

Title: Using Data Analysis to Review Linear Functions

Brief Overview:

This activity is intended as an end of semester review of linear functions. It is assumed that each student has worked through other data analysis problems on the graphing calculator. Students will use data provided by the teacher (sample attached), or data they have collected or researched (Internet, newspapers, student data collection, etc.). Students will use the graphing calculator to construct a scatter plot, find the line of best fit, determine function properties if applicable, and make predictions. The student will summarize predictions and write a brief analysis of their data.

Links to Standards:

- **Mathematics as Problem Solving**

Students will use, with increasing confidence, problem-solving approaches to investigate and understand mathematical contents. They will also recognize and formulate problems from situations within and outside mathematics, through data analysis. They will apply the process of mathematical modeling to chosen real-world problem situations.

- **Mathematics as Communication**

Students will express mathematical ideas in writing a brief analysis of data and predictions; they will also ask clarifying and extending questions related to mathematics they have read or heard about.

- **Mathematics as Reasoning**

Students will make and test conjectures based on predictions.

- **Mathematical Connections**

Students will recognize equivalent graphical and algebraic representations of linear functions. They also will relate procedures in one representation to procedures in an equivalent representation.

- **Algebra**

Students will represent situations that involve variable quantities with equations; they will use tables and graphs as tools to interpret equations; and they will solve equations.

- **Functions**

Students will represent and analyze relationships using tables, equations and graphs; they will recognize that a variety of problem situations can be modeled by the same type of linear function; and they will understand the general properties of functions.

- **Statistics**

Students will construct and draw inferences from charts, tables, and graphs that summarize data from real-world situations. They will use a line of best fit to make predictions from data.

Links to Maryland High School Mathematics Core Learning goals

- **1: Functions and Algebra**

The student will demonstrate the ability to investigate, interpret, and communicate solutions to mathematical and real world problems using patterns, functions, and algebra.

- **1.1:** The student will analyze a wide variety of patterns and functional relationships using the language of mathematics and appropriate technology.
- **1.1.2:** The student will represent patterns and functional relationships in a table, as a graph, and/or by mathematical expression.
- **1.2:** The student will model and interpret real-world situations, using the language of mathematics and appropriate technology.
- **1.2.1:** The student will determine the equation for a line, and describe using numbers, symbols and graphs.
- **3: Data Analysis and Probability**
The student will demonstrate the ability to apply probability and statistical methods for representing and interpreting data and communicating results, using technology when needed.
- **3.1:** The student will collect, organize, analyze, and present data.
- **3.1.1:** The student will design and/or conduct an investigation that uses statistical methods to analyze data and communicate results.
- **3.2:** The student will apply the basic concepts of statistics and probability to predict possible outcomes of real-world situations.
- **3.2.1:** The student will make informed decisions and predictions based upon the result of simulations and data from research.
- **3.2.2:** The student will make predictions by finding and using a line of best fit .

Grade/Level:

Appropriate for any grade level of Algebra I

Duration/Length:

Two to four 50-minute periods, depending on how data is collected

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Estimating, rounding, and place value
- Graphing linear equations
- Interpreting data and finding equation of line on TI 83
- Finding the equation of a line using slope and y-intercept
- Applying properties of functions

Objectives:

Students will:

- graph a set of data points on a coordinate graph.
- estimate the slope of a line.

- determine the line of best fit.
- use a TI 83 to organize, graph, and interpret a data set.
- use a TI 83 to write an equation for their data set.
- write a brief analysis for their data.
- make predictions relevant to their data.
- apply properties of functions.
- recognize and formulate the graphical representation of a real world situation.
- work cooperatively in pairs.

