THE NATION'S NEWSPAPER

Math TODAY Teacher Edition

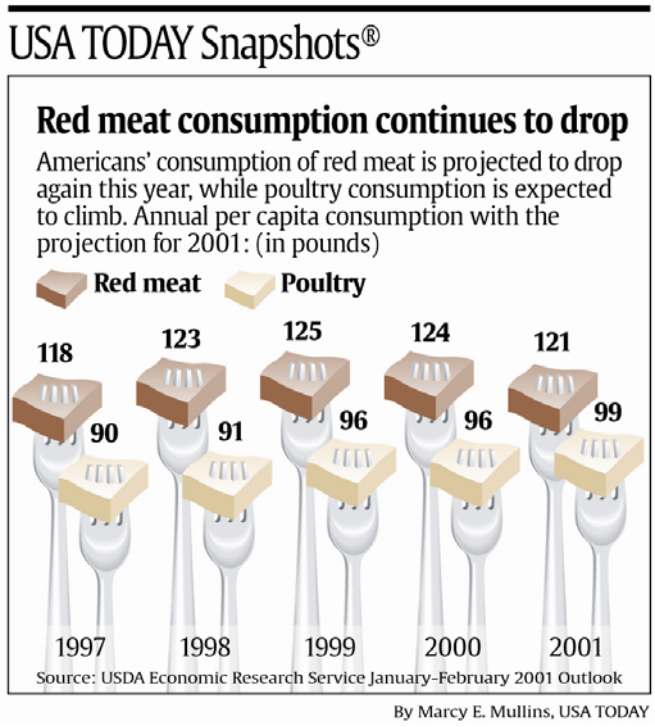
USA TODAY

NO. 1 IN THE USA

Activity 9:

Red meat consumption continues to drop

by Bob Tower



Activity Overview:

The USA TODAY Snapshot, "Red meat consumption continues to drop" will allow students to work with two sets of data over the same time period. This activity will show how a system of equations can be used to answer questions about the data set. The students will use the data about red meat consumption to make a prediction about poultry consumption.

Concepts:

- Solving a system of equations graphically
- Developing scatter plots for two sets of data
- Identifying independent and dependent variables
- Identifying the best-fit model (linear and quadratic) for a scatter plot
- Making reasonable estimates/predictions

Activity at a Glance:

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

Materials:

- TI-Navigator™ system
- TI-83 Plus family or TI-84 Plus family of graphing calculators
- Science Tools App

Recommended:

- USA TODAY Newspapers
- Multimedia Projector
- TI Keyboards

Prerequisites:

Students should be familiar with linear and quadratic equations and they should know how to:

- create scatter plots
- determine the intersection of two equations using the calculator
- determine the regression model for a data set

TI navigator

For use with the TI-Navigator™ Classroom Learning System

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Student Objectives:

- Explore linear and quadratic functions and graphs
- Interpret and develop mathematical (regression) models using TI graphing calculators
- Use various methods to analyze real-world problems (graph data, symbolic representations)

Background:

Students will explore two different data sets in this activity. Students solve systems of equations by using linear and quadratic models with real-world data. Students will use mathematics to look at agricultural data and make reasonable predictions.

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:

USDA Economic Research Service
January - February 2001 Outlook

Activity Extensions:

- Students can explore the North American Meat Processors Association website, www.namp.com, to find articles about red meat and poultry consumption.
- Have the students select one article that addresses the trend seen in the data from the USA TODAY Snapshot, "Red meat consumption continues to drop," and share it with the class.
- Have students use USA TODAY as a source for articles about the impact of the latest diet trends in the United States and around the world on red meat consumption and poultry consumption. Create a bulletin board to display articles found by students.
- Encourage students to search for information about how the per capita consumption is determined at the United States Department of Agriculture website, www.usda.gov, and share their findings with the class.

Curriculum Connections:

- Family and Consumer Science
- Health/Physical Education
- Agriculture
- Science

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Teacher: **Student:**

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.
- 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.
- This is an opportunity to show students how to create a group on the calculator. This will allow them to save their data, equations, and window settings for later use if more information is found on a website or in the USA TODAY.
- This is an excellent time to talk to the students about the dangers of extrapolating from a data set.

