

## Pattern Play

### Brief Overview:

Patterns can be identified by using given elements, and then can be represented or extended. Pattern blocks are designed to help students create and describe patterns. Overhead projector sets of pattern-block shapes are useful for demonstrating designs for the whole class to see. Learning how and when to look for a pattern can help you solve problems. A growing pattern involves the progression from one step to the next. Each new step is related to the previous step as defined by the pattern. The overall pattern should be discussed in two important ways:

### NCTM Content Standard/National Science Education Standard:

**Standard: Algebra: Understand patterns, relations, and functions**

#### **Expectation:**

- Describe, extend, and create non-numeric growing or repeating patterns.
- Represent and analyze growing patterns using symbols, shapes, designs or pictures

### Grade/Level:

**Grades 3-4**

### Duration/Length:

**3 days (90 minutes each day)**

### Student Outcomes:

#### **Students will:**

- Be able to show at least 3 levels but no more than 5 levels of a given pattern.
- Apply a strategy by drawing a picture.
- Review simple addition and subtraction patterns.

- **Determine whether a given relation is a function, and**
- **Calculate functional values for a given function**

Materials and Resources:

- **Snap Cubes**
- **Color Tiles**
- **Attribute Blocks**
- **Fraction Triangles**
- **Maracas**
- **Small drum**
- **Number Generators/Dice**
- **Counters (clear)**
- **Hundred Chart**
- **Calculator (class set)**
- **Crayons**
- **Index cards**
- **Chess Board**

Development/Procedures:

Lesson 1

Pre-Assessment

- **Use classroom objects to help students understand the word pattern.**
- **Point to things in the room, such as floor tiles, a row of windows, or a patterned border around a bulletin board. As you identify repeating patterns, say: *This is a pattern.***
- **Show other objects to students and have them respond with, "This is a pattern," or "This is *not* a pattern."**
- **Model an ABC pattern using sound or motion, such as clap, stomp, kick (repeated many times). Explain that you are making a pattern by doing the same thing over and over. Ask students to identify the core, or what is being repeated. (Clap, Stomp, Kick)**

- **Model an AB pattern, such as snap and hop (repeated many times). Ask students to identify the core, or what is being repeated. (snap and hop)**
- **Invite students to make their own patterns or use instruments to make up sound patterns. Have them identify the core in each pattern.**

Launch- Why Mosquitoes Buzz in People's Ears by Verna Aardema, Illustrated by Leo and Diana Dillon

- **Read the book with the class.**
- **While reading the selection, discuss the patterns that you see forming.**
- **Periodically stop while reading the selection to identify the core pattern.**
- **Discuss scenarios where students may see/use patterns i.e.: animals (leopards-spots, zebras-stripes, birds/butterflies-wings)**

This Caldecott award winning African tale uses the cumulative format. It's a pour quoi tale or myth, telling how some natural phenomena came to be. In this case it's why mosquitoes buzz in people's ears. According to this tale, it happened this way: a mosquito said something foolish to the iguana that put sticks in his ears so that he would hear no more foolishness. This frightened the next animal that saw the iguana and so went the chain of action and panic until a monkey inadvertently killed an owlet that caused the mother owl to mourn and neglect her duties of waking the sun. When the animals finally figured out the tragedy, they blamed the mosquito and were furious with him. That's why mosquitoes buzz in people's ears. They are asking if everyone is still angry with them.

Teacher Facilitation

- **Record the following scenario on the overhead projector "Creating a New Calendar". Mr. Tucker is making a new calendar. He started a pattern to place around the calendar's border. His pattern started this way: triangle, triangle, square, diamond, triangle, triangle, square, diamond. He asked his class to think about the next four shapes in the pattern. If Mr. Tucker continued this pattern what would be the next four shapes?**

- Say: We can use letters for shapes in the pattern. A can represent triangle, B can represent square, and C will represent a diamond. Have students make an AABC pattern using their blocks and label the blocks with the correct letters.
- Give other patterns, such as AABB or ABBA, for additional independent practice. Have students work in pairs (preferably those that are on different math levels) to build and label the patterns.
- Students should then take turns making their own geometric shape patterns.

### Student Application



1. Say: Use the cubes to show Step 1.

What do you add to Step 1 to get to Step 2? (Answer: two cubes)

What do you add to Step 2 to get to Step 3? (Answer: two cubes)

What would you add to Step 3 to get Step 4? (Answer: two cubes)

How many cubes do you add each time? (Answer: two cubes)

How many cubes would be in Step 1? Step 2? Step 3? Step 4? Step 5?

Complete the table below for each step. Some have been done for you.

Step Number	Step 1	Step 2	Step 3	Step 4	Step 5
Number of Tiles	1	3	5		

Growing patterns may have a position component, as well as a numeric component. In the following example, the number of triangles increases by one from one step to the next step. Each triangle added in the new step is a horizontal flip of the previous triangle.



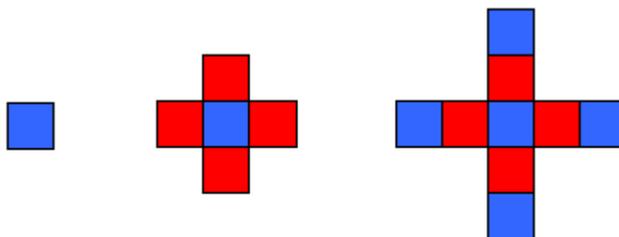
**If the pattern continues what would be the next step?**

**How many triangles are in the next step?**

**What will the next step look like?**

Step Number	Step 1	Step 2	Step 3	Step 4	Step 5
Number of Tiles	1	2	3		

Discuss growing patterns and how they may expand from the center of the representation rather than from adding on to the end of the previous representation. In the following example they may also include alternating colors.



Step 1

Step 2

Step 3

**(Step 1- Blue)**

**(Step 2- Four outside cubes are red and the cube in the middle is blue)**

**(Step 3- The four outer cubes are blue, the next four are red and the middle cube is blue)**

- Use color tiles to show Step 1.
- What do you add to Step 1 to get Step 2? (Answer: four red tiles)
- What do you add to Step 2 to get Step 3? (Answer: four blue tiles)
- What would you add to Step 3 to get Step 4? (Answer: four red tiles)
- How many tiles do you add each time? (Answer: four tiles-color will vary)
- How many would be in Step 1? Step 2? Step 3? Step 4? Step 5?

Complete the table below. Some have already been done for you.

Step Number	Step 1	Step 2	Step 3	Step 4	Step 5
Number of Tiles	1	5	9		

Mr. Williams is having the class play a game with Snap cubes. Each pair makes a pattern that is four shapes long, and repeats it four times. Then the students write a list of directions on how to re-create the pattern. What type of pattern was made with the Snap Cubes?

Introduce the problem. Have the students do the activity to solve the problem.

Distribute Snap Cubes, paper, and pencils to pairs of students.

