

Exploring Squares and Square numbers

Teacher's Guide

Developing students' number sense is an important part of mathematical education. Number sense helps students understand relationships between numbers, connect symbols with the concepts they represent, and enables students to conceptualize mental math problems more easily.

Thinking about square numbers is an interesting way to develop students' number sense, generate excitement about mathematics, and add depth to topics such as multiplication, area, & perimeter.

Small to Large Squares in Order; Mini Poster Pre-Activity

In this activity your students will need a sheet of construction paper, one or more sheets of graph paper, scissors, glue, and a pencil.

Creating a mini poster to show a sequential series of square numbers will prepare your students for success when they tackle the main activity. Invite students to cut out various squares from the graph paper. You may want to set an upper limit to the size of the squares or you may not. Have your students arrange the squares on the construction paper from small to large. Discuss the patterns made by the squares. Encourage students to identify and cut out any more squares needed to complete the sequence. Glue the squares in place. You may want to have your students return to the mini posters after completing the worksheet. They can record the height, width, area, perimeter, and difference on their mini posters, as they did on the worksheet.

Planning and Preparation

Review activity to identify tricky vocabulary, novel concepts, and other teaching opportunities.

Identify learning goals for your students based on school, district, or state academic standards.

Decide how to group your students; whole class, small groups, pairs, or individuals.

Collect materials and make copies. Students could use six different colored pencils, crayons, or highlighters, but these are optional. Also, they might benefit from having a centimeter ruler handy.

Plan questions and discussion topics that will best support your students' learning.

Exploring Squares & Square Numbers; Activity

This activity provides your students with an opportunity to discover more about multiplication, area, perimeter, and eventually algebra and algebraic thinking.

As your students explore squares and square numbers, help them use new vocabulary correctly, extend their ideas, make connections between squares and other mathematical concepts, and get excited about some of the subtle patterns found in mathematics.

Make it easier: Begin by completing #4 on the back of the page first. Ensure your students understand the vocabulary used in this activity. Have students identify and discuss any words in the text that puzzle them such as; product, adjacent, format, sequence, consecutive, and so on.

Make it challenging: Have individuals, pairs, or small groups prepare and present a response to one of the questions on the back of the page. It could be an oral presentation, a poster, a flow chart, or a slide show.

Thinking like a Mathematician

Offering students a chance to think mathematically is important for several reasons. Our world is infused with math; it becomes more central to our lifestyle each day. Understanding mathematical concepts, being able to evaluate information from a logical perspective, and having the confidence & insight that come with mathematical thinking prepare your students for success.

Talking like a mathematician: Mathematicians, and math students who think like them, use words like consecutive, tessellate, and hypotenuse in everyday conversation. Taking ownership of mathematical vocabulary is essential for building your students' understanding. Help your students pronounce vocabulary correctly. Encourage (and eventually require) them to use new vocabulary words when talking and writing about math.

Difference between consecutive square numbers: The first few square numbers are 1, 4, 9, 16, 25, 36 & 49. The difference between 1 & 4 is 3, the difference between 4 & 9 is 5, and the next differences are 7, 9, 11, and 13. The distance between each square number and its neighbor is the series of odd numbers! (*Seriously, how incredible is this?*)

Pattern in perimeter of squares as they increase size: A square centimeter has a perimeter of 4 cm. The perimeters of consecutive square numbers increase by 4 each time. Is this because squares have four sides? (*Great question, how could we find out?*) Now we are thinking like mathematicians.

Odd/even pattern in sequential square numbers: We know there is always an odd number between two consecutive square numbers. What else do we know about odd numbers? Well, the sum of two odd numbers will always be an even number. So, the sum of the first square number 1, and 3 will be an even number (in this case 4, which is the next square number). When we add an even number (like 4) with an odd number (like 5, the next odd number after 3) the sum will always be an odd number (in this case 9, which is the next square number). The Rainbow Squares activity explores this idea.

Rainbow Squares: Follow up Activity

A fun, follow up activity that continues to build students' number sense and deepen their understanding of squares.

Materials: large scale graph paper, crayons, colored pencils, or highlighters in rainbow colors, scissors, paper clip, brad, or glue, pencil and paper.

Have students cut out eight squares with areas of 1 to 64 cells (or larger as long as they are adjacent squares).

Have students leave the smallest square white, then color the rest from small to large in the colors of the rainbow; red, orange, yellow, green, blue, indigo, violet. They should put their initials on the back of each square.

Invite students to look for patterns by creating various arrangements with the squares. Then have them stack squares with smallest on top, align the bottom left corner of all squares. Clip, pin, or glue squares in place.

Have students make a chart showing the colors of the rainbow and number of cells showing for each color. They should give a title to their paper and write about any patterns they observed or questions they still have.

Make it easier: Let students use copies of attached pages to get started.

Make it challenging: Let students measure their own squares on plain paper, or include more information in the charts such as: area, perimeter, height, width or difference between consecutive square numbers.