Section 4.5 Optimization Problems

# Topic 1: Optimization

Consider a pair of real numbers $x$ and $y$ that have a sum of 20. Of all possible pairs, which has the greatest product?

| ***x*** | ***y*** | ***x* + *y*** | ***P* = *xy*** |
| --- | --- | --- | --- |
| 1 | 19 | 20 | 19 |
| 5.5 | 14.5 | 20 | 79.75 |
| 9 | 11 | 20 | 99 |
| 13 | 7 | 20 | 91 |
| 18 | 2 | 20 | 36 |

The condition  is called a **constraint**. The quantity we wish to optimize (maximize or minimize) is called the **objective function**. In this case the objective function is , and our goal is to maximize the value of *P*.

# Topic 2: Optimization Guidelines

**Guidelines for Optimization Problems**

1. Read the problem carefully. Identify the variables and organize the given information. Draw a picture when appropriate.
2. Identify the objective function (the function to be optimized). Write it in terms of the variables of the problem.
3. Identify the constraint(s). Write them in terms of the variables of the problem.
4. Use the constraint(s) to eliminate all but one independent variable of the objective function.
5. With the objective function expressed in terms of a single variable, find the interval of interest for that variable.
6. Use methods of calculus to find the absolute maximum or minimum value of the objective function on the interval of interest. If necessary, check the endpoints.