

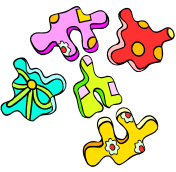
Parallel Model Overview



Lesson Topic: Patterns, Patterns, Everywhere

Subject Area(s): Math

Grade Level(s): Kindergarten



Context:

This unit can be adapted to meet the needs of a mixed-ability general education class, or a group of gifted learners for differentiated services. Although this was designed as a unit each lesson could be taught separately.



Length:

2-3 weeks, one hour daily sessions.



Lesson Summary:

The lessons, included in this unit, address the need for students to see patterns and their purpose. The unit highlights patterns found within mathematical topics as well as patterns found in the environment. The first lesson illustrates to students that patterns are a part of their environment and that patterns can be seen everywhere. This lesson emphasizes the power of patterns in allowing us to know what to expect from our world. The second lesson helps students to make the connections that patterns are an important element in math that allow us to solve problems and predict what will come next. The third lesson investigates patterns found in addition problems. It specifically focuses on the pattern of adding 10 to an addend. The lesson investigates how the patterns involved in basic addition facts can help solve addition problems with greater numbers. The fourth lesson investigates patterns found in addition problems. It specifically focuses on the Commutative Property of Addition and the Zero Property of Addition. The lesson explores how the patterns involved in basic addition facts can help solve other addition problems and how they can make mental math easier. The fifth lesson explores our base 10 number system and patterns found in it. We want students to realize that patterns often serve a purpose and that they allow for prediction.



Content



Parallel(s) Targeted:

Core Curriculum: Students are introduced/re-introduced to key facts, concepts, principles, and skills in math

Curriculum of Practice: unit requires students to assume the roles of mathematicians to investigate the patterns found among mathematical concepts.

Curriculum of Connections: unit addresses the macroconcept of patterns that exist in our environment as well as patterns found in mathematics.

Curriculum of Identity: unit encourages students to observe the patterns among mathematical topics and their own lives. It illustrates the importance and usefulness of patterns in everyday living as well as in math.

Standards:

NCT 3 Represent numerals up to 10 with objects

NCT 6 Develop a concept of numbers, zero through ten; count groups of 10 or fewer objects saying how many; record the number.

OPR 1 Model and explain addition and subtraction to 10 using concrete objects.

PFA 1 Identify, copy/model, and describe patterns found in common objects, sound, and movement

PFA 4 Explore number patterns such as odd/even, using concrete materials.

Concept(s):

Patterns



Generalizations/Enduring Understandings:




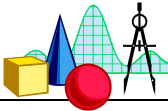
1. Patterns have segments that are repeated.
2. Patterns allow for prediction.
3. Patterns exist in the natural or man-made worlds.
4. Patterns are used to help solve problems.

Knowledge: (facts and content knowledge from the Program of Studies)

Students will...

- Understand that patterns have segments that are repeated
- Understand patterns are used to help solve problems
- Understand that patterns can be found in math
- Understand patterns found on the hundreds chart
- Understand the commutative property of addition
- Understand the property of zero

| | |
|---|---|
| | <p>Skills: (a proficiency, ability, strategy, method, or tool)</p> <ul style="list-style-type: none"> • Categorize examples and non-examples of patterns • Find patterns in the environment • Discover patterns among math concepts • Solve math problems • Compare and Contrast number systems |
|  <p>Assessment</p> | <p>The teacher will use pre-assessment, ongoing assessment (both formal and informal), and post assessment to monitor student progress. The teacher will monitor conceptual understandings, factual information, and application of skills at specific intervals throughout the unit. Observations, conversations, and the completed final products will be used to check for effort and competency. At the end of the unit there are released test items from the Virginia Standards of Learning that you could use these questions with the students.</p> |
|  <p>Introduction</p> | <p>Essential Questions:</p> <ol style="list-style-type: none"> 1. What are patterns? 2. How do patterns help us? 3. Where are patterns found? 4. How can patterns help you solve problems? |

