	1	430/7	200	
X4	0	1	0	0	1	0	2	
x1	0	14	1	0	0	1	20	

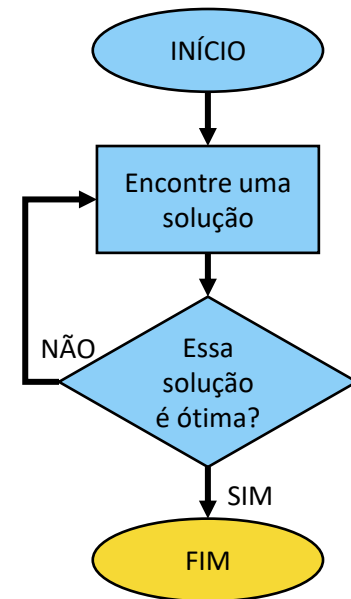
$$Z^* = 40$$

$$x_1^* = 20$$

$$x_2^* = 0$$

Passo 4

- Encontrar a solução ótima



	Z	X1	X2	X3	x4	X5	RHS	RATIO
Z	1	1	0	0	0	2	40	
X3	0	-1060	0	1	1	430/7	200	
X4	0	1	0	0	1	0	2	
x1	0	14	1	0	0	1	20	

$$Z^* = 40$$

$$x_1^* = 20$$

$$x_2^* = 0$$

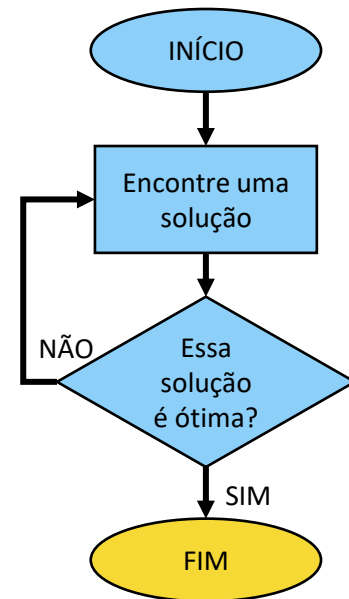
Passo 4



FAKE NATTY!

