

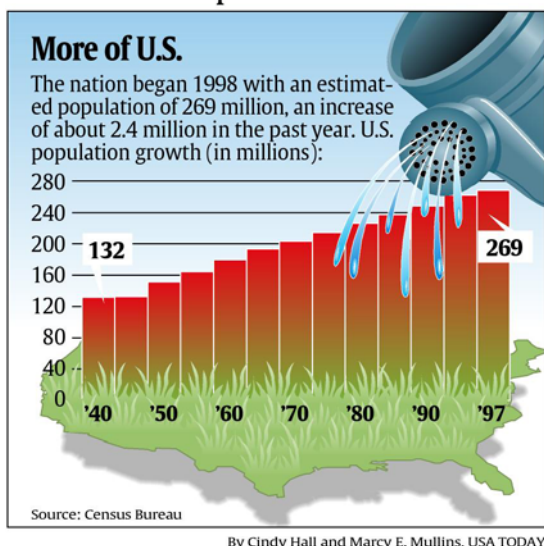


Activity 4:

More of U.S.

by: Bob Tower

USA TODAY Snapshots



Activity Overview:

Using the USA TODAY Snapshot, "More of U.S.," students will learn how to interpret data presented in a graphical form. Students will determine the rate of change (slope) and build a linear model ($y = mx + b$) from this data. The model will be used to make a prediction about the future growth of the U.S. population if the current trend continues.

Concepts:

- Finding rate of change (slope)
- Reading and interpreting graphs
- Describing the correlation between independent and dependent variables
- Using slope-intercept form of linear equations
- Modeling data with linear functions
- Evaluating, synthesizing, and analyzing real-world data

Activity at a Glance:

- Grade level: 9-12
- Subject: Algebra
- Estimated time: 50 minutes

Materials:

- TI-Navigator™ system
- TI-83 Plus and TI-84 Plus family of graphing calculators

Recommended:

- USA TODAY Newspapers
- Multimedia Projector
- TI Keyboards

Prerequisites:

Students should know how to:

- create a linear regression model
- make a prediction using the linear regression model
- find rate of change and include appropriate labels

TI | navigator.

For use with the TI-Navigator™
Classroom Learning System



Student Objectives:

- Find the rate of change (slope) for a given set of data
- Determine a linear regression model from data
- Predict an answer using the linear regression model
- Use appropriate labels (units) for the rate of change
- Create a scatter plot of the data

Background:

In this activity, students will determine the growth rate of the U.S. population and find a linear model from the data to predict the population in the future if this trend continues. Students will have the opportunity to demonstrate their understanding of rate of growth (slope), linear equations, independent/dependent variables, and positive/negative correlation between variables, using real-world data.

Since this is a real-world problem, students will have the opportunity to apply algebraic concepts to meaningful topics. This context illustrates the need for using appropriate labels for the variables and for the rate of change values that the students will calculate.

This is an excellent opportunity to use the Science Tools App for graphing and analyzing the data. Students can benefit from learning how to use different methods to solve a problem.

Preparation:

- Download the activity files to your computer: Teacher Edition, Student Edition, Transparency, Activity Center Settings, Lists, and LearningCheck™ Assessment. (See Appendix B for a list of the files.)
- Make copies of the Student Edition for your class. Students can refer to the Student Edition during the activity and use it to record their work.
- Set up your TI-Navigator system and make sure you are familiar with the following functions: Send to Class, Collect from Class, Screen Capture, Quick Poll, Activity Center, LearningCheck Assessment and Class Analysis.
- Students will need a TI-83 Plus or TI-84 Plus graphing calculator, either working in pairs or individually.
- Recommendations:
 - Multimedia Projector for sharing the Activity Center, Quick Polls, and Screen Captures with your students
 - TI Keyboards to easily answer LearningCheck assessment questions

Data Source:

U.S. Census Bureau

Activity Extensions:

- Have students find articles in the USA TODAY that pertain to or are impacted by census data. Related topics include population trends, fastest growing cities and states, housing, and social and economic trends. Look at the Census Bureau website, www.census.gov, and have students write a report on population and economic trends in different regions of the United States. Assign students different states or regions to explore.
- Encourage students to check out the Census section on USA TODAY's website, www.usatoday.com, for related news stories and interactive national and state demographic data. This section can be found in the News section of USATODAY.com.
- Encourage students to call or visit their local/state government agency and inquire about the population trends in their area.

Curriculum Connections:

- Social Studies – current events
- Speech and Debate – topics of interest
- History – previous growth trends
- English – research topics

**Teacher:****Students:****Classroom Management Tips:**

- You may use the transparency for a class discussion before students start working. This will give students a better understanding of how to read the graphic and retrieve data.
- Remind students to carefully read all parts of the graphic before they start interpreting data.
- Let students know at the beginning of the activity if you want the numbers rounded to a specific number of decimal places (provided answers are rounded to at least two decimal places).
- Students can work individually or in small groups on this activity.