Materials/Resources/Printed Materials:

- TI-83 graphing calculators and overhead
- Data sets (either student-gathered or provided by teacher)
- Graph paper
- Rulers
- Colored pencils

Development/Procedures:

- The teacher will provide or students should obtain data as a resource for their project.
- The teacher should review the basic data interpretation functions of the TI-83 Graphing Calculators using an example from a simple data set.
- Students will work in pairs cooperatively to complete their activity. The teacher should suggest that each student have a specific role (i.e., calculator operator, activity sheet recorder). Only one activity sheet per pair will be necessary. The teacher will circulate and monitor the progress of the students. The teacher will serve as a guide through the activity and provide assistance to pairs that are having difficulty.
- Each pair will write a brief analysis of their findings and predictions. Extension activities are provided for further analysis and assessment.

Performance Assessment:

The teacher will circulate among pairs as a facilitator and observe student behavior. Student achievement will be based on observed behavior (team work, on task, focused, appropriate discussions) and student activity sheets.

Extension/Follow Up:

- Construct a histogram and box and whiskers with TI-83 graphing calculator. Calculate mean, median and mode of data.
- Have students write up a report and present formally to class on posterboard paper.
- Depending on type of data, students can research and compare similar data from other time periods.
- The Larson, Kanold and Stiff textbook “Algebra 1, An Integrated Approach,” has a resource manual called “Technology using Calculators and Computers” that has excellent data sets for a variety of levels.

Authors:

Denise M. Harrison
Montgomery Blair H.S.
Montgomery County, MD

Fred J. Kim
Seneca Valley H.S.
Montgomery County, MD

Maria M. Legato
Montgomery Blair H.S.
Montgomery County, MD

NAME: _____

DATE: _____

Student Activity Sheet

I. Data Collection

1. Collect data and construct graph on graph paper. Be careful labeling x- & y- (independent and dependent). Be sure to label your axis.
2. On your graph paper draw in your line of best fit. Pick two points on the line and find the slope of the line. Use this to find the y-intercept and write an equation for the data.

Your equation of the line of best fit : _____

II. Data Interpretation

1. Enter data into **STAT** list on TI-83 graphing calculator. Enter x-values into **L1** and y-values into **L2**.
2. Setup the plot parameters.
 - Move the cursor to Plot "**ON**", then press **ENTER**.
 - Move the cursor to "**TYPE**", then press **ENTER**.
 - For "**XLIST**", press **2nd L1**.
 - For "**YLIST**", press **2nd L2**.
 - For "**MARK**", use the 1st entry (the box).
3. Press **ZOOM**, then select # **9 (ZoomStat)** to graph your plot. Go to **WINDOW** and record below.

Xmin: _____

Ymin: _____

Xmax: _____

Ymax: _____

Xscl: _____

Yscl: _____

4. Press **STAT**, go to **CALC**, and select # 4 (**LinReg (ax + b)**), then press **ENTER**. Record your values for a and b, rounded to five decimal places. What do “a” and “b” represent in the calculator’s model?

a= _____

b= _____

5. Press **Y=** and clear all equations, then press **VAR**s and select # 5 (**Statistics**). Go to **EQ** and press **ENTER**. (This will put the calculator’s equation to your data into Y_1)

Calculator’s Equation _____

6. Type **your** line of best fit from **I # 2** into Y_2 . Press **GRAPH** and see if your line (yours will be the second line that is graphed) is the same as or close to the calculator’s equation. If your equation is significantly different, give an explanation for the discrepancy.

Are they close? _____

7. On your graph paper, sketch the calculator’s equation for the data. (Use the trace key to obtain accurate points.)

III. Predictions and Analysis

1. Based on your data, make two predictions based on your independent variable and two based on your dependent variable. For example, if you are looking at the average salaries of professional football players from 1980 to 1990, you may want to predict the salaries in 1999 and 2050. You may also want to look at the salary of a football player in 1920, or vice versa.

HINTS for calculating your predictions:

- Press **2nd TRACE** and select #1 (**value**), then press **ENTER**. Choose your x value.
- Substitute value (for either x or y) into your equation. Be sure to approximate to five decimal places.
- Press **2nd WINDOW** and move cursor to “**ASK**” for both variables. Press **2nd GRAPH** and key in the appropriate values. Press **ENTER** to obtain and record value.