| | |
|--|---|
| <p>Teaching Methods</p>  <p>Learning Activities</p>  <p>Flexible Groupings</p>  | <p>What are the primary teaching methods you will employ in this unit?</p> <ul style="list-style-type: none"> • Direct Instruction • Demonstration/Modeling • Inquiry-Based Instruction • Socratic Questioning • Cooperative Learning • Concept Attainment <p>What learning activities will be used to engage students?</p> <ul style="list-style-type: none"> • Analytical Thinking Skills: Identifying characteristics, Making observations, Discriminating between same and different, Comparing and contrasting, Categorizing, Seeing relationships, Finding patterns • Critical Thinking Skills: Inductive thinking, Deductive thinking, Identifying missing information • Executive Processes: Metacognition, Generalizing, Problem Solving • Creative Thinking Skills: Listing attributes, Brainstorming <p>How will you use flexible instructional groupings to address differences in readiness, interest, and learning preference?</p> <p>This unit utilizes a variety of grouping strategies (whole class, small groups, pairs, or independent study) that can be used according to readiness level, interest, and learning preference. Pre-assessments will determine readiness and interest-level and will guide the grouping of students. Heterogeneous, whole-class grouping are used to share knowledge, build on each other's ideas, and generate conclusions. Homogenous groups can be utilized when advanced students are ready to move ahead independently and other students may need more assistance. Opportunities for scaffolding instruction are inherent throughout the lessons.</p> |
| <p>Products</p>  | <p>What are the major products that students will produce?</p> <ul style="list-style-type: none"> • Math Path Book • Drawings of examples and non-examples of patterns • Completed patterns chart • Completed math problems |



Resources

What resources will enhance this unit?

- Pattern Picture Books
- Examples and non-examples picture cards of patterns
- Websites on patterns provided in the teacher reflection portion of lesson
- Hundreds Chart
- Index cards with numbers or number tiles



Extensions

How will you extend student learning?

There are several opportunities for extension activities outlined in the Teacher Reflections.



Ascending Levels

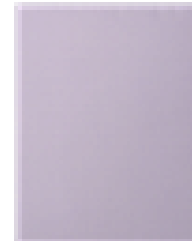
Throughout the unit there are opportunities to meet individual students' needs. Questioning, scaffolding, and grouping can be utilized to provide extra support for students. The unit also addresses the needs of advanced learners by providing them with extensions to delve deeper into the material being studied. For example, students who show an advanced understanding of patterns may research patterns in art, music, nature or another field of interest. Other extensions are outlined in the teacher reflections portion of the unit.

Lesson 1: Session 1

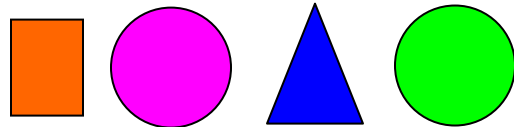
1. Tell the students that they are going to act like detectives to solve a mystery. Explain that they are going to try and figure out how items placed in a “yes” group are similar. Explain that all of the items in the “yes” group share a common attribute. Tell them that items that do not have this attribute will be placed in the “no” column.
2. Present one item at a time under the “yes” and “no” signs. Present the clearest example first in both columns. After placing several items in each category ask the students where they think the next item that you show goes, in the “yes” or “no” column. If students are unsure you can place it in a neutral category and come back to it at a later time.
3. After about six examples in each category ask the students, “What is the same about the examples in the “yes” column? What attributes do the “yes” examples share?” List the attributes where all students can see. List all the suggestions even if they are wrong. If the students name the concept, patterns, as an attribute ask, “What makes the examples fit that category?”
4. Once students have defined the concept have them provide examples for the “yes” category. Ask students to draw a picture of an example that would belong in the “yes” category and one that would belong in the “no” category.
5. Ask students to define pattern. Ask students to list some of the examples of patterns they found in their everyday life. Ask students why patterns are important. Tell students that in the next lessons we will be searching for patterns in our environment.

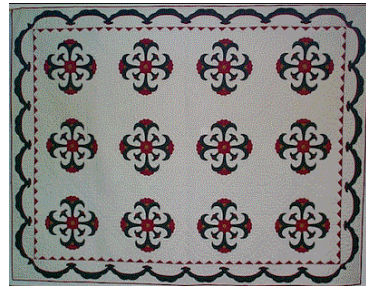
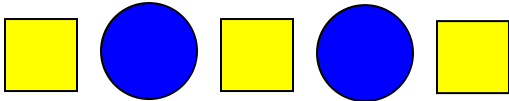
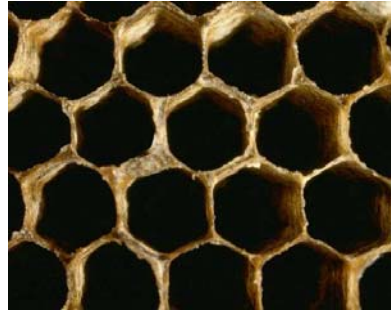
Some items to use for the “yes” category: a quilt, a strip of wallpaper, a sewing pattern, a numerical sequence, a geometric sequence, a spider web, a strip of paper dolls. Some items to use for the “no” category: a plain paper towel, solid wallpaper, a birthday card, a list of random numbers, a plain drinking glass. Picture cards have been included or you can use your own examples.

