Patterns, Squares and Circles and Algebraic Expressions
Haehl—Introductory Algebra

I had my students do this activity the third day in Introductory Algebra. The first day students had done an activity about constants and variables that also had a similar pattern recognition activity (attached at the end of this activity). In the first activity, we had a follow-up discussion with the entire class and discussed which terms ended up as variable patterns and which were constant. In this activity, each group had a slightly different pattern. I gave each group a transparency to report about their particular activity and graded each group with the rubric below.

The concepts/skills/notation that surfaced from the activity and follow-up discussion:

- Correct use of the words "variable" and "constant"
- Learning how to write "$n \times n$" as n^2
- Reinforcement of what a term is.
- What are "like terms?"
- What is a coefficient?
- How do you substitute a value into a formula?
- You can't use the same variable to represent two different concepts—"n is the card number, so it cannot represent the total circles and square on a card."

This activity can be expanded to Intermediate or College Algebra by introducing function notation, dependent and independent variable, graphing and list features of a graphing calculator, talking about sequences, have more complicated patterns (decreasing patterns, exponential) and by having students come up with at least 2 patterns established by the 3-card sequence.

Student groups get the following grading sheet before they start the activity and I graded the activity while students did the presentation.

Grading Rubric

	Excellent	**Good**	**Satisfactory**
Explanations are clear, writing is easy to read, and correct mathematical language is used.	3	2	1
Presenter communicates with the class and makes eye contact.	3	2	1
Everyone participates and contributes.	3	2	1
Total Points:			

Comment below or on the back about how your group worked together. (It is possible that an individual who did not participate or was out of the room for a substantial part of the discussion will receive reduced points.)

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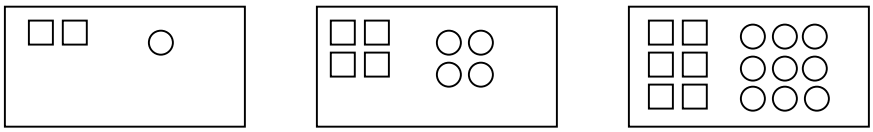
Group 1: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



1. If the first three cards numbered 1, 2, and 3, have the following number of squares and circles on the respective cards, fill in the table below to show how many circles and squares would be on the next cards in the sequence.

Card Number	Number of Squares	Number of Circles	Total Squares and Circles
1			
2			
3			
4			
5			
6			

2. Using the variable, n, to write a mathematical formula to show how many total circles and squares would be on the nth card.

3. Show how to substitute into the formula above to determine how many circles and squares would be on the 1000^{th} card.

4. Fill in the information on the transparency provided and present your problem to the class.

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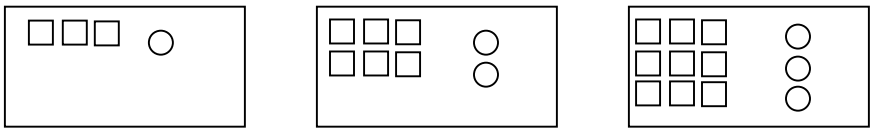
Group 2: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



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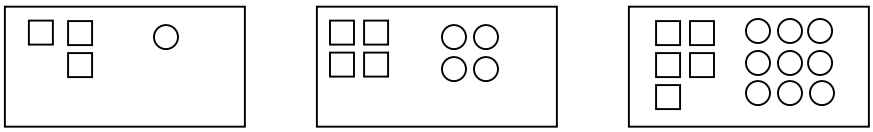
Group 3: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



1. If the first three cards numbered 1, 2, and 3, have the following number of squares and circles on the respective cards, fill in the table below to show how many circles and squares would be on the next cards in the sequence.

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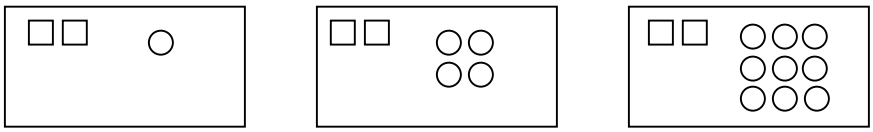
Group 4: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



1. If the first three cards numbered 1, 2, and 3, have the following number of squares and circles on the respective cards, fill in the table below to show how many circles and squares would be on the next cards in the sequence.

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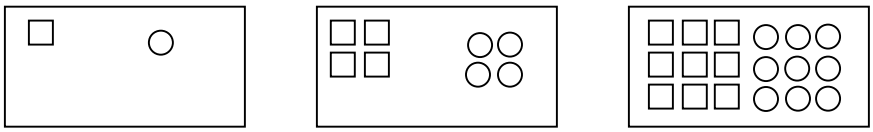
Group 5: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



1. If the first three cards numbered 1, 2, and 3, have the following number of squares and circles on the respective cards, fill in the table below to show how many circles and squares would be on the next cards in the sequence.

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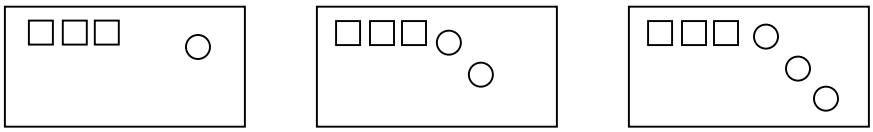
Group 6: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



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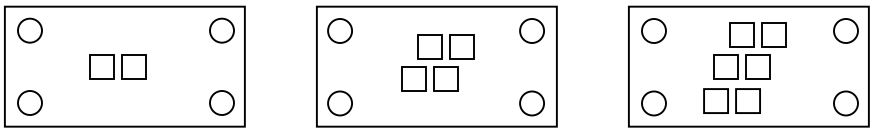
Group 7: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



1. If the first three cards numbered 1, 2, and 3, have the following number of squares and circles on the respective cards, fill in the table below to show how many circles and squares would be on the next cards in the sequence.

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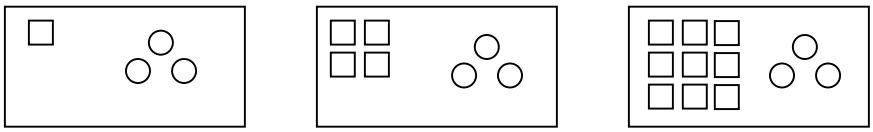
Group 8: Cards 1, 2, and 3 have the number of squares and circles as shown below.

Card 1 Card 2 Card 3



1. If the first three cards numbered 1, 2, and 3, have the following number of squares and circles on the respective cards, fill in the table below to show how many circles and squares would be on the next cards in the sequence.

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What is a Variable, What is a Constant?
Martha Haehl
Introductory Algebra

1. What does the words "variable" mean to you outside of a math class? Describe a way the word, variable, might be used in a newscast or newspaper, a magazine, or in everyday conversation.

2. What does the words "constant" mean to you outside of a math class? Describe a way the word, constant, might be used in a newscast or newspaper, a magazine, or in everyday conversation.

3. Describe what the word, variable, means to you in mathematics.

4. Describe what the word, constant, means to you in mathematics.

Pattern Recognition, Constants and Variables
Martha Haehl, Introductory Algebra

Scenario: Three creators—Jebula, Maliba, and Noble—of planet *Outthere* decided to spiff up the globe by laying 3 colors of tile in various patterns on the surface. Each creator chose her favorite color and devised her own scheme for laying the tiles. On the 1st three days the creators laid tiles as shown in the table below. (The tiles were slightly curved so that they fit on the curved surface of *Outthere*.)

	Jebula (Red)	Maliba (Purple)	Noble (Green)
Day 1	1 tile	1 tile	1 tile
Day 2	1 tile	2 tiles	2×2 square of tiles
Day 3	1 tile	3 tiles	3×3 square of tiles

1. Following a pattern implied in the table, how many tiles of each color were laid on the 3rd, 4th, 5th, 6th, 7th, 8th, 9th, and10th days, 19^{th} day, 108^{th} day, 1095^{th} day? How many total tiles were laid for each day?

	Red	Purple	Green	Total Tiles
Day 3				
Day 4				
Day 5				
Day 6				
Day 7				
Day 8				
Day 9				
Day 10				
Day 19				
Day 108				
Day 1095				

2. In words, explain to someone how he or she would calculate how many tiles of each color and the total number of tiles that would be laid in one day—without knowing in advance which day it is (the 1^{st}, 2^{nd}, 99^{th}, for example).

3. Use your description from Question 2 to write a formula to calculate the total number of tiles that would be laid on the *n*th day. Identify the constant and variable terms in your formula.

   Total number of tiles laid on *n*th day: _____
   (formula)

4. For each creator, describe whether you would categorize the number of tiles laid each day as "constant" or "variable." Explain how you made the determination.

	Constant? Variable?	Explanation
Jebula (Red)		
Maliba (Purple)		
Noble (Green)		