What's My Model?

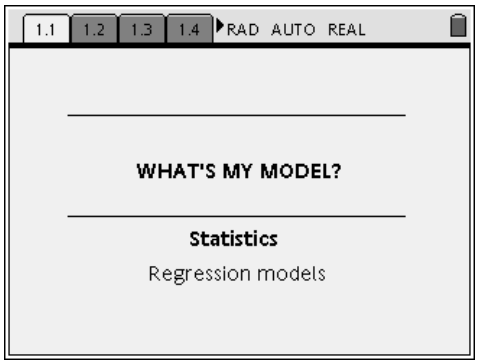
ID: 8518

Name _____

Class _____

In this activity, you will explore:

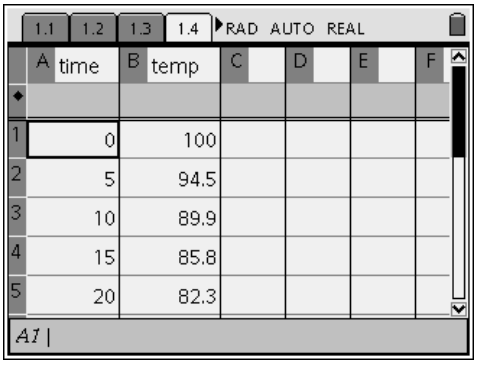
- *Using regression equations to mathematical model an event*

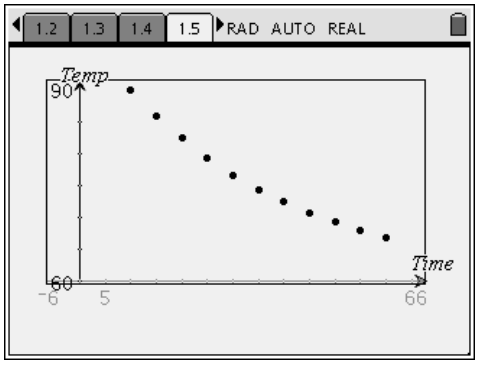


Open the file *StatAct01_WhatsMyModel_EN.tns* on your handheld and follow along with your teacher to work through the activity. Use this document as a reference and to record your answers.

Introduction

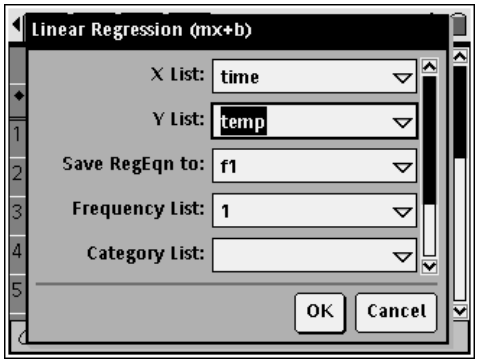
On a cold day in January, your friend brought you a cup of hot chocolate. You were extremely grateful—after all, he did include several marshmallows. Unfortunately, it was **way** too hot to drink. While waiting for it to cool, you wondered, "Is it possible to predict how long it takes for this very hot chocolate to cool down?" Luckily, you brought a temperature probe for your TI-Nspire handheld and collected the data (minutes, °C) shown on page 1.4. Then, you displayed a scatter plot of the data on page 1.5.



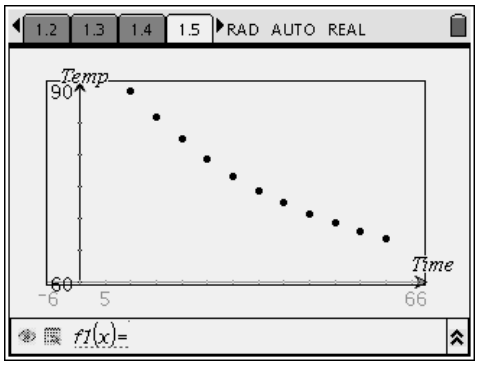


A Linear Model

First, try a linear model. On page 1.4, move the cursor to cell C1, select **MENU > Statistics > Stat Calculations > Linear Regression (mx + b))** and set the options to match those shown to the right. (Use tab to move through the options.) The **1st Result Column** may be set at **d[]**. The results of this regression are then displayed in Columns D and E, and the regression equation has bee saved as the function **f1**(*x*).



To display the graph of this model, advance to the scatter plot on page 1.5. With the Function Entry Line active (if it is not active, press ctrl + G) navigate to display the equation for **f1**, and press enter to show its graph.



