Describing, Extending and Generalizing Growing Patterns
and Numeric Patterns

Brief Overview:

This concept development unit focuses on growing patterns, both pictorially
and numerically. Throughout this unit students will focus on describing,
extending and generalizing growing and numeric patterns.

NCTM Content Standard/National Science Education Standard:

1. Describe, extend, and make generalizations about geometric and numeric
   patterns.
2. Represent and analyze patterns and functions, using words, tables, and
   graphs.

Grade/Level:

Grade 3

Duration/Length:

This unit will extend over 3 days. Each day will last approximately 60
minutes in length.

Student Outcomes:

Students will:

- Describe, extend, create and make generalizations about geometric
  and numeric patterns
- Represent and analyze patterns and functions, using words, tables, and
  graphs
- Use patterns to make predictions and solve problems.

Materials and Resources:

- Word bank list
- Two color counters-several sets for student use, 1 set for overhead use
- Chart paper and markers
- Pattern Blocks
- Calculators
- Red Pencil
- Teacher Resources
- Student Resources
Development/Procedures:

Lesson 1
Pre-Assessment
Students should be able to recognize patterns and use words to describe the patterns they see. The pre-assessment will be imbedded in the launch. Display a growing pattern to identify students’ prior knowledge of patterns.

Launch-

Display Teacher Resource 1 on overhead. Ask the students to describe what they see. Say: What do you notice about these circles? (There are red and yellow circles. They get bigger each time.) Say: Describe what you mean by "bigger." (There are more red circles in each level. I see a pattern. Each time there is a new level; there is one more red circle.)

- This will assess students’ prior knowledge of growing patterns. Include vocabulary such as; levels or terms, circle or two-color counters, increasing pattern, decreasing pattern, row, column, and use of numbers. The definition of a term or level is “each one of the parts making up the pattern.” A pattern is a sequence or order of objects that repeat or grow. As new vocabulary is introduced, add the words to a word wall in the front of the room. (This can be done on chart paper or a reserved place on the chalkboard)

Teacher Facilitation –

- Display the definition for rule on the board; “A rule is finding the relationship between numbers or objects in a pattern.” Lead students to identify the rule that is shown. (In example 1, RULE-Add 1 red two-color counters in each level. In example 2, RULE-we are taking away 1 dog in each new level.)

- Display an example pattern that is not a pattern with overhead two-color counters (see Teacher Resource-1) and ask students to evaluate to see if a rule exists. (A pattern follows a predictable sequence. There is no predictable sequence in this example. No rule can be stated.) Introduce students to the term “growing pattern” and write it on the Word Bank. Make sure that students understand that this is a pattern that changes by adding
levels/terms that differ by the number of shapes seen in a sequence that grows by level or term.

- Show students the Reptile Pattern on Teacher Resource 1b.
- Ask students if the levels of the reptiles follow a predictable pattern? How do you know? (Yes, because the tail increases by 2 rhombuses in each level.) Model for students how this is written in the space provided.

**Student Application –**

Use Student Resource 1 prepared on cards. Give 1 card to groups of 3 or 4 students. Students take on roles of recorder, speaker, taskmaster, and displayer. Groups are to describe the growing pattern on their given card and record this description on Student Resource 1a. Encourage students to refer to the word bank and use at least 3 vocabulary words to describe their patterns. When the task is completed the speaker reads the recorded description of their group's pattern and the other groups are to match this description in order to identify the correct pattern card.

**Embedded Assessment –**

Distribute Student Resource 2 with descriptions separated from the pictorial representations. Students match each description to the appropriate pattern. Use student checklist to record which students need review and which ones are ready for extension.

**Reteaching/Extension –**

- Based on responses on Student Resource 2, ask students why they chose the descriptors they did for each pattern. Ask students who made several errors what confused them about the descriptions and see if they can make it clearer to understand in the future. Review again the vocabulary and how it describes the patterns.

- For those who have understood the lesson, ask students to extend to Level 4 for any one of the patterns on the Student Resource.
Place various examples from Student Resource 2 on the overhead. Ask students to predict what they think Level 4 would look like. Ask students to tell whether or not the extension follows the pattern established by Levels 1, 2, and 3. Ask: “What is the rule for this pattern?” You may need to refer to the word wall and review the definition for rule.

