Tuesday, October 29, 2013 (Day 37)

- Swipe your I.D.
- Pick up your graded work.
- Exam 3 tomorrow Covers Chapter 5.
  - Bring your O.U. I.D. to the exam

Today: Finishing Section 5-6 Optimization

Optimization Example #2 (similar to Suggested Exercise 5-6#1)

Find positive numbers x, y such that

- their product is 9000
- The sum $10x + 25y$ is minimized

Solution

Step 1 Write an equation involving x & y that expresses the fact that their product is 9000.

solution $x \cdot y = 9000$ equation I

Step 2 Write an equation involving x & y that expresses the information about the sum.

Solution Let S stand for the sum $10x + 25y$.

That is $S = 10x + 25y$ equation II

Goal is to minimize the value of S.

Step 3 We want to eliminate the variable y.

Start by solving equation I for y in terms of x.

result: $y = \frac{9000}{x}$ new equation I

Step 3 Substitute Equation I into Equation II to eliminate y.

result $S = 10x + 25\left(\frac{9000}{x}\right)$

Notice: this equation
- only involves S and x
- it is solved for S in terms of x.

So this equation gives us S as a function of the variable x.

Use function notation to say that:

$$S(x) = 10x + \frac{25(9000)}{x}$$

Our goal is to find the value of x that minimizes the value of $S(x)$.

What is the Domain?

We're told that x, y must be positive numbers.

So the domain is all $x > 0$.

That is, the interval $(0, \infty)$

So our job is to ~~[illegible]~~ minimize

$$\$(x) = 10x + \frac{25(9000)}{x}$$

on the interval $(0, \infty)$

Step 5 Use calculus to solve the minimization problem.

Find critical values of $S(x)$

We will need $S'(x)$

It will help to first rewrite $S(x)$ in more useful form.

rewrite $S(x) = 10x + 25(9000)x^{-1}$

derivative $S'(x) = \frac{d}{dx}\left(10x + 25(9000)x^{-1}\right)$

$= 10 + 25(9000)(-1)x^{(-2)}$

$$S'(x) = 10 - \frac{25(9000)}{x^2}$$