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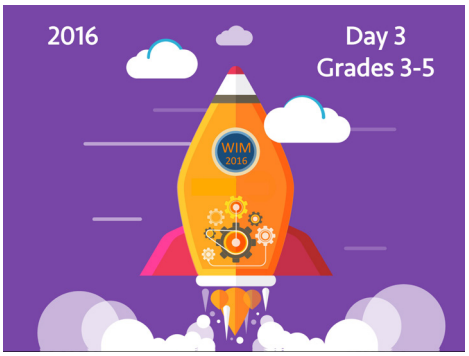

Introduction:

This activity invites students to explore patterns and build their understanding of variables, algebraic expressions, and connections between visual patterns and algebraic representations. The path that students will take is unpredictable and they may struggle and make lots of mistakes. This is part of an important process. Start the activity with the video "Believe in Yourself" so that students hear the message that when they struggle their brain is growing and synapses are firing to create pathways in the brain.

Agenda for the day:

Activity	Time	Description/Prompt	Materials
Mindset Video	5 min	Play the mindset video, *Believe in Yourself* https://www.youcubed.org/wim2-day-3/	Mindset Video day 3, *Believe in Yourself*
Squares to Stairs	40 min	1. How do you see the pattern growing? Explore the pattern alone. 2. Share different ways of seeing the pattern growing with the whole class. Record this in the same was as a number talk. 3. Have teams explore what figure 10 and 55 would look like and how many squares they would each have. Encourage the use of visuals, tables, and graphs for justification. 4. Ask teams to make sense of whether or not you can use 190 squares to make a figure for this pattern. Encourage the use of visuals, tables, and graphs for justification.	• Tiles/counters • Student handout • Paper/journals • Pencil/pen • Markers/colored pencils
Whole class discussion	10 min	Ask students to share any patterns or other interesting observations.	• White board • Poster paper
Closing	5 min	You may like to close the lesson by reminding students of the importance of believing in themselves. When they believe in themselves their brains grow more when they struggle or make a mistake.	

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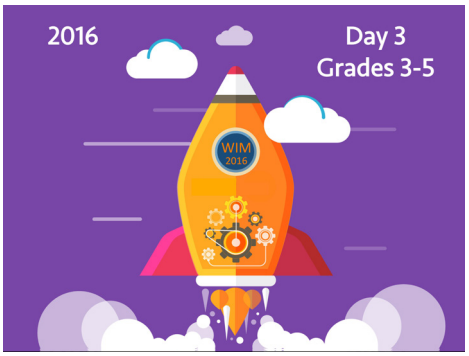

Activity: Squares to Stairs

This activity invites students to explore patterns and make sense of how they see a pattern growing and how that gives them information to answer questions about the pattern. During this exploration students may use manipulatives, visual patterns, numeric patterns, and algebraic expressions to make sense of how the pattern is growing.

To get started, display the pattern and ask students to think about how they see the pattern growing.

How do you see the pattern growing?

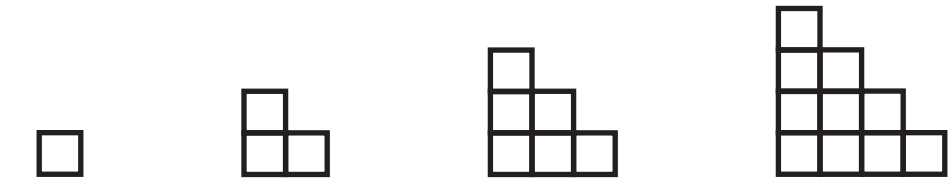

Figure 1 Figure 2 Figure 3 Figure 4

Give the class a couple of minutes just to think alone, then pass out the student handout so they can record using color how they see the pattern growing. When you notice a student waiting, ask them if they can see another way the pattern is growing.

Once every student has a chance to record something, pull the class together for a sharing of the different ways of seeing the pattern grow. Organize and record this sharing like you would a number talk by asking for volunteers to share their way of thinking. Ask for a volunteer to share how they see the pattern growing, record their way of seeing and their name. Ask the class to raise their hand if they saw it the same way, and then ask who saw it differently and select someone new to share. Continue like this until all of the unique ways of seeing the pattern grow have been recorded on the board.

Leaving all of the ways of seeing on the board, move students into working with their teams to answer questions about the pattern. Ask them to make sense of:

1. What does figure 10 look like and how many squares does it have?
2. What does figure 55 look like and how many squares does it have?
3. Can you use 190 squares to make a stair-like structure? Justify your thinking with different representations visually, numerically, algebraically.

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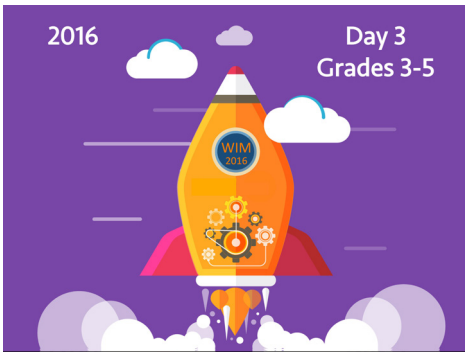

Depending on your group of students you might also want to ask them to think about how to represent the number of squares in any figure number.

When answering the questions, students may need to start using other representations of the pattern to answer and justify what they get. This is an opportunity to make space for students to make connections between visuals, numbers and expressions to build strong justification. If they first notice the pattern or find an answer using numbers ask them to think about it visually and algebraically and if they first think about it visually ask them to think about it numerically and algebraically.

When it seems like it is a good time to pull the teams together, start by asking students to share what patterns they found while working to answer the questions. Then ask teams to share what they got when answering the questions. As different students get a chance to share, ask if there is agreement and encourage students to ask each other how they know until it makes sense. Make space for students to share other strategies for answering the question also, especially if they have used a different representation because this helps students see connections across strategies and representations.

Close by asking students to share what they thought of as the key mistakes they made during this activity and why they were key in their exploration of the pattern.

Extensions for the activity:
• How can you figure out how many total squares are in any figure?
• If you have 1,478 squares, can you make a stair-like structure using all of the squares?
• Here are some nice links to Gauss' proof for the addition of numbers in this activity, which could be explored by students or their teacher!
https://en.wikipedia.org/wiki/1_%2B_2_%2B_3_%2B_4_%2B
https://betterexplained.com/articles/techniques-for-adding-the-numbers-1-to-100/

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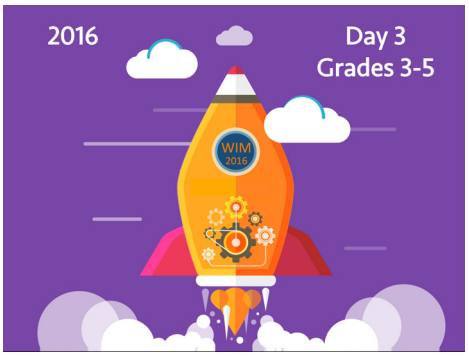
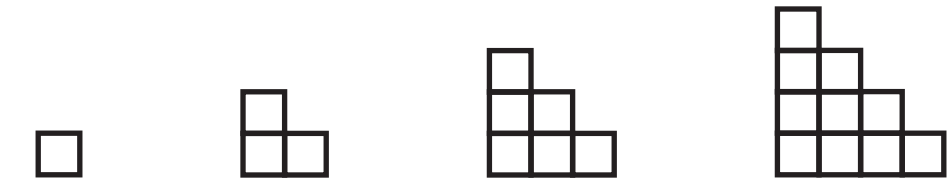
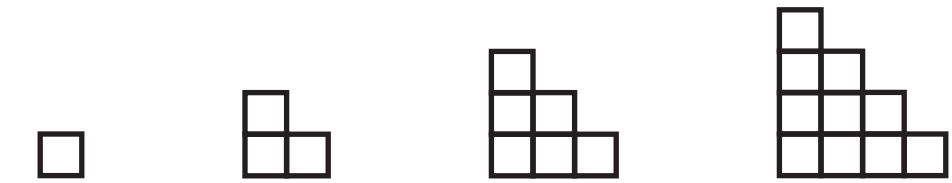
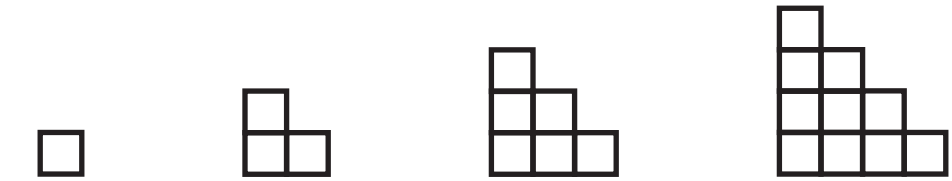


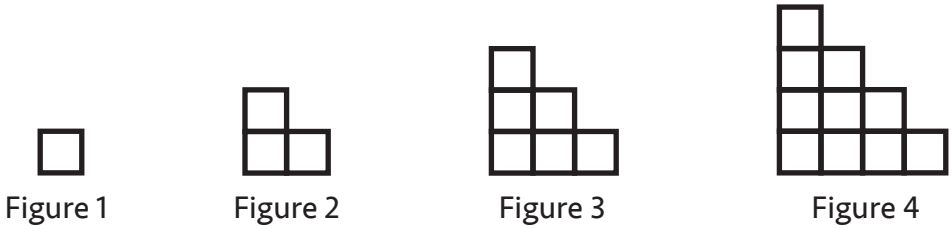
Squares to Stairs

How do you see the pattern growing? Use different colors to show how you and other people see the shape growing.









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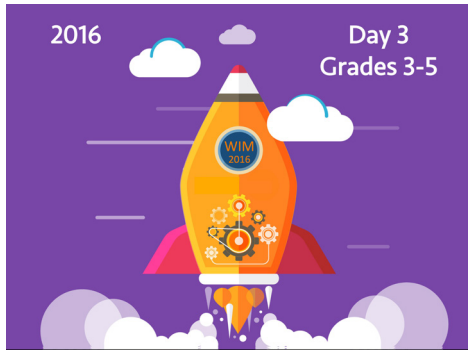

Squares to Stairs

How do you see the pattern growing?

Figure 1

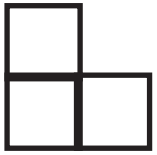

Figure 2

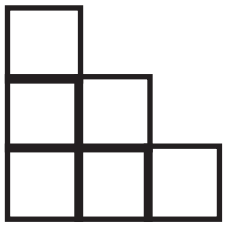

Figure 3

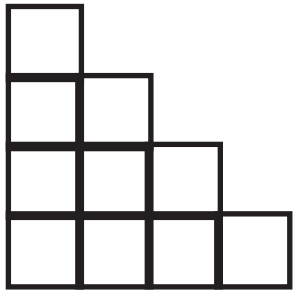

Figure 4