Standard: Benchmark Number:MA.912.C.3.8.

Subject Area: Mathematics,

Body of Knowledge: Calculus

Grade: 9-12

Standard: [Applications of Derivatives](http://www.floridastandards.org/Standards/PublicPreviewIdea120.aspx) - Apply knowledge about derivatives to find slopes of curves and the related tangent lines. Analyze and graph functions, finding where they are increasing or decreasing, their maximum and minimum points, their points of inflection, and their concavity. Solve optimization problems, find average and instantaneous rates of change (including velocities and accelerations), and model rates of change. Find slopes and equations of tangent lines, maximum and minimum points, and points of inflection. Solve optimization problems, and find rates of change.

Objectives:

* Students will be able to recognize same parameters can produce different areas.
* Solve equations relating to optimization by differentiating
* Use maple to compute and graph problems

Materials:

* Computer with Maple software
* Paper and pencil
* Textbook
* Prezi with images relating to Demonstration examples.

Planning:

Pre lesson activity:

Students will have learned the concepts of :

* Curve sketching
* Finding maximum/minimum values using derivatives
* Finding local maximum/minimum values using derivatives
* Understanding derivatives are rates of change

Lecture activity:

The first thing I will do is introduce a real world scenario where these techniques are needed. This scenario will later be done by the students. This will have students feel like the material is relevant. (See Practice activity).

I will spend a little time introducing a theoretical view of how rates of change and how they are applied. Students thus far have learned how to apply derivatives to a 2-Deminsional curve, which at this point, relates mainly to a set of data. With optimization we will be looking at the finding the maximum area and volume of a space that can be produce with a given parameter. My lecture will be brief. I will

* State that the change is lengths of the sides of the shape is a rate of change
* The rate of change effects the outcome of the shape
* Area is a function and therefore, by finding the derivative they can find critical points.
* Recap: critical points of a derivative function are max/ min points of the standard function.

Demonstration:

Using a pre-designed Prezi, I will show examples of the computational work and how it relates to the theory.

* Example question:
  + A farmer has 2700 ft of fencing and he wants to wants to surround a rectangular region. What are the dimensions of the field that has the largest area?

Practice activity.

Students will have practice problems to do as homework. This will allow them to get a feel for the process and understand the main idea. We will discuss the solutions in class. All questions are related to real world scenarios.

* Examples:
  + Packaging dimensions for UPS
  + Can sizes for Cola Co.
  + Construction sites areas
  + others

Assessment:

This is a multiday group project. Students will get in small groups and need to solve the the following scenario:

* You and your group are an architectural firm who need to create a floor plan for a new luxury apartment complex. Due to the location of the of the apartments each suite will be relatively small. The creators want each suite to have a full kitchen and a fair size living area. Each apartment must include the following:
  + 4 equal rooms
  + A kitchen with (here I would give some specifications of what the kitchen should be like)
  + A living area that takes up as 4/9 of the floor plan
  + A bathroom per each room. Must find dimensions.
* The apartment is a single floor plan. The contractors also only have 500 feet of drywall for each apartment.

Students will use Maple on the computer to graph there floor plans and show computations. Maple is professional level software that allows these functions. Students will also need to label the lengths of the parameter. Students will present their floor plans when they have completed them. Grades will be given based off of completion. I will be there to assist students with technical help, but this assignment is made for them to figure it out as a group.

I will have a rubric that I will fill out. The content I will evaluate

* Computation work
* Explanation – detail
* Image layout
* effort