6.2: Applications of Extrema

In this chapter we will apply calculus to maximum and minimum problems.

Solving an Applied Extrema Problem
1. If possible sketch a picture including the variables.

2. Decide on the variable that must be maximized or minimized. Express that variable as a function of **one** other variable.

3. Find the domain of the function.

4. Find the critical points for the function from Step 2.

5. If the domain is a closed interval, evaluate the function at the endpoints and at each critical number to see which yields the absolute maximum or minimum. If the domain is an open interval, apply the critical point theorem when there is only one critical number. If there is more than one critical number, evaluate the function at the critical numbers and find the limit as the endpoints of the interval are approached to determine if an a absolute maximum or minimum exists at one of the critical points.

Example. A closed box with a square base is to have a volume of $10,000\ cm^3$. The material for the top and bottom of the box costs \$2 per square centimeter, while the material for the sides costs \$3 per square centimeter. Find the dimensions of the box that will lead to the minimum total cost. What is the minimum total cost?

Example. In planning a cafe, it is estimated that a profit of \$4 per seat will be made if the number of seats is no more than 30 inclusive. On the other hand, the profit on each seat will decrease by 10 cent for each seat above 30.
(A) Find the number of seats that will produce the maximum profit.
(B) What is the maximum profit?