

### Applications of the Derivative Worksheet II

**Instructions:** Answer all questions on a separate piece of paper. This homework is due October 19.

General Mills Cereal Company has just announced plans to make their popular children's cereals with whole grains. To generate sales, it has been decided to redesign the box that these cereals come in. Two teams—the shipping and the design team—must make recommendations on the dimensions of a cereal box.

You, as the project manager, mandate that the girth of each cereal box be no larger than 20 inches and that the height of a cereal box be fixed at 10 inches.

**Part I: The Shipping Team** When cereal is shipped to the supermarket, it usually comes inside a bigger box (the shipping box). Assume the total volume of the shipping box is 25,000 cubic inches. Because the height of the cereal box will still be 10 inches, they will be able to fit two stacks of cereal boxes in a shipping box. The shipping team wants to continue to fit 5 cereal boxes on the width and want to minimize the number of cereal boxes they put in on the length.

1. Identify all the relevant information you need to solve this problem. Your list should include information given to you about mandates on cereal box size and information about the shipping box.
2. Let  $n$  be the number of cereal boxes they can fit into a shipping box on the length. Write an expression for the volume of the shipping box in terms of the number of cereal boxes that fit on the length. Recall that for a box, the volume is equal to the length times the width times the height.
3. Determine the width  $w$  of a cereal box that minimizes the number of cereal boxes that can be fit into a shipping box on the length, and then determine the dimensions of a cereal box. What is curious about these dimensions?
4. Determine the number of cereal boxes that can be fit into a shipping box.
5. What are the dimensions of the shipping box?

**Part II: The Design Team** The design team wants to determine a design of a cereal box that minimizes the total cost of making one. Because cardboard costs money, you have the following unit costs for materials:

Faces	\$ .017 per square inch
Sides	\$ .04 per square inch
Top & Bottom	\$ .01 per square inch

6. Write an expression for the cost of making a cereal box.
7. Find the dimensions of the cereal box that minimize the cost.

**Part III: Evaluation by project manager** After receiving the recommended dimensions from the supply and design team, you realize that they have two different dimensions given.

8. Find the number of cereal boxes that would fit in a shipping box if you used the Design Teams' dimensions.
9. In your opinion, whose cereal box dimension (the Supply Team or the Design Team) would you recommend and why? If you cannot arrive a sound decision, state what additional information you might need reach a conclusion.