Squares to Stairs
Grades 6-12

Introduction:
This activity is all about connecting geometric thinking and algebra, specifically algebraic expressions.

Agenda:

Activity	Time	Description/Prompt	Materials
Explore	30 min	Explore the pattern	• Paper, pencil/ pen • Tiles/counters • Student hand-out, page 3 • Paper/journals • Pencil/pen • Markers/col-ored pencils
Discuss	30 min	1. How did you see the pattern? What did you notice? 2. Discuss Gauss' conjecture that the sum of the first n positive integers is equal to $^{n}/2$ (n + 1) 3. Does this conjecture apply to the pattern? How do you know?	• Squares to Stairs visual, page 4

Activity:

We use this activity to continue building understanding of variable and writing algebraic expressions for geometric representations of patterns. We connect the way students are seeing the shape growing to patterns in numeric expressions to Gauss' conjecture.

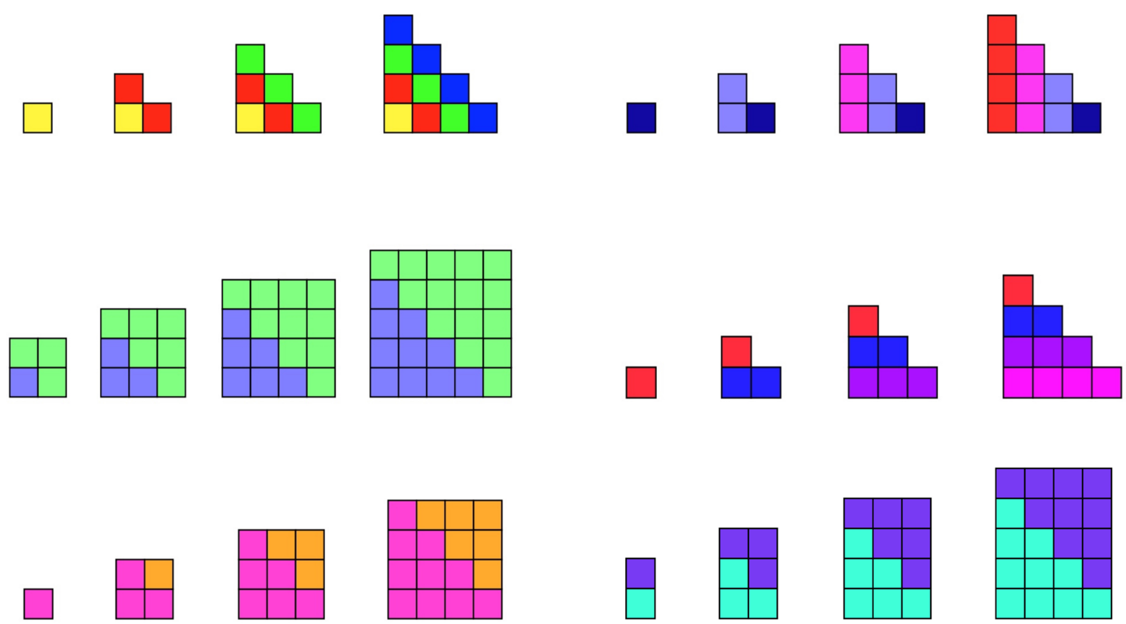
Set students up to work in groups to make sense of how the pattern is growing. As teams explore, they start noticing a pattern in the number of squares in the columns moving from left to right. When you pair the number of squares in the first column on the left with the number of squares in the last column, the farthest right column, you get a sum of one more than the figure number. If students are recognizing this pattern with numbers ask them to think about how they see the same thing visually, in each figure.

When it is a good time to pull the teams together, we start by asking students to share how their youcubed®

group saw the pattern growing. After getting at least one idea shared from each team, we named the pattern students were describing. For example, when you pair the number of squares in the first column on the left with the number of squares in the last column, the farthest right column, you get a sum of one more than the figure number. This resembles Gauss' conjecture about the sum of the first n positive numbers. We asked teams to think about whether or not the figures in Squares to Stairs follow Gauss' conjecture.

Extensions:

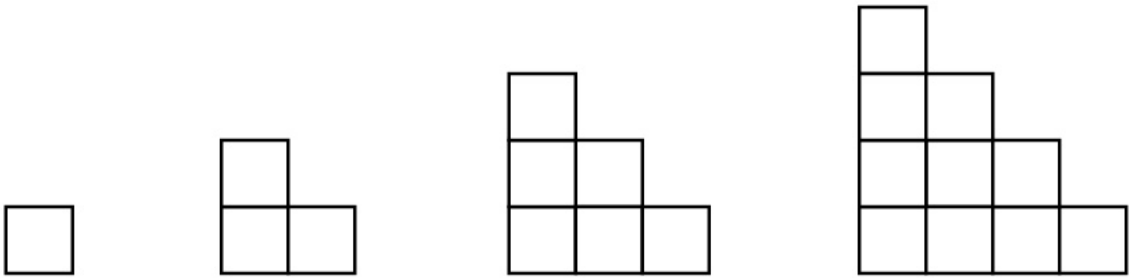
- Make your own visual pattern and prepare a visual proof for finding the number of shapes in any case number.
- How is this problem related to the Shapes Task?



