The Greatest Area Activity

Modeling Non-Linear Data

A classic problem looking at maximizing the area of rectangles given fixed perimeters. Uses graphing calculators to analyze data collected and to model a parabolic equation. Compiling class data provides a preliminary glance at families of quadratics.

Mathematical Concepts Explored	Technology Used/Materials Needed	Commands/Functions Utilized
• Explore non-linear relationships • Problem solving using physical models • Work with area formulas and develop an understanding of how changes in dimension affect area • Graph a quadratic equation • Practice setting up a list to build a mathematical model of a problem	• Student Worksheet • Extra graph paper, chart paper • TI83+ • View screen for discussion/processing	• y= • graph/table • trace • formula

California Mathematics Content Standards Addressed by this Activity

5th grade

- Algebra and Functions 1.4 - Identify and graph ordered pairs
- Algebra and Functions 1.5 - Solve problems involving linear functions with integer values; write the equation and graph resulting ordered pairs
- Measurement and Geometry 1.2 - Construct a cube and rectangular box from two-dimensional patterns; compute the surface area
- Differentiate between, and use appropriate units of measures for, two- and three-dimensional objects (i.e., find the perimeter, area, volume).

6th grade

- Algebra and Functions 3.1 - Use variables in expressions describing geometric quantities
- Algebra and Functions 3.2 - Express in symbolic form simple relationships arising from geometry

7th grade

- Algebra and Functions 1.5 - Represent quantitative relationships graphically; interpret meaning of graphs or parts of graphs
- Measurement and Geometry 2.1 - Use perimeter, area (2-dimensional), surface area (3-dimensional) and volume formulas routinely

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Prior Knowledge

Students should be familiar writing variable expressions. They should also have some experience with the formula for finding area. Students should also be familiar with using a graphing calculator in problem solving situations and making scatterplot using plot function.

Activity Agenda, Teacher Notes and Points for Discussion

	Teacher will…	**Student will…**
1.	Tell the students they will be exploring areas when the perimeter is fixed. Demonstrate an example of several rectangles with a fixed perimeter of 20. Tell students it is not necessary to draw both the 1x9 and the 9x1 rectangles on the graph paper but both should be put into the data table. Pass out worksheets and assign fixed perimeters (24, 30, 35, and 40) to different groups.	Participate in class discussion clarifying questions for this activity.
2.	Monitor groups as they work. If necessary, model which data items go into L1 and L2.	Students work in groups finding rectangles and entering data into their tables. When they have finished finding all of the integer length rectangles, students will put data into L1 and L2 on the graphing calculator.
3.	When all of the groups have plotted their data, you may need to have a class discussion to help students formulate their equations. Possible solutions include $y = x(\frac{fixedperimeter - 2x}{2})$ or $y = x(\frac{fixedperimeter}{2} - x)$.	Students generate an equation to model their data. After entering their equations, students verify their graph passes through their data points. Students will then find the maximum area in the table generated from their equations.
4.	Distribute presentation materials. Give students 10 minutes to prepare their summaries.	Students prepare a summary presentation.
5.	Facilitate class discussion on findings.	Students generalize their findings.