



Towers Grade 6-8

Introduction

This activity allows students to explore a 3-dimensional growth pattern. Typically the growth patterns students are familiar with are 2-dimensional growth patterns. This growth pattern is also distinctive in that there are different ways for students to see the growth. Students may come up with different solutions depending on how they see the pattern. This gives students an opportunity to share their assumptions for how the pattern is growing before describing their solutions.

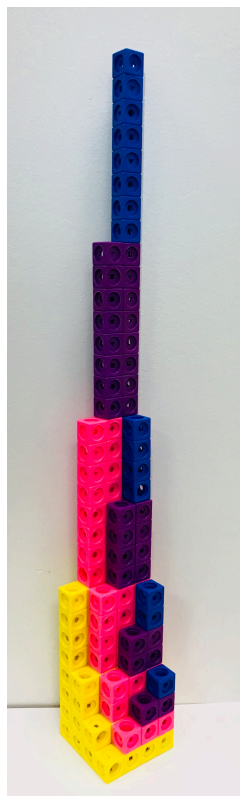
Agenda

Activity	Time	Description/Prompt	Materials
Mindset Message	10 min	Play the mindset video.	Mindset Video
Explore	20 min	<ul style="list-style-type: none"> Introduce the problem. Give students time to explore Towers. 	<ul style="list-style-type: none"> Towers Pattern: Case 5 Towers handout Maths journals Pencils Colored pencils or pens Colored cubes: yellow (15), pink (45), purple (30), blue (15) or substitute with other materials
Discuss	10 min	Invite students to share their findings.	
Debrief Mindset Message	5 min	Debrief the mindset messages for this activity.	

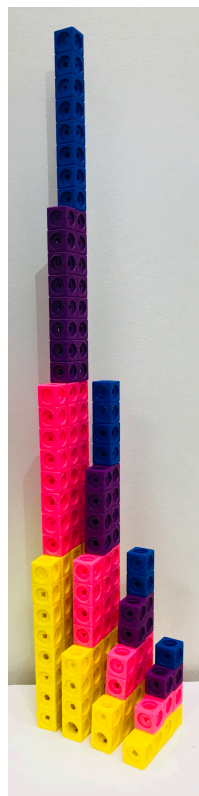


Activity

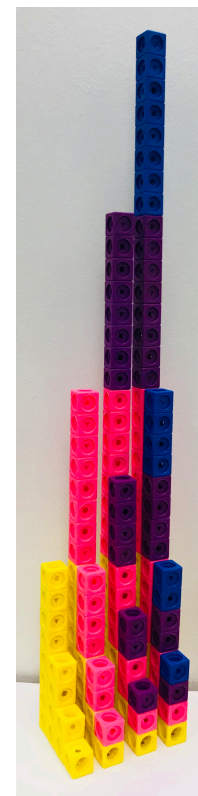
Introduce the problem to students and project the picture of case 5 view 3. Give them colored cubes for building their own tower along with colored pens or pencils for sketching. Allow them to work in partners or groups as they explore how the pattern is growing. Let them know that there are different and defensible ways to see cases 1-4 and beyond based on case 5 and the growth in the pattern, so it will be important to share with each other the decisions behind their conjectures. Remind them of the strategies they just saw discussed in the video and to use some of them while they explore the tower pattern.



Case 5
View 1



Case 5
View 2



Case 5
View 3

As students are working, encourage them to share with each other how they see the pattern growing and give their reasoning. Invite them to give clear descriptions to each other. Encourage them to ask questions of each other to understand how their peers are seeing the pattern growing. Listen for student's explanations as they describe how tall the tallest tower will be in case 5, in case 100 and in the n^{th} case. Encourage students to use representations that make sense to them. The representations students will likely use are describing in words, sketching well-labeled diagrams, and writing numeric and algebraic expressions. Remind students they can choose the representation they use and do not need all three.

When partners or groups see the pattern growing in different ways, they may get a different answer for



what case 100 and any number n would look like and the number of cubes it would have. When you hear this happening in a group encourage them to be open to each other's ideas and be skeptical. When they ask if there is more than one answer for the case 100 and n , ask them what they think; if they think there could be more than one way to see the pattern growing and if that means there could be more than one answer. Support partners and groups in a discussion about what agreements they want to make or if it makes sense to have multiple answers.

Once students have an opportunity to explore all of the questions, bring the class together to share their findings. Invite students to share different ways they saw the growth. Encourage them to be skeptics. Share with them that part of being a mathematician is to ask questions and to give clear explanations with reasons.

Once students have shared all the different ways they see the shape growing, ask students to share how many cubes are in the tallest tower and how they know. Move the conversations to students sharing what the n^{th} case would look like and how it would be different depending on how you saw the pattern growing. Have students share and explain how many cubes in the n^{th} case and what it would look like, encourage them to share all of the different representations they used: visual, table, graph, algebraic expression. Discuss the representations shared with the class. Have a conversation about the connections between the different representations of the n^{th} case and the number of cubes in the tallest tower in the n^{th} case. Ask students how their representation relates to the expression for the number of cubes in n^{th} case.

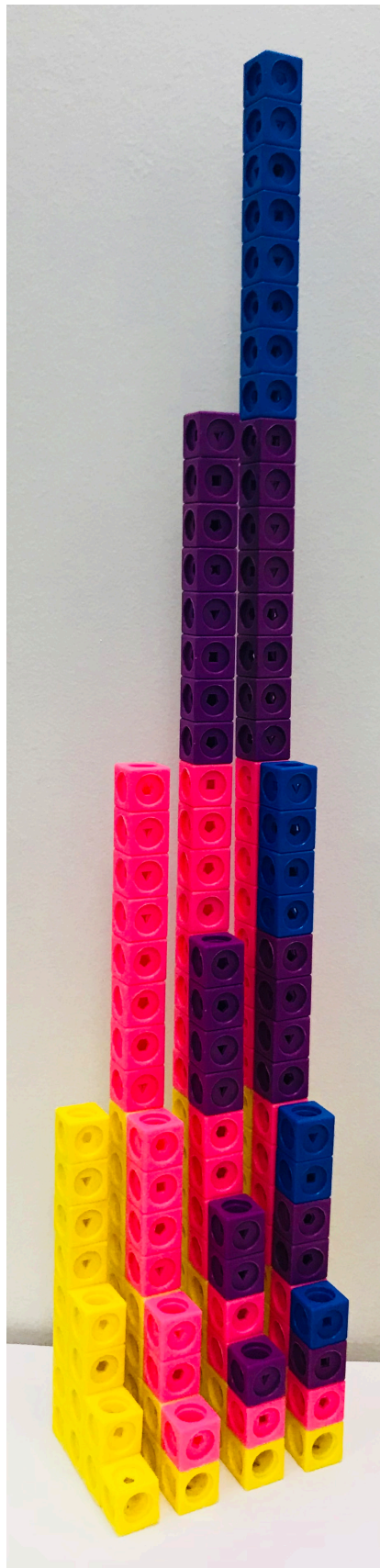
If students see the pattern growing differently there will be different answers for the 100th and n^{th} cases. This creates an opportunity to share the idea with students that there can be different answers to the same problem depending on how you see it. This is common in mathematics and why it is important to be clear about how you see something.

Extension

- Make your own 3-Dimensional growth pattern and describe how it is growing.
- How do you see the different slices of the pattern related to each other?

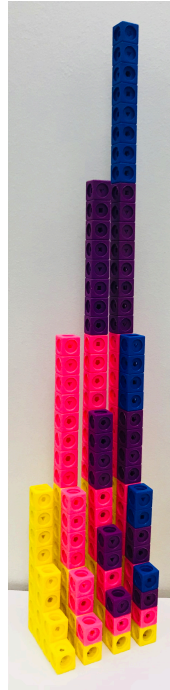
Towers Pattern

Case 5



Towers

Here is case 5 of a tower pattern built using multilink cubes:



Case 5

How do you see this pattern growing? What do you think case 1, 2, 3, and 4 would look like?

Consider the following questions about the tower:

- How many cubes do you think are in the tallest tower in case 5? Why?
- What would your tower in case 100 look like?
- How many cubes do you think are in the tallest tower in case 100? Describe how you know.
- What do you think the n^{th} case looks like?
- How many cubes do you think are in the tallest tower in the n^{th} case?