









Activity 10

Climate and Temperature: Sinusoidal Models

The average temperature in any location changes with the season. In this activity, you will develop a model for the average temperatures in your hometown.

Exploration

1. Open a new TI InterActive! document. Title this page **Monthly High Temperatures**. Be sure to include your name and the date at the top of this report.
2. Click on Spreadsheet  to open the Data Editor. In cell **A1** type **High Temp** and in cell **A2** type **Month**.
3. Click on the Web Browser icon  to open TI InterActive!'s Internet Browser. Click on the Data Sites icon . Under the **Activity Book Links** category, click *TI InterActive! Math for High School*. Choose **Activity 10: Climate and Temperature**.
4. Once the page has loaded in the browser, enter your hometown as the location. Look up the average high temperatures for this location. Highlight the Fahrenheit temperatures for January through December and then **Extract** to download the data into the open Data Editor.
5. The Fahrenheit data are extracted into cells B1:M1. Enter the numbers **1-12** in cells B2 to M2 to represent the months where 1 = January, 2 = February, etc. Click on Save to Document .

6. In a Math Box , define the maximum temperature of this list as **tempmax: = max(B1:M1)**, the minimum temperature of this list as **tempmin: = min(B1:M1)**, and the average temperature as **tempavg: = mean(B1:M1)**.
7. In Math Boxes, define **f(x): = a * sin(b * (x - c1)) + d**,
g(x): = a * cos(b * (x - c2)) + d, **a: = 1**, **b: = 1**, **c1: = 0**, **c2: = 0**, and **d: = 0**.
8. Select Graph . Click on the Stat Plots tab. Enter **B2:M2** in the first field and **B1:M1** in the second field. Click in the box to the left of these fields to select the plot.
9. Click on the $f(x)$ tab. Enter **f(x)** in y1 and **g(x)** in y2.
10. Click on . Set up the window with **x: [0, 12]**, **Xscale: = 1**, and **y: [0, 120]**, **Yscale: = 10**. Click on the Animate tab. Change the Draw Speed to Medium and the Draw Type to Sequential.
11. Click on the Label tab in the Format dialog box. Title this graph **Average High Temperatures**. Label the X-Axis **Months** and the Y-Axis **Fahrenheit Temperatures**. Click on OK. Click on Save to Document .

Analysis

Record the answers to the following questions in the report. Be sure to write in complete sentences when answering these questions.

1. Record the maximum, minimum, and average temperatures.
2. Scroll up in the document. Double-click on **d: =** and define an initial estimate for the vertical translation as $d: = \frac{\text{tempmax} + \text{tempmin}}{2}$.
3. How does changing d affect the graphs of $f(x)$ and $g(x)$?
4. Redefine the amplitude as $a: = \frac{\text{tempmax} - \text{tempmin}}{2}$.
5. How does changing a affect the graphs of $f(x)$ and $g(x)$?
6. What is the period of this graph?

7. Redefine b : = $2\pi/\text{your_period}$.
8. How does changing b affect the graphs of $f(x)$ and $g(x)$?
9. The horizontal shift for $f(x)$ is $c1$. Adjust $c1$ until you have a good fit.
10. Make any further adjustments to a , b , $c1$, and d to have a good fit. Record the sine function that fits this data.
11. The horizontal shift for $g(x)$ is $c2$. Adjust $c2$ until you have a good fit.
12. Make any further adjustments to a , b , $c2$, and d to have a good fit. Record the cosine function that fits this data.
13. What is the significance of the value of d for this data set?
14. What is the significance of the value of a for this data set?
15. What is the significance of the value of b for this data set?
16. What is the significance of the value of $c1$ and $c2$ for this data set?
17. Save this document as **climate.tii**. Print a copy of this document.