Activity Step-by-Step:

The following steps represent a suggested TI-Navigator classroom procedure to answer the focus questions.

1. Send to Class – send population data from 1940 through 2000
2. Calculator – create a scatter plot of the data and a regression model (round to four significant digits)
3. Screen Capture – check student understanding
4. Calculator – based on the regression model, predict the population of the U.S. in 2010
5. Quick Poll – True/False, population represents the dependent variable
6. Quick Poll – True/False, there is a negative correlation between the independent and dependent variables
7. Activity Center – enter two equations that would have the same y-intercept but different slope values
8. Activity Center – enter two equations that would have the same slope but different y-intercepts
9. Quick Poll – True/False, m represents the increase in population per year in millions
Quick Poll – Multiple Choice, the initial population affects the: (A) slope, or (B) y-intercept?
10. Optional: LearningCheck Assessment – answer the focus questions and discuss the results with your class to check for understanding

See below for details on each of these steps.

Focus Questions:

- What is the rate of change in population per year? What would be the appropriate units for this value?
- Determine a linear model that would represent the growth in population over the given time period.
- Based on your model, what will be the estimated population of the United States in 2010?
- What is the correlation between years and population growth?

Teacher:

Student:

**STEP 1 – SEND TO CLASS**

1. After students have logged into TI-Navigator, send the “More of U.S.” data (MT04L1.8xl and MT04L2.8xl) to the class using **Force send to students now**.

The data represents the U.S. population growth (in millions) from 1940 to 1997. Students will use this data to predict the population in 2010.

2. Prompt students to exit the TI-Navigator system.

1. Press **[APPS]** and select NavNet, login using your username and password.
2. Wait for the teacher transfer – the data is downloaded in two lists, L1 and L2.
3. Once the data is downloaded, press BACK (**[ZOOM]**) and then **[4]** to EXIT APP.

**STEP 2 – CALCULATOR**

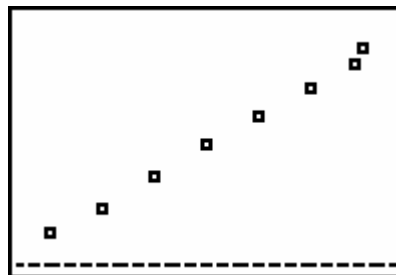
1. Prompt the class to create a scatter plot and a linear regression model using the data in L1 and L2.
2. Instruct students to round to four significant digits.

1. Create a scatter plot using the population data in lists L1 and L2.
2. Use the regression capabilities of the calculator to determine a linear model for the data.
3. Enter the model in Y1, rounding values to four significant digits.

**STEP 3 – SCREEN CAPTURE**

1. Use **Screen Capture** to check student understanding.

The scatter plot should look like the image on the right. If not, this is an opportunity to discuss appropriate independent and dependent variables, and window settings for this problem.

**STEP 4 – CALCULATOR**


1. Instruct your students to use their calculators to predict the population of U.S. in 2010, using the regression model.
2. Instruct your students to return to the TI-Navigator system when you are ready to go to the next step.

1. Use the model to calculate the population of the U.S. in 2010 and record the answer.
2. Press **[PRGM]**, select GONAVNET and press **[ENTER]**.

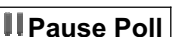
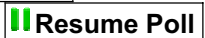

Teacher:


Students:

**STEP 5 – QUICK POLL**


1. From the pull-down menu select **True False**; make sure the **Resubmit** option is turned off.
2. Press  when you are ready to start.
3. Instruct your class to mark **True** or **False** and send their answer to this question:

Q. Population represents the dependent variable.




A. True
4. Discuss with your class to check for understanding.
NOTE: Select  to have a class discussion, then select  to continue.
5. Press  when you are ready to go on to the next step.


1. Mark answer True or False and press SEND ().

**STEP 6 – QUICK POLL**

1. From the pull-down menu select **True False**; make sure the **Resubmit** option is turned off.
2. Press  when you are ready to start.
3. Instruct your class to mark **True** or **False** and send their answer to this question:

Q. There is a negative correlation between the independent and dependent variables.

A. False
4. Discuss with your class to check for understanding.
NOTE: Select  to have a class discussion, then select  to continue.
5. Press  when you are ready to go on to the next step.

1. Mark answer True or False and press SEND ().

**STEP 7 – ACTIVITY CENTER**

In the next two steps of this activity, you will use the equation to investigate slope and y-intercept.

1. Announce to the students that they are now going to use the equation from this investigation and Activity Center to investigate slope and y-intercept.

**Teacher:**

2. In Activity Center, use **Load Activity Settings** to load MT_MoreUS1.act.
3. Press **Start Activity** to begin.
4. Instruct your students to enter two equations that would have the same y -intercept as the regression model but different growth rates (slope values), rounded to four significant digits.
5. As submissions appear, discuss the following with your class to check for understanding:
 - Submissions that are particularly interesting or ambitious
 - Submissions that have common errors

NOTE: Select **Pause Activity** to have a class discussion. Select **Resume Activity** to continue.

