

Math Lessons

Functions and Graphing

Teacher Notes

EARTHQUAKE!

Concepts

Regression, Data Analysis, Scatterplots, Linear, Quadratic, Exponential, Power and Logarithmic Equations, Modeling

Objectives

Students will

- use mathematics to represent natural phenomena;
- analyze the relationship between two data sets by using scatterplots;
- explore various regression equations for scatterplots, including linear, quadratic, exponential, power, and logarithmic;
- determine how well regression equations fit the data sets;
- linearize a data set and graph the resulting data in a scatterplot;
- communicate findings about the relationship between real–world data sets.

Prerequisite Skills

Students will need to

- enter data into a spreadsheet or graphing calculator;
- make scatterplots using technology;
- find regression equations of various types using technology;
- find regression coefficients and evaluate the fit of a regression equation to a scatterplot.

NCTM Standards

Algebra Standard

- Understand patterns, relations, and functions.

Measurement Standard

- Understand measurable attributes of objects and the units, systems, and processes of measurement.

Connections Standard

- Recognize and apply mathematics in contexts outside of mathematics.

Representation Standard

- Use representations to model and interpret physical phenomena.

Time to Complete

This activity can probably be completed in a 50 to 60 minute class period with the Conclusion section to be completed as homework. If the students are not familiar with the technology, the activity will take longer.

This activity can be assigned to individual students or groups of students as a project to be completed over

several weeks time. If you choose to assign it as a project, you may want students to display their conclusions and graphs on a poster board, in a portfolio, or on a Web page.

Teaching Suggestions

The directions are written assuming students will use spreadsheet software that has graphing capabilities. Using spreadsheet software instead of a graphing calculator will make this activity go more smoothly. If a graphing calculator is used, students will need one that has the capability to hold data in three columns. Students may find it very helpful to print the scatterplots. They will need to use graphing software for this. If you have a lot more time available, students can make the scatterplots with paper and pencil, but this will be very time-consuming and tedious.

This activity can be used as an introduction to the technology or as an introduction to finding regression equations, including the types listed in the Analysis section of the activity. Or, it can be used to allow students to practice graphing and finding regressions equations after the concept has been taught in class.

This activity will go more quickly if students work in groups of 2 or 3. You can have them complete the Question section in their groups or you can use the questions for a whole-class discussion.

Results

Students will probably find that exponential equations are the best fit for the Richter number and increase in magnitude or Richter number and energy released scatterplots. A quadratic equation fits the increase in magnitude versus energy released plot and a linear equation fits the linearized data.

Sample Answers [Students' answers may vary.]

Analysis

1 and 2.

a.

b.

c.

Questions

1. Yes; all three scatterplots represent functions because each x -value is paired with only one y -value.

2. exponential equation; $y = 0.1 \cdot e^{2.3026x}$

3. exponential equation; $y = 0.000006 \cdot e^{3.4559x}$

4. quadratic equation; $y = 0.00000004x^2 + 0.1371x - 1514$

5.

Richter Number	Ln of Increase in Magnitude
1	0
2	2.302585093
3	4.605170186
4	6.907755279
5	9.210340372
6	11.51292546
7	13.81551056
8	16.11809565

6. linear; $y = 2.3026x - 2.3026$