We want students to eventually come to the conclusion that the power of patterns is that they allow us to predict what will come next and they allow us to solve problems that would be very tedious to solve otherwise. We want students to look for these patterns to help them to make connections, predict what will come next, and solve problems.



1, 7, 3, 5, 12, 57





2, 4, 6, 8, 10, 12



Lesson 1: Session 2

1. Begin the lesson by reading *Lots and Lots of Zebra Stripes: Patterns in Nature* by Stephen R. Swinburne and *Nature's Paintbrush : The Patterns and Colors Around You* by Susan Stockdale. Ask the students to look around the classroom to find any patterns. Create a list of patterns that are highlighted within the classroom.
2. Ask students what a pattern is. Explain to students that we can find patterns everywhere we look in our environment and that patterns often have a purpose. Tell students that sometimes patterns are made by nature and sometimes they are made by people. Ask students to give an example of a natural pattern. Ask students to give an example of a pattern made by people.
3. Ask students how patterns can be helpful to us. Record students' responses on chart paper
4. Tell the students that we are going to be looking for patterns in our everyday lives. Ask students how they use patterns in their lives, record responses. Discuss student responses and ask how each example is important or helpful.
5. End the session by telling students that patterns are all around us. Explain that we will begin a journey that helps us to see patterns in our environment and discover their purpose.

Nature's Paintbrush investigates the ways in which the patterns and colors found in nature help plants and animals survive. For example, the tigers wavy stripes allow it to blend in with its surroundings and hunt undetected, and the circular pattern of flower petals attracts bees to the flowers center where they spread pollen. Each page or double-page spread begins with a question (e.g., Have you ever noticed the eyespot near the tail of a butterfly fish? or Have you ever been pricked by a cactus?) followed by a brief, lyrical explanation (Editorial Review from **School Library Journal**.) You could use this format to create your own book at the end of the lesson.

This list will be an ongoing list throughout the lesson that can be updated and revised.

You want to emphasize the purpose of specific patterns and how they are helpful. For example, if students mention the sun comes up each morning ask them how knowing this is helpful. We eventually want students to come to the conclusion that patterns allow for prediction and help us solve new problems from our previous experience. However, we want them to generate this conclusion rather than telling them. So, allow students to add to the list of why they think patterns are helpful and we can revisit and update this list throughout the lessons.

Lesson 1: Session 3

1. Remind the students of the lesson we previously completed by asking them for examples of patterns in our everyday lives.
2. Ask the students, “What is a path?” Tell the students that we will create a math path that illustrates all of the places we can find patterns. Explain that we will begin our math path by taking a walk around the school and taking pictures of anything that relates to patterns.
3. As a class walk around the predetermined path. Have students point out places where patterns can be found. For example, if one of your pit stops is the cafeteria you could ask, “What patterns can be found in the cafeteria?” “Does this pattern help us?” “How does this pattern help us?” “Does this pattern have a purpose?” “If so, what is the purpose?” Students may mention that they go through the line the same way each day. This pattern helps keep order and people from getting hurt. At each pit stop have students verbalize patterns found and how they may help us. Take pictures of these places or things.
4. After you have completed the math path return to the classroom. Tell the students that the next time you meet you will be working in groups to create a book that illustrates all of the patterns found at the pit stops along the math path.

Teachers want to create the math path prior to the lesson. Select several pit stops where you think finding patterns would be advantageous along the math path.

If a digital camera is not available you may have students draw pictures of the places or write the location or item on a post-it note. Again we want students to eventually conclude that patterns help bring order to our lives and allow for prediction.

