**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**January 22nd, 2013**

**AP Calculus, Mrs. Sulkes**

**4:8 Approximating Values – An Application**

**Error Propagation**

*Often, physicists and engineers make errors in measurement by using physical measuring devices, and would like to calculate the estimation of these errors.*  They use a method called “Error Propagation.”

***Terms:***

**Error in Measurement**: If you let represent the measured value of a variable and let  represent the exact value, then  is the *error in measurement.*

**Propagated Error**: If the measured value  is used to compute another value , the difference between  (the exact value) and  (the measured value) is the *propagated error*.

That is , and . Therefore, *propagated error* can be represented by calculating the value of .

**Relative Error and Percent Error:** The *relative error* is a value that helps you determine if the propagated error is large or small. It is computed by comparing  with , or . The *percent error* is the percent of the relative error.

***Examples:***

1. Suppose that the height of a square is measured to be 36. The possible error in the measurement is 0.25 cm.

1. Use differentials to approximate the **propagated error** in computing the area of the square.
2. **Percent error or Relative Error:** Would you say that the propagated error you found in part **a** is large or small? The best answer is to compare the change in area to the area (*A).* Calculate the ratio .

2. The radius of a sphere is measured to be 6 inches, with a possible error of 0.02 inches.

1. Use differentials to approximate the maximum possible error in calculating the volume of the sphere and then the surface area of the sphere.
2. Find the percent errors in part a. Would you say they are large or small?

3. The propagated error in the measured **area** of a circular disk is  cm. The maximum error in the measurement of the radius is 0.2 cm. Use differentials to find the **measured radius** of the circular disk.

4. Use differentials to approximate 