

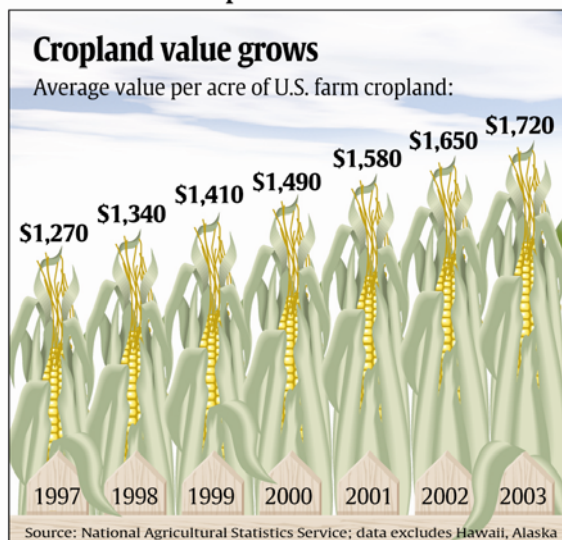


Activity 5:

Cropland value grows

by: Bob Tower

USA TODAY Snapshots



By Shannon Reilly and Marcy E. Mullins, USA TODAY

Activity Overview:

Students will create a scatter plot for the data in the USA TODAY Snapshot, "Cropland value grows" and identify the independent and dependent variables for the data. The students will find the rate of change for the data and label this value with appropriate units. Students will determine a linear model to fit the data and then use this model to make predictions.

Concepts:

- Finding rate of change (slope)
- Reading and interpreting graphs
- Identifying the 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: 8-12
- 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:

- enter data into the List Editor
- 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

**Teacher:****Student Objectives:**

- Find the rate of change (slope) for a given set of data
- Determine a linear regression model from data
- Use the regression model to make predictions
- Use appropriate labels for the rate of change
- Create a scatter plot for the data

Background:

In this activity, students will determine the growth rate of U.S. cropland, and find a linear model from the data to predict the value of an acre of cropland in the future, should this trend continue. Students will have the opportunity to demonstrate their understanding of rate of growth (slope), linear equations, and independent/dependent 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.

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

Students:**Data Source:**

National Agricultural Statistics Service

Activity Extensions:

- Have students explore the National Agricultural Statistics Service website (www.usda.gov/nass/) for additional agricultural statistics.
- Ask students to find articles in the USA TODAY that deal with issues and topics that impact the ability of the U.S. to provide safe and ample food supply.

Curriculum Connections:

- Agriculture/FFA
- Economics/Business

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

- You may use the transparency for a class discussion before the students start working. This will give the 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 collecting data.
- Students can work individually or in small groups to assist each other. 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 solution.
- This activity can be used as a review of concepts or a culminating activity with the class.

Students:**Activity Step-by-Step:**

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

1. Quick Poll – Open Response, based on the Snapshot, what represents the independent variable?
2. Quick Poll – Open Response, based on the Snapshot, what represents the dependent variable?
3. Send to Class – send cropland value data from 1997 through 2003
4. Calculator – create a scatter plot for the data and determine a regression model
5. Screen Capture – check student understanding
6. LearningCheck Assessment – answer the focus questions and discuss the results with your class to check for understanding
7. Calculator – use linear models to estimate the average value of U.S. farmland for 2004, 2005, and 2006
8. Activity Center – enter the estimated average value per acre of U.S. farmland for 2004, 2005, and 2006

See below for details on each of these steps.


Focus Questions:

- According to the USA TODAY Snapshot, "Cropland value grows," what values represent the independent and dependent variables?
- Determine the "rate of change" in average cropland value per year and interpret the meaning of this value.
- Estimate the average value per acre of U.S. farm cropland in 1996 and 2004.

Teacher:




Students:



**STEP 1 – QUICK POLL**

1. After students have logged into TI-Navigator, select **Open Response** from the **Quick Poll** pull-down menu and check **Resubmit** so that students may change their answers.
2. Press  **Start Poll** when you are ready to start.
3. Instruct the class to answer this question:


Q. Based on the Snapshot, what represents the independent variable?

A. Years
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.




1. Press , select Na vNet, and login.
2. Input answer and press SEND ().
3. Resubmit answer as needed during the class discussion.


**STEP 2 – QUICK POLL**

1. From the pull-down menu select **Open Response** and check **Resubmit** so that students may change their answers.
2. Press  **Start Poll** when you are ready to start.
3. Instruct the class to answer this question:

Q. Based on the Snapshot, what represents the dependent variable?

A. Average value per acre of U.S. farm cropland
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.

1. Input answer and press SEND ().
2. Resubmit answer as needed during the class discussion.

Teacher:**STEP 3 – SEND TO CLASS**

1. Send the “Cropland value grows” data (MT05L1.8xl and MT05L2.8xl) to the class using **Force send to students now**.
The data represents the average cropland value data from 1997 through 2003.
2. Once the data is downloaded, instruct your students to exit the TI-Navigator system.