Lesson 1: Session 4

1. Share the photos taken previously along the math path. Explain to the students that we will create a book showing patterns found in our environment and their purpose.
2. Distribute a photo to each student. Instruct students to think about how this pattern helps us or what its purpose is. Have students write a sentence or two about the purpose of the pattern or how it helps us function in our daily lives. Share an example of a completed book page with the students
3. Allow students time to complete their sentences. After all students have finished their sentences have students share their completed page with the class.
4. End the lesson by discussing what students learned about patterns. You can lead students to the idea that patterns allow for prediction through questioning and discussion. We want students to understand that patterns help to tell us what to expect from our world. Ask students how they think finding patterns in math could help us learn? Tell students that throughout future lessons we will be investigating patterns found in math and how they can help us solve problems.

Modification for Learner Need:

Students who can not write independently could orally dictate the purpose of the pattern and how it helps us function in our daily lives. They could also use a tape recorder to record their response if one is available.

An example is provided. You may use the example or create your own page to use with the students.

Optional Extension:

As a class or individual students who demonstrate an advance understanding of patterns may complete research on patterns in nature, music, art, music, literature, etc. The following are websites with information on patterns:

<http://www.uen.org/themepark/patterns/naturepatterns.shtml>

http://atschool.eduweb.co.uk/sirrobhitch.suffolk/patterns_nature/

think finding



Have you ever noticed **that the bell rings each morning?** This pattern helps by **letting us know when it is the right time to start school.**



Have you ever noticed _____

This pattern helps by _____

9. As the chart is shaded ask questions which encourage the children to look for patterns in the numbers. Which number will be next? How do you know? Do you think that we will get to this number (point to a number that doesn't end in a 5 or 0)? Why or why not? Do you think that we will get to this number (point to a number that ends in a 5 or 0)? Why or why not? Ask students for their observations and write them on the board or chart paper.

10. Using pictures of other items have pairs of students investigate the patterns up to at least 6.

Pictures could include:

- person (2 legs)
- spiders (8 legs)
- tricycles (3 wheels)
- bicycle (2 legs)
- stool (3 legs)

11. Have the pair of students chart the number patterns. After students have completed a chart they should shade in the skip counting pattern on a hundreds chart. Lastly, students should write three observations they notice about the patterns they formed.

12. As a class discuss the patterns found on the hundreds chart. Encourage students to find odd and even number patterns and patterns in the tens and ones places. Ask student how knowing these patterns may be helpful in math. Ask students why skip counting is important in math. Share the following quote with students, "Arithmetic begins with learning to count by ones after that, it is a never-ending search for shortcuts to avoid one by one counting." Ask students what they think this quote means. Ask students how all of the patterns found can help them reach this goal.

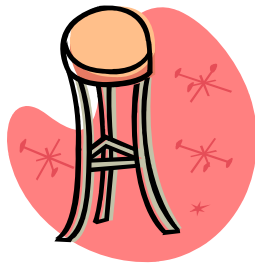
Observations may include: numbers are all in a column, all numbers have zero or 5 in the ones place, visually it makes two long columns etc.

Modification for Learner Need:

Depending on students' needs you may group in partners or students could work individually.

Author of the quote is unknown.

Again, we want this discussion to lead the students to the idea that mathematics is built upon patterns and finding patterns in math can help us solve future problems or make tedious problems easier to solve.



| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 67 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

Hundreds Chart

Lesson 3: Session 1

1. Tell the students that today you are going to practice adding ten to another addend. On the board write the problem $3 + 10$. Ask students what the sum is. Ask students to share various strategies they used to solve the problem.
2. Demonstrate finding the solution using the hundreds chart. Using a blue crayon shade in the number 3 space and count on 10 more spaces. Shade the 13 number space blue.
3. Ask students what the sum of $6 + 10$ is. Have students share strategies they used to solve the problem. Tell the students you want to demonstrate finding the solution using the hundreds chart. Using a red crayon shade the number 6 space and count on 10 more spaces. Shade the 16 number space red.
4. Ask students what the sum of $8 + 10$ is. Have students share strategies they used to find the solution. Tell the students you want to demonstrate finding the solution using the hundreds chart. Using a green crayon shade the number 8 space and count on 10 more spaces. Shade the 18 number space green.
5. Ask the students if they notice any patterns about the colored spaces.
6. Ask students what the sum of $13 + 10$ is. Have students share strategies they employed. Tell the students you want to demonstrate finding the solution using the hundreds chart. Using a yellow crayon shade the number 13 space and count on 10 more spaces. Shade the 23 number space yellow. Ask if this problem follows the same pattern as the previous problems. Ask students if they can think of a quicker way to solve the problem then counting one space at a time.

