

1. Larry and Tony are baking cupcakes and banana mini-loaves to sell at a school fundraiser.

- No more than 60 cupcakes and 35 mini-loaves can be made each day.
- Larry and Tony are able to bake at least 80 items, in total, each day.
- It costs \$0.50 to make a cupcake and \$0.75 to make a mini-loaf.

Determine the numbers of cupcakes and mini-loaves that Larry and Tony should make in order to minimize cost. What is the minimum cost?

variables and restrictions:

let  $c$  represent the number of cupcakes,  $c \in \mathbb{W}$

let  $m$  represent the number of mini-loaves,  $m \in \mathbb{W}$

constraints:

$$c \geq 0$$

$$m \geq 0$$

$$c \leq 60$$

$$m \leq 35$$

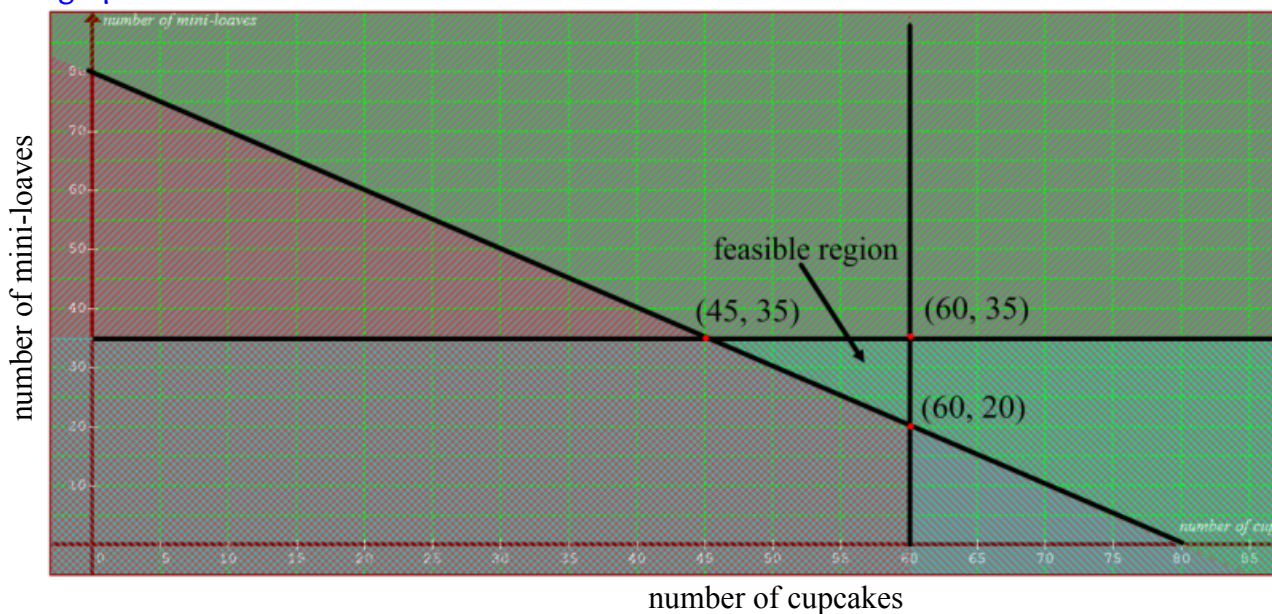
$$c + m \geq 80$$

objective function:

let  $C$  represent cost

$$C = 0.50c + 0.75m$$

graph:



evaluate:

$$\text{For } (45, 35): C = 0.50(45) + 0.75(35) = \$48.75$$

$$\text{For } (60, 35): C = 0.50(60) + 0.75(35) = \$56.25$$

$$\text{For } (60, 20): C = 0.50(60) + 0.75(20) = \$45.00 *$$

conclusion:

Larry and Tony should make **60 cupcakes** and **20 mini-loaves** in order to minimize cost to **\$45.00**

## 2. A vending machine sells juice and water.

- The machine can hold a maximum of 100 bottles.
- At most, 3 bottles of water are sold for each bottle of juice.
- Each bottle of water sells for \$1.00 and each bottle of juice sells for \$1.25.

Determine the numbers of bottles of juice and water that would result in the maximum possible revenue. What is the maximum revenue?

variables and restrictions:

let  $w$  represent the number of water bottles,  $w \in \mathbb{W}$

let  $j$  represent the number of juice bottles,  $j \in \mathbb{W}$

constraints:

$$w \geq 0$$

$$j \geq 0$$

$$w \leq 3j$$

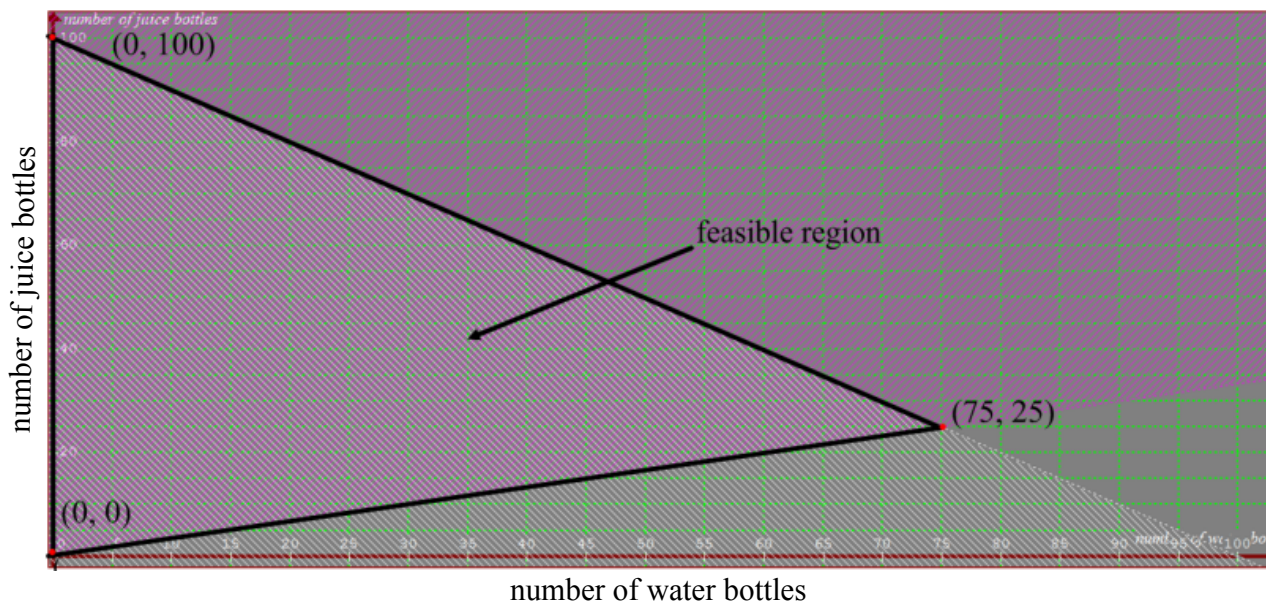
$$w + j \leq 100$$

objective function:

let  $R$  represent revenue

$$R = w + 1.25j$$

graph:



evaluate:

$$\text{For } (0, 0): R = 0 + 1.25(0) = \$0$$

$$\text{For } (0, 100): R = 0 + 1.25(100) = \$125 *$$

$$\text{For } (75, 25): R = 75 + 1.25(25) = \$106.25$$

conclusion:

0 bottles of water and 100 bottles of juice would maximize revenue to \$125.



3. A sports equipment manufacturer produces snowboards and skis.

- It takes 4 hours to cut and mould each board and 4 hours to cut and mould each pair of skis. A maximum of 60 hours is spent on the cutting and moulding process.
- It takes 1 hour to finish a board and 2 hours to finish a pair of skis. A maximum of 20 hours is spent on the finishing process.
- The profit is \$75 for each snowboard and \$65 for each pair of skis.

