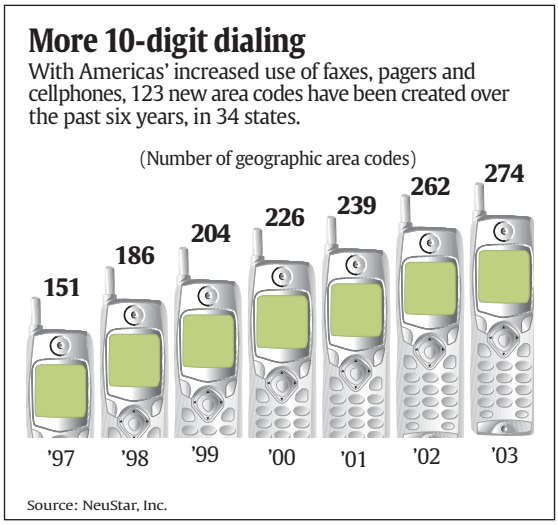
Math TODAY™ Challenge
Teacher Edition

USA TODAY
NO. 1 IN THE USA

More 10-digit dialing

By: Brenda Perkins

USA TODAY Snapshots®



By Steven Snyder and Adrienne Lewis, USA TODAY

Activity Overview:

It used to be that a household had one phone number, which easily accommodated everyone in the family. But today, with personal faxes, pagers and cellphones, the typical contemporary family has several "phone numbers." The USA TODAY Snapshot "More 10-digit dialing" displays the affect that all of these communication devices have on our need for additional area codes to accommodate the technology.

In this activity, students will graph the data and determine the line of best fit. Students will write the equation of their line and use it to make predictions about the number of area codes needed in the future.

Concepts:

- Linear model
- Rate of change (slope)
- Predictions using a linear equation

This activity works with TI navigator A Classroom Learning System

Activity at a Glance:

- Grade level: 9-11
- Subject: Algebra
- Estimated time required:

Materials:

- TI 83 Plus family or TI-84 Plus family
- Graph paper
- Straightedge
- Overhead view screen calculator for instruction/demonstration
- Student handout
- Transparency
- USA TODAY newspapers

Prerequisites:

Students should know how to:

- use the list editor of the calculator
- set up a scatter plot and graph using the calculator.
- draw and write the equation of the line of best fit.
- use the equation to make predictions.
- interpret the meaning of the slope and y-intercept.

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

More 10-digit dialing

Objectives:

Students will:
- make a scatter plot using data.
- determine and draw a line of best fit.
- calculate the equation in slope-intercept form of their line of best fit.
- use their equation to make predictions.

Background:

Some topics in mathematics appear time and time again in different courses. Linear regression is one of those topics that continue to reappear. In Algebra I, students learn how to create scatter plots and draw in a line of best fit and then calculate the equation by hand. In Algebra II, students discover the regression feature of their graphing calculator along with the median-median fit line. In Statistics, students can begin to understand the origins and the method behind the regression equation. A good foundation in linear models is imperative in order for students to understand other regression types and the purpose of real world application.

The USA TODAY Snapshot "More 10-digit dialing" is real data that lends itself beautifully to a linear model. The subject of the USA TODAY Snapshot and article, “Colleges catch the cellphone wave” is relevant to the students' lives. They can easily relate as their pockets beep, vibrate or play a merry tune while they stroll the halls.

Preparation:

- Provide one graphing calculator for each student.
- Each student should have a copy of the corresponding student activity sheet.
- Provide or require the students to have a sheet of graph paper and a straightedge.

Data Source:

NeuStar, Inc.

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

Data Analysis and Probability
- Develop and evaluate inferences and predictions that are based on data.

Number and Operations
- Compute fluently and make reasonable estimates.

Algebra
- Understand patterns, relations, and functions.
- Use mathematical models to represent and understand quantitative relationships.
- Analyze change in various contexts.

Problem Solving
- Solve problems that arise in mathematics and in other contexts.
- Apply and adapt a variety of appropriate strategies to solve problems.

Connections
- Recognize and use connections among mathematical ideas.
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- Recognize and apply mathematics

*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.

More 10-digit dialing

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.
- Linguine can be used to help the students determine the line of best fit. It works well because it is flat and narrow enough for the students to see their points. It also works well on the overhead.
- Note that the students are asked to enter their x-value as years in their 4-digit format. You may want the students to convert the x-values to some number since a base year. This helps the scatter plot to fit neatly into the first quadrant.

Activity Extension:

- Have students write and conduct a survey on communication devices and determine the number of "phone numbers" needed per student.
- Have students research different cellphone plans. These plans are often linear models with a fixed start-up fee and monthly cost. This could easily lead into a system of linear equations or piecewise functions depending on how the plans are analyzed.
- Have students create a map of the United States, color it by population density and add in the area codes.
- Have students read USA TODAY to research news trends and events related to the communications industry or emerging communications technologies.

Curriculum Connections:

- Family and Consumer Science
- Statistics
- Business
- Social Studies

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-Navigator™ Basic Skills Guide for information on using the TI-Navigator Classroom Learning System

Teacher Notes:

More 10-digit dialing

Assessment and Evaluation:

Activity 1
Reading the Article

Q. What is the increase in percent of college students with cellphones over the last three years?

A. 78 - 34 = 44%

Q. How much income did Miami University lose in revenue from long distance calls due to cellphones? Why was this significant to the university?

A. The university lost approximately $300,000. This amount was typically sufficient to pay for their landlines.

Q. What is the cost to a university for a cellphone per student compared with the cost to an individual?

A. University rates can be any where from $15 a month to $1.50 month. A similar plan for an individual could cost them almost $40.

Q. What is the allure for service providers?

A. 1) Access to a captive audience. 2) College students are tech-savvy and heavy talkers.

Q. Why didn't St. Norbert College's cell plan work?

A. The plan costs nearly five times as much as the former landline. Frequently, students come with their own cellphones and so it was therefore a duplication of service.

Q. How could cellphones revolutionize higher education?

A. Cellphones could be used as student ID, a campus debit card and a key to residence halls. The university could send text messages to all students.

Q. What is one drawback of having so many cellphones on campus?

A. The noise level has increased as students use their cellphones between classes. The walkie-talkie feature of some cellphones has especially contributed to this.

More 10-digit dialing

Assessment and Evaluation (continued):

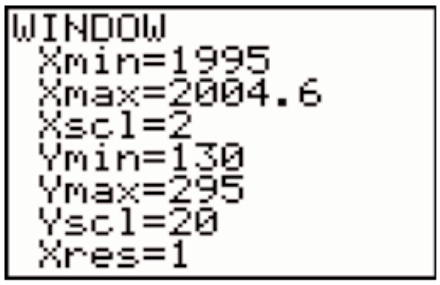
Activity 2

Note: The answers will vary slightly from student to student depending on their line of best fit. These answers are based on the linear regression from the calculator.

Q. What is the independent variable? **What is the dependent variable?**

A. Independent: Time in Years Dependent: Number of Area Codes

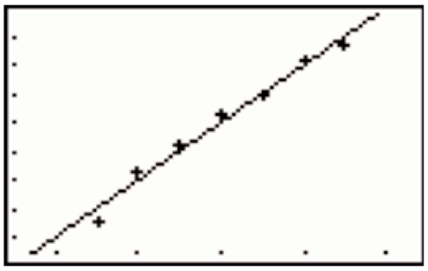
Q. What is the window setting you used to graph the scatter plot on your calculator?

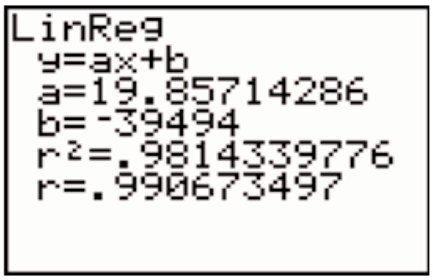


A. x - Min:_____ x - Max:_____
y - Min:_____ y - Max:_____

Q. List the two points you chose on your line of best fit. Mark them P and Q on your graph paper. Find the equation of your line. Show all work.

A. P (_____, _____) Q(_____, _____)





Q. What is the slope of your line and what meaning does it have in relationship to this problem?

A. The slope is 19.9 and implies that the number of area codes is increasing by approximately 20 a year.

Q. What is the y-intercept of your line and what meaning does it have in relationship to this problem?

A. The y-intercept is -39,494 and implies that in the year zero there were -39,494 area codes, which has no actual meaning.

More 10-digit dialing

Assessment and Evaluation (continued):

Q. According to your equation, what was the number of area codes needed in the year 2000? Use either the trace or table feature of your calculator and round your answer to the nearest whole number.

A. The equation estimated there to be 220 area codes in the year 2000.

Q. According to your equation, in what year were 200 area codes needed? Use either the trace or the table feature of your calculator and round your answer to the nearest year.

A. The equation estimated that in the year 1999 there were approximately 200 area codes.

Q. Predict the number of area codes needed in the year 2020.

A. Using the linear regression, there will be approximately 617 area codes needed in 2020.

Q. Predict when a four-digit area code will be needed. In other words, when will there need to be over 1000 area codes? Do you think this is a reasonable estimate? Why or why not?

A. Around the year 2040, the current 3-digit area code will be obsolete. We may run out of area codes long before this as new devices are created and may use available phone numbers even quicker.

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.