- (Refer to Student Resource 2: In the first example. Level 4 has a 4th row with 2 rectangles. Rule: Each level increases by adding a new row of 2 rectangles to the pattern. In the 2nd example-Level 4 have 4 triangles in the 4th row. Rule is to add a new row with the number of triangles that correspond to the number of levels. In the 3rd example- Level 4 have 2 dark hearts in the top row and 1 white heart in the bottom row. Rule- Decrease the number of hearts in each row with each new level. In example 4, Level 4 has 5 circles in 4 rows. Rule-Add a new row and increase each row by 1 circle.)

Launch –

- On the overhead use 2 color counters to create a growing pattern. Encourage students to recall vocabulary used during yesterday’s lesson to describe the pattern.

- Distribute 2 color counters to all students and have them replicate overhead pattern. With a partner, ask students to predict and create what the next level of the pattern will look like. Ask them to state a rule for what they made in their extension. (Rule – Add 1 red-counter to the beginning of each new level.)

- An example of a good conversation about this growing pattern would sound similar to this:

Teacher: What do you notice about these circles?
Ethan: There are red and yellow circles.
Spencer: They get bigger each time.

Teacher: Describe what you mean by "bigger."
Spencer: There are more red circles in each level.
Kathleen: I see a pattern. Each time there is a new level; there is one red circle.

Teacher: What do you think the fifth level will look like?
Sarah: I think it will be one red circle bigger than level 4.

Teacher: Can you show me?
Sarah uses pattern blocks to build the fifth level.

Teacher Facilitation –
Distribute pattern blocks. Have students create a fish using a triangle, hexagon and trapezoid. For Level 2, have students add 2 more trapezoids to the tail. For level 3, add two more trapezoids to the tail.

- **Think Aloud** - As I look at my fish; I notice the tail is growing. In level 1 there was a triangle, hexagon and trapezoid. In level 2 there were 3 trapezoids. In level 3 there were 5 trapezoids. As I think ahead, I can predict level 4 will have 7 trapezoids because in each level the number of trapezoids is increasing by 2. (1, 3, 5, ___, ____.) Can you predict the 5th level?

At this point, create the fish using pattern blocks on the overhead. Have students look at the pattern. Ask: “Can you predict how many trapezoids will be used in level 5 just by looking at the function table?” (Introduce the term “function table.” Define it as “a table that shows the relationship between two series of numbers, i.e.- the level number and the number of trapezoids being used for each level.” The same rule will apply to each level.) Add the words function table to the word wall.

Ask the students to show what level 5 would look like using their pattern blocks or call on a student to come up to the overhead to reveal their findings. Ask the class: “Were they right?” Restate the rule for the function table (Add 2 to the preceding number of trapezoids.)

- Complete Teacher Resource 2, how long is the fish’s tail? as a class. Ask students to assist you in completing the table.

- Replicate Teacher Resource 3 on the overhead. Ask students to describe the pattern they see. Students should replicate the pattern with their own two-color counters
  - Teacher Think Aloud – “I see that level one has 2 yellow counters on each side of the figure and 4 red counters in the middle (4+4=8 Total). In level 2, there are still 2 yellow counters on each side but we have added 4 more red counters to the middle to make a total of 8
red counters \((4+8=12)\). In level three there are 2 yellow counters on each side and we have added 4 more red counters to the middle to make a total of 12 red counters \((4+12=16)\).” (Place these totals in the function table to the right.)

- Encourage students to create a rule that reflects what is happening in the pattern. (A middle row of 4 two-color counters is added in each level. \textit{Add 4}.)
- After identifying the rule ask students how to extend the pattern to level 5? Level 6? At this point the students should be able to give you the amount of counters that will be in level 7. Ask students to explain why their answer is correct. Encourage the use of vocabulary throughout their explanation. See \textit{Teacher Resource 3Answers} for a sample answer.

**Student Application –**

- Divide students into two groups.
  - Group 1, consisting of students who are struggling with the concept
  - Group 2 consisting of students who are ready to practice on their own.
- Distribute Student Resource 3a-c to group 1. Allow students to use pattern blocks to build the first 3 levels as shown on RS-3a. Encourage students to use pattern blocks to extend the pattern to level 4. Have students count the total number of blocks used to build level 4. Add that total to the function table on SR-3b. Continue the process through level 6. \textit{Ask: What is happening as Frank grows each day?} Once the table is complete ask students to write the rule at the bottom of SR-3b. Ask students to complete the brief constructed response on SR-3c. Encourage them to use what they know about growing patterns in their answer. See \textit{Student Resource 3 Answers} for sample answers.
- Distribute SR-4 to group 2. Allow them to use square pattern blocks as necessary. Have them complete the function table and brief constructed response independently.
- Once both groups have completed their applications have a representative come to the front of the room to describe what they have found.

