

INVESTIGATION: GRAPHICAL MODELS

PURPOSE: To determine and describe the relationship between the temperature of a cup of hot water and the time it is allowed to cool.

TOOLS: Mug, Thermometer, Clock/Timer

The thermometer and mug are fragile.

Replacement cost for thermometer is \$5. ALL group members are responsible for returning the equipment in good condition.



PROCEDURE: With 1 or 2 partners:

1. Obtain a cup of boiling water and a thermometer from your teacher.

Be **very** careful.

2. Record the water temperature in your cup every minute for 20 minutes in a table in google sheets. Set up your table like the one shown below. Be as accurate as possible.

Time (min)	Temperature (°C)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

On your Chromebook

1. To enter the times, enter 0 in cell A2, then Enter =A2+1 in cell A3. Click enter. Click back on cell A3, grab the blue box in the bottom corner and drag it all the way down to cell A22.

2. Record your temperature data in your spreadsheet.

3. Include columns in your spreadsheet for “First Differences,” (Enter =b3-b2 in cell c2) then drag that formula down. “Second Differences” (drag formula from cell c2 across to d2 then drag that formula down) and the “Ratio” between consecutive pairs of temperatures. (enter =b3/b2)

DO NOT DO THESE CALCULATIONS BY HAND.

4. Create a scatter plot with time on the horizontal axis and temperature on the vertical axis.

5. “Customize” your scatter plot by clicking on “Series”. Scroll down and check the Trendline box. Change from a Linear Trendline to an Exponential Trendline.

6. Merge cells to create a textbox (alternately, just start typing in a cell or type in google docs and paste into a cell).

Include the names of all group members

and your answers the following questions:

a) Describe in words, the relationship between temperature and time.

b) Explain how you know that the relationship is neither linear nor quadratic.

c) Consider the numbers in the ratio column. Describe any trends.

d) What is the lowest temperature that the hot water will eventually reach?

7. Share your assignment (one per group).

Be sure to include the names of all group members