

Quadratic Reasoning: The Sandbox Problem

Summary	
This lesson is an introduction to quadratics. It gives students an opportunity to explore quadratic patterns numerically and graphically, as they choose.	
Utah State Core Standard	
<p>Standard 3 Students will solve problems using spatial and logical reasoning, applications of geometric principles, and modeling.</p> <p>Objective 3.3 Solve problems using visualization, spatial reasoning, and geometric modeling.</p> <ul style="list-style-type: none"> • Solve problems involving absolute value and quadratic functions algebraically and graphically. 	
Desired Results	
Benchmark/Enduring Understanding	
Students will understand the relationships between numbers in a quadratic pattern.	
Essential Questions	Skills
<p>How are quadratic patterns different than linear patterns?</p> <p>What situations can be modeled with quadratic functions?</p> <p>What do quadratic patterns look like, both graphically and numerically?</p>	<ul style="list-style-type: none"> • Relate perimeter, area, and volume of a rectangle. • Represent patterns numerically and graphically.
Assessment Evidence	
The second question in this lesson asks students to synthesize what they discovered in the first problem and relate their understanding to new conditions.	

Instructional Activities
<p>Launch:</p> <p>Explore: This is a good lesson for partners or groups. Students should be encouraged to work the problem without explanations from the teacher. If students get stuck, they may be prompted to try drawing possible versions of the sandbox and recording the results. They may wish to organize their results in a table or graph, but they should be allowed to choose the method that is effective for them.</p>

Summarize: Selected student solutions should be presented to the class to illustrate the quadratic patterns. If possible highlight both a table and a graphical solution. Ask students to contrast the pattern they found in this problem with a linear function.

Materials Needed

Graph paper to draw possible solutions
Graphing calculators (suggested)

Quadratic Reasoning: The Sandbox Problem

The Addams family is building a rectangular sandbox that will be one foot deep. Gomez has decided to use lumber that is one foot wide. He bought 30 feet of lumber to enclose the sandbox. Find the dimensions of the sandbox with the greatest volume. Show how you got your answer and justify your solution. Be sure to include units in your explanation.

The family decides that they can afford to buy 50 ft^3 of sand. What dimensions should they use to build the sandbox? Justify your solution.

