

## **PATTERNS H.O.T. LESSON**

**Grade Level and Course:** 9<sup>th</sup> grade Algebra 1

**Time Frame:** Two class periods or 94 minutes

### **Content Objectives:**

- Students will be able to recognize a pattern after examining Figure 1 thru 4 and generalize this pattern to Figure 100 and beyond.
- Students will be able to model a mathematical situation using an algebraic equation.
- Students will be able to build further on order of operations when examining algebraic expressions and using order of operations to show that the equations are equivalent.
- Students will be able to further build an understanding of the meaning of symbols and a sense of perimeter and a function.

### **Language Objectives:**

- Students will be able to verbally explain how they “saw” the pattern and connect this to algebraic expressions.
- Students will be able to work on explaining their thinking and recording in words the pattern that they recognized along with how many tiles there are in a particular figure.
- Students will be able to verbalize their thinking when discussing how an algebraic expression represents the pattern.

### **Higher Order Thinking:**

- Students will be able to generalize a pattern to other figures.
- Students will be able to connect the algebraic expression to the geometry.
- Students will be able to examine different algebraic expressions and explain how these different expressions are essentially equivalent.

### **Materials:**

- Tiles (algebra tiles or linking cubes)
- Task card (1 per student)
- Markers/colored pencils
- Poster paper
- Calculator (optional)
- Exit Slip

### **DAY 1:**

#### **Begin lesson**

- Introduce students to the prompt. Let them know that they will be working with patterns similar to the problem they completed the day before. Review group norms, group roles, group-questions, and check-points. Make sure students understand what they are responsible for individually and as a group. Also, emphasize that the goal is not to just get the answer, but to be able to explain your thinking.

**Individual Think Time:**

- Give students 10 minutes to complete the first question individually. As this task is demanding, it is important to give students space to think about the Figure and try to create the drawing for Figure 5. Remind students that they should respect other students by staying put and quiet during this individual work time.

**Group-Work:**

- Tell groups approximately how long they have to work on the task.
- Monitor groups as students work and offer positive feedback for group behaviors that are productive.
- Respond when a group has a question. Check to make sure it is a group question before answering!
- Respond when a group raises their hand for at a check point.
- Check Point:
  - Ask one student from the group to explain what Figure 100 looks like. Make sure the student is specific enough. Here, the student can use a diagram or the tiles to show what Figure 100 looks like. Also, ask the student how many tiles there are in Figure 100. Listen for the students to explain what the Figure number tells us about what the Figure looks like and how many tiles there are. For example:
    - How do you know that there are 100 tiles on the bottom and the top of Figure 100?
    - How does knowing that it is Figure 100 help us determine the number of tiles in the figure?
  - Ask a different student to explain what Figure 100 looks like and how many tiles there are using a *second method*.
  - Possible follow-up questions:
    - Ask another student to explain what Figure 200 would look like. How many tiles are there in this figure?
  - When the students in a group can explain to your satisfaction, give them a sticker and place on the Check Point line. Prompt them to complete the next task, which is to display their work and reasoning on a piece of poster paper. Explain to them that everyone should be contributing, not just the person writing.
  - If students cannot explain, say that you'll come back in a few minutes. Let the group talk it over for a bit.
- End group work time and have the groups return their supplies. Also, have student gather their group work and put together to hand in. Tell students that tomorrow, they will get a chance to present their work to the class and share their thinking and reasoning.

**DAY 2:****Whole-Class Debrief:**

- Give each group about 5 minutes to gather their work and discuss their thinking and reasoning. This will allow the students to refresh their memory on what they did the previous day. This will also help students be more comfortable when presenting their work.
- Prior to the presentations, provide students with positive feedback on productive group work the previous day. Think about what you noticed students were doing well in groups? How were they discussing the different ideas? Did members of the group contribute to the work? Also, go over classroom norms on presentations. Ask students how they should act while another group is presenting.
- Each group should get some time to present their work. Not all members of a group must speak, but all must stand together during the presentation. Students may ask questions at the end. While groups are presenting, take note of the different methods that groups came up with. What are some similarities? Differences?
- When all groups have finished presenting, have a class discussion on the different methods that the groups explained. How are these methods different? How are they similar? Also, discuss any algebraic expressions for the patterns that groups developed if they had time. How do the algebraic expressions represent the pattern? If there are more than two algebraic expressions, compare the two. How are they the same? How are they different?
- If no groups were able to come up with any algebraic expressions, write a few of the following on the board and have a discussion on how each of these expressions represents the pattern. Compare two of the expressions. How are they the same? How are they different?
  - $n^2 + 1$
  - $(n + 1)^2 - 2n$
  - $(n^2 - 2) + (n + 1)$
  - $(n - 1)^2 + 2n$
  - $(n + 1)(n - 1) + 2$
- Using order of operations, get students to realize that all of the algebraic expressions were equivalent to each other.

**Closure:**

- Collect all work.
- Hand out the Exit Slips and give students some time to complete these.
- Provide students with positive feedback on their behavior during the presentations and how the groups presented overall.