Sample discussion questions:

 - What is the meaning of slope in this problem?
 - How would different growth rates affect the population in 2010?
 - Under what conditions will the population be increasing or decreasing?
 - Under what conditions will the population be higher or lower than the original population?
6. Press **Stop Activity** when you are ready to go to the next step.

Student:

1. From the TI-Navigator home screen press Activity Center.
 2. When prompted, enter the two equations.
 3. OPTION: Press **PLOT** (**WINDOW**) to view the graph of your equations before sending to make sure the graph will be seen in the Activity Center window.
- Press **Eqn** (**WINDOW**) to go back and make changes to your equations before sending.

**STEP 8 – ACTIVITY CENTER**


1. In Activity Center, use **Load Activity Settings** to load MT_MoreUS2.act.
2. Press **Start Activity** to begin.
3. Instruct your students to enter two equations that would have the same growth rate (slope) as the regression model but different y -intercept values rounded to four significant digits.
4. As submissions appear, discuss the following with your class to check for understanding:
 - Submissions that are particularly interesting or ambitious
 - Submissions that have common errors

NOTE: Select **Pause Activity** to have a class discussion. Select **Resume Activity** to continue.

1. From the TI-Navigator home screen press Activity Center.
 2. When prompted, enter the two equations.
 3. OPTION: Press **PLOT** (**WINDOW**) to view the graph of the equations before sending to make sure the graph will be seen in the Activity Center window.
- Press **Eqn** (**WINDOW**) to go back and make changes to your equations before sending.


**Teacher:****Students:**

Sample discussion questions:

- What is the meaning of the y -intercept in this problem?
 - How would different y -intercepts affect the population in 2010?
 - Under what conditions will the population increase or decrease?
 - Under what conditions will the population be higher or lower than the original population?
5. Press  **Stop Activity** when you are ready to go to the next step.







STEP 9 – QUICK POLL

1. From the pull-down menu select **True False**; make sure the **Resubmit** option is turned off.
2. Press  **Start Poll** when you are ready to start.
3. Instruct your class to mark **True** or **False** and send their answer to this question:




Q. m represents the increase in population per year in millions.


A. True
4. Discuss with your class to check for understanding.


NOTE: Select  **Pause Poll** to have a class discussion, then select  **Resume Poll** to continue.
5. Press  **Stop Poll** when you are ready to go on to the next step.
6. From the pull-down menu select **Multiple Choice A Thru B**, make sure the **Resubmit** option is turned off.
7. Press  **Start Poll** when you are ready to start.
8. Instruct your class to mark and send their answer to this question:

Q. The initial population affects the: (A) slope, or (B) y -intercept?

A. (B) y -intercept
9. Discuss with your class to check for understanding.

NOTE: Select  **Pause Poll** to have a class discussion, then select  **Resume Poll** to continue.
10. Press  **Stop Poll** when you are ready to go on to the next step.

1. Mark answer True or False and press SEND ().






2. Mark answer A or B and press SEND ().


Teacher:

Student:



STEP 10 – OPTIONAL LEARNINGCHECK ASSESSMENT

1. Using  **Send to Class**, distribute the LearningCheck assessment file MoreUS.edc to your students using **Force send to students now**.
2. Prompt them to open the  LearningCheck assignment and answer the following questions:
 - Q. What is the rate of change in population per year? What would be the appropriate units for this value?**
 - A. The rate of change is 2.4450659781985 million people per year (exact answer from the calculator). Following the significant digits rule, the rate of change is 2.445 million people per year.
 - Q. Determine the linear model that would represent the growth in population over the given time period.**
 - A. The linear model is: $y = 2.445x + -4610$ when considering the significant digits rule. The answer from the calculator is $y = 2.4450659781985x + -4613.962708$.
 - Q. Based on your model, what will be the estimated population of the United States in 2010?**
 - A. The estimated population is 304.5 million if using the significant digits rule for the equation. The estimated population is 300.6 million if using the exact answer from the calculator.
 - Q. What is the correlation between years and population growth?**
 - A. The relationship shown in the graph represents a positive correlation between years and the population. As the years increase, the population increases.
3. Select  **Class Analysis** and make sure all of the students have completed the assignment.
4. Select  **Collect From Class**.
NOTE: Before collecting the answers, we recommend that you check these options:
 - **Delete Answer File from Device after Collect**
 - **Delete Assignment File from Device after Collect**
5. Using  **Class Results Slide Show**, discuss the results with your class to check for understanding.

1. From the TI-Navigator home screen press  Network Apps.
2. Select LearnChk.
3. Select the MoreUS assignment and follow the prompts to answer the questions.

NOTE: TI Keyboards may be used to answer the questions.