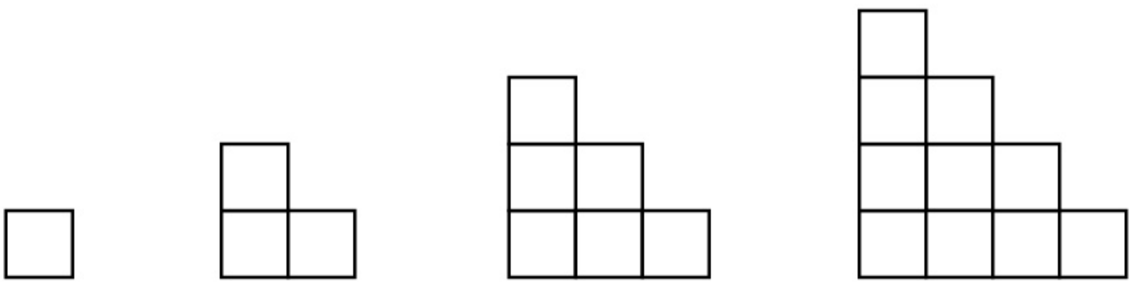
A few of the ways people see the shape growing.

Squares to Stairs Handout

How do you see the shapes growing?



Case 1 Case 2 Case 3 Case 4



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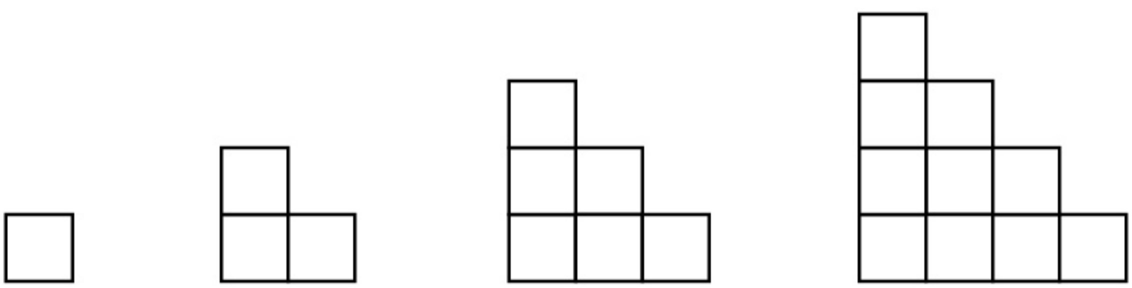

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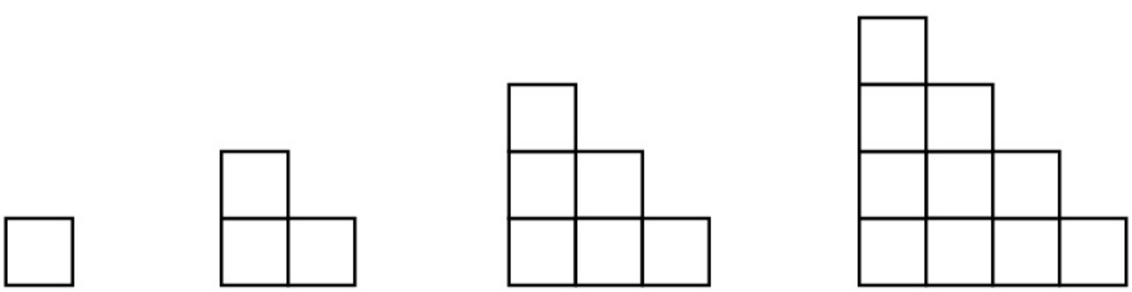
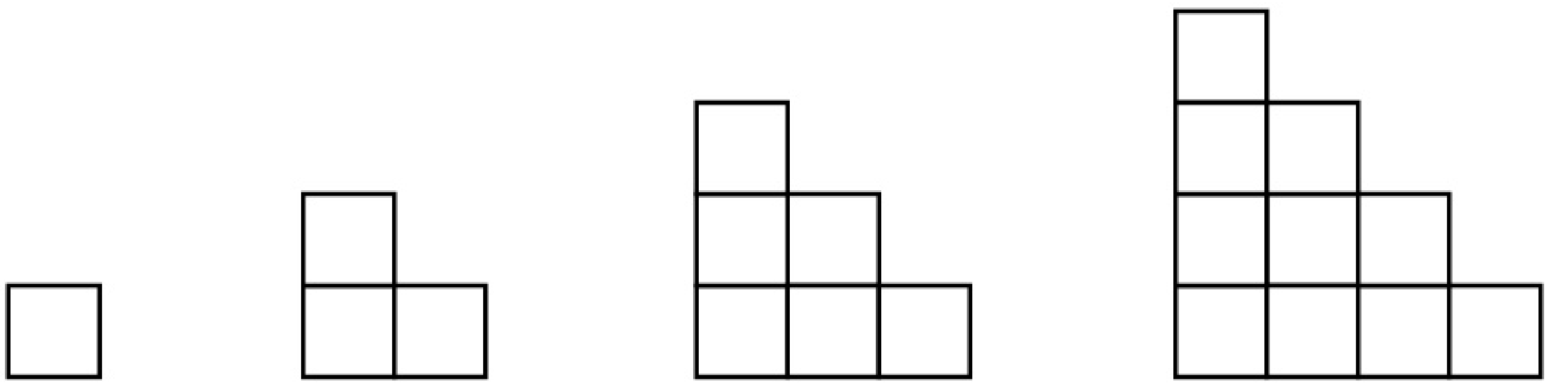


Case 1 Case 2 Case 3 Case 4

Squares to Stairs Visual



Case 1 Case 2 Case 3 Case 4

What does figure 10 look like and how many squares does it have?

What does figure 55 look like and how many squares does it have?

Can you use 190 squares to make a stair-like structure? Justify your thinking with different representations visually, numerically, algebraically.