



**Math Solutions**<sup>®</sup>

FOUNDED BY MARILYN BURNS

# **Solving the Why: Algebra Intervention for Struggling Students**

Le’Vada Gray

NCTM Regional Conference

Session #244

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# Math Solutions

Committed to:

- Making understanding the center of all learning
- Creating classrooms where students are continually asked to think, reason, and make sense of mathematics



# This session will help you:

- strengthen your math content and pedagogical knowledge for the purpose of making algebra accessible for students;
- increase your understanding of how students learn algebra; and
- experience tasks and instructional strategies that promote reasoning, communication and making sense of algebra as described in CCSS Standards and Mathematical Practices.



# Algebra

What do we want students to be able to understand and demonstrate about algebra?



# Algebraic Thinking

Students should be able to:

- Use or set up a mathematical model
- Gather and record data
- Organize data and look for patterns
- Describe and extend patterns
- Generalize findings (often into a rule)
- Use findings/rules to make predictions



“Algebraic thinking encompasses the set of understandings that are needed to interpret the world by translating information or events into the language of mathematics in order to explain and predict phenomena.”

*Ann Lawrence and Charlie Hennessey, Lessons for Algebraic Thinking: Grades 6-8*



# Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.



# Guess My Rule

Starting Value	Using the Rule	Final Value
6		11

For any starting value of “n,” the final value will be

\_\_\_\_\_.



# Guess My Rule

**Play at least one game of “Guess My Rule” with a partner against another pair of partners.**

**As you play:**

- think about your strategies
- think about the ways in which you are communicating your algebraic thinking



# Processing the Game

- What do you like about this game?
- How will students use/demonstrate algebraic thinking during this game?
- What CCSS mathematical practices were demonstrated as you played this game?



# Math Talk Formats

Whole Group

Small group

Partners



# Piles of Tiles



# Standards for Mathematical Content (CCSS)

## Expressions and Equations

- Students apply and extend previous understandings of arithmetic to algebraic expressions.
- Students solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- Students understand the connections between proportional relationships, lines, and linear equations.



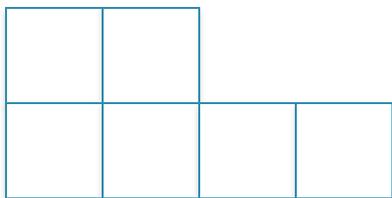
# Standards for Mathematical Content (CCSS)

## High School: Algebra

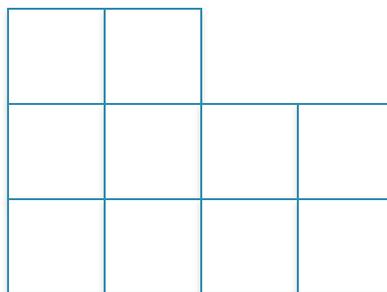
- Students understand solving equations as a process of reasoning and explain the reasoning.
- Students create equations that describe numbers or relationships.

# The First 3 Stages of a Growing Pattern

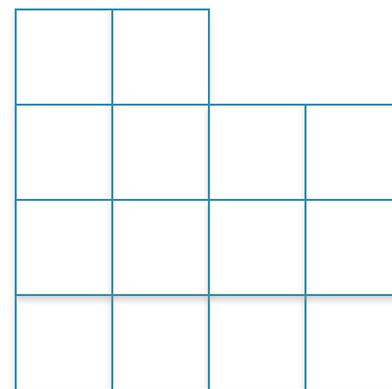
**Stage 1**



**Stage 2**

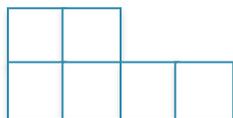


**Stage 3**

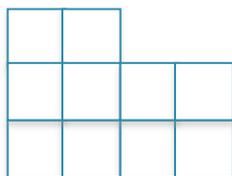


# The First 5 Stages of a Growing Pattern

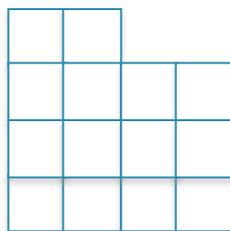
Stage 1



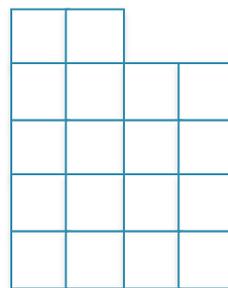
Stage 2



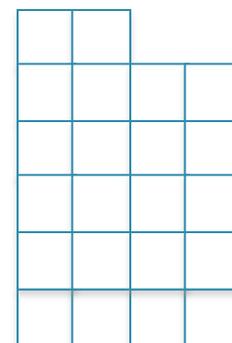
Stage 3



Stage 4



Stage 5





<b>Stage</b>	<b>What I See</b>	<b>Total # of Tiles</b>



# Piles of Tiles Task

## Task:

- On your own first, determine how you see the growth pattern. Find the number of tiles in Stage 10, 25 or 100. Record your thinking in an expanded T-chart.
- Share your thinking with a partner.
- Record your partner's way of seeing the growth pattern and make an appropriate expanded t-chart for this interpretation.
- With your partner, write the rule using words and an equation to match your t-chart.



# Making Connections Explicit

1. In what ways do you see the tiles growing?
2. In what ways do you see the tiles remaining the same?



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## Big Ideas About Algebraic Thinking

- There is often more than one way to interpret a pattern.
- It is important to honor each student's interpretation of a pattern.
- There are tools to help students organize, record, and find patterns in their thinking
- Finding an explicit rule for a pattern opens the door for students to the power of algebra to generalize and predict.



# Types of Rules

**Iterative** – a rule that can be used to find the value of any stage of a pattern by using the value of the previous stage

**Example: Add 2 to the previous stage**

**Explicit** – a rule that can be used to find the value of any stage of a pattern without knowing the values of the previous stage

**Example: Add 2 to four times the stage number**



# Processing

- Why is it important to look for multiple ways to describe a pattern?
- What specific elements of algebraic thinking are addressed in this lesson?



# Final Processing

- In what ways did you add to your knowledge of mathematical/pedagogical content about algebra?
- Based on your experiences today, what do you understand about how students learn algebra?
- What instructional strategies did we use today that will support students' understanding of algebra?



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**Thank You!**

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