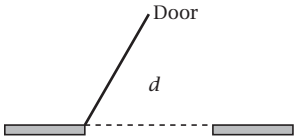
Name: _____ Group Members: _____

Exploration 1-1a: Instantaneous Rate of Change of a Function

Date: _____

Objective: Explore the instantaneous rate of change of a function.



The diagram shows a door with an automatic closer. At time $t = 0$ s, someone pushes the door. It swings open, slows down, stops, starts closing, then slams shut at time $t = 7$ s. As the door is in motion, the number of degrees, d, it is from its closed position depends on t.

1. Sketch a reasonable graph of d versus t.

2. Suppose that d is given by the equation

   $d = 200t \cdot 2^{-t}$

   Plot this graph on your grapher. Sketch the results here.

3. Make a table of values of d for each second from $t = 0$ through $t = 10$. Round to the nearest 0.1°.

t	*d*
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

4. At time $t = 1$ s, does the door appear to be opening or closing? How do you tell?

5. What is the average rate at which the door is moving for the time interval [1, 1.1]? Based on your answer, does the door seem to be opening or closing at time $t = 1$? Explain.

6. By finding average rates using the time intervals [1, 1.01], [1, 1.001], and so on, make a conjecture about the *instantaneous* rate at which the door is moving at time $t = 1$ s.

7. In calculus you will learn by four methods:
   - algebraically,
   - numerically,
   - graphically,
   - verbally (talking and writing).

   What did you learn as a result of doing this Exploration that you did not know before?

8. Read Section 1-1. What do you notice?