Determine how many snowboards and pairs of skis should be manufactured in order to maximize profit. What is the maximum profit?

variables and restrictions:

let  $b$  represent the number of snowboards,  $b \in \mathbb{W}$

let  $s$  represent the number of skis,  $s \in \mathbb{W}$

constraints:

$$b \geq 0$$

$$s \geq 0$$

$$4b + 4s \leq 60$$

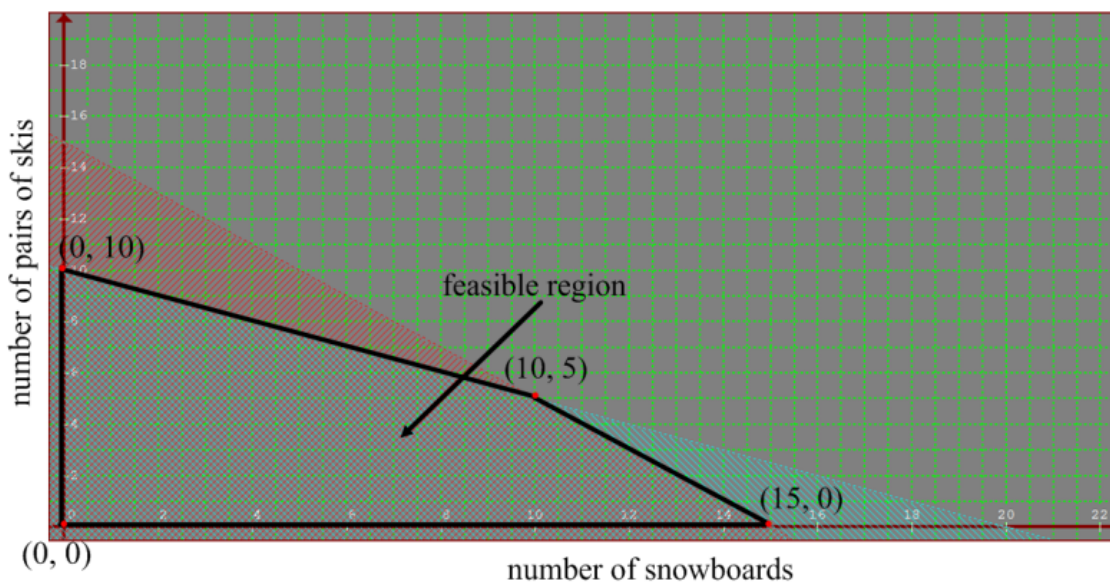
$$b + 2s \leq 20$$

objective function:

let  $P$  represent profit

$$P = 75b + 65s$$

graph:



evaluate:

$$\text{For } (0, 0): P = 75(0) + 65(0) = \$0$$

$$\text{For } (0, 10): P = 75(0) + 65(10) = \$650$$

$$\text{For } (10, 5): P = 75(10) + 65(5) = \$1075$$

$$\text{For } (15, 0): P = 75(15) + 65(0) = \$1125 *$$

conclusion:

15 snowboards and 0 pairs of skis should be manufactured to maximize profit to \$1125.

4. Bella makes wallets and belts from recycled tires.

- She can make no more than 4 wallets and at least 10 belts in a day.
- She makes no more than 20 items, in total, in a day.
- Each belt costs \$1.50 to make, and each wallet costs \$2.25.

Determine the combination of wallets and belts that would minimize cost. What is this minimum cost?

variables and restrictions:

let  $w$  represent the number of wallets,  $w \in \mathbb{W}$

let  $b$  represent the number of belts,  $b \in \mathbb{W}$

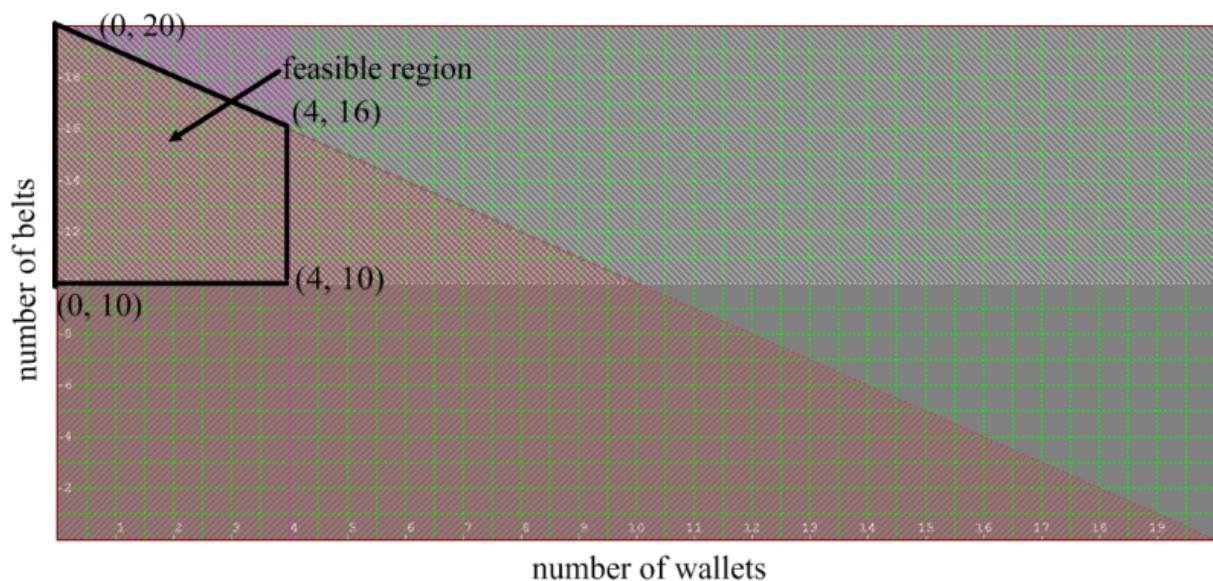
constraints:

$$\begin{aligned}w &\geq 0 \\b &\geq 0 \\w &\leq 4 \\b &\geq 10 \\w + b &\leq 20\end{aligned}$$

objective function:

$$\begin{aligned}\text{let } C &\text{ represent cost} \\P &= 2.25w + 1.50b\end{aligned}$$

graph:



evaluate:

$$\text{For } (0, 10): C = 2.25(0) + 1.50(10) = \$15 *$$

$$\text{For } (0, 20): C = 2.25(0) + 1.50(20) = \$30$$

$$\text{For } (4, 16): C = 2.25(4) + 1.50(16) = \$33$$

$$\text{For } (4, 10): C = 2.25(4) + 1.50(10) = \$24$$

conclusion:

0 wallets and 10 belts should be manufactured to minimize profit to \$15.

5. Caleb and Madison sell tacos and burritos from a food cart.

- No more than 50 tacos and 75 burritos can be made each day.
- Caleb and Madison can make no more than 110 items, in total, each day.
- It costs \$0.75 to make a taco and \$1.25 to make a burrito.

Determine the maximum possible cost to produce these food items. How many tacos and burritos would have to be sold?

variables and restrictions:

let  $t$  represent the number of tacos,  $t \in \mathbb{W}$

let  $b$  represent the number of burritos,  $b \in \mathbb{W}$

constraints:

$$t \geq 0$$

$$b \geq 0$$

$$t \leq 50$$

$$b \leq 75$$

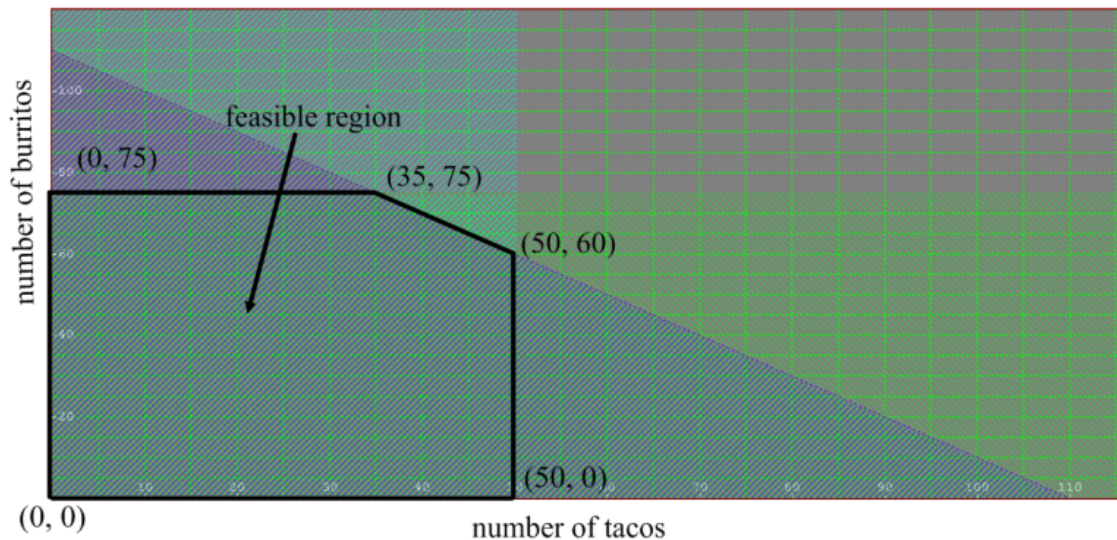
$$t + b \leq 110$$

objective function:

let  $C$  represent cost

$$C = 0.75t + 1.25b$$

graph:



evaluate:

$$\text{For } (0, 0): C = 0.75(0) + 1.25(0) = \$0$$

$$\text{For } (0, 75): C = 0.75(0) + 1.25(75) = \$93.75$$

$$\text{For } (35, 75): C = 0.75(35) + 1.25(75) = \$120 *$$

$$\text{For } (50, 60): C = 0.75(50) + 1.25(60) = \$112.50$$

$$\text{For } (50, 0): C = 0.75(50) + 1.25(0) = \$37.50$$

conclusion:

The maximum possible cost is \$120 for 35 tacos and 75 burritos.



6. Yanni collects stamps and baseball cards.

- He has at most 100 stamps and at most 75 baseball cards.
  - He has at least 1 stamp and at least 1 baseball card.
  - He has no more than 150 items, in total.
  - Each stamp cost him 10 cents and each baseball card cost him 50 cents.
- a. Determine the *minimum* amount that Yanni could have spent on his collection and for how many stamps and baseball cards this would be.
- b. Determine the *maximum* amount that Yanni could have spent on his collection and for how many stamps and baseball cards this would be.

variables and restrictions:

let  $s$  represent the number of stamps,  $s \in \mathbb{W}$

let  $b$  represent the number of baseball cards,  $b \in \mathbb{W}$

constraints:

$$s \leq 100$$

$$b \leq 75$$

$$s \geq 1$$

$$b \geq 1$$

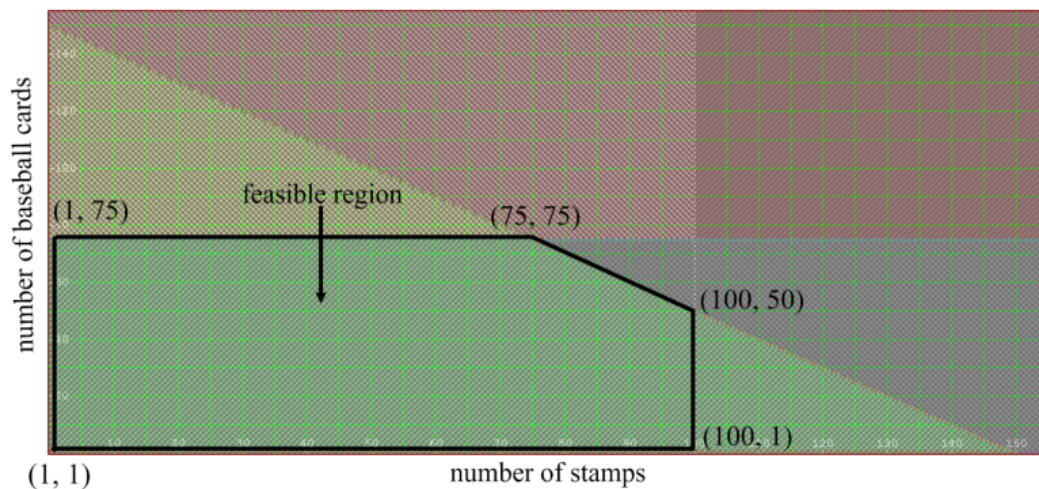
$$s + b \leq 150$$

objective function:

let  $C$  represent cost

$$C = 0.1s + 0.5b$$

graph:



evaluate:

$$\text{For } (1, 1): C = 0.1(1) + 0.5(1) = \$0.60 *$$

$$\text{For } (1, 75): C = 0.1(1) + 0.5(75) = \$37.60$$

$$\text{For } (75, 75): C = 0.1(75) + 0.5(75) = \$45 *$$

$$\text{For } (100, 50): C = 0.1(100) + 0.5(50) = \$35$$

$$\text{For } (100, 1): C = 0.1(100) + 0.5(1) = \$10.50$$

conclusion:

- a) The minimum that Yanni could have spent is **\$0.60** on **1 stamp** and **1 baseball card**.
- b) The maximum that Yanni could have spent is **\$45** on **75 stamps** and **75 baseball cards**.

7. A local artist classifies her paintings as either scenic or portrait.

- She limits the number of paintings she does to a maximum of 8 per week.
- It takes her an average of 6 hours to do a scenic painting and an average of 3 hours to do a portrait. She works a maximum of 30 hours per week.
- She sells her scenic paintings for \$300 and her portrait paintings for \$200.

Determine the numbers of scenic and portrait paintings that would maximize revenue.

variables and restrictions:

let  $s$  represent the number of scenic paintings,  $s \in \mathbb{W}$   
let  $p$  represent the number of portrait paintings,  $p \in \mathbb{W}$

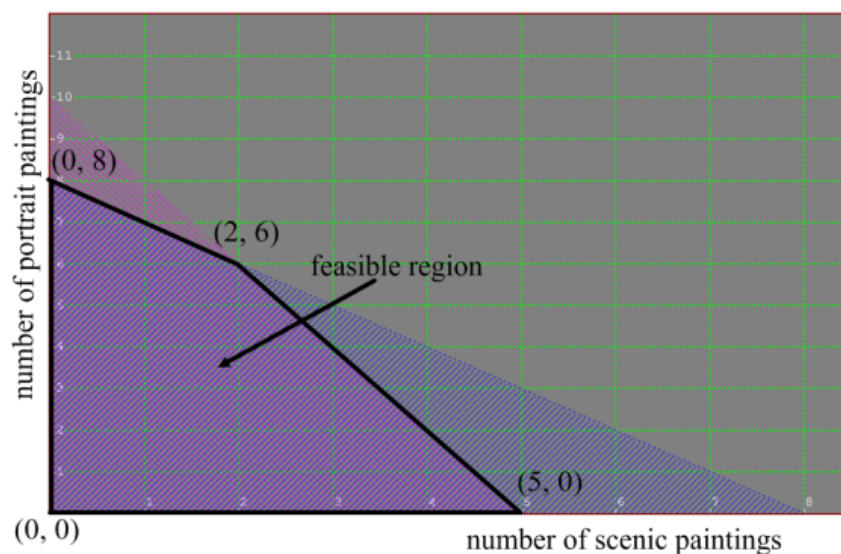
constraints:

$$\begin{aligned}s &\geq 0 \\ p &\geq 0 \\ s + p &\leq 8 \\ 6s + 3p &\leq 30\end{aligned}$$

objective function:

$$\begin{aligned}\text{let } R &\text{ represent profit} \\ R &= 300s + 200p\end{aligned}$$

graph:



evaluate:

$$\text{For } (0, 0): R = 300(0) + 200(0) = \$0$$

$$\text{For } (0, 8): R = 300(0) + 200(8) = \$1600$$

$$\text{For } (2, 6): R = 300(2) + 200(6) = \$1800 *$$

$$\text{For } (5, 0): R = 300(5) + 200(0) = \$1500$$

conclusion:

2 scenic and 6 portraits should be painted in order to maximize profit to \$1800.