**Embedded Assessment –**

- SR-5-Growing Hearts

**Reteaching/Extension –**
• Extension- Ask students to create their own growing pattern using pattern blocks. Ask them to see if a partner can extend their pattern 3 more levels. The following link has a great lesson for growing patterns including questions to help with facilitation. http://illuminations.nctm.org/LessonDetail.aspx?ID=L304

• Reteaching- Spend more time with hands on manipulation of growing patterns allow them to build and count various examples. The following website has some good pattern starters that you can use for additional support. http://teams.lacoe.edu/documentation/classrooms/linda/algebra/activities/patterns/growpattern.html

Lesson 3
Pre-Assessment –
Return Student Resource 5 from yesterday used as the embedded assessment. Go over correct responses and stress that the rule was to add 2 hearts to each level that increases the number of rows. Draw the students’ attention to the function table.

Launch –
Re-write the following number sequence from the function table horizontally: 4, 6, 8, 10, ___, ___, ___ Ask: How is this similar to the function table? (It was the output portion of the function table.) Ask the students if this is a pattern. Why? (It follows a logical sequence of numbers that increase by 2.) Ask, “Can we predict what the next 3 numbers will be?” (12, 14, 16.) “Why?” (They follow the rule of adding 2 to each number.)

Teacher Facilitation –

• Ask the students how this pattern differs from the previous growing patterns that they worked with over the last 2 days. (It uses numbers only.) Tell them that this is called a numeric pattern because it uses numerals only. Make a Venn diagram on the overhead and help the class compare numeric patterns to growing non-numeric patterns. Make sure that students recognize that they both have rules that demonstrate increasing or decreasing growth.
Display and distribute Student Resource 6. Discuss Months/Weeks table and ask them how it resembles the function tables they have made before. Ask, “What is the rule?” (Increase by 4.) “Use the table to find out how many weeks there would be 8 months.” (32) “How many months would 28 weeks be?” (7)

Say: “Now let’s look at how we can compare decades to years. A decade is a group of 10 years. Who sees a pattern in the years sequence?” Ask students to state a rule for the years’ numeric pattern. (Counting by hundreds.)

Looking at Centuries to Years (Presenting in decreasing order) ask students if they can find a pattern in this number sequence 800, 700, 600, 500, etc. Ask what the rule is for this sequence. (Decrease by 100.) “Now complete the chart and use it to discover the number of years in 1 century.” (100). Ask the students if they can describe the pattern in any other way. (Numbers go down by 1 followed by 2 zeros.)

Present Student Resource 7. Read the story problem aloud with the students. Ask students to look at just the Number of People row and ask what the rule is for that pattern. (+2). Now look at the cost pattern. “What is the rule for that pattern?” (+$3). Ask the students to complete the Cost pattern. How can the table help them to solve the problem? Permit use of calculators to keep adding 3. (16 people will pay $24.)

Student Application –

(Each step of the student application will be preceded by a brief teacher facilitation. Students move on to independent work as they show understanding of the concept. Each bullet begins again with a brief teacher facilitation followed by shared or independent student completion. )

Distribute Student Resource 8. Ask: What do you notice about the numbers in Example 1? (Increasing by 2.) Display on overhead +2 in between each number in the pattern. Direct students’ attention to number 1. Ask: What number does the pattern begin with? (6.) Does it matter that it does not begin at zero?” (No.) Stress to the students that it does not matter where a pattern begins. The process of determining the pattern depends on how the following numbers change each time. When there are two numbers together you can find the difference between the numbers to determine the rule.

Teacher Think Aloud: On number 1, I see the numbers 6 and 9 next to each other in the sequence. I know 9-6= 3 because I counted up.
Write (6, 7, 8, and 9) on the overhead to show your thinking or demonstrate by using your fingers.

**Since the numbers are increasing I know I need to add 3 to each number.** (Continue your thinking aloud by demonstrating how students will insert (+3) following each number in the pattern and continuing the pattern.)

