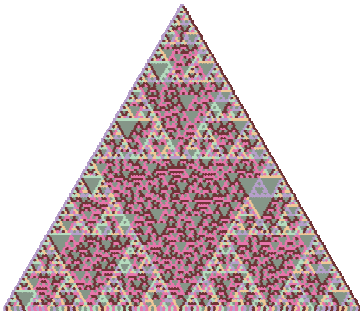
Number Sense/Algebra/ Geometry Institute Summer 2010

Lesson Plan 1: Pascal's Triangle

Faculty Name: Rachel Allhands

School: Kirkpatrick Elementary

Grade Level: 4th



Teaching Objective:

Mississippi Mathematics Frameworks: 4th Grade: Objective 2A: Analyze a given numeric pattern and generate a new one. Institute framework: The student will understand, represent, and analyze patterns, relations, and functions

Instructional Activities:

- The teacher will ask students to explain what a pattern is.

- TTW explain to students that patterns are seen every day. Give students a few basic examples on transparency of patterns and ask the students to identity the rule and extend them:
  - **85 , 96 , 107 , 118 , 129 , 140 , 151 , 162, ____**
  - **60 , 63 , 66 , 69 , 72 , 75 , 78 , 81, ____**
  - **114 , 104 , 94 , 84 , 74 , 64 , 54 , 44, ____**

- Give students a few examples of more complicated patterns:
  - **0, 1, 1, 2, 3, 5, 8, 13, 21, 34, _____**
  - **1, 8, 27, 64, 125, 216, 343, 512, 729, _____**

- Show students an outline of Pascal's Triangle with only the ones filled in (Attachment 1). TTW explain that each number on the triangle is called an element, and that the rows of elements can be added to find a sum for that row. Also explain that each new element is formed by adding the two elements directly above it. Give each student a copy of the triangle with only the outside ones. Explain to students that since they know the rule of the triangle, they should be able to figure out the numbers without ever having seen Pascal's Triangle. Have students try to fill in the first few rows of elements. Have students discuss what the triangle looks like and how it is made using number patterns and predictions.

- Show students a transparency that contains sections of Pascal's Triangle (Attachment 2). TTW cover a few of the numbers with 2 color counters. Have the students figure out the covered elements.

- TSW be allowed to work with a partner. Give each partner group a foam sheet with sections of Pascal's Triangle on each. Next, give all students foam pieces with missing pieces of the sections. The students must work with their partner to fill in the missing pieces of the section of the triangle. Allow the students about 7 minutes to fill in the missing numbers. After they have completed their missing numbers, go over the answers together by having the students come up and fill in the answers on transparency.

- TTW explain that now we will look at a pattern that is a little bit more complicated. Give each partner group a copy of the first 12 rows in Pascal's Triangle (Attachment 3) and a blank copy of the flower shapes (Attachment 7). Have students choose a group of 7 numbers that make a flower shape and write their numbers in the flower shape. Have the students color the center hexagon gray. Have the students use two colors to alternate for the outside hexagons. TSW complete a worksheet (Attachment 4) that identifies the product of all hexagons colored one shade and all hexagons colored the 2^{nd} shade. Ask students, "What is the similarity between the two?" TSW also write the prime factorization of all the hexagons in one shade and all hexagons in the 2^{nd} shade. TSW write an explanation of their summary. (Example with key included as attachment 5 and 6)

- TTW ask students if they chose a different 7 elements in another section to work with, would the results be the same. Discuss why or why not.

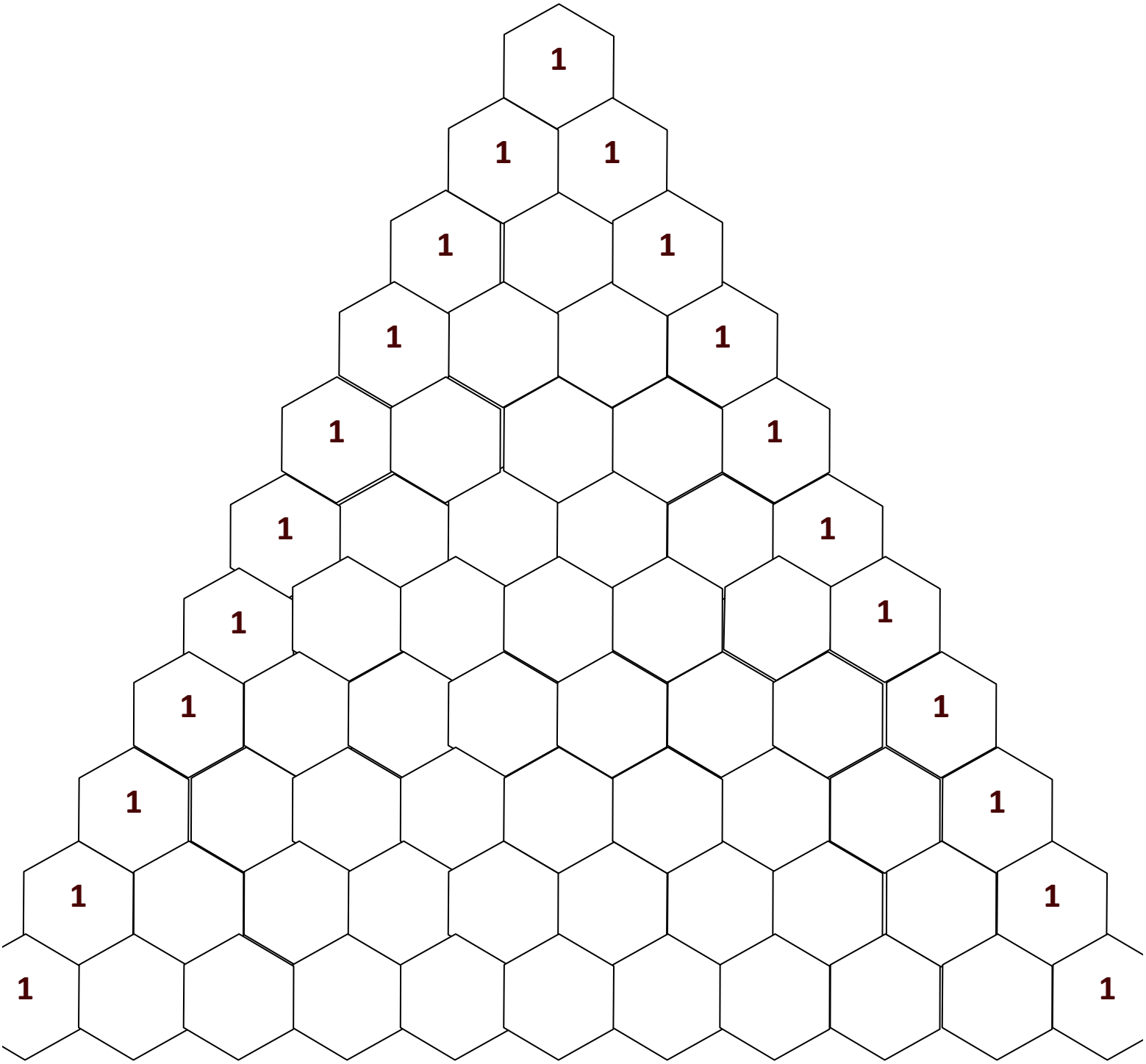
Materials and Resources:

- Teacher created worksheets (Attachments 1, 3, 4, 5, 6, 7, and 8)
- Teacher created transparencies (Attachment 1, 2, 3, 7)
- Crayons
- http://mathforum.org/workshops/usi/pascal/petals_pascal_answers.html

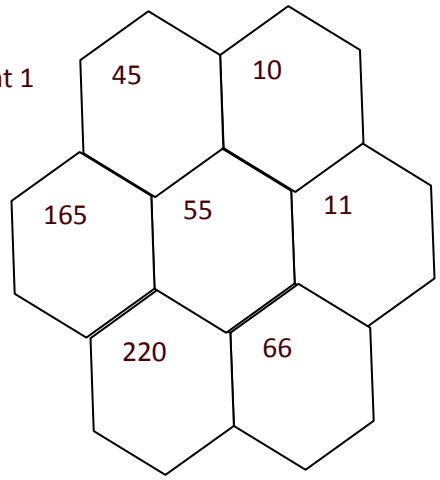
Assessment:

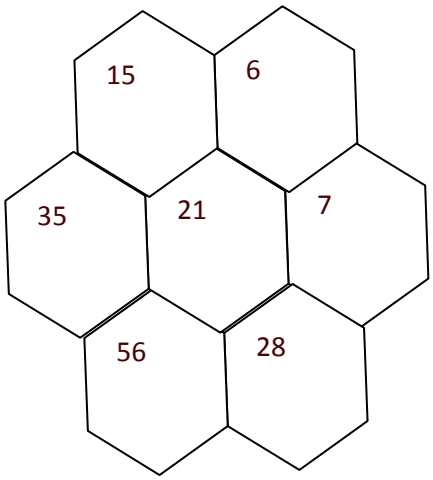
- Observe to make sure all students are working correctly. Visually check to make sure that the foam pieces are in order. TTW keep a checklist (attachment 8) as to whether the students got correct answers.

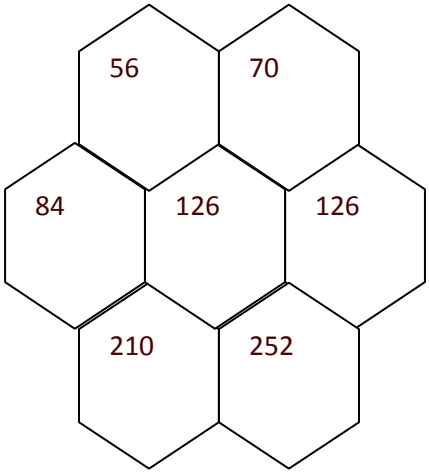
DISCOVERING PATTERNS

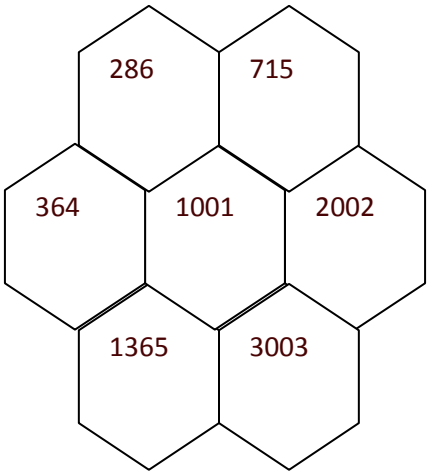


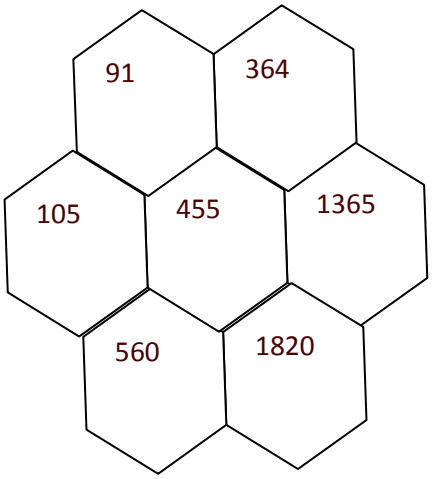
Attachment 1

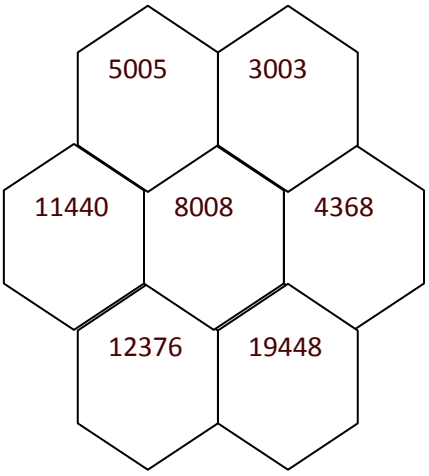


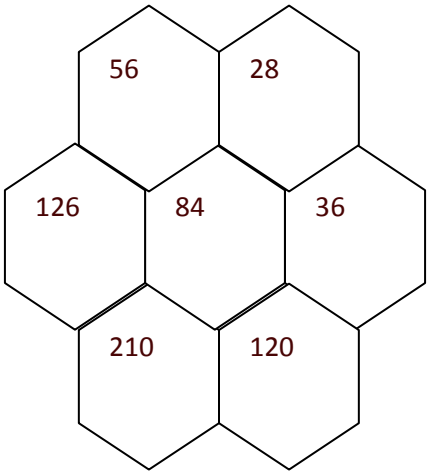






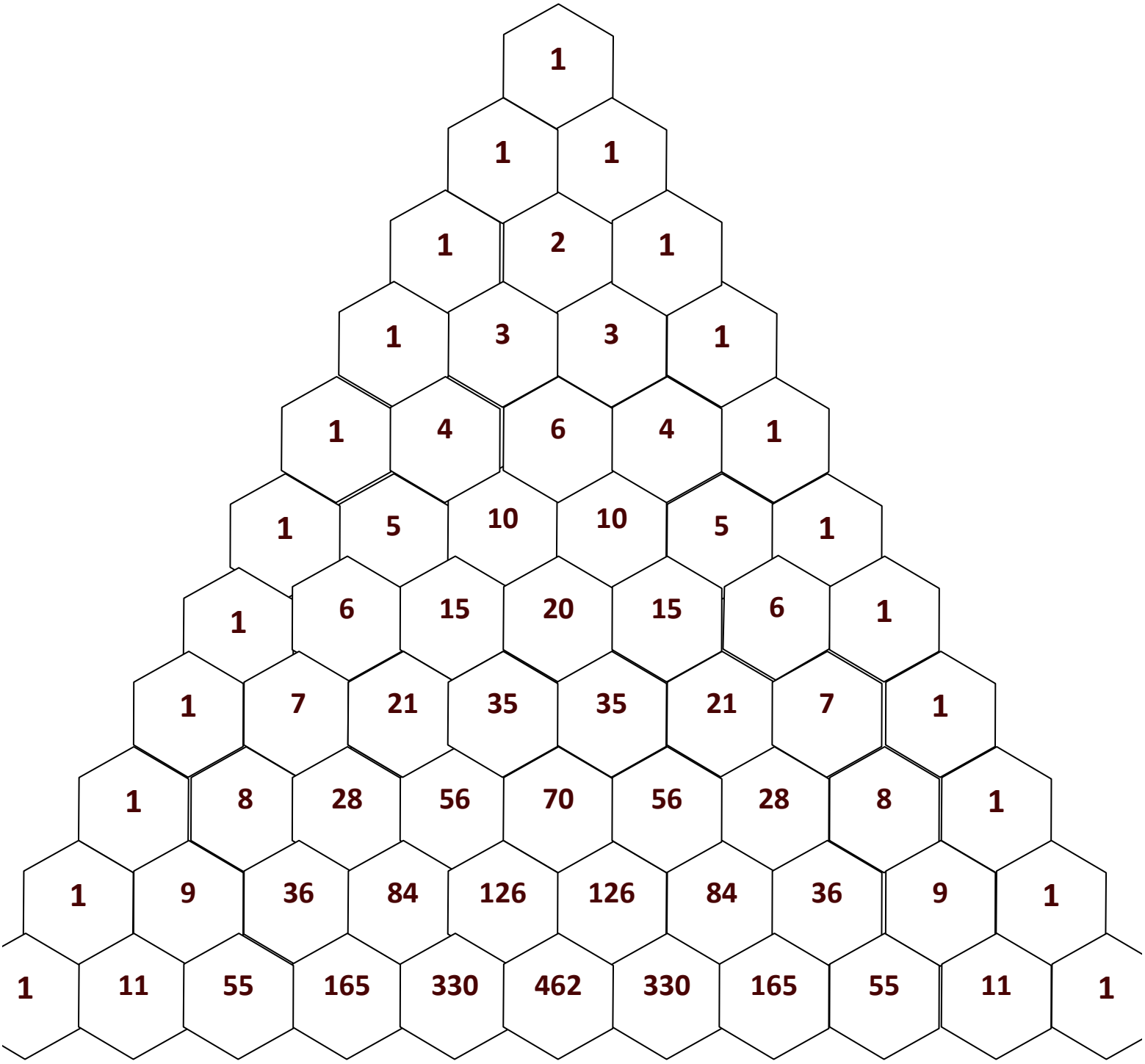






Attachment 2

DISCOVERING PATTERNS



Attachment 3

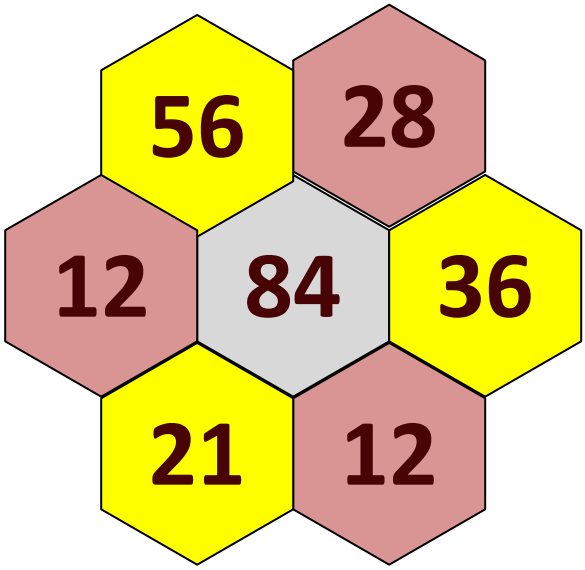
Discovering Patterns

Directions: Choose a group of 7 hexagons that form a "flower" shape. Color the middle circle gray. Choose 2 colors for the outside hexagons. Alternate with your two colors so that three hexagons are one color and the other 3 are a different color.

1. What is the product of the three numbers in your first color?
   _____ x _____ x _____ = _____
2. What is the product of the three numbers in the second color?
   _____ x _____ x _____ = _____
3. What do you notice about the two products:
   _____
4. Write the prime factorization of the 3 numbers in your first color:
   _____, _____, _____
5. Write the prime factorization of the 3 numbers in your second color: _____, _____, _____
6. Compare the prime factorization of the two sets of numbers. Write an explanation of your discovery.
   _____
   _____
   _____
   _____
   _____

Attachment 4

Provided by The Math Forum - http://forum.swarthmore.edu



Attachment 5

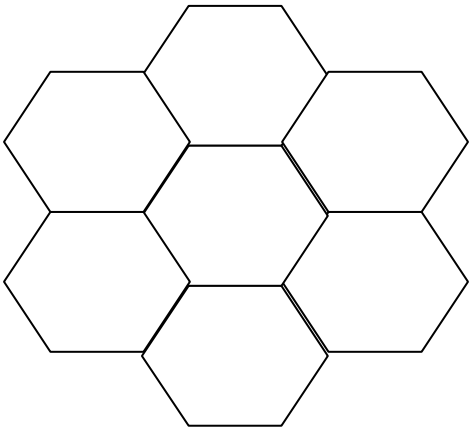
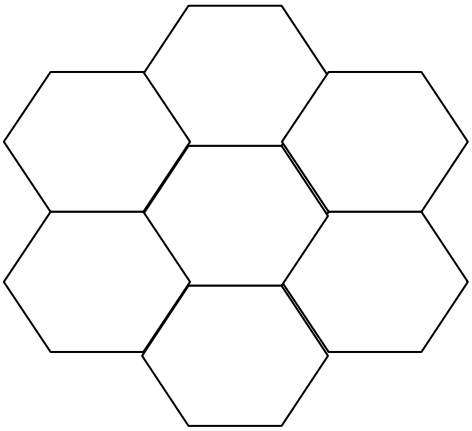
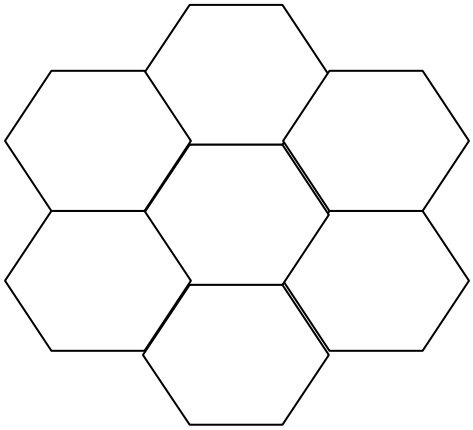
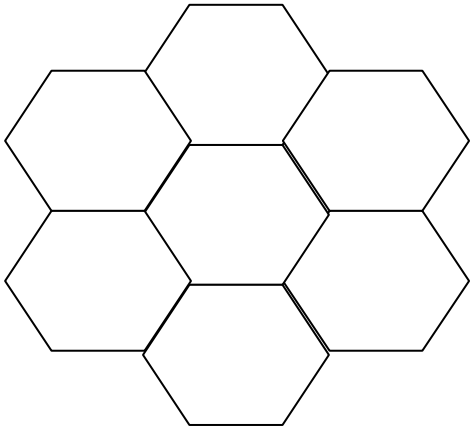
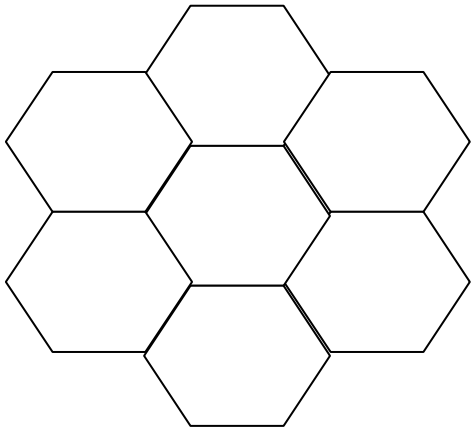
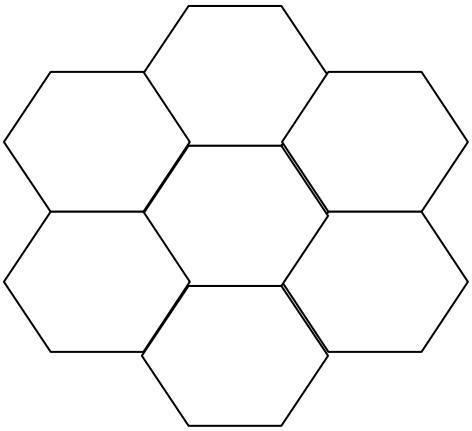
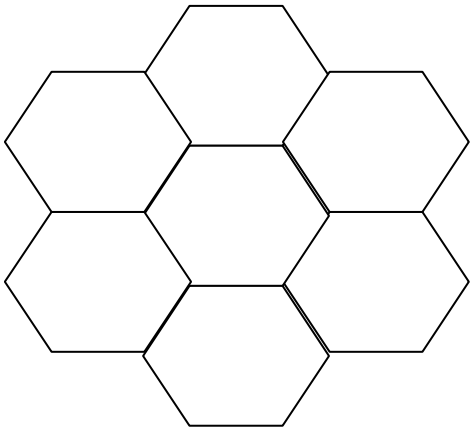
Discovering Patterns

Directions: Choose a group of 7 hexagons that form a "flower" shape. Color the middle circle gray. Choose 2 colors for the outside hexagons. Alternate with your two colors so that three hexagons are one color and the other 3 are a different color.

1. What is the product of the three numbers in your first color?
   28 x 120 x 126 = 423,360
2. What is the product of the three numbers in the second color?
   56 x 36 x 210 = 23,360
3. What do you notice about the two products: They are the same.
4. Write the prime factorization of the 3 numbers in your first color:
   2 x 2 x 7, 2 x 2 x 2 x 3 x 5, 2 x 3 x 3 x 7
5. Write the prime factorization of the 3 numbers in your second color: 2 x 2 x 2 x 7, 2 x 2 x 3 x 3, 2 x 3 x 5 x 7
6. Compare the prime factorization of the two sets of numbers. Write an explanation of your discovery. They have the same number of 2's, the same number of 3's, the same number of 5's, and the same number of 7's.

Attachment 6 (Key for example in attachment 5- Answers will vary)

Provided by The Math Forum - http://forum.swarthmore.edu

Attachment 7

Student Name	Understanding of Triangle (5)	Can Extend Numbers in Triangle (5)	Correct Prime Factorization (5)	Participation (5)	Total

Attachment 8