	Z	X1
Z	1	1
X3	0	-1060
X4	0	1
x1	0	14

RHS	RATIO
40	
200	
2	
20	



$$Z^* = 40$$

$$x_1^* = 20$$

$$x_2^* = 0$$

Método Gráfico

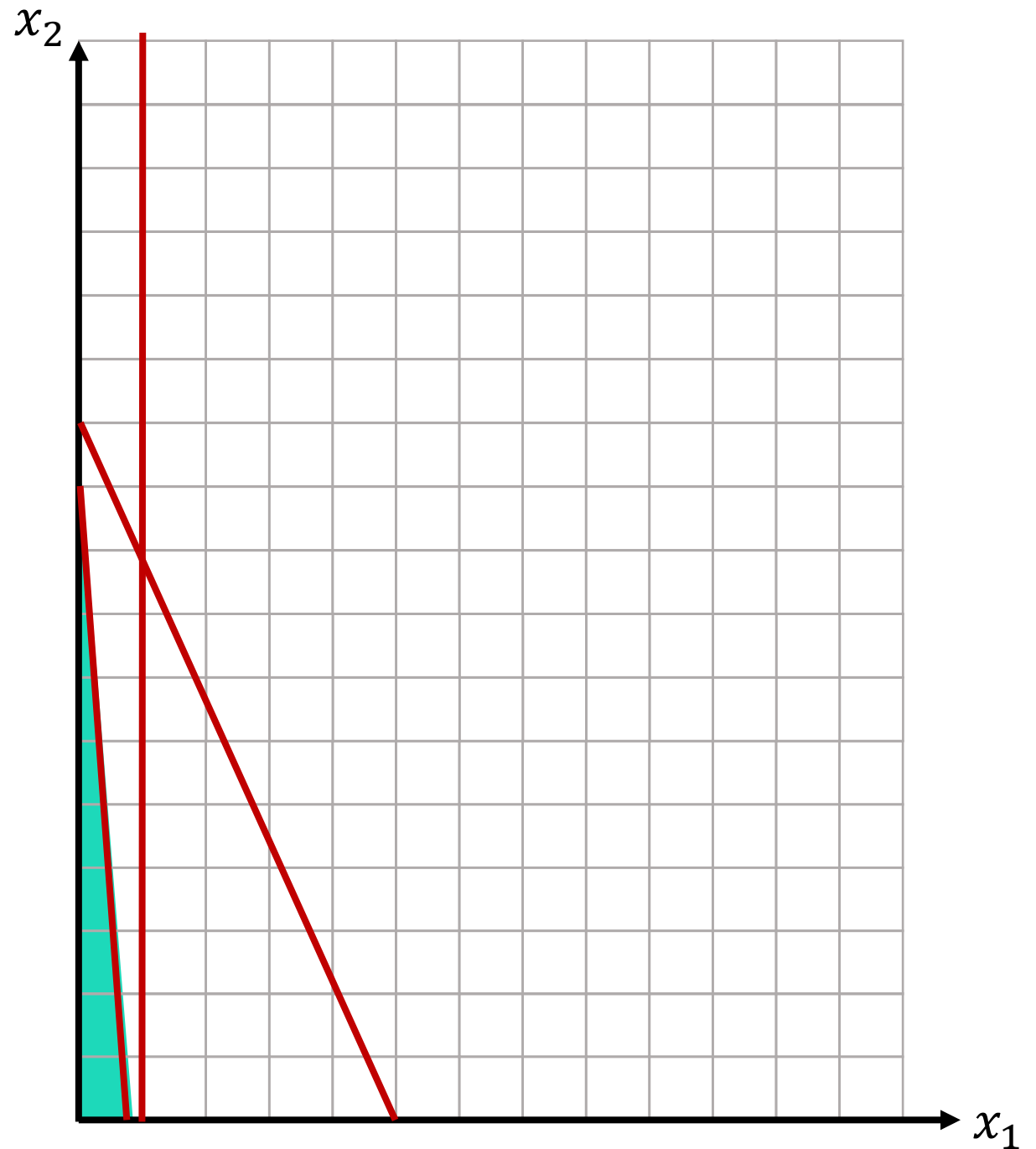
$$\text{Maximizar } Z = 27x_1 + 2x_2$$

$$200x_1 + 90x_2 \leq 2000$$

$$x_1 \leq 2$$

$$14x_1 + x_2 \leq 20$$

$$x_1, x_2 \geq 0$$



Método Gráfico

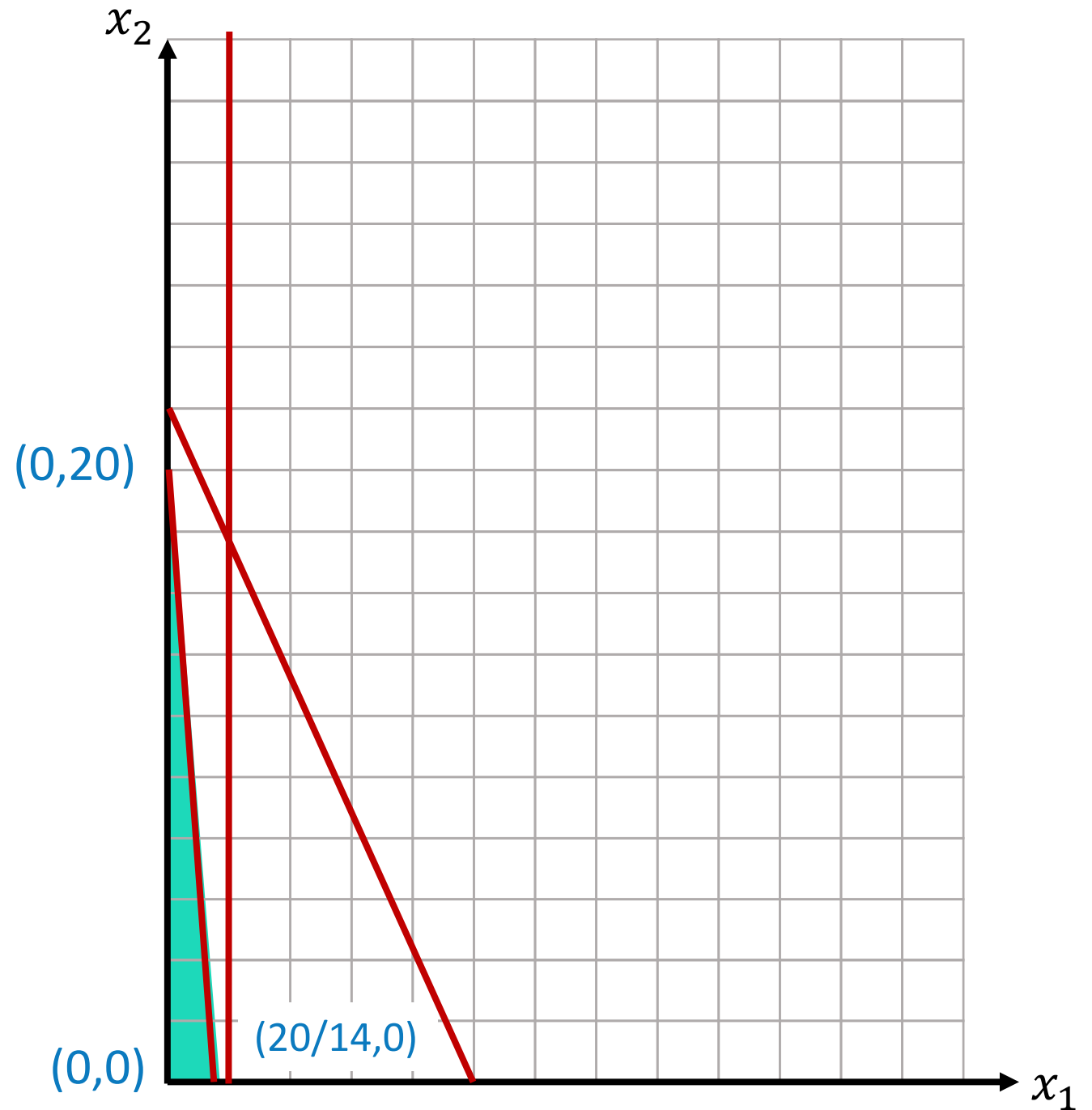
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