- Focus student attention on number two. Ask: **Working with larger numbers isn’t as difficult as it seems. Does anyone see any similarities between these numbers?** (The zero in the one’s place will stay the same each time.) The change is with the numbers in the hundreds and tens places. Have students underline these numbers in red. (57, 58, 59, 60.) **How are these changing?** (Increasing by 1’s.) Even though the tens place is increasing by 1, the pattern shows increasing by 10’s because one ten is the same as 10 ones. Write +10 in each circle in the pattern. This shows 57 tens as 570, 58 tens, as 580. 59 tens as 590. But what comes next? (60 tens). **How would we write 60 tens?** (As 600). Now complete the pattern on your own.

- Look at the number sequence in number 3. How are these numbers all the same? (They have a 5 in the ones place.) If the 5 do not change, the part that changes will be the tens and hundreds. Ask students to use their red pencil to underline the tens and ones in each number. (34 33, 32.) Ask: **What do you notice about these numbers?** (they are decreasing by 1) **Remember 1 ten is the same as 10 ones so our rule is subtract 10 from each number.** Encourage students to work with a partner to complete the rest of the pattern. Continue guiding the students through numbers 4 and 5 slowly releasing them to practicing independently. Students should complete numbers 6-8 independently. If students finish early have them check their answers with their partner. (Go over answers for numbers 6-8 before moving on to the embedded assessment.)

**Answer key is on Teacher Resource 9.**

**Embedded Assessment –**

Distribute Student Resource 9. This is to be done independently. Use a student checklist and record which students are demonstrating complete,
partial, or basic understanding. Answer Key can be found on Teacher Resource 10.

Reteaching/Extension –

- Extension- The teacher can create a numeric pattern on a sentence strip and cut each number apart. Ask students to arrange the numbers in an increasing or decreasing pattern and identify a rule. (Create a variety of patterns for students to work with.

- Reteach- Some students may have difficulty transitioning to counting backwards. In order to assist them in mastering this concept encourage students to work from right to left to find the difference. Then allow them to use a calculator to subtract each number. (Remember, they aren’t being graded on their ability to add and subtract. You want to make sure they are able to find the common difference in a pattern and extend it.)

Summative Assessment:

Have students complete Student Resource 10. Answers can be found on Teacher Resource 11.

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Describing Patterns

Look at the pattern next to each letter. Describe what you see in words. Then predict what you think Level 4 will look like and tell why.

Use words from the word bank in each of your descriptions.

WORD BANK
Level
Row
Column
Increasing/increases
Decreasing/decreases
Objects or Shapes