1. Have one student in the pair make a shape pattern that is four blocks long. Then have his/her partner repeat the pattern with cubes and twice more on their papers. Ask: What shapes are repeated? What order are they in?
2. Have students identify the original part of the pattern (core) that repeats and trace it with their finger. Ask: Is the

original part of your pattern repeated exactly? Are the shapes in the same order every time the pattern repeats?

Direct the student pairs to work as a group to write the directions on how to form their pattern.

3. Have groups exchange directions with one another and then work to recreate the new pattern with their blocks and model in their journal.
- \*4. Students may have difficulty recognizing a pattern composed of more than two shapes. Suggest that a student use string or yarn to circle what they think is the core of the pattern.

### How Do Patterns Grow?

Step 1:

Using manipulatives such as snap cubes, model a growing pattern such as the one shown below. Have students use snap cubes to copy the growing pattern.



(Above pattern is red, blue, red, blue, blue, red, blue, blue, blue)

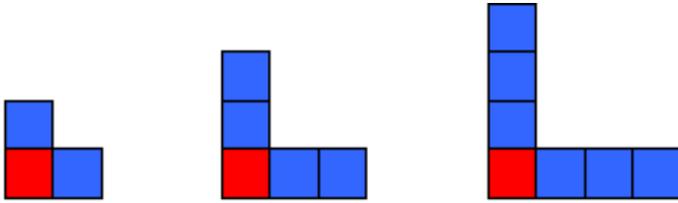
Have students expand the pattern to the next level.

Class discussion: Ask Students

- How many red cubes are in the next stage?
- How many blue cubes are in the next stage?
- What does the next level look like?
- How many total cubes are in the next stage?
- Describe the pattern. Tell about the number of red cubes and the number of blue cubes in each stage. Tell about the total number of cubes in each stage.

## Step 2: Say

Now model the following growing pattern and have students copy it.



(On all above patterns the red cube is in the lower left vertex of the set and all other cubes are blue)

\* The above sample is a modification for Special Population Students

### Class discussion:

- How is this growing pattern like the previous one?  
(Answer: red and blue cubes, each time the number increases)
- How is this growing pattern different from the previous one?  
(Answer: The first growing pattern only increased numerically and expanded at one end, while this one also increases numerically and expanded at one end, while this one also increased numerically and expands in two places.)
- How many red cubes are in the next level?
- How many blue cubes are in the next level?
- What would the next level look like?

Let's keep a count of the cubes in a chart for levels 1-4. The first level has been done for you.

Level	1	2	3	4	5	6	7
Number of Red Cubes	1						
Number of Blue Cubes	2						
Total Number of Cubes	3						

- Describe number patterns in the chart.

- Use your pattern to predict the number of red cubes in levels 5, 6 and 7.
  - Use your pattern to predict the number of blue cubes in levels 5, 6 and 7.
6. With students, reread the problem. Have students extend the pattern by drawing a picture to figure out how many cubes would have been in the fifth, sixth and seventh section (s). Then have students write to explain how they draw their conclusions.

### Embedded Assessment

See Appendix A- Teacher Resource 1

### Reteaching/Extension

1. Have students use the green triangles from Pattern Blocks (or the paper triangle provided on page 39) to make the following pattern.
2. Ask students to predict how many green triangles it will take to make the next larger triangle of the same shape. Continue the pattern.
3. In the table on the recording sheet, have students draw each triangle and then record the number of blocks it took to make it (its area in green triangles).
4. Have students investigate the patterns in their tables, use the calculator to predict the area of the 95<sup>th</sup> triangle, and write their predictions on the recording sheet.
5. Have students choose a different Pattern Block (such as the blue rhombus) and perform the same investigation.
6. Ask students to compare the patterns generated by the different shapes and write about their discoveries.

See Appendix A-Teacher Resource 2

## Lesson 2

### Pre-Assessment

Distribute a copy of Student Resource 1 to each student. Students should provide the next term in the pattern,

### *Launch*

- Demonstrate on a hundred chart how to skip count by 2, 5, and 10. Mark the pattern using counters.
- Each partner takes a turn using counters to mark a 2, 5, and 10 pattern on a hundred chart. The other student guesses the pattern.
- The partners read the numbers in the pattern while uncovering the numbers.
- Students can skip count by 2, 5, and 10 with calculators. Partners take turns starting with zero and continuing to press + and the number to make the pattern.
- As the student with the calculator calls out a number, the partner colors that number on the hundred chart.
- Have students use calculators to recheck the number patterns on the hundred chart.

### Teacher Facilitation

Distribute pre-assorted sets of attribute blocks. Post the following numbers on the overhead or board: Using the attribute blocks to represent (2, 4, 6, 8, 10). What is the pattern? (Add 2) Say: There are different ways to describe this pattern. Ask: How could you describe this pattern with numbers? (Each group has 2 more pattern blocks than the previous group)

- Ask: What is the rule for this pattern? (Add 2 to each group) Say: Supposed the pattern was reversed and started with 16, then 14, then 12, and so on. Ask: Would the rule be the same or different? How can you tell? Students should see that the rule is subtracting 2. Discuss the difference between growing patterns and decreasing patterns.

- Say: Explain how you would use the “add 2” rule to predict the next three numbers in the pattern.

### Solve It

Re-read the problem with students then have them extend the patterns by drawing a picture to determine the core pattern the teacher would have in the tenth section. Then have students write to explain how they drew their conclusions.

- Have students work in pairs. Ask one student in a pair to create a growing or decreasing pattern using stacks of one color of color tiles. Then have his or her partner describe the rule and extend the pattern five terms.
- Give students a pattern such as the sequence 2, 3, 5, 9, 17 (double the number and subtract 1). Have them show the pattern with Snap Cubes, find the rule and extend the pattern.
  1. While students remain in their seats, go to each group and give them the same number of circles. Give each group a calculator, a piece of paper and pencil.
  2. Instruct one student from each group to transcribe the number of Tiles/Cubes and state the pattern.
  3. Have students try to following problems independently.
    - a) Identify the next three numbers in the pattern below.

30, 29, 27, 24, \_\_\_\_, \_\_\_\_, \_\_\_\_

- A. 20, 15, 9                      B. 15, 9, 2                      C. 15, 10, 5  
 D. 24, 27, 29

### Student Application

1. Ask students to create a pattern 3, 6, 9...with tiles/cubes. The teacher may wish to draw a pattern on the board to show students how to arrange their tiles/cubes.

2. Have students describe the pattern to their groups. Ask: What is the rule for this pattern? Students should recognize that each group of tiles/cubes has three more terms than the previous group.
3. Say: Now that you know the rule you can predict. What are the next three steps in this pattern?

\* Students may be confused by patterns that descend in size if they have only seen ascending patterns. Write out the patterns 15, 13, 11, 9, 7, 5, 3, 1 and then use color tiles to model the pattern and show the students the visual decline in the pattern corresponding to the numerical values.

