

Optimization Problems

For each of the following optimization problems:

- ✓ Clearly define the variables and state any restrictions
- ✓ Write the constraints
- ✓ State the objective function
- ✓ Graph the constraints
- ✓ Evaluate the objective function for *each* vertex of the feasible region and compare the results
- ✓ Write a statement that answers the question(s)

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?

2. A vending machine contains bottles of water and juice.

- 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 water and juice that would result in the maximum possible revenue. What is the maximum revenue?

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?

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?

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?

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.

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.