Students:

1. Wait for the teacher transfer – the data will be downloaded in two lists, L1 and L2.
2. Once the data is downloaded, press BACK (**ZOOM**) and then **4** to EXIT APP.

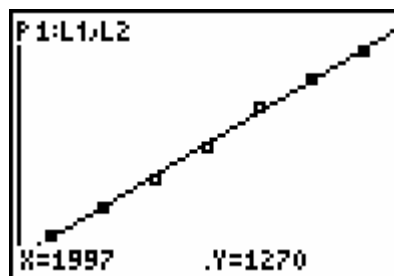
**STEP 4 – CALCULATOR**

1. Instruct your students to use their calculators to create a scatter plot for the data and determine a regression model.

1. Press **2nd** **Y=** and adjust the settings for the scatter plot.
2. Press **WINDOW** and set the appropriate window values for the data.
3. Use the regression capabilities of the calculator to determine the line of best fit.
4. Paste this equation into the **Y=** editor.
5. Press **GRAPH** and **TRACE** and wait for instructions.

**STEP 5 – SCREEN CAPTURE**

1. Use **Screen Capture** to check student understanding.
The scatter plots and regression line should look similar to the image on the right. If not, take this opportunity to discuss appropriate independent and dependent variables, scatter plot setup, and window settings for this problem.
2. Instruct your students to return to TI-Navigator when you are ready to continue the activity.



1. Press **PRGM**, select GONAVNET and press **ENTER**.

Teacher:

Students:

**STEP 6 –****LEARNINGCHECK ASSESSMENT**

- Using **Send to Class**, distribute the LearningCheck assessment file Cropland.edc to your students using **Force send to students now**.
- Prompt the students to open the **LearningCheck** assignment and answer the following questions:
 - Q. Determine which is the independent variable and which is the dependent variable.**
 - Independent – Year, Dependent – Average value per acre (\$)
 - Q. Determine the "rate of change" in average cropland value per year and interpret the meaning of this value.**
 - Accept answers between 70 and 90.
 - Q. Using the linear regression model, what value represents the "rate of change?"**
 - The rate of change is 76.428571428571 using the value from the calculator or 76.43 if rounded to four significant digits. (See Screenshot #1)
 - Q. What is the meaning of the "rate of change?"**
 - The rate of change means that there is an average increase of \$76.43 per acre per year.
 - Q. Estimate the average value per acre of U.S. cropland in 1996 and 2004.**
 - Average value per acre of U.S. cropland in 1996: \$1,188.57 (\$1,154.28 using four significant digits).
Average value per acre of U.S. cropland in 2004: \$1,800 (\$1,765.72 using four significant digits).
- Select **Class Analysis** and make sure all of the students have completed the assignment.
- 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**
- Using **Class Results Slide Show**, discuss the results with your class to check for understanding.
- Instruct your students to exit TI-Navigator when you are ready to go to the next step.

- From the TI-Navigator home screen press **[2]** Network Apps.
- Select LearnChk.
- Select the Cropland assignment and follow the prompts to answer the questions.

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

Screenshot #1

- Press BACK (**[ZOOM]**) and then **[4]** to EXIT APP.

Teacher:**STEP 7 – CALCULATOR**

1. Instruct students to use their linear models to estimate the average value of U.S. farmland for 2004, 2005, and 2006.
2. Remind students of the different ways that the estimates may be found.
 - Home screen calculation
 - TABLE
 - TRACE
3. Instruct your students to return to TI-Navigator when you are ready to go to the next step.

Students:

1. Use the capabilities of the calculator to estimate the average value of U.S. farmland for 2004, 2005, and 2006.
2. Record your estimates on the student handout.
3. Press **PRGM**, select GONAVNET and press **ENTER**.

**STEP 8 – ACTIVITY CENTER**

1. In Activity Center, use **Load Activity Settings** to load MT_Cropland.act.
2. Press **Start Activity** to begin.
3. Instruct students to enter the estimated average value per acre of U.S. farmland for 2004, 2005, and 2006.
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.

Sample discussion questions:

- Do you think this pattern in the average value per acre will continue into the future?
 - What would be some reasons for an increase or decrease in value? What does the y-intercept mean in this situation?
5. Press **Stop Activity** when you are ready to conclude the activity.

1. Press **1** Activity Center.
2. When prompted, enter three estimates for the average value per acre of U.S. farmland to the data in the lists on the calculator.
3. Press **SEND** (**Y=**) when ready to submit the estimated values. You may enter all values at once and press **SEND**, or enter points individually and press **SEND**.
4. Press **PLOT** (**ZOOM**) and **DRAW** (**@**) to see a scatter plot of the data on the calculator.
5. Press **BACK** (**ZOOM**) and **LIST** (**ZOOM**) to go back to the list of data.