#### Embedded Assessment

See Appendix A- Teacher Resource 3

See Appendix B- Student Resource 2

#### Reteaching/Extension

- Teach students the cheer "2, 4, 6, 8, who do we appreciate!" Note the different meanings of skip.
- Model skip counting by 2's, 3's, 4's, 5's, 10's, 100's, and 1000's. Have students identify the interval and continue the interval and pattern.
- Divide the group into teams of three or four. Have each group draw an interval card and skip count by the designated number. Observers should listen to identify the interval and correct missteps.
- Challenge students to make a birthday chart with the two headings "my age" and "year". Have them to continue the chart to show the years in which they will be 10, 20, 30, 40, .....100 years old.

### Lesson 3

#### Pre-Assessment

- How many of you have played the game of chess?
- What patterns do you recognize on a chessboard?
- Do you like rice?

- Review skip counting

Launch- The King's Chessboard by David Birch

The king in the title is an Indian potentate who receives a service from a wise man and insists on repaying the favor. The wise man finally requests the familiar mathematical puzzle of the chessboard, on whose first square is placed a single grain of rice, on whose second square is placed two grains, four on the third square, and so on. The king, who is too proud to admit that he can't calculate the sum total of the gift, foolishly grants the wish, at least until it becomes clear that it will wipe out his stock. Finally, in spite of his pride, he takes back his repayment, justly embarrassed because of his stupidity and the wise man's obvious generosity in not wanting a repayment in the first place. The story may be recognizable to older readers familiar with mathematical puzzles, but it will be new to beginning mathematicians and readers.

- Read the book with the class.
- While reading the selection, discuss the patterns that you see forming.
- Periodically stop while reading the selection to identify the core pattern.
- Discuss scenarios where students may see/use patterns i.e.: Whose square receives the first grain of rice? Whose square receives the second grain of rice? Whose square receives the third grain of rice etc?
- Students will create their own chessboard and proceed to follow the pattern indicated in the reading selection. Students will begin with the first square (top right) and continue to the last square (bottom left).

Teacher Facilitation

Distribute pattern blocks

- Present the following problem on the overhead projector:  
Ms. Lang and her students are planting a vegetable garden in the corner of the schoolyard. She put 2 plants in the

1. Teacher will say: There are different ways to describe this pattern. Ask: How could you describe the pattern with numbers? (Each pair of students has 2 more pattern blocks than the previous group.)
2. Ask: What is the function for the pattern? (Multiply the row times 2 to each group.) Say: Suppose the pattern was reversed and started with 16, then 14, then 12, and so on?  
  
Ask: Would the rule be the same or would it change? How can you tell?  
Students should see that the rule is dividing by 2. Discuss the relationship between the row and the number of plants.
3. Say: Explain how you used the "multiply 2" rule to predict the next three numbers in the pattern.

### Solve It

With students, reread the problem. Have students extend the pattern by drawing a picture to figure out how many plants Ms. Lang planted in the tenth section of the garden. Then have students complete a BCR explaining how they arrived at their answer.

See Appendix B-Student Resource 3

- Ask students to create the pattern 5, 7, 11, 16 with blocks as shown in the photograph. You may wish to model the pattern on the board to show students how to arrange their blocks.
- Have students describe the pattern to their groups. Ask: What is the rule for this pattern? Students should recognize that each group of blocks has two more blocks than the previous group.

- **Say:** Now that you know the rule, you can predict what comes next in the pattern. Ask students to predict the next three steps in the pattern and extend the pattern using blocks.

n	2n
1	2
2	4
3	6
10	20

n	n/ 2
168	
147	
126	
105	

### Student Application

#### Embedded Assessment

Identify the next three numbers in the pattern below.

**75, 69, 62, 54, 45, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_**

- A. 44, 43, 42, 41      B. 40, 32, 28, 16      C. 35, 24, 12**  
**D. 24, 27, 29**

#### Reteaching/Extension

See Appendix B- Student Resource 4

#### Summative Assessment:

**See Appendix A- Teacher Resource 5**

### Appendix A: Teacher Resources

- Teacher Resource 1**
- Teacher Resource 2**
- Teacher Resource 3**
- Teacher Resource 4**
- Teacher Resource 5**

Appendix B: Student Resources

**Student Resource 1**

**Student Resource 2**

**Student Resource 3**

**Student Resource 4**

**Authors:**

**Beverley L. Pullman  
Skyline Elementary School  
Prince George's County, MD**

**Walter T. Largent Jr. M.Ed.  
North Forestville Elementary School  
Prince George's County, MD**



Name \_\_\_\_\_

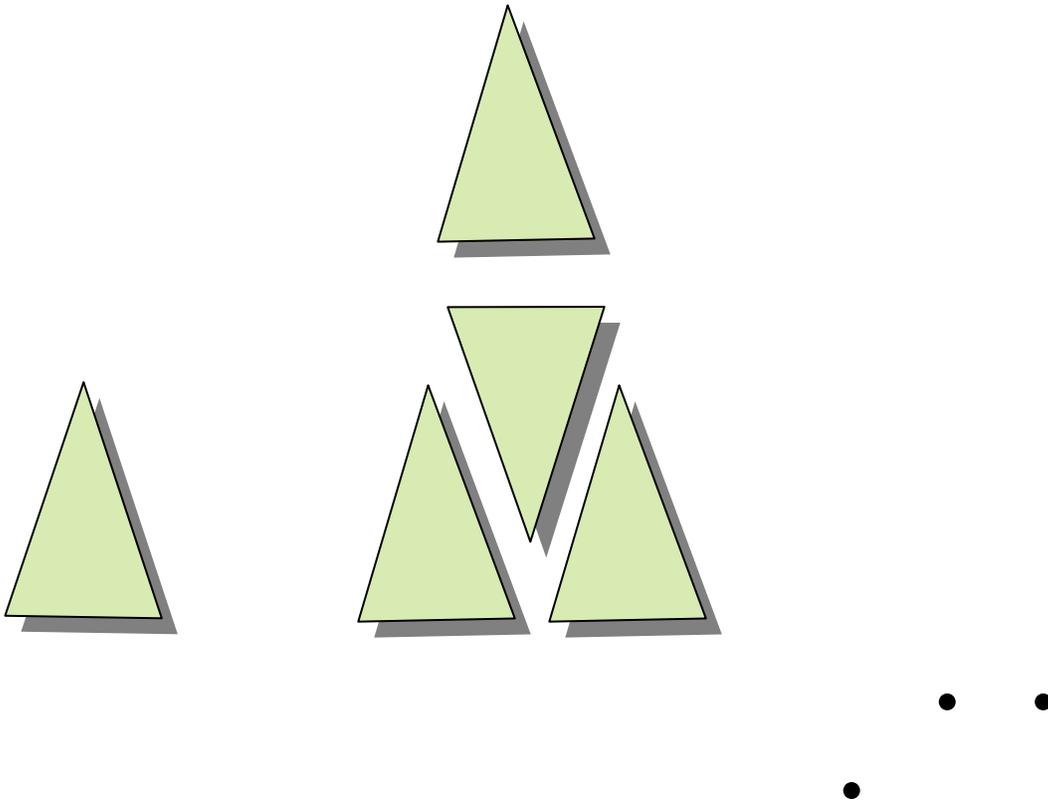
Date \_\_\_\_\_

Teacher \_\_\_\_\_

Part A

S. R.

Use the green triangles to continue the following pattern.