Here is an example:
This is a (n) Increasing pattern.
Level 1 shows 2 objects in 1 row.
Level 2 shows 2 objects in 2 rows.
Level 3 shows 2 objects in 3 rows.
I predict level 4 will show 2 objects in 4 rows because each level increases by adding a row of 2 objects.
I think it will look like this:

```
  3 3
  3 3
  3 3
  3 3
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I have pattern ___.
This is a ________________ pattern.

Level 1 shows __________________________________________________________
Level 2 shows __________________________________________________________
Level 3 shows __________________________________________________________
I predict level 4 will show________________________________________________
_____________because____________________________________________________

I think it will look like this:

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Group Member Names: _______________  _________________  ___________________  _________________
Teacher Directions: Make enough copies of this game for \( \frac{1}{2} \) or your class. Cut out the pictures and their descriptions. Mix them up and have students work with a partner to match the description to the correct picture.

Pattern Match Game

This growing pattern is increasing.
Level 1 has 1 row of 2 shapes.
Level 2 has 2 rows of 2 shapes.
Level 3 has 3 rows of 2 shapes.

This growing pattern is increasing.
Level 1 has 1 row of 1 shape.
Level 2 has added a second row with 2 shapes.
Level 3 has added a third row with 3 shapes.

This is a decreasing pattern.
Level 1 has 5 shapes in the 1st row and 4 shapes in the second row.
Level 2 has 4 shapes in the 1st row and 3 shapes in the second row.
Level 3 has 3 shapes in the 1st row and 2 shapes in the second row.

This is an increasing pattern.
Level 1 has 1 row of 2 shapes
Level 2 has 2 rows of 3 shapes
Level 3 has 3 rows of 4 shapes.
Grow Your Own Frankenstein

Use the pattern blocks to build what you think Frankenstein will look like when he is 4 days old. 5 days old? 6 days old? Fill in the table on the next page with your findings.
Complete the table to describe the growing pattern.

<table>
<thead>
<tr>
<th>Days Old</th>
<th>Total Number of Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

How many blocks will there be when Frank is 7 days old? __________

Part B.

Explain why your answer is correct
Use what you know about growing patterns in your explanation.
Use words and/or numbers in your explanation.

__________________________________________________________________________________________

_______________________________________________________

The Rule is _________________________________
<table>
<thead>
<tr>
<th>Days Old</th>
<th>Total Number of Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

Name_________________________________
<table>
<thead>
<tr>
<th>Days Old</th>
<th>Total Number of Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>
Assessment

Part A.
How many blocks will there be when Frank is 7 days old? 11

Part B.
Explain why your answer is correct.
Use what you know about growing patterns in your explanation.
Use words and/or numbers in your explanation.

My answer is correct because the table follows a rule.
Each day Frank grows 1 block bigger. As the days increase by 1 Frank’s body also increases by 1. The answer is that on day 7 there are 11 blocks on Frank.
Part A: How many squares will there be in level 10? ______________

Part B: Explain why your answer is correct.

Use what you know about growing patterns to explain why your answer is correct.

Use words and/or numbers in your explanation:

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________
**Part A** - How many squares will there be in level 10? _41______________

**Part B** - Explain why your answer is correct.

Use what you know about growing patterns to explain why your answer is correct. Use words and/or numbers in your explanation.

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**Level 1** has 5 squares, **Level 2** has 9 squares, **Level 3** has 13 squares,

9-5=4 So, I know each level adds 4 squares.

**Level 9**- 33+4 = 37  
**Level 10**- 37+4 = 41
Part A- How many hearts will there be in level 7? ________________
Part B- Explain why your answer is correct.
Use what you know about growing patterns to explain why your answer is correct.
Use words and/or numbers in your explanation.
Part A- How many hearts will there be in level 7? _______16_______

Part B- Explain why your answer is correct.
Use what you know about growing patterns to explain why your answer is correct.
Use words and/or numbers in your explanation.

In level 1 I see 4 hearts. In level 2, I see 6 hearts. In level 3, I see 8 hearts. I know that 2 hearts are added each time a new level is made. In level 6, there are 14 hearts, so I add 2 to get 16 hearts in level 7.
**Numeric Patterns**

Directions: Find a pattern to complete each table.

**Example**

<table>
<thead>
<tr>
<th>Minutes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seconds</td>
<td>60</td>
<td>120</td>
<td>180</td>
<td>240</td>
<td>300</td>
<td>360</td>
<td>420</td>
<td>480</td>
</tr>
</tbody>
</table>

The rule is: Add 60 seconds for each additional minute.

1.

<table>
<thead>
<tr>
<th>Months</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeks</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The rule is: ________________________________

2.

<table>
<thead>
<tr>
<th>Decades</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The rule is: ________________________________

3.

<table>
<thead>
<tr>
<th>Centuries</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td>800</td>
<td>700</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The rule is: ________________________________
Numeric Patterns-ANSWERS

Directions: Find a pattern to complete each table.

Example

<table>
<thead>
<tr>
<th>Minutes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seconds</td>
<td>60</td>
<td>120</td>
<td>180</td>
<td>240</td>
<td>300</td>
<td>360</td>
<td>420</td>
<td>480</td>
</tr>
</tbody>
</table>

The rule is: Add 60 seconds for each additional minute.

1.

<table>
<thead>
<tr>
