Math TODAY™ Challenge
Teacher Edition

USA TODAY
NO. 1 IN THE USA

Heat Watch

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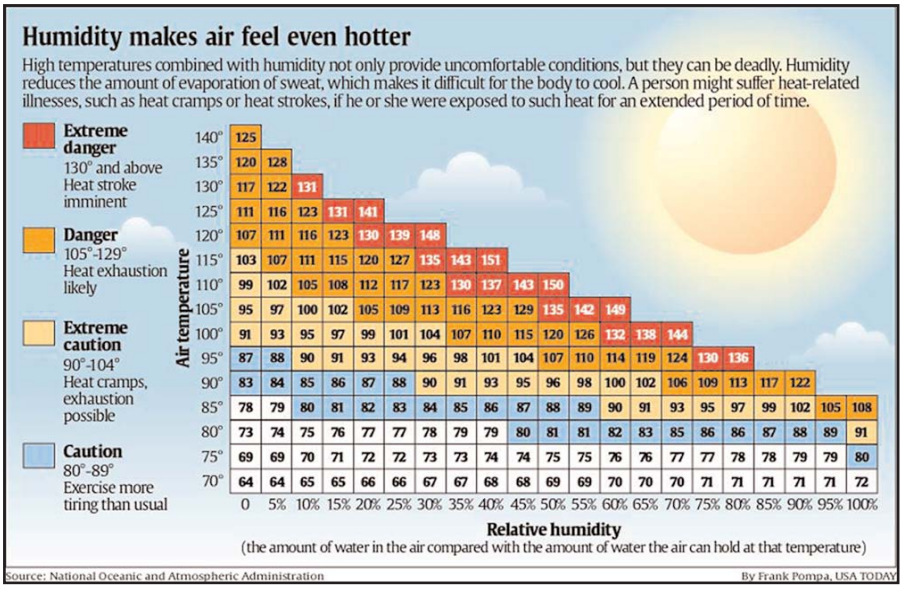

Activity Overview:

This activity will use data from the USA TODAY infograph "Humidity makes air feel hotter." Students will explore linear and quadratic functions to determine how well they model the relationship between air temperature and the heat index. When the models have been determined students will use these models to make predictions about the heat index when given a specific temperature.

Concepts:

- Modeling real-world data with linear and quadratic functions
- Creating scatter plots using real-world data
- Comparing data in graphical and numerical form
- Analyzing rate of change
- Using piecewise functions to connect models

Objectives:

Students will:

- explore linear, quadratic and the cubic functions that will model the relationship between air temperature and heat index at fixed relative humidity values.
- investigate piecewise functions to model real-world data.
- make generalizations and apply the findings.

Activity at a Glance:

- Grade level: 7-10
- Subject: Algebra
- Estimated time required: 60-90 minutes

Materials:

- TI-83 Plus or TI-83 Plus Silver Edition
- Overhead view screen handheld for instruction/demonstration
- TI InterActive! (optional)
- Student handout
- Transparency
- Cellsheet™ App (optional)

Prerequisites:

Students should know how to:

- enter data into lists.
- build regression models.
- create a scatter plot.
- create piecewise models.

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Background:

Heat index is a measure used to describe the relationship between humidity and temperature and how this makes you feel on a hot day. Mathematical models of the data will be determined and used to predict the temperature when given the heat index and to predict the heat index when given the temperature. This activity will look at the difference between data that will generate a linear graph and a quadratic graph.

Preparation:

- Provide one graphing handheld for each student.
- Each student should have a copy of the corresponding student activity sheet.
- TI InterActive! on each computer (optional).
- Projection device if presenting TI InterActive! to the class.

Classroom Management Tips:

- Students will have a better understanding of how to read the graphic and retrieve data if you use the transparency for a class discussion before the students start working.
- Remind students to carefully read all parts of the graphic before they start collecting data.
- Students can work individually or in groups to assist each other as they learn the various features of the handheld.
- Technology appeals to almost all students. Encourage all students to handle and use the graphing handhelds. The TI graphing handhelds are designed to be durable for daily classroom use and backpack portability.
- If possible, use an overhead view screen graphic handheld for instruction. It will make it much easier for you to provide instructions and directions if the students can see the display on your graphing handheld.
- Piecewise functions will be used to model a data set that requires two different functions.
- If the activity takes longer than a class period have the students create a Group on the handheld of all the lists and models so that they can access this information at a later time.

Data Source:

National Oceanic and Atmospheric Administration

National Council of Teachers of Mathematics (NCTM) Standards*:

Algebra Standard

- Understand patterns, relations, and functions.
- Use mathematical models to represent and understand quantitative relationships.

Connections Standard

- Recognize and apply mathematics in contexts outside of mathematics.

Representation Standard

- Use representations to model and interpret physical, social and mathematical phenomena.

*Standards are listed with the permission of the National Council of Teachers of mathematics (NCTM), www.nctm.org. NCTM does not endorse the content or validity of these alignments.

Additional Resources:

Student Handout

Transparency

TI Technology Guide, for information on the following:

- TI-83 Plus
- List Editor
- TI Interactive!

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Activity Extension:

- Research this topic using the National Oceanic and Atmospheric Administration (NOAA) Web site (www.noaa.gov).
- Find articles in USA TODAY that relate to the effects of a heat wave on people or the economy of a region.

Curriculum Connections:

- Health and Physical Education - Explore the effects on the human body during exercise.
- Anatomy and Physiology - Explore the effects on the human body when these extreme conditions prevail.
- Geography - Explore which regions are experiencing extreme heat and humidity.

Teacher Notes:

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Assessment and Evaluation:

Activity 1: A linear model, $y = mx + b$

Q. What is the air temperature at 0% humidity when the heat index is 105°F?
A. The air temperature would be about 116.9°F.

Activity 2: A quadratic model, $y = ax^2 + bx + c$

Q. What is the air temperature when the humidity is 50% and the heat index is 105°F?
A. The air temperature would be about 93.8°F

Q. What is the minimum air temperature when the Extreme danger category is reached if the relative humidity is 50%?
A. The air temperature would be about 103.5°F

Activity 3: A cubic model, $y = ax^3 + bx^2 + cx + d$

Q. If the relative humidity is 100% what is the air temperature when the heat index is 105°F?
A. The air temperature would be about 84.3°F

Activity 4:

Answers will vary but there should be reference to the higher the relative humidity and air temperature the higher the heat index. When the heat index is high there is potential for fatigue, sunstroke, heat cramps and heat exhaustion with continued exposure. The sweat glands are used to help the cooling process through sweating. The evaporation of the sweat takes away the heat and will help the body cool. If there is high humidity then the evaporation process is hindered because the air is already saturated with humidity.

Activity 5:

Choosing the data points from 0-65% relative humidity produces the following linear equation: $y = .2x + 78$. The data points from 65-100% relative humidity produces the following quadratic equation: $y = .0048x^2 + -.3048x + 90.857$

The piecewise function that would represent this data set is:

$$f(x) := \begin{cases} .2x+78 & 0 \le x \le 65 \\ .0048x^2+-0.3048x+90.857 & 65 < x \le 100 \end{cases}$$