2. Using the space provided, write a paragraph (5 to 6 sentences) including your predictions and a brief analysis for your data. For example, trends, patterns, and/or relationships between your variables.

IV. Properties of Functions

1. Look at your linear function and determine:

Domain: _____

Range: _____

Is it continuous? _____

Is there a max or min? _____

Is it increasing or decreasing? _____

Any x- or y-intercepts? _____

If so, what are they? _____

Hints:

-Adjust **WINDOW** and press **TRACE**

-Substitute zero in the equation for x to find the y-intercept and zero in the equation for y for the x-intercept.



Current cigarette smoking by persons 18 years of age and over, according to sex, race, and age: United States, selected years 1965-93

[Data are based on household interviews of a sample of the civilian noninstitutionalized population]

<i>Sex, race, and age</i>	1965	1974	1979	1983	1985	1987	1988	1990	1991	1992	1993
All persons	Percent of persons 18 years of age and over										
18 years and over, age adjusted	42.3	37.2	33.5	32.2	30.0	28.7	27.9	25.4	25.4	26.4	25.0
18 years and over, crude	42.4	37.1	33.5	32.1	30.1	28.8	28.1	25.5	25.6	26.5	25.0
All males											
18 years and over, age adjusted	51.6	42.9	37.2	34.7	32.1	31.0	30.1	28.0	27.5	28.2	27.5
18 years and over, crude	51.9	43.1	37.5	35.1	32.6	31.2	30.8	28.4	28.1	28.6	27.7
18-24 years	54.1	42.1	35.0	32.9	28.0	28.2	25.5	26.6	23.5	28.0	28.8
25-34 years	60.7	50.5	43.9	38.8	38.2	34.8	36.2	31.6	32.8	32.8	30.2
35-44 years	58.2	51.0	41.8	41.0	37.6	36.6	36.5	34.5	33.1	32.9	32.0
45-64 years	51.9	42.6	39.3	35.9	33.4	33.5	31.3	29.3	29.3	28.6	29.2
65 years and over	28.5	24.8	20.9	22.0	19.6	17.2	18.0	14.6	15.1	16.1	13.5
White:											
18 years and over, age adjusted	50.8	41.7	36.5	34.1	31.3	30.4	29.5	27.6	27.0	28.0	27.0
18 years and over, crude	51.1	41.9	36.8	34.5	31.7	30.5	30.1	28.0	27.4	28.2	27.0
18-24 years	53.0	40.8	34.3	32.5	28.4	29.2	26.7	27.4	25.1	30.0	30.4
25-34 years	60.1	49.5	43.6	38.6	37.3	33.8	35.4	31.6	32.1	33.5	29.9
35-44 years	57.3	50.1	41.3	40.8	36.6	36.2	35.8	33.5	32.1	30.9	31.2
45-64 years	51.3	41.2	38.3	35.0	32.1	32.4	30.0	28.7	28.0	28.1	27.8
65 years and over	27.7	24.3	20.5	20.6	18.9	16.0	16.9	13.7	14.2	14.9	12.5
Black:											
18 years and over, age adjusted	59.2	54.0	44.1	41.3	39.9	39.0	36.5	32.2	34.7	32.0	33.2
18 years and over, crude	60.4	54.3	44.1	40.6	39.9	39.0	36.5	32.5	35.0	32.2	32.7
18-24 years	62.8	54.9	40.2	34.2	27.2	24.9	18.6	21.3	15.0	16.2	19.9
25-34 years	68.4	58.5	47.5	39.9	45.6	44.9	41.6	33.8	39.4	29.5	30.7
35-44 years	67.3	61.5	48.6	45.5	45.0	44.0	42.5	42.0	44.4	47.5	36.9