<th>Months</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeks</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>28</td>
<td>32</td>
</tr>
</tbody>
</table>

The rule is: ________________________________

Add 4

2.

<table>
<thead>
<tr>
<th>Decades</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>

The rule is: ________________________________

Add 10

3.

<table>
<thead>
<tr>
<th>Centuries</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td>800</td>
<td>700</td>
<td>600</td>
<td>500</td>
<td>400</td>
<td>300</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

The rule is: ________________________________

Subtract 100
Problem 1
Tickets for the Hannah Montana Concert cost $3 for every couple. If 16 people go to the concert, how much will they pay for tickets? (Hint: Complete the table below.)

<table>
<thead>
<tr>
<th>Number of people</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$3</td>
<td>$6</td>
<td>$9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Problem 1
Tickets for the Hannah Montana Concert cost $3 for every couple. If 16 people go to the concert, how much will they pay for tickets? (Hint: Complete the table below.)

<table>
<thead>
<tr>
<th>Number of people</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$3</td>
<td>$6</td>
<td>$9</td>
<td>$12</td>
<td>$15</td>
<td>$18</td>
<td>$21</td>
<td>$24</td>
</tr>
</tbody>
</table>
Number Patterns
You can think of number patterns as tricks with rules.

Halloween Trick: You receive 2 pieces of candy each house you go to.

0 +2 2 +2 4 +2 6 +2 8

The rule is +2

Directions: Determine the rule that was used to make each pattern. Insert it between each number in the pattern.

1. 6 9 12 15 ___ ___ ___
The rule is _________________________

2. 570 580 590 600 ___ ___ ___
The rule is _________________________

3. 345 335 325 315 ___ ___ ___
The rule is _________________________

4. 275 280 285 290 ___ ___ ___
The rule is _________________________

5. 601 501 401 301 ___ ___ ___
The rule is _________________________
Try some on your own…

6. 15  ○ 19  ○ 23  ○ 27  ○ ___ ○ ___ ○ ___
The rule is ______________________________

7. 728  ○ 726  ○ 724  ○ 722  ○ ___  ○ ___  ○ ___
The rule is ______________________________

8. 220  ○ 230  ○ 240  ○ 250  ○ ___  ○ ___  ○ ___
The rule is ______________________________

How do you find the rule?
____________________________________________________
____________________________________________________
____________________________________________________
____________________________________________________
Number Patterns-ANSWERS

You can think of number patterns as tricks with rules.

Halloween Trick: You receive 2 pieces of candy each house you go to.

0 +2 2 +2 4 +2 6 +2 8

The rule is +2

Directions: Determine the rule that was used to make each pattern. Insert it between each number in the pattern.

1. 6 +3 9 +3 12 +3 15 +3 _18_ +3 _21_ +3 _24_

The rule is _______________________________

Add 3

2. 570 +10 580 +10 590 +10 600 +10 _610_ +10 _620_ +10 630

The rule is _______________________________

Add 10

3. 345 -10 335 -10 325 -10 315 -10 _305_ -10 295 -10 285

The rule is _______________________________

Subtract 10

4. 275 +5 280 +5 285 +5 290 +5 _295_ +5 _300_ +5 305

The rule is _______________________________

Add 5

5. 601 -100 501 -100 401 -100 301 -100 _201_ -100 101 -100 1

The rule is _______________________________

Subtract 100
Try some on your own…

6. 15 □ +4 □ 19 □ +4 □ 23 □ +4 □ 27 □ +4 □ _31 □ +4 □ _35 □ +4 □ _39 □

The rule is ___ Add 4 ________________________________

7. 728 □ -10 □ 726 □ -10 □ 724 □ -10 □ 722 □ -10 □ _720 □ -10 □ _218 □ -10 □ _216 □

The rule is _____ Subtract 10 _____________________________

8. 220 □ +10 □ 230 □ +10 □ 240 □ +10 □ 250 □ +10 □ _260 □ +10 □ _270 □ +10 □ _280 □

The rule is ___ Add 10 _________________________________

How do you find the rule?
____________________________________________________
____________________________________________________
____________________________________________________
____________________________________________________
Assessment

Find the pattern and finish the sequence of numbers. State the rule for each numeric pattern. You may use your calculators.

1. 14, 18, 22, 26, ____, ____, ____ Rule: _____________________

2. 702, 704, 706, 708, ____, ____, ____ Rule:_____________________

3. 605, 600, 595, 590, ____, ____, ____ Rule:_____________________

4. 265, 275, 285, 295, ____, ____, ____ Rule:_____________________

5. 878, 876, 874, 872, ____, ____, ____ Rule:_____________________

6. 50, 53, 56, 59, ____, ____, ____ Rule:_____________________

7. 999, 899, 799, 699, ____, ____, ____ Rule:_____________________

8. 87, 187, 287, 387, ____, ____, ____ Rule:_____________________

9. 645, 635, 625, 615, ____, ____, ____ Rule:_____________________

10. **** Bonus: Create a numeric pattern of your own and state the rule that you used.
      ____, ____, ____, ____, ____, ____ Rule:_____________________

      3...2...1...0
Assessment - Answers

Find the pattern and finish the sequence of numbers. State the rule for each numeric pattern. You may use your calculators.

1. 14, 18, 22, 26, __30__, __34__, __38__
   Rule: __Add 4_________________

2. 702, 704, 706, 708, __710__, __712__, __714__
   Rule: __Add 2_________________

3. 605, 600, 595, 590, __585__, __580__, __575__
   Rule: __Subtract 5_________________

4. 265, 275, 285, 295, __305__, __315__, __325__
   Rule: __Add 10_________________

5. 878, 876, 874, 872, _870___, _868___, _886___
   Rule: __Subtract 2_________________

6. 50, 53, 56, 59, _62___, __65__, __68__
   Rule: __Add 3_________________

7. 999, 899, 799, 699, _599___, _499___, _399__
   Rule: __Subtract 100___________

8. 87, 187, 287, 387, __487__, __587__, __687__
   Rule: __Add 100_________________

9. 645, 635, 625, 615, __605__, __595__, __585__
   Rule: __Subtract 10___________

10. **** Bonus: Create a numeric pattern of your own and state the rule that you used.

    _____, _____, _____, _____, _____, _____
    Rule: __________________________
Summative Assessment- Growing and Numeric Patterns

Draw a picture to show the next level of the growing pattern.

Step A

