



Shapes Task

Grades 3-12

Introduction:

This is a rich activity that prompts wonderful discussions between students, allowing them to see pattern growth and develop meaning for it. One class period may not be enough time for this lesson, you may want to spread it out over two lessons. Usually when growing cases are given out, they have the instruction: How many are in the 10th case or 20th case? with no discussion of the different visual ways people see the cases. But when students can share and discuss the different ways they see shapes, they develop meaning and understanding of the functional growth, that doesn't come when students only focus on numbers.

Agenda:

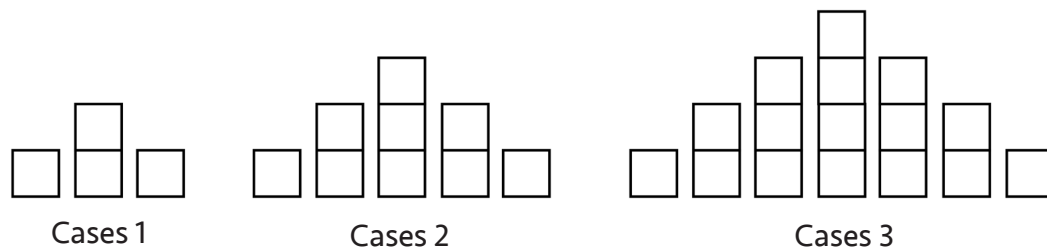
Activity	Time	Description/Prompt	Materials
Growing Shapes	35 min	<ol style="list-style-type: none"> 1. How do you see the shapes growing? Ask students to think alone at first. 2. Ask students to share their methods, drawing them on the board. 3. Name the methods, with the students' name and possibly a method name e.g. the raindrop method. 4. Ask students to find out how their group saw the shapes growing 5. Ask students to think about the 100th case. 6. Ask the students to construct tables and link their numbers and visuals. 7. Ask them to think about how they would describe the generalization in words. 	<ul style="list-style-type: none"> • Paper, pencil/ pen • Colored pencils/ markers • Shapes Task, page 4. One copy per student • Shapes Task for display, page 5. One copy • One page of chart paper per group if you want to have classroom posters • Plastic squares
Group Presentations	10 min	Invite groups to share any patterns or other interesting observation.	



Activity:

This is one of our favorite tasks as it asks students to look at growing cases and describe how they see the shapes growing. Usually students are given growing cases with the question: How many are in the 10th or 20th case? We have found it really helpful to ask a different question first – “How do you see the shapes growing?” “Please don’t think about numbers just the growth of the shape.” This usually prompts eight or nine different ways of seeing the growth of the shapes. Ask students to think of this question on their own before moving to groupwork; if you ask them to start in groups most people will end up seeing it in the ‘same’ way.

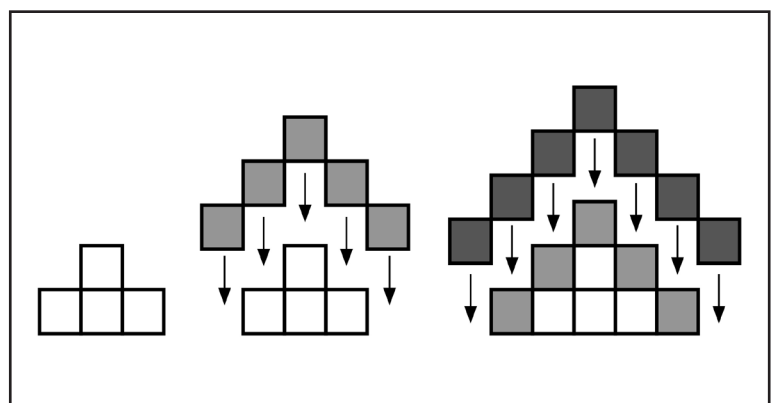
How do you see the shapes growing?



After asking the students: How do you see the shapes growing? Give student some time to think alone. You can find out when people are ready by using a number talk strategy: Ask students to show you a “quiet thumb” when they have had enough time. Putting hands up puts other students under pressure, so a quiet thumb – one held by their chests, not waived in the air, works better.

We have asked many people – teachers, students, and others how they see the shapes grow. This has shown us that there are many different ways of seeing the growth, and people are fascinated to see the different ways.

After you have asked students how they see the shape growing invite different students to the front board to share their ways of seeing with the class. A nice way to do this is to project the shape onto the front board, so that students can draw around it. We always name the different methods, with the students’ name and a name for the method. For example some people see the shape growing as additional squares on the top of each column:



One of our students named this the raindrop method.

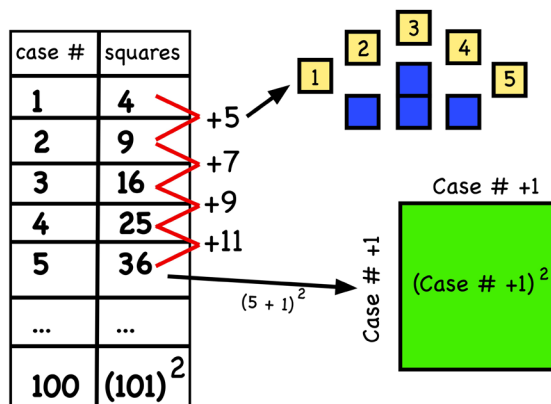


When we used this with 6th graders they saw the shapes grow in 8 different ways. The students were a little unsure about names at first but we helped them with the first ones and they got the hang of it. After we looked at the different ways people saw the shapes we gave students our handout and asked them to talk in their groups, finding out all the ways people saw the shape growing and then showing each method on the handout. You may like students to show one or more methods on a classroom poster.

We then challenged the groups of students to use one of their methods to extend the patterns they found to show what the 10th or 20th case looked like. Students may want to use grid paper to extend the patterns. Encourage students to make a chart of what they have discovered about how the pattern is growing. Students can use colors and labels to show off how the pattern is growing.

After they had thought visually about the 10th or 20th case we asked them to think about numbers, if they hadn't already – how many would the 10th or 20th case have? What would it look like? And how do the numbers relate to the visual solution? Encourage students to connect their numbers to the visuals. Ask them where they see the extra squares in their pictures and in the numbers in the chart they have made.

This task has a low floor and a high ceiling – the low floor means anyone can see how the shape is growing, but it extends to high levels and the function that is represented by the shapes is a quadratic function. The visual on the right is not meant to be shared with the students but is for you as the teacher. We don't expect 4th and 5th grade students to use variables, but we wanted you to see the progression of the content.



As a class, discuss the following questions:

- Did you need to make every case to know what the 10th or 20th case would look like?
- How can you describe what the 10th or 20th case would look like? How did you know?
- What happens to the pattern as you extend it to the 10th or 20th case?
- How did you figure out how many squares would be in the 10th or 20th case?

Extension:

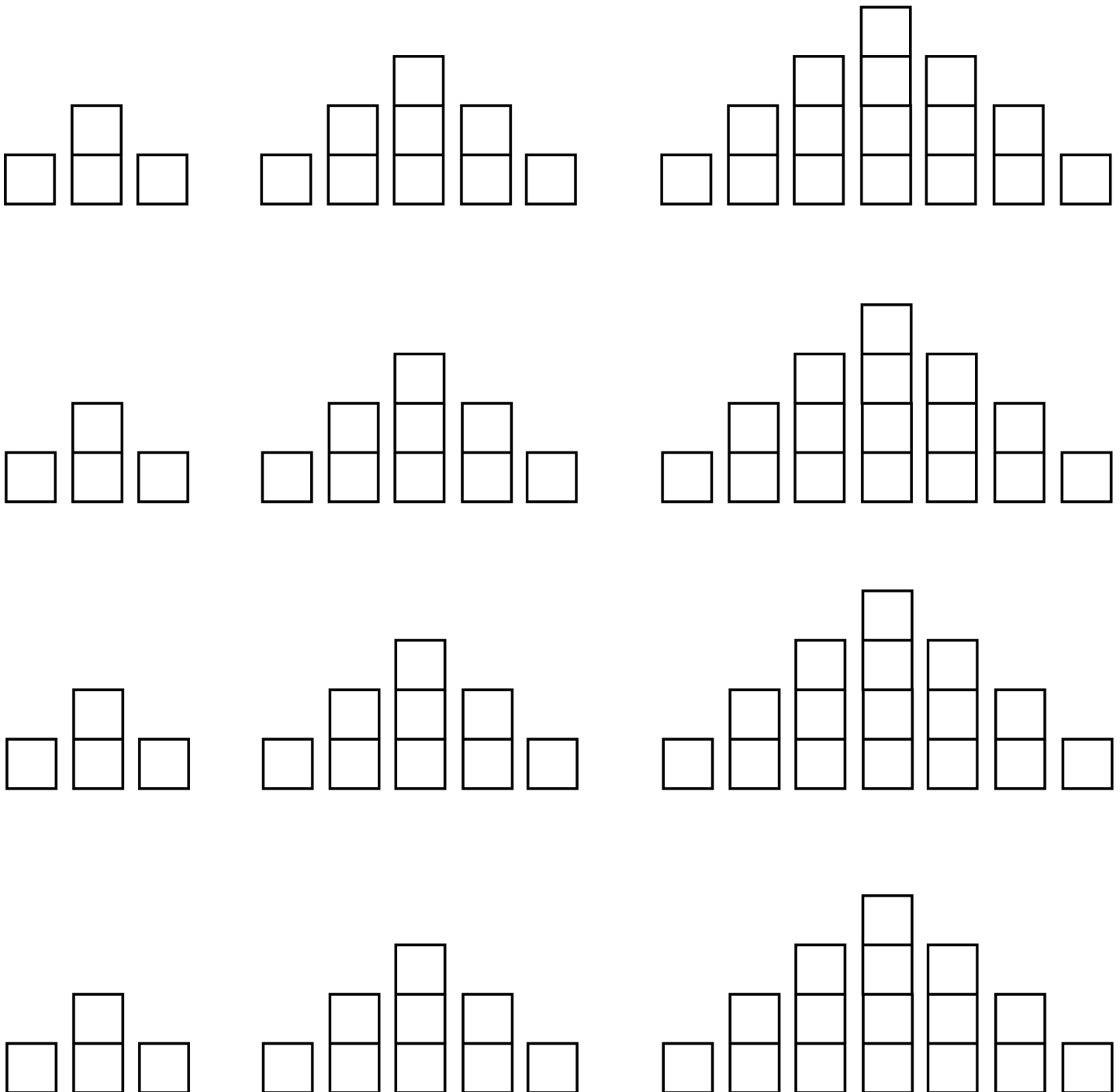
- Which case would have 289 squares?

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