- A. 5
- B. 7
- C. 9
- D. 11

**BCR: Jamie has to complete the pattern:**



**Step A:**

**Jamie has to complete this geometric pattern:**

**What figure would be placed next in the pattern?**

---

---

**Step B:**

**Explain why your answer is correct.**

**Use what you know about patterns in your explanation.**

**Use words, numbers and/or symbols in your explanation.**

---

---

---

---

---

---

---

---

---

---

Answer Key

SR:

- A. 5
- B. 7
- C. 9
- D. 11

BCR: Jamie has to complete this geometric pattern:  
What figure would be placed next in the pattern?

Step A:  
Draw the next level of the pattern.



Step B:  
Explain why your answer is correct.  
Use what you know about patterns in your explanation.  
Use words, numbers and/or symbols in your explanation.

Answer

Step A:

Step B:  
The pattern is continuing to grow. 1, 3, 5, 7, 9.

$$1 + 2 = 3$$

$$3 + 2 = 5$$

$$5 + 2 = 7$$

$$7 + 2 = 9$$

## Teacher Resource 3 (cont'd)

MSA Mathematics - BCR Rubric 2 The response demonstrates a complete understanding and analysis of a problem

- **Application of a reasonable strategy in the context of the problem is indicated.**
- **Explanation<sup>1</sup> of and/or justification<sup>2</sup> for the mathematical process(es) used to solve a problem is clear, developed, and logical.**
- **Connections and/or extensions made within mathematics or outside of mathematics are clear.**
- **Supportive information and/or numbers are provided as appropriate.** 3

1 The response demonstrates a minimal understanding and analysis of a problem

- **Partial application of a strategy in the context of the problem is indicated.**
- **Explanation<sup>1</sup> of and/or justification<sup>2</sup> for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.**
- **Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.**
- **Supportive information and/or numbers may or may not be provided as appropriate.** 3

0 The response is completely incorrect, irrelevant to the problem, or missing. 4

Notes:

**1 Explanation refers to students' ability to communicate how they arrived at the solution for an item using the language of mathematics.**

**2 Justification refers to students' ability to support the reasoning used to solve a problem, or to demonstrate why the solution is correct using mathematical concepts and principles.**

**3 Students need to complete rubric criteria for *explanation, justification, connections and/or extensions* as cued for in a given problem.**

**4 Merely an exact copy or paraphrase of the problem will receive a score of "0".**

Name \_\_\_\_\_

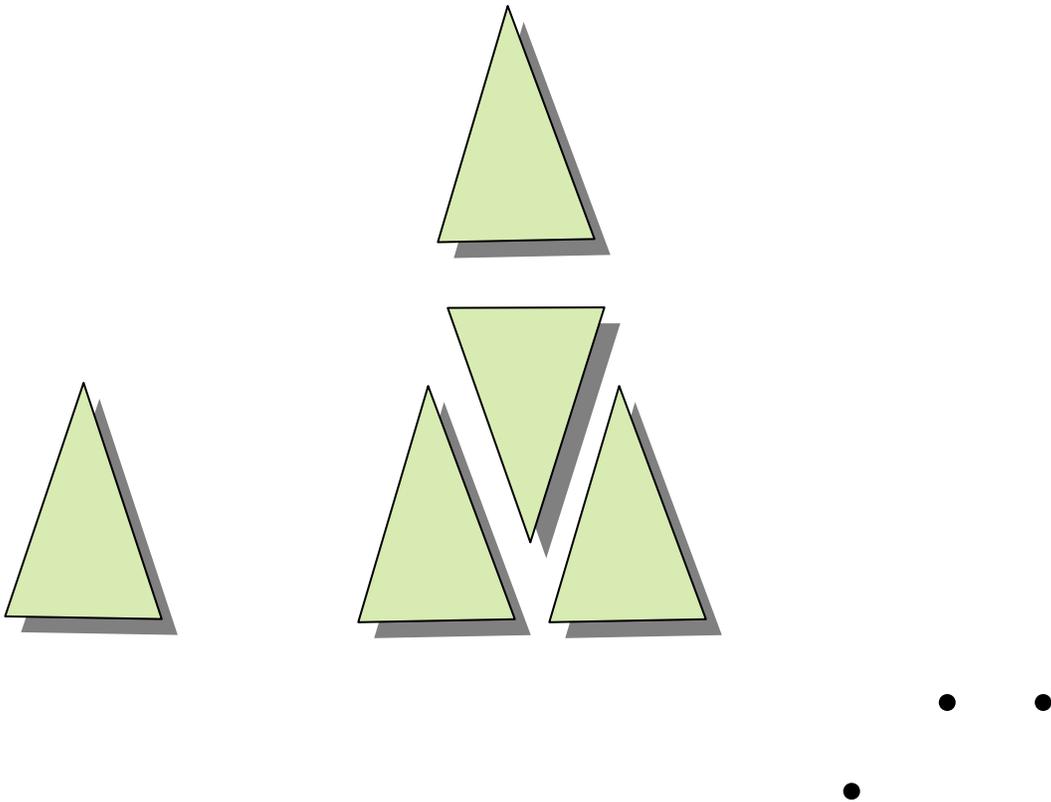
Date \_\_\_\_\_

Teacher \_\_\_\_\_

Part A

S. R.

Use the green triangles to continue the following pattern.



Summative

Name \_\_\_\_\_

Date \_\_\_\_\_

Teacher \_\_\_\_\_

### Patterns

Select the shape that comes next in the pattern.

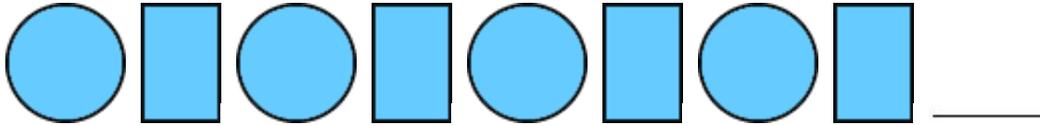
1. 

\_\_\_\_\_

---

Select the shape that comes next in the pattern.

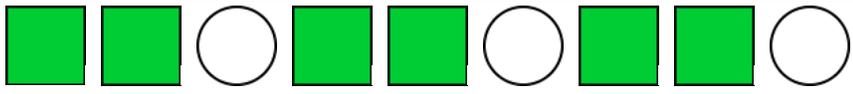
2. 