- What is the linear regression equation?

  f1(*x*) = _____

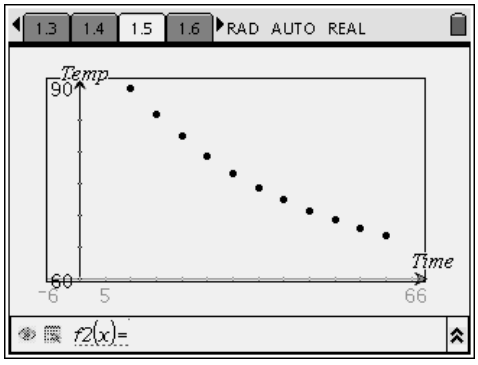
- Sketch the graph of **f1**(*x*) on the scatter plot to the right.
- Use the model to predict the temperature of the hot chocolate after 60 minutes. (You may use the *Calculator* application on page 1.7.) _____
- What do you observe about the predictions from the linear model? How can you see this from the graph?

- What assumptions does this model contain that run against the data?

A Quadratic Model

Upon looking at the data, it appears that for long intervals of time, the data does not seem to be linear, but curved—perhaps modeled by a quadratic function? Return to the spreadsheet and again place the cursor in cell C1. Select **MENU > Statistics > Stat Calculations > Quadratic Regression**. Set the options as before, ***except*** save the regression equation to **f2**. (It is ok for the results of this regression overwrite the previous regression in Columns D and E.)

To display the graph of this model, first go to the scatter plot and hide the graph of the previous regression equation—select **MENU > Tools > Hide/Show** and click on the graph. Then access **f2** in the Entry Line and press enter. (This process of hiding the previous regression and displaying the current regression is used throughout the rest of this activity.)



- What is the quadratic regression equation?

  f2(*x*) = _____

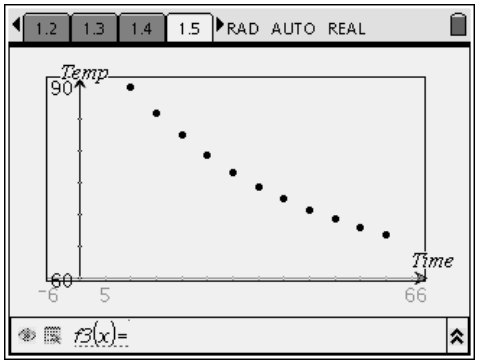
- Sketch the graph of **f2**(*x*) on the scatter plot above.
- Use the model to predict the temperature of the hot chocolate after 60 minutes. _____

- What do you observe about the predictions from the quadratic model? How can you see this from the graph?

- What assumptions does this model contain that run against the data?

An Exponential Model

An even closer look at the data reveals that the graph seems to mimic a radioactive decay graph. As before, follow the steps to perform a regression; this time, choosing an **Exponential Regression**.



- What is the quadratic regression equation?

  f3(*x*) = _____

- Sketch the graph of **f3**(*x*) on the scatter plot to the right.

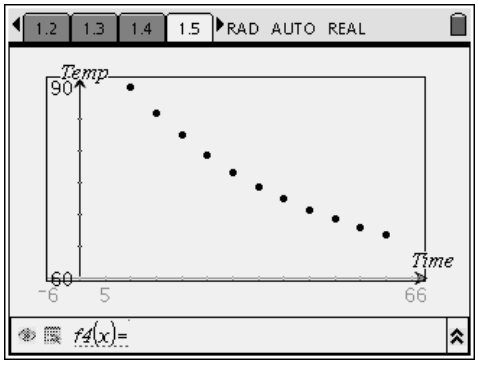
- Use the model to predict the temperature of the hot chocolate after 60 minutes. _____

- What do you observe about the predictions from the exponential model?

- What assumptions does this model contain that run against the data?

A Logistic Model

Consider that the hot chocolate will eventually reach room temperature and not get any colder. This suggests a *logistic* equation. Once more, follow the steps to perform a regression; this time, choosing **Logistic Regression (d ≠ 0)**.



- What is the logistic regression equation?

  f4(*x*) = _____

- Sketch the graph of **f4**(*x*) on the scatter plot to the right.

- Use the model to predict the temperature of the hot chocolate after 60 minutes. _____
- What do you observe about the predictions from the logistic model?

- What assumptions does this model contain that run *with* the data?