You may use any color crayon to shade in the spaces. The point of using a different color for each problem is so students can visually see that the “blue” shaded spaces are in the same column above each other.

7. Ask students what the sum of

$16 + 10$ is. Have students share strategies used. Tell the students you want to demonstrate finding the solution using the hundreds chart. Using a purple crayon shade the number 16 space and count on 10 more spaces. Shade the 26 number space purple. Ask if this problem follows the same pattern as the previous problems. Ask students if they think this pattern would apply to any problem where 10 is one of the addends. Tell the students you want to complete an investigation to test this theory.

8. Distribute hundreds chart to students.

Write the following problems on the board:

$$42 + 10 =$$

$$56 + 10 =$$

$$68 + 10 =$$

Instruct students to complete the problems. After students have had time to complete the problems bring them back together.

9. Ask students to share their findings.

Students should make the connection that the blue squares are in the same column, the red squares are in the same column, and the green squares are in the same column. They may also conclude that the sum has the same number in the ones place as the original addend and the number in the tens place is one greater.

You want students to make the connection that when adding 10 to any addend you can just move down one space from the addend.

As a class shade in the squares for each addition problem and decide whether or not it follows the pattern noted.

Repeat process with each problem

10. Lead a discussion on how knowledge of this pattern can be helpful in math. Ask students the following questions:

- a. How does finding patterns in math help us solve problems?
- b. Does this pattern only help in adding 10?
- c. Would it help if we had to add 20? How?
- d. Does this pattern help if we wanted to add 13?

Students should make the connection that the purple squares are in the same column. They should also conclude that the sum has the same number in the ones

place as the original addend and the digit in the tens place is one greater.

You may want to use white boards to complete the problems instead of paper and pencil.

them start at the 15 space and count on 13 more. Then show them a quicker way using the knowledge we just gained about adding 10. Start at the fifteen space move straight down for 10 and ask the students how many more we would have to add to make 13. Students should conclude 3 more. Move to the right three more spaces. Have students complete various problems using the hundred chart.

You want students to make the connection that if you wanted to add 20 you would move down two spaces.

11. Have a student come up to the hundreds chart and add $15 + 13$. Have

Modification for Learner Need:

This portion of the lesson could be eliminated if you feel it would be too difficult of a concept for your students to grasp. Or, you may have a small group of students complete this section of the lesson who demonstrate a firm grasp of the concepts thus far.

| Unit Sequence | Teacher Reflections |
|---|--|
| <p><i>Lesson 3: Session 2</i></p> <ol style="list-style-type: none">1. Tell the students that they are going to be exploring patterns found in addition. Write the addition problem $4 + 3$ on the board. Ask the students what the sum of $4 + 3$ is. After students answer ask what strategies they used to find the sum.2. Write the addition problem $40 + 30$ on the board. Ask students what is different about this problem from the first problem. Ask the students what is the same about this problem from the first problem.3. Tell the students that you want to use the hundreds chart to find the sum of $40 + 30$. Starting at the 40 space count on 30 more spaces.4. Explain to the students that it took a long time to count 30 more spaces. Ask students if anyone could think of a quicker strategies using what we know about skip counting by 10s. Encourage | <p>students to come to the conclusion that you could move straight down since we learned that moving down on the hundreds chart is 10 more. You would have to do this three times to reach 30. Demonstrate this strategy to the class.</p> <ol style="list-style-type: none">5. Ask the students if you arrived at the same sum. Ask students which method was easier or quicker. Write the sum on the board.6. Ask students what is different about this sum from the first sum. Students should note that the both sums have a 7 but the second one has a zero.7. Write the addition problem $2 + 3$ on the board. Ask the students what the sum is. After students answer ask what strategies they used to find the sum.8. Write the addition problem $20 + 30$ on the board. Ask students what is |

You want students to make the connection that both problems have the digits 4 and 3 but in the second problem they are in the tens place.

+ 30. Starting at the 20 space count on 30 more spaces.

10. Explain to the students that it took a long time to count 30 more. Ask students if anyone could think of a quicker strategies using what we know about skip counting by 10s. Encourage students to come to the conclusion that you could move straight down since we learned that moving down on the hundreds chart is 10 more. You would have to do this three times to reach 30. Demonstrate this strategy to the class.

11. Ask the students if you arrived at the same sum. Ask students which method was easier or quicker. Write the sum on the board.

