THE NATION'S NEWSPAPER



Humidity makes air feel even hotter

By: Bob Tower

nesses, such as heat	cramps	or he	at st	roke	s, if h	ne or	she	were	exp	osed	to st	uch Ì	neat	for a	next	ende	ed pe	eriod	ofti	me.		
 Extreme danger 130° and above Heat stroke imminent Danger 105°-129° Heat exhaustion likely Extreme caution 90°-104° Heat cramps, exhaustion possible 	140°	125																				
	135°	120	128	6																		
	130°	117	122	131																		
	125°	111	116	123	131	141																
	120°	107	111	116	123	130	139	148	Ĩ													
	H 115°	103	107	111	115	120	127	135	143	151	_											
	110°	99	102	105	108	112	117	123	130	137	143	150		_								
	d 105°	95	97	100	102	105	109	113	116	123	129	135	142	149		-						
	9 100°	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144	Ì.	_				
	iP 95°	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136	630.0			
	90°	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122	5	
	85°	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	105	10
	80°	73	74	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86	87	88	89	91
Caution	75°	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80
Exercise more	70°	64	64	65	65	66	66	67	67	68	68	69	69	70	70	70	71	71	71	71	71	72
tiring than usual		0	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100

Activity Overview:

The USA TODAY Infograph "Humidity makes the air feel even hotter" shows the relationship between humidity, air temperature and the heat index. Students will create two scatter plots and, based on the value of the correlation coefficient (r2) and determine the best fit model for each scatter plot. The graph will be used to describe the behavior of the dependent variable for each model as the independent variable increases. Students will use their models to predict (interpolate) the heat index for a given relative humidity at different temperatures.

Concepts:

- Modeling data
- Evaluating functions
- Describing end behavior of a function

Activity at a Glance:

- Grade level: 9-12
- Subject: Pre-calculus
- Estimated time required:

Materials:

- TI-83 Plus family or TI-84 Plus family
- Overhead view screen calculator for instruction/demonstration
- Student handout
- Transparency
- USA TODAY newspapers (recommended)

Prerequisites:

Students should:

- know how to create a scatter plot using a graphing calculator.
- have experience with the regression capabilities of the calculator.
- know how to use the correlation coefficient to decide the best fit model.
- know how to use the capabilities of the calculator to interpolate using



©COPYRIGHT 2005 USA TODAY, a division of Gannett Co., Inc.

This activity was created for use with Texas Instruments handheld technology.

Copyright © 2000 by the National Council of Teachers of Mathematics, Inc. www.nctm.org. All rights reserved.

For more information, visit: www.education.usatoday.com education.ti.com/usat

USA TODAY.

Humidity makes air feel even hotter

Objectives:

Students will:

- create a scatter plot of real-world data.
- solve problems using numerical, algebraic, and graphical models.
- analyze end behavior of a function.
- identify appropriate basic functions with which to model real-world problems.

Background:

The heat index (HI) is a measure used to describe how humidity and temperature interact to affect the way you feel on a hot day. Students will explore the end behavior of the scatter plots and explain the relationship observed between the independent and dependent variables. The appropriate basic functions to model the real-world data will be determined and used to evaluate the models for specific independent values.

Preparation:

- Provide one graphing calculator for each student.
- Each student should have a copy of the corresponding student activity sheet.

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.
- Students can work individually or in small groups on this activity. Working in groups is especially helpful as they learn the various features of the calculator.
- Allow students to talk about the "how" and "why" approach they used to find the solutions.
- Assign students to groups and use this activity as a review of linear and cubic functions.
- Before students begin the activity, explain your expectations for their response to Activity 2.
- This activity can be used as a review of the technology and how to use technology to help answer real-world problems.



Data Source:

National Oceanic and Atmospheric Administration

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

Algebra Standard

- Understand patterns, relations, and functions.
- Represent and analyze mathematical situations and structures using algebraic symbols.
- Use mathematical models to represent and understand quantitative relationships.

Problem Solving Standard

 Solve problems that arise in mathematics and in other contexts.

Communication Standard

• Organize and consolidate their mathematical thinking through communication.

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

USA TODAY.

Humidity makes air feel even hotter

Activity Extension:

- Have students make a scatter plot, on the same coordinate plane, for each humidity level in the table with the given air temperatures as the independent variable and the heat index as the dependent variable. Ask them to write a paragraph describing what the graphs show.
- Have students explore www.weatherimages.org/data/heatindex.html for the formula to determine heat index.
- Encourage students to explore USA TODAY newspapers and USATODAY.com's weather section(www.usatoday.com/weather/resources/basics/ wworks0.htm) for articles related to relative humidity, air temperature and/or heat index. Ask the to write a one-page report on one of the articles.

Curriculum Connections:

- Physical Education/Health
- Sciences



Additional Resources:

- Student handout
- Transparency
- TI Technology Guide, for information on the following: TI-83 Plus family, TI-84 Plus family and List Editor
- TI-NavigatorTM Basic Skills Guide for information on using the TI-Navigator Classroom Learning System

Teacher Notes:





Humidity makes air feel even hotter

Assessment and Evaluation:

Activity 1:

Determine the models that would best represent the graphs of air temperature vs. heat index for 5% and 25% relative humidity.

A. Model and r^2 for the graph of L1 and L2

84

99884

inRe9

y=ax+b

a=.957ू

2.

9994





(The quartic regression results in the same values as the cubic model and the leading coefficient is zero, so we will use the cubic model.)

-4

9

Activity 2:

What do your models reveal about the behavior of the heat index as air temperature increases?

A. The heat index will increase but it will have a constant rate of change as the air temperatures increase for the linear function. The heat index will increase and it will have an increasing rate of change as the air temperatures increase for the cubic function. The cubic graph grows at a faster rate than the linear graph as the air temperature continues to increase.

Activity 3:

What is the air temperature when the graph of each model would enter the Extreme Caution category?

A. The heat index values begin at 90° when entering the Extreme Caution category. The predicted air temperature is 97° with 5% relative humidity when the Extreme Caution category is reached using the linear function. The predicted air temperature is 91.5° with 25% relative humidity when the Extreme Caution category is reached using the cubic function.



If you are using the TI-Navigator Classroom Learning System, send the provided LearningCheck assessment to your class to gauge student understanding of the concepts presented in the activity. See the TI-Navigator Basic Skills Guide for additional information on how this classroom learning system may be integrated into the activity.