Name:_____

Tables, Graphs, Formulas, and Words
Differential Equations: Voltage in a Discharging Capacitor.

The preliminary goal of this activity is to gather data, present the data, analyze the data, model the data, and to discuss in writing what we have done and what we have discovered.

The ultimate goal of this activity is to integrate four ways of presenting mathematical/scientific information (tables, graphs, formulas and words) into a unified whole.

In this activity we will be collecting voltage versus time data of a capacitor discharging through a resistor. This will serve as the basis for an investigation of first-order differential equations.

I: Procedure

1) Hook up a simple circuit involving a capacitor, resistor, voltmeter and battery.
2) After testing the circuit and charging the capacitor, we will remove the battery and measure the voltage across the capacitor every 15 seconds for eight minutes. We will be recording voltage and time.

II: Data Table

The first step in your presentation is to create a well made data table. This should be done on a computer. We will discuss as a group what we need to include, but you should have some good ideas of your own.

III: Graphs

The heart of this activity will be a voltage versus time graph. We will probably also decide to include graphs relating charge and current versus time. There could be other options. We will have to try various things and discuss as a class what it is, exactly, that we want to convey with our graphs. This step is interrelated with step IV (Formulas). We will most likely have to revisit our graphs several times over the course of the activity as we decide what is important and how we wish to present it.

We will also be including other visual elements in our paper including circuit diagrams and pictures of the experimental setup.

IV: Formulas

Modeling data with equations is a critical part of this activity. We will be using the Trend Line function in OpenOffice Calc to help us generate equations that model our data. As a class we will have to decide which relationships are the most interesting and determine how we can generate equations that model them. The fundamental question we will have to ask ourselves is whether the equations we generate give us clear insight into the relationships between our variables.

We will be learning how to use an equation editor to add equations to our writing.

V: Writing

This assignment is designed to address a very important need at BMA. That is the need to improve student writing. In particular, this assignment is designed to improve technical writing. The purpose of this assignment is to *write* about what we have done.

1) You will have to write on the following topics:
    a) Procedure: How did we collect data? How did we generate graphs? How did we generate equations?
    b) Purpose: Why did we choose to present the graphs and equations that we did?
    c) Explanations: What should a reader be looking for in the tables, graphs and formulas?
    d) Results: How well do our models match our experiments? How could they have been improved?
    e) Extensions/Conclusions: What did we learn? How can we generalize this?
2) The writing process will involve several steps:
    a) Notes: You should be taking notes during this entire activity.
    b) Class Discussions: We will have frequent class discussions about what we want to say and how we want to say it.
    c) Outlines: We will generate outlines for our writing, both individually and as a group.
    d) First draft: You will generate a first draft to share with your peers.
    e) Peer editing: Your peers will read and comment on your first drafts.
    f) Second draft: You will generate a second draft to share with me.
    g) Teacher editing: I will make comments and sit down with you to discuss your second draft.
    h) Final draft: You will complete and hand in a final draft.

VI: Calculus

We are also tasked with improving our understanding of Calculus during this activity. This activity is based off of the concept of first-order differential equations. This concept is presented in chapter 11 of the textbook. At the end of this process, we should have a better understanding of how to use differential equations to model a real-world application. It is very important that we included this topic in our writing, formulas and graphs.