12. Ask students what is different about this sum from the first sum.

13. Repeat this process with other addition facts until you feel students begin noticing the pattern.

14. Ask students if anyone detects a pattern among the addition facts.

Discuss the patterns.

15. Ask the students how knowing this pattern is helpful.

Remind them of the conclusion they came to about the two problems: Both problems had the digits 4 and 3 but the second problem had a zero in the ones place.

different about this problem from the first problem and what is the same.

9. Tell the students that you want to use the hundreds chart to find the sum of 20

Students should respond that both problems have the digits 2 and 3 but in the second problem they are in the tens

place. Students should also note that the second problem contains a zero.

Optional Extension: If you feel the students are ready you may introduce problems that extend to the hundreds place value. For example, you could use the problem $200 + 300$ to extend the pattern.

Students should note that the both sums have a 5 but the second one has a zero. Remind them of the conclusion they came to about the two problems: Both problems had the digits 2 and 3 but the second problem had a zero in the ones place.

Students should see the basic addition fact ($4 + 3 = 7$), and understand that greater sums are similar because the digits on the left are the same. Only the number of zeros to the right varies.

You want students to come to the conclusion that finding patterns in math helps them to solve other problems. You want them to understand that we learn to use what we already know to address new problems. Tell students that when they are solving a math problem they should ask themselves, “This reminds me of...” or “How is this problem like other problems I have solved before?”

1. Explain to students that many times in our lives we have to choose which order we want to complete a list of things to do. For example, if we had two errands to run, going to the grocery store to purchase ice cream or going to the toy store to buy a toy which errand would you go to first if it was 95° outside? Why? If the grocery store was going to close in 5 minutes and it was cold outside which errand would you go to first? Why?

2. Ask students if they would put their shoes on first or their pants? Why? Could you reverse the order? Is there ever a time you would reverse the order? Explain to students that it doesn't matter the order you complete the tasks because they all will be accomplished but that one way may be easier or quicker than another way.

3. Tell the students that we will be investigating patterns found in addition problems today. On the board write the problem $4 + 8$ and ask students what the sum is. Ask students to share strategies they used.

4. Next, write the problem $8 + 4$ on the board and ask students what the sum is. Ask students what is the same about the two equations (They have the same sums. They both have the numerals 4 and 8) Ask them what is different about the two equations (The order of the addends is different.)

5. On the board write the problem $5 + 6$ and ask students what the sum is. Ask students to share strategies they used.

6. Next, write the problem $6 + 5$ on the board and ask students what the sum is. Ask students what is the same about the two equations (They have the same sums. They both have the numerals 6

You may want to give students a different example than the one provided. The purpose of the example is to illustrate that we often have to prioritize events and we select the order to complete tasks on a number of factors including convenience. Similarly, in math you may select to complete the addition of multiple addends in a different order than sequentially from left to right if it makes solving the problem easier.

the pattern. Once students have made the connection explain that this pattern has a name: Commutative Property of Addition. Ask students how they think this property could make addition easier?

8. Write $5 + 7 + 5$ on the board and tell the students that you want them to add these numbers mentally. As a class have students add the numbers from left to right. Then ask the students if they think it would be easier if we switch the numbers to $5 + 5 + 7$. Switch the numbers and then add the problem mentally as a class. Ask students which way was easier. Why?

9. Write $9 + 3 + 1$ on the board and tell the students that you want them to add these numbers mentally. As a class have students add the numbers from left to right. Then ask the students if they think it would be easier if we switch the numbers to $9 + 1 + 3$. Switch the numbers and then add the problem mentally as a class. Ask students which way was easier. Why?

10. Distribute index cards that have the numerals 0-9 on them. Each index card should only have one digit and the students should have two sets. Students should also have an index card with the addition sign and the equal sign. Create problems similar to the ones above and instruct the students that they may move the digits anyway they would like. Have students share the order of their problem and ask why they selected that particular order.

the two equations (The order of the addends is different.)

7. Repeat steps 3-4 using different equations until students begin to notice

You want students to come to the conclusion that changing the order of the addends does not change the sum. To help them remember you can tell them

that numbers can move “commute” to anywhere in the expression.

Students should conclude that it was easier the second way since they all knew $5 + 5$ was 10.

Students should conclude that it was easier the second way since they all knew $9 + 1$ was 10.

You may want to use magnetic numbers on the board and complete the activity as a whole class rather than using index cards. Or, you could use tiles instead of index cards. The main goal is for students to be able to physically manipulate the order of the numbers.