```
:):
:(:)
:*:
```

Step B

Describe the 6th level of the growing pattern.

Explain why your answer is correct.
Use what you know about growing patterns in your explanation.
Use words and/or numbers in your explanation.

<table>
<thead>
<tr>
<th>Level Number</th>
<th>Number of Smiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Continue the patterns below and state the pattern rule.

1. 553, 563, 573, ___, ___, ___  Rule:_____________________

2. 898, 798, 698, 598, ___, ___, ___  Rule:_____________________

3. 605, 600, 595, 590, ___, ___, ___  Rule:_____________________

4. Create a decreasing pattern on the lines below. The first number is done for you.
   a. 88, ___, ___, ___, ___, ___  The rule is_____________________
Summative Assessment- Growing and Numeric Patterns

Draw a picture to show the next level of the growing pattern.

Step A

[Picture of growing pattern]

Step B
Describe the 6th level of the growing pattern.

Explain why your answer is correct.
Use what you know about growing patterns in your explanation.
Use words and/or numbers in your explanation.

I saw that in level 1 there were 4 smiley faces.

In level 2 there were 6 smiley faces.

In level 3 there were 8 smiley faces.

I am adding 2 to each level. 4, 6, 8, so I know level 4 will be 10, level 5 will be 12 and level 6 will be 14.

Continue the patterns below and state the pattern rule.

1. 553, 563, 573, _583__, __593__, _603__  Rule:_____Add 10

2. 898, 798, 698, 598, _498__, __398__, __298__  Rule:_____Subtract 100

3. 605, 600, 595, 590, _585__, __580__, __575__  Rule:_____Subtract 5

4. Create a decreasing pattern on the lines below. The first number is done for you.

b. 88, ____, ____, ____

The rule is__________________________
Pre Assessment & Launch
Can you describe what you see below?

The rule is _____________________________________________

Let’s describe another example.

The rule is _____________________________________________
Is this a growing Pattern?

Is there a rule? _________________

Reptile Pattern

Describe what is happening as the level increases.

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
# How Long is the Fishes Tail?

<table>
<thead>
<tr>
<th>Level (Input)</th>
<th>Number of Trapezoids Used (Output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
## How Long is the Fishes Tail?

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<tr>
<th>Level (Input)</th>
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</thead>
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<tr>
<td>1</td>
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</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
</tr>
</tbody>
</table>
Can you find the rule?

Be sure to include the rule in your explanation.

Part A. How many circles will there be in a level 7? _______________________

Part B. Explain why your answer is correct.
Use what you know about growing patterns to explain why your answer is correct.
Use words and/or numbers in your explanation.

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________
Part A. How many circles will there be in a level 7? ______32______________

Part B. Explain why your answer is correct. Use words and/or numbers in your explanation.
Each level is increasing by 4 red counters. I know this because I found the difference between 8 and 12 was 4. I
know level 6 has 28 counters so 28 + 4+ = 32. So my answer is 32 counters will be in level