Activity Step-by-Step:

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

1. Send to Class – send the “Red meat consumption continues to drop” data files to the class
2. Calculator – create two scatter plots and two regression models
3. Calculator – adjust the window settings to see the intersection of the regression models
4. Quick Poll – Open Response, what is the value for Xmax in your window settings?
5. Quick Poll – Multiple Choice, the slope (rounded to tenths) of the linear model is – A) -1.4, B) -4503.3, C) 2.3, D) 5426.6, or E) -5424418.6?
6. Calculator – use a quadratic regression model to find five ordered pairs
7. Activity Center – submit five ordered pairs in a list using the model for the “Red meat consumption continues to drop” data
8. Activity Center – enter a quadratic function in vertex form to fit the class data points
9. Quick Poll – Open Response, how many points of intersection are there between the linear model and the quadratic model?
10. 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:

- If the trend in the data seen in the USA TODAY Snapshot, "Red meat consumption continues to drop" persists, when will the annual per capita consumption of poultry equal the annual per capita consumption of red meat?
- Explain why the *y*-intercepts of the regression models will not have meaning in the consumption per capita-year context.
- According to the USA TODAY Snapshot, "Red meat consumption continues to drop" when will poultry consumption per capita reach the maximum consumption per capita that red meat did during this time period?

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Teacher: **Student:**

STEP 1 – SEND TO CLASS

1. After students have logged into the TI-Navigator system, send the "Red meat consumption continues to drop" data (MT09L1.8xl, MT09L2.8xl, and MT09L3.8xl) to the class using **Force send to students now**.

   The data represents the red meat and poultry per capita consumption from 1997 to 2001.
2. Instruct your students to exit TI-Navigator when you are ready to go to the next step.

1. Press [APPS], select `NavNet`, and login.
2. Wait for the teacher transfer – the data is downloaded in three lists, `L1`, `L2`, and `L3`.
3. Once the data is downloaded, press `BACK` ([ZOOM]) and then [4] to `EXIT APP`.

STEP 2 – CALCULATOR

1. Instruct your students to create two scatter plots (`L2` vs `L1` and `L3` vs `L1`).
2. Instruct your students to create a quadratic regression model for `L2` vs `L1` and store the model in `Y1`.
3. Instruct your students to create a linear regression model for `L3` vs `L1` and store the model in `Y2`.

1. Press [2nd] [Y=] and adjust the settings for the scatter plots.
2. Press [WINDOW] and set the appropriate window values for the data.
3. Linear Regression:

   Press [STAT] [▶] [5] [L1] [,] [L2] [,] `Y1` [ENTER]
4. Quadratic Regression:

   Press [STAT] [▶] [4] [L1] [,] [L3] [,] `Y2` [ENTER]
5. Press [GRAPH].

STEP 3 – CALCULATOR

1. Instruct students to adjust the window settings to see the intersection of the regression models.
2. Instruct students to return to the TI-Navigator system when you are ready to go to the next step.

1. Press [WINDOW] and make the appropriate changes to the window settings so that you can see the intersection of the two regression models.
2. Press [PRGM], select `GONAVNET` and press [ENTER].

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Teacher: **Student:**

STEP 4 – 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. What is the value for Xmax in your window settings?

   A. Must be greater than or equal to 2003.2
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 to the next step.

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

STEP 5– QUICK POLL

1. From the pull-down menu select **Multiple Choice A Thru E** 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. The slope (rounded to tenths) of the linear model is:

   A) -1.4
   B) -4503.3
   C) 2.3
   D) 5426.6
   E) -5424418.6

   A. C) 2.3
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 to the next step.
6. Instruct your students to exit TI-Navigator when you are ready to go to the next step.

1. Mark answer A, B, C, D, or E and press SEND (Y=).
2. Resubmit answer as needed during the class discussion.

3. Press 4 to EXIT APP.

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Teacher: **Student:**

STEP 6 – CALCULATOR

1. Remind the students to use their quadratic regression model to find five ordered pairs and record their answers on the student answer sheet for later use.
2. Instruct your students to return to the TI-Navigator system when you are ready to go to the next step.

1. Find five ordered pairs using the quadratic regression model for the years shown in the Snapshot, "Red meat consumption continues to drop."
2. Record your ordered pairs on the student answer sheet
3. Press PRGM, select GONAVNET and press ENTER.

STEP 7 – ACTIVITY CENTER

1. In the Activity Center, use **Load Activity Settings** to load MT_RedMeat1.act.
2. Press **Start Activity** to begin.
3. Instruct your students to send five ordered pairs (try to include the vertex) in a list using the model for the "Red meat consumption continues to drop" data.
4. Select the **Graph-Equation** tab.
5. Enter the regression model to fit the data when the students are finished submitting ordered pairs.
6. 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.
7. Press **Stop Activity** when you are ready to go to the next step.

1. From the TI-Navigator home screen press 1 Activity Center.
2. When prompted, enter the ordered pairs in L1 and L2, and on the graph.
3. Press MARK (Y=) to submit each point.

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Teacher: **Student:**

STEP 8 – ACTIVITY CENTER

1. In the Activity Center, use **Load Activity Settings** to load MT_RedMeat2.act.
2. Press **Start Activity** to begin.
3. Instruct your students to enter a quadratic function in vertex form, $y = a(x - h)^2 + k$, to fit the class data points.
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:
   - *What does the value of "a" change on the graph of the quadratic?*
   - *What is the equation for the axis of symmetry?*
   - *What happens to the graph if "a" is negative? positive?*
5. Press **Stop Activity** when you are ready to go to the next step.

1. When prompted, enter the quadratic function in vertex form and press SEND (Y=).

   OPTION: Press PLOT (@) to view the graph of the equations before sending.
2. Continue to edit the equation to have a better fit to the data.

STEP 9 – 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. How many points of intersection are there between the linear and the quadratic models?

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

   NOTE: You may select **Pause Poll** to have a class discussion, then select **Resume Poll** to continue.
5. Press **Stop Poll** when you are ready to go to the next step.
6. Instruct your students to return to the TI-Navigator home screen.

1. Input answer and press SEND (Y=).
2. Resubmit answer as needed during the class discussion.
3. Press 2nd [QUIT] to return to the TI-Navigator home screen.

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Teacher: **Student:**

STEP 10 – LEARNINGCHECK ASSESSMENT

1. Using **Send to Class**, distribute the LearningCheck assessment file RedMeat.edc to your students using **Force send to students now**.
2. Prompt them to open the **LearningCheck** assignment and answer the following questions:

   Q. If the trend in the data seen in the USA TODAY Snapshot, "Red meat consumption continues to drop" persists, when will the annual per capita consumption of poultry equal the annual per capita consumption of red meat?

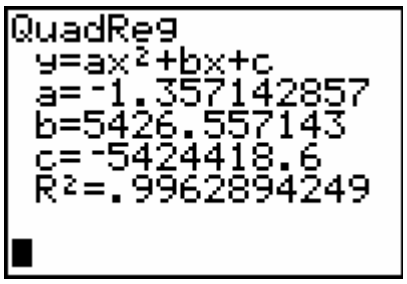
   A. Screenshots #1, #2, and #3 show the regression models that were found. According to our regression models the annual per capita consumption of poultry would equal the annual per capita consumption of red meat in 2003.

   Q. Explain why the *y*-intercepts of the regression models will not have meaning in the consumption per capita-year context.

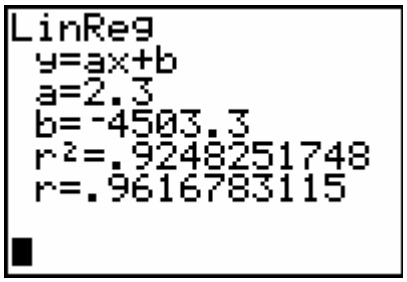
   A. Both *y*-intercepts are negative numbers and per capita consumption will not be less than zero.

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

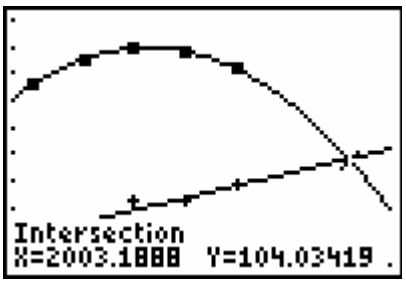
***NOTE**: TI Keyboards may be used.*



Screenshot #1



Screenshot #2



Screenshot #3

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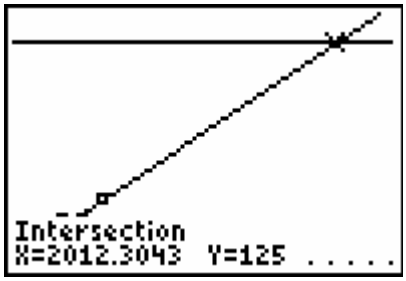
Teacher:

Q. According to the USA TODAY Snapshot, "Red meat consumption continues to drop" when will poultry consumption per capita reach the maximum consumption per capita that red meat did during this time period?

A. Screenshot #4 shows that the maximum consumption value reached for red meat was 125 pounds in 1999. Poultry consumption is expected to reach 125 pounds in 2012 according to our model.

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.

Student:



Screenshot #4

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