11. Ask students how knowing this property will help them in math.

12. Tell the students that we will be investigating another pattern found in addition problems. On the board write the problem $9 + 0$ and ask students what the sum is. Ask students to share strategies they used.

13. Next, write the problem $8 + 0$ on the board and ask students what the sum is. Ask students to share strategies they used.

14. On the board write the problem $5 + 0$ and ask students what the sum is. Ask students to share strategies they used.

15. Repeat steps 3-4 using different equations until students begin to notice the pattern. You want students to come to the conclusion that adding a zero has no effect on the sum. Once students make this connection explain that this pattern has a name: Property of Zero, when you add zero to any number that number is the sum.

16. Ask students how knowing this property will help them in math.

We want students to conclude that knowing these properties helps makes

solving problems easier as well as making mental math easier

Once again, we want students to realize that knowing math properties will help make solving problems easier.

1. Tell the students that we are going to imagine that they are from another planet named, Zoomax. Explain that we have been given the job of gathering all of the zoots (type of berry eaten by individuals on the planet Zoomax) and recording how many zoots we have to give to the king.

2. Explain that this is a difficult task because the people on Zoomax have no number system and have not developed a way to represent “how many”. Ask the students what numerals we use to represent quantities. Students should respond with the numerals 0-9.

3. Show students a jar of marbles which represent the zoots. Tell them that you want to brainstorm ways we could represent the amount of marbles without using our numbers 0-9. For example, we could use shapes. A square could be one, a circle two, etc. Ask volunteers for other ways to represent numbers and record on chart paper.

4. Tell the students you are going to use shapes to represent “how many”. As a class decide which shape will represent 1 and write it on the board. Then ask which shape will represent 2 and write it on the board. Continue in this manner until students run out of shapes. Lead a discussion on the advantages and disadvantages of this number system.

Ask students if we were able to count all of the marbles in the jar. Would this be a problem? Why or why not?

Ask students if we were using our numbers if we would be able to represent all of the marbles in the jar? How is this possible if we only have 10 numerals?

Make sure students know what a number system is prior to the beginning of the lesson.

Examples of student responses may include: tally marks, colors, squiggle lines, pictures etc.

You want students to come to the conclusion that you are not able to count large numbers using the shapes because you have a limited number of shapes.

6. Explain that this is the number system you are going to use on the planet Zoomax. A rhombus will mean one, a square 2, a triangle 3, etc. Place a secret number of marbles in the bag and write a shape on the board that represents how many marbles are in the bag. Show the students the shape you wrote on the board and ask them how many marbles are in the bag. Ask how they knew. Continue this procedure several times until students understand that each shape represents a specific number.

7. Begin counting the marbles in the jar and stop at 11. As you count the marbles write the number we use to represent the quantity as well as the shape we would use on the planet zoomax.

8. Ask the students what shape represents the number 11. Students should respond that you all don't have a shape to make 11. Ask them if this would be a problem. Ask a student to write the number 11 on the board and continue up to the number 25. Ask students what patterns they notice in our number system.

9. Ask students to brainstorm ways to make the number 11 if they only use the shapes on the board. Record the students' responses on chart paper. After each suggestion have students make several numbers using their system (try to include numbers that they may be able to make as well as numbers that they wouldn't be able to make) and

5. On the board write the following shapes:



You want students to realize that although we have a limited number of numerals we can make any number with the ten digits since we repeat them using columns.

Some sample suggestions may include color the shapes. For example, red rhombus is 11, red square 12, red triangle 13, etc. Another suggestion may be to make them different sizes. Some students may suggest that you may combine shapes together. For example, you could use a circle and rhombus to make 6 or 51.

discuss the advantages or disadvantages of this number system.

You want to emphasize that even though we have a limited number of symbols we

have to be able to make a lot of numbers by manipulating the symbols which we are able to do in our number system.