\_\_\_\_\_

---

Draw the shapes that come next in the pattern.

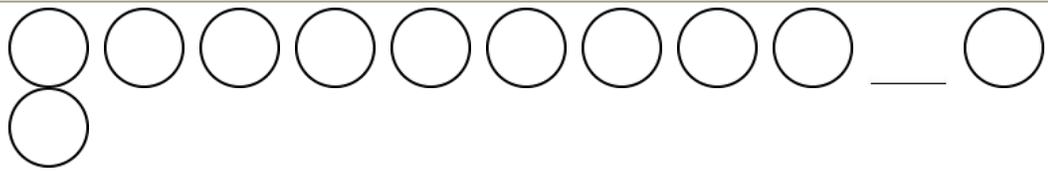
3. 

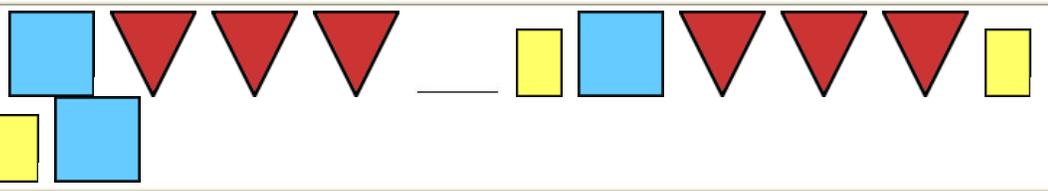
\_\_\_\_\_

4. 

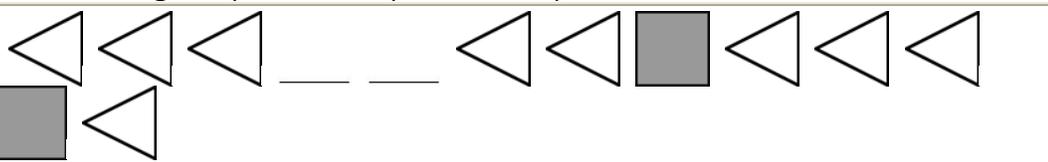
\_\_\_\_\_

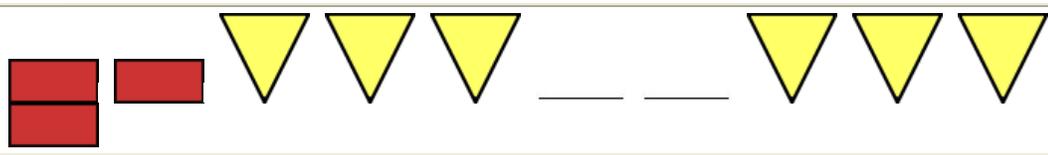
Draw the missing shape to complete each pattern.

5. 

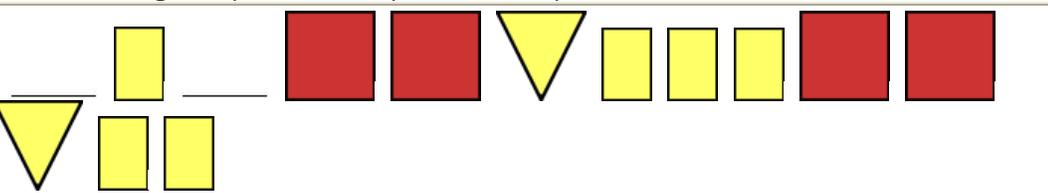
6. 

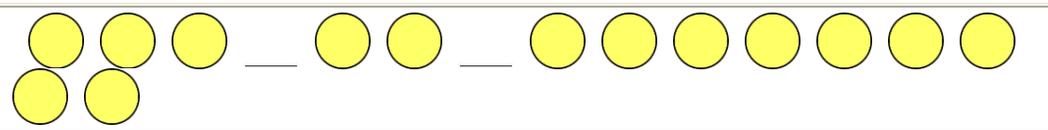
Draw the missing shapes to complete each pattern.

7. 

8. 

Draw the missing shapes to complete each pattern.

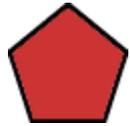
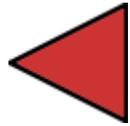
9. 

10. 

Select the shape that comes next in the pattern.

11. 

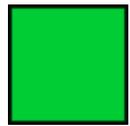
\_\_\_\_\_

A   B 

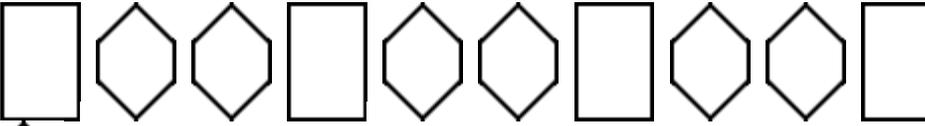
Select the shape that comes next in the pattern.

12. 

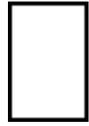
\_\_\_\_\_

A   B 

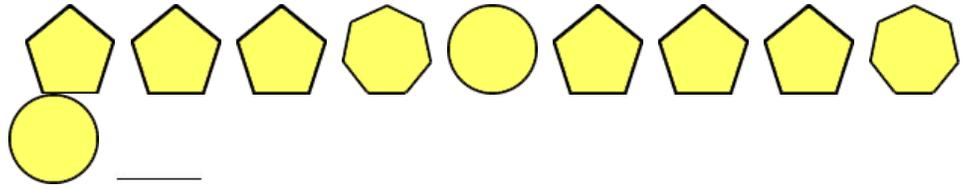
Select the shape that comes next in the pattern.

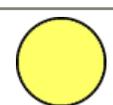
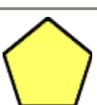
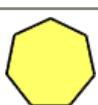
13. 

 \_\_\_\_\_

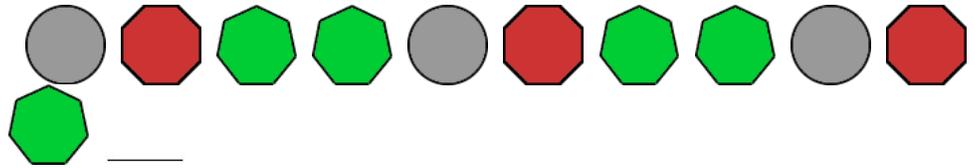
A   B 

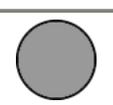
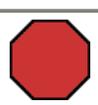
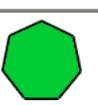
Select the shape that comes next in the pattern.

14. 

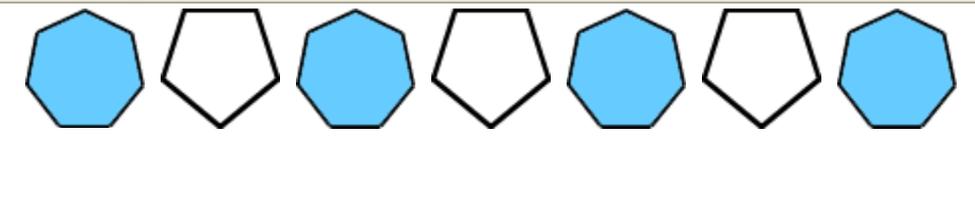
A   B   C 

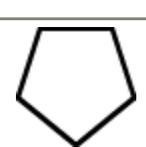
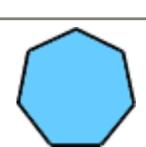
Select the shape that comes next in the pattern.

15. 

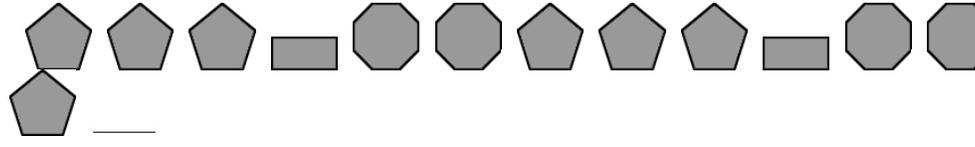
A   B   C 

Select the shape that comes next in the pattern.

16. 

A   B 

Select the shape that comes next in the pattern.

17. 

A   B   C 

1.



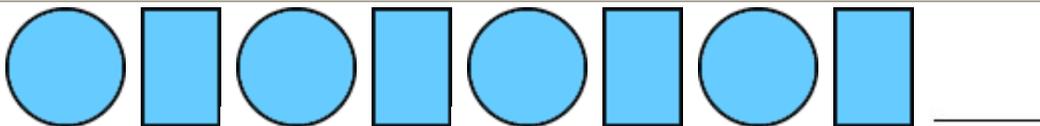
\_\_\_\_\_

(A)  (B) 

Answer= (A) 

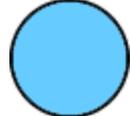
Select the shape that comes next in the pattern.

2.

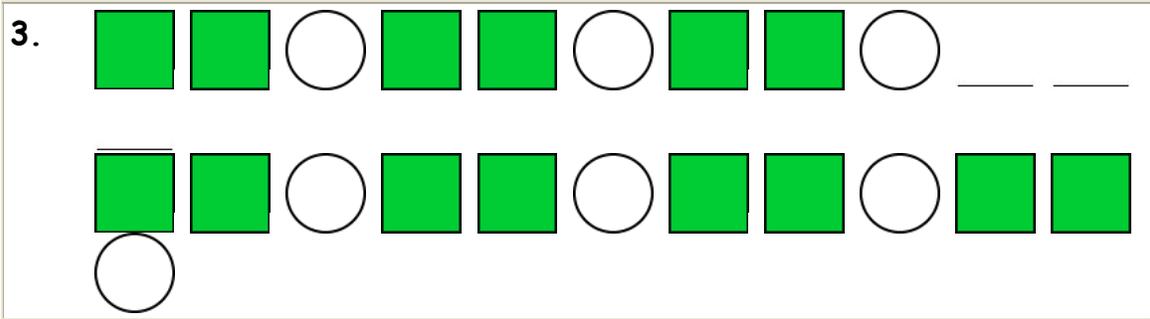


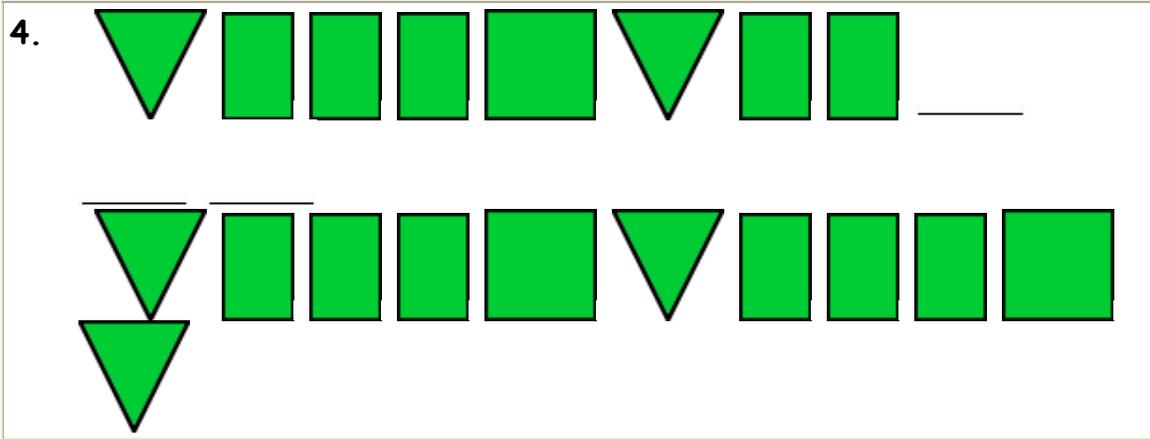
\_\_\_\_\_

(A)  (B) 

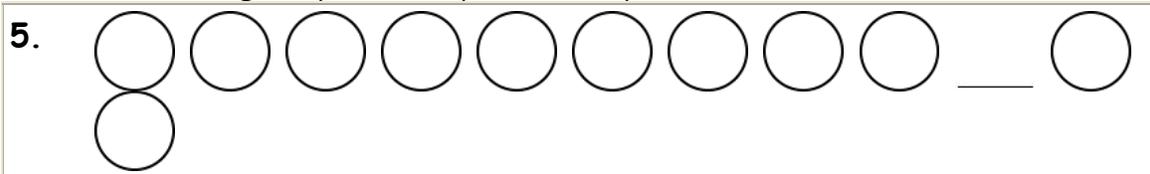
Answer= (B) 

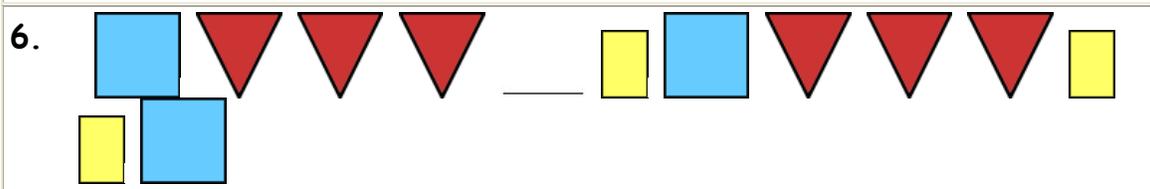
Draw the shapes that come next in the pattern.

3. 

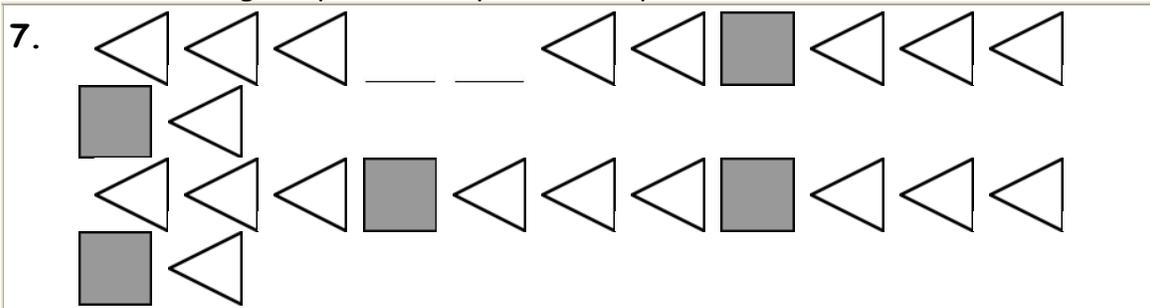
4. 

Draw the missing shape to complete each pattern.

5. 

6. 

Draw the missing shapes to complete each pattern.

7. 

8.

Draw the missing shapes to complete each pattern.

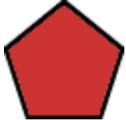
9.

10.

Select the shape that comes next in the pattern.

11.

\_\_\_\_\_

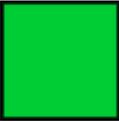
(A)  (B) 

Answer = (A) 

Select the shape that comes next in the pattern.

12. 

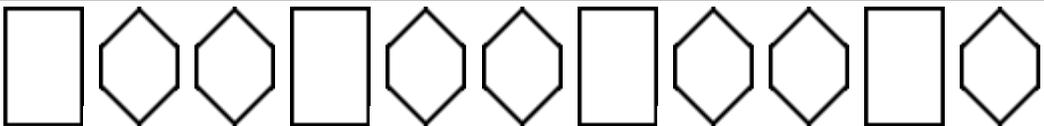
---

A   B 

---

Answer =  B 

Select the shape that comes next in the pattern.

13. 

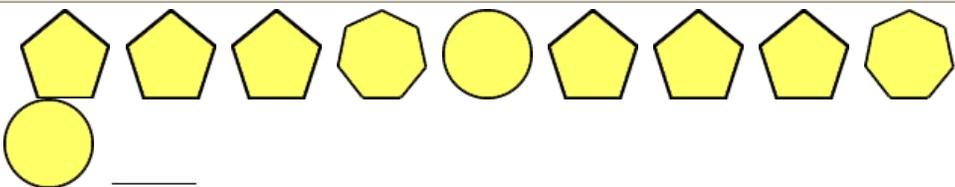
---

A   B 

---

Answer =  A 

Select the shape that comes next in the pattern.

14. 

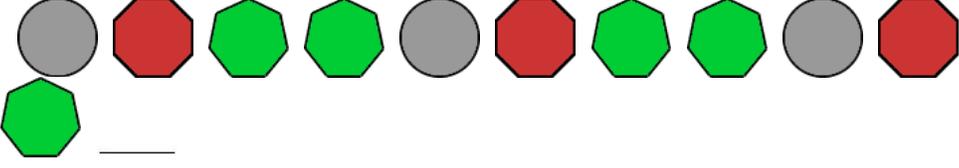
---

A   B   C 

---

Answer =  B 

Select the shape that comes next in the pattern.

15. 

---

(A)      (B)      (C) 

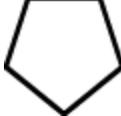
---

Answer =  (A) 

Select the shape that comes next in the pattern.

16. 

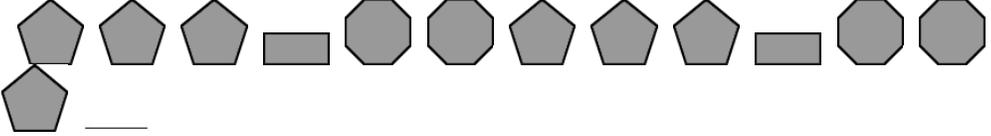
---

(A)      (B) 

---

Answer =  (B) 

Select the shape that comes next in the pattern.

17. 

---

(A)      (B)      (C) 

---

Answer =  (B) 

## Skip Counting

Fill in the missing numbers to complete the pattern.

1. Skip-count by 2's. 21, 19, 17, _____, _____	2. Skip-count by 2's. 30, 32, _____, 36
3. Skip-count by 2's. 23, 25, 27, _____, 31	4. Skip-count by 2's. 28, 26, 24, _____, 20, _____
5. Skip-count by 2's. 34, 32, 30, 28, _____	6. Skip-count by 2's. 7, 9, 11, _____, _____
7. Skip-count by 2's. 47, 45, 43, _____, _____, _____	8. Skip-count by 2's. 27, 29, 31, _____, _____, 37
9. Skip-count by 2's. 45, 43, 41, _____, _____, _____	10. Skip-count by 2's. 32, 30, _____, _____, 24
11. Skip-count by 2's. 22, 24, _____, _____, 30	12. Skip-count by 2's. 38, 40, _____, _____
13. Skip-count by 2's. 34, 32, 30, _____	14. Skip-count by 2's. 14, 12, _____, 8, _____
15. Skip-count by 2's. 41, 43, _____, _____	16. Skip-count by 2's. 10, 12, _____, _____, 18
17. Skip-count by 2's. 33, 31, 29, _____, _____, 23	18. Skip-count by 2's. 8, 10, 12, _____, _____, 18

Answer Key- Teacher Resource 3

1. Skip-count by 2's. 21, 19, 17, <u>15</u> , <u>13</u>	2. Skip-count by 2's. 30, 32, <u>34</u> , 36
3. Skip-count by 2's. 23, 25, 27, <u>29</u> , 31	4. Skip-count by 2's. 28, 26, 24, <u>22</u> , <u>20</u> , <u>18</u>
5. Skip-count by 2's. 34, 32, 30, 28, <u>26</u>	6. Skip-count by 2's. 7, 9, 11, <u>13</u> , <u>15</u>
7. Skip-count by 2's. 47, 45, 43, <u>41</u> , <u>39</u> , <u>37</u>	8. Skip-count by 2's. 27, 29, 31, <u>33</u> , <u>35</u> , 37
9. Skip-count by 2's. 45, 43, 41, <u>39</u> , <u>37</u> , <u>35</u>	10. Skip-count by 2's. 32, 30, <u>28</u> , <u>26</u> , 24
11. Skip-count by 2's. 22, 24, <u>26</u> , <u>28</u> , 30	12. Skip-count by 2's. 38, 40, <u>42</u> , <u>44</u>
13. Skip-count by 2's. 34, 32, 30, <u>28</u>	14. Skip-count by 2's. 14, 12, <u>10</u> , <u>8</u> , <u>6</u>
15. Skip-count by 2's. 41, 43, <u>45</u> , <u>47</u>	16. Skip-count by 2's. 10, 12, <u>14</u> , <u>16</u> , 18
17. Skip-count by 2's. 33, 31, 29, <u>27</u> , <u>25</u>	18. Skip-count by 2's. 8, 10, 12, <u>14</u> , <u>16</u> , 18

Name \_\_\_\_\_

Date \_\_\_\_\_

Teacher \_\_\_\_\_



Step A:

SR:

If the pattern continues, what will the next number be?

8, 12, 16, \_\_\_\_\_, \_\_\_\_\_

- A. 22, 26, 30
- B. 15, 20, 25
- C. 23, 26, 29
- D. 20, 24, 28
- E. 19, 22, 25

Step B:

If the pattern rule changes to add two, subtract one beginning with the number eight what would the next three numbers be? Use words, numbers, and/or symbols to explain your answer.

Explain why your answer is correct.

Use what you know about patterns in your explanation.

Use words, numbers and/or symbols in your explanation.

---

---

---

---

---

## Student Resource 4 cont'd



1. If students were to complete a knitting project what would you want the pattern to look like? Please remember that your pattern must have a core.

## Teacher Resource 4

### Answer Key to Student Resource 4



Step A:

SR:

If the pattern continues, what will the next number be?

8, 12, 16, \_\_\_\_\_, \_\_\_\_\_

- A. 22, 26, 30
- B. 15, 20, 25
- C. 23, 26, 29
- D. 20, 24, 28
- E. 19, 22, 25

Step B:

If the pattern rule changes to add two, subtract one beginning with the number eight what would the next three numbers be? Use words, numbers, and/or symbols to explain your answer.

Explain why your answer is correct.

Use what you know about patterns in your explanation.

Use words, numbers and/or symbols in your explanation.

(Explanations will vary but must have the following)

MSA Mathematics - BCR Rubric

2 The response demonstrates a complete understanding and analysis of a problem

- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation<sup>1</sup> of and/or justification<sup>2</sup> for the mathematical process(es) used to solve a problem is clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics are clear.
- Supportive information and/or numbers are provided as appropriate. 3

1 The response demonstrates a minimal understanding and analysis of a problem

- Partial application of a strategy in the context of the problem is indicated.
- Explanation<sup>1</sup> of and/or justification<sup>2</sup> for the mathematical process (es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate. 3

0 The response is completely incorrect, irrelevant to the problem, or missing. 4

Notes:

1 Explanation refers to students' ability to communicate how they arrived at the solution for an item using the language of mathematics.

2 Justification refers to students' ability to support the reasoning used to solve a problem, or to demonstrate why the solution is correct using mathematical concepts and principles.

3 Students need to complete rubric criteria for *explanation, justification, connections* and/or *extensions* as cued for in a given problem.

4 Merely an exact copy or paraphrase of the problem will receive a score of "0".

Name \_\_\_\_\_

Date \_\_\_\_\_

**INSTRUCTIONS:** Read the following passage below and answer the question.

---



## Nature's Repeating Patterns

By Jane Runyon

<sup>1</sup> "Good morning, class," said Mrs. Kim. "Today we are going to talk about patterns in nature. Can anyone tell me what a pattern is?"

<sup>2</sup> Julie raised her hand right away. "My mom uses a pattern when she is sewing. She pins the pattern to the material she is using and cuts around it."

<sup>3</sup> "Very good, Julie," said Mrs. Kim. "Can anyone else give an example?"

<sup>4</sup> "Last weekend my dad put up new wallpaper in our living room," said C. J. "He said he had to be careful and match the pattern. The paper had flowers in it, and he had to make sure the flowers lined up the same way."

<sup>5</sup> "Another good example," said Mrs. Kim. "We are going to talk about that kind of pattern today. We are going to discuss things which repeat over and over again."

<sup>6</sup> "You mean we're going to talk about pictures on paper?" questioned Matthew.

<sup>7</sup> "Not exactly," answered Mrs. Kim. "We're going to discuss events

that occur over and over in nature. But we're going to start by looking at some patterns and answer questions about them."

8 Mrs. Kim walked to the chalkboard in front of the class. On the board she drew a star, a square, and a circle. "If we wanted to repeat these figures in a pattern, what would you draw next?"

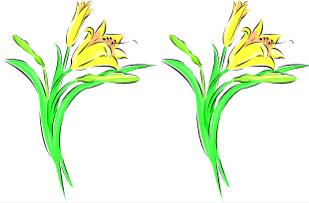
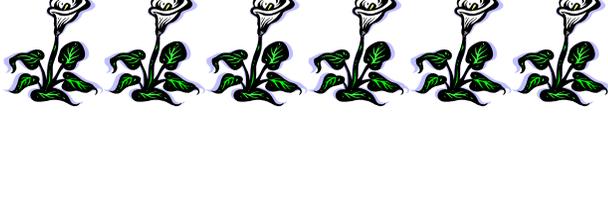


Name \_\_\_\_\_

Date \_\_\_\_\_



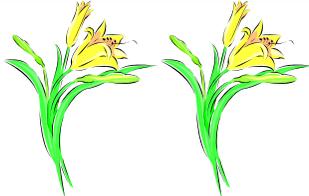
Ms. Lang and her students are planting a vegetable garden in the corner of the schoolyard. She put 2 plants in the first section, 4 in the second section and 6 in the third section. What is the rule for the pattern? Can you find how many plants she will put in the tenth section?

Section 1		Amount of Plants
Section 2		Amount of Plants
Section 3		Amount of Plants
Section 4		Amount of Plants

<b>Section 5</b>		<b>Amount of Plants</b>
<b>Section 6</b>		<b>Amount of Plants</b>
<b>Section 7</b>		<b>Amount of Plants</b>
<b>Section 8</b>		<b>Amount of Plants</b>
<b>Section 9</b>		<b>Amount of Plants</b>
<b>Section 10</b>		<b>Amount of Plants</b>

Name \_\_\_\_\_ Date \_\_\_\_\_

Ms. Lang and her students are planting a vegetable garden in the corner of the schoolyard. She put 2 plants in the first section, 4 in the second section and 6 in the third section. What is the rule for the pattern? Can you find how many plants she will put in the tenth section?

Section 1		Amount of Plants
Section 2		Amount of Plants
Section 3		Amount of Plants
Section 4	8 plants (type of plant may vary)	Amount of Plants
Section 5	10 plants (type of plant may vary)	Amount of Plants

<b>Section 6</b>	<b>12 plants (type of plant may vary)</b>	<b>Amount of Plants</b>
<b>Section 7</b>	<b>14 plants (type of plant may vary)</b>	<b>Amount of Plants</b>
<b>Section 8</b>	<b>16 plants (type of plant may vary)</b>	<b>Amount of Plants</b>
<b>Section 9</b>	<b>18 plants (type of plant may vary)</b>	<b>Amount of Plants</b>
<b>Section 10</b>	<b>20 plants (type of plant may vary)</b>	<b>Amount of Plants</b>