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Squares & More Squares
Day 2

Introduction

This activity invites students to explore a geometric pattern and make sense of the many different ways they see the pattern. This activity allows students to visualize, identify, and generalize patterns. Students will explore the connections between multiple representations of a growth pattern.

Agenda

Activity	Time	Description/Prompt	Materials
Mindset Message	10 min	Play the mindset video, ***Believe in Yourself***, https://youcubed.org/weeks/week-4-community-college/	Mindset Video day 2, ***Believe in Yourself***
Launch	20 min	• Introduce students to the Squares & More Squares pattern. • Ask students to think about how the pattern is growing.	• Squares & More Squares: How do you see the pattern growing? • Colored pencils or pens
Explore	20 min	• Have groups work together as they explore this pattern. • Encourage students to show off the growth across multiple representations. • Remind students to highlight the connections across the representations using color, arrows, and words.	• Squares & More Squares: Making Conjectures • Colored pencils or pens • Graph paper • Maths journals • Pencils or pens
Discuss	10 min	• Have students share their ways of seeing the pattern. • Invite students to share their conjectures.	
Debrief Mindset Message	5 min	Ask students to reflect on the importance of believing in themselves. Ask for some volunteers to share a time when they believed in themselves during the activity or a time when they surprised themselves in what they could do during the activity!	

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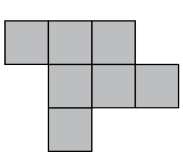
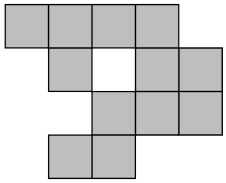
Activity

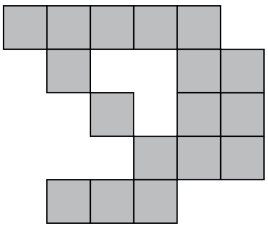
Project the pattern and ask students to think about how they see the pattern growing. Give students the Squares & More Squares: How do you see the pattern growing? handout and ask them to start individually. Encourage students to use color to show what they see. There are many different ways students will see this growth pattern. We encourage you to have extra copies on hand. The handout has four sets of case 1-3 of the pattern, invite students to show their different ways of seeing and let them know you have more copies if they can think of more than three different ways of seeing.



Case 1



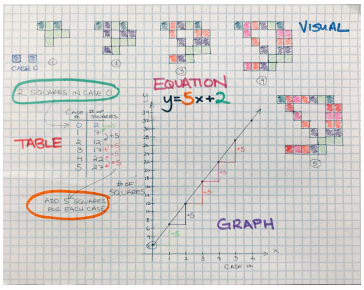
Case 2



Case 3

Have groups start working together to explore this pattern by sharing their different ways of seeing with the rest of their group. Encourage them to take turns sharing one way of seeing at a time until they have heard all the ideas people are bringing to the group. Give students the next handout, Squares & More Squares: Making Conjectures. Encourage students to create multiple representations to explore the pattern further and see what ideas it gives them about each case and how the number of squares is changing. When working with patterns we want to encourage students to recoginize, extend, and generalize. This will look different for each student depending on how they see the pattern growing and what representation(s) they are working with.

Make space for the activity to focus on multiple representations by encouraging students to take the time they need to make sense of the third question. This question is about making multiple representations and showing the growth in each representation. Encourage students to show the growth across multiple representations. They can choose to show this in any of the representations they want: the visual, words, a table, a graph, and an algebraic equation. Invite them to highlight the connections across the representations using color, arrows, and words.



Once groups have time to explore the connections in the multiple representations, bring the class together for a discussion. Start the discussion by inviting students to share all the different ways they saw the pattern growing. Invite students to share different representations of the geometric pattern: words, visuals, table, graph, and algebraic equations. Encourage students to make connections back to the visuals. For example, when a student shares an algebraic equation ask students where they see this in the visual. Ask students what connections they see across the representations. Also ask students what they noticed within each representation about how the pattern was growing. Ask students if all the algebraic equations are equivalent. How do we know? Have students discuss this within their groups for a few minutes.

Open the discussion to the negative case. What did students notice about a negative case across the

multiple representations? What would happen if we continued to explore negative cases within the table, graph and visual? Why? If students have not yet had a chance to explore this give them additional time to discuss this in their groups and then share out as a class.

As students discuss and highlight the ways they see the pattern growing ask them what this type of function is represented by this pattern and how they know.

Extension

- Make your own pattern. How does the way your pattern grows compare to the way this pattern grows?

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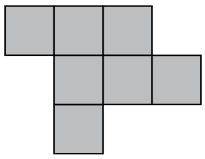
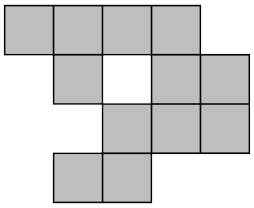
Squares & More Squares

How do you see the pattern growing?



Case 1



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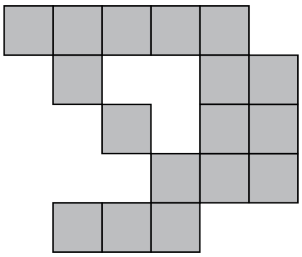

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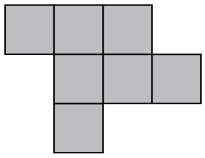
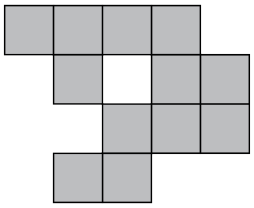


Case 1



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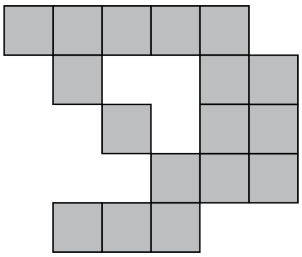

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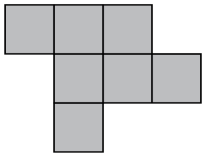
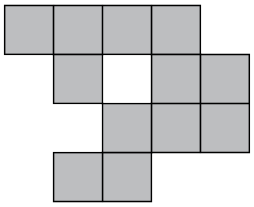


Case 1



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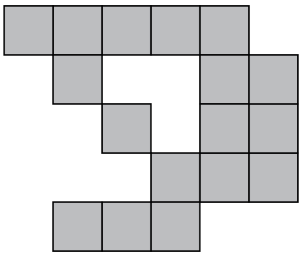

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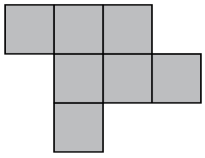
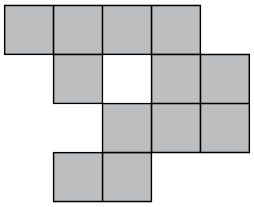


Case 1



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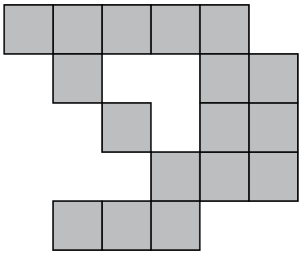

Case 3

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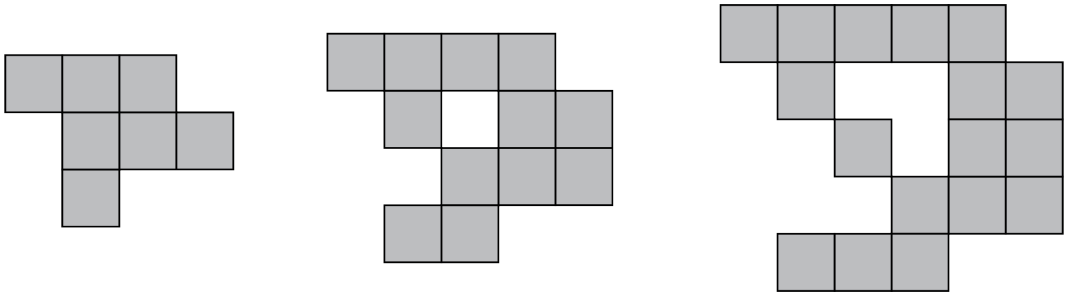
Squares & More Squares

Making Conjectures



Case 1 Case 2 Case 3

How do you see the pattern growing? Draw cases 4 and 5. Color-code where you see the new squares being added.

How many squares will be in the tenth case? How many squares will be in the -1 case?

Use multiple representations to show how the pattern is growing: the visual, a table, a graph, and an algebraic expression. Show the connections between the representations using color-coding, arrows, and words.

What kind of function does this pattern represent? How do you decide? Use the multiple representations to justify your decision.