1. Ask the students what symbols we use to represent numbers. Students should respond with the numerals 0-9. Ask students what we use to represent numbers on the planet Zoomax. Students should respond shapes.
2. Tell the students that we are now going to use color chips to represent numbers today. Tell the students that we have three color chips, white ones, blue ones, and red ones. Explain that whenever you have ten white ones, you can exchange them for one blue one; or anytime you want to exchange a blue one for ten white ones you can do that. And any time you have ten blue ones, you can trade them in for one red one, or vice versa.
3. Show them how to count ten blue ones (representing ten's) saying, "10, 20, 30...100" so they can see that a red one is worth 100.
4. Lay down eleven white chips and say, "If we exchange 10 of these white ones for a blue one, what will we have?" Students should respond something like, "one blue and one white".
5. Repeat this procedure using mixtures of red, blue, and white chips until they students can readily and easily represent numbers.
6. Ask the students, "If you have 15 white ones, what can you trade?" "I have three blue chips, how many white chips could I get?"
7. Have students make various numbers using the fewest possible chips. Some numbers to use are: 30, 60, 12, 15, 31, 34, 54, 103, 15, etc.
8. Tell the students you have two blue chips and four white chips. Ask the students what number this would

9. Introduce the Target Number game to students. Divide the class into two groups, Team A and Team B. Tell the students that you will give a target number that the students will try to reach using the chips. Each group will have a turn to put one chip on the board. The first group that reaches the target number wins. Demonstrate a game scenario to the students by writing the number 24 on the board. Tell the students that they can use any colored chip they want when it is their turn. Divide the board into three squares and write red, blue, and white in the

| | | |
|-----|------|-------|
| Red | Blue | White |
|-----|------|-------|

appropriate square. Remind the students that the goal is to reach the number 24. Place chips on the square while modeling your strategy. For example, say, “I think I will put a blue chip down since 24 is a large number.” On the board write the number 10 since you have just made the number 10. Then have a student select a chip to put down. Ask them why they choose the chip they did. Have them write the new number down. For example, if they put a blue chip down change the number from 10 to 20. If they put a white chip down change the number from 10 to 11. Make sure you emphasize that the blue chips represent 10 while the white chips represent 1. Again select a chip to place down and use think alouds to model your strategy. For example, you may say, “The new number is 20 so if I put a blue chip down I will go over my target number and lose. The only option to put

You want to reinforce that the chips still represent the same quantity by saying, “That is still eleven, right?” Point at the blue one and say 10 and 1 is eleven.

represent. Continue telling them amounts of chips and have the students tell you what number it makes.

down now is white chips. Place a white chip in the box and write 21 on the board since that is your new number.” Have a student select a chip and explain why he/she selected the chip they did. Make sure they change the number to the new number created. Each time you can have the students count the chips starting with the blue ones and then the white ones. It is now your turn to select a chip. Again tell the students why you are selecting the chip you do. The student should reach 24 on their next turn. If students use consecutive white chips make sure to exchange them for a blue chip once they get to 10.

10. After you answer any questions play several rounds of the game. Use different target numbers each time. Lead discussions by questioning students on why they select the chips they do. Each time have students count the chips to verbalize what number they have represented with the chips.

You want students to really grasp the concept that a blue chip really represents ten although it is one chip.

Lesson 5: Session 3

1. Remind the students of the Target Number game we played previously. Show the students a blue chip and two white chips. Ask students what number that represents. Students should respond 12. Ask the students why it doesn't represent 3. Students should respond that the blue chip makes 10. Ask students why we don't just use 10 white chips instead of 1 blue chip. Make some numbers using the colored chips and have students tell you what numbers the chips represent.
2. Tell the students that when we count we use numbers instead of colored chips. Ask the students what numerals we use. Students should respond with the numerals 0-9. Explain that with these 10 digits we can make any number we want to. Using marbles count one at a time and write the corresponding number on the board until you reach the number 9. Using the white chips have a student show you how you would represent the number 9.
3. Next count out 10 marbles and ask the students how you would represent 10 with chips. Students should respond that you would use the blue chip because that means 10. Ask the students using numbers how we would write 10. Ask the students if the one means you only have one marble. Students should respond no. Ask them what it means.
4. Have students make the number 11 using chips. Ask the students what the blue chip means. Ask the student what the white chips means. Pointing to the number 11 ask the students what the 1 in the tens column means. Ask what the 1 in the ones column means.

You want to lead the students to the idea that the 1 means you have one group of ten and the 0 means you have 0 ones. Relate this concept back to the chips. The blue chip means you have 1 group of 10 white chips.

Again, you want to emphasize that the one in the tens column means you have one group of ten it is the same as a blue chip and that the one in the ones column means you have one which is the same as the white chip.

5. Write the number 34 on the board. Have a student represent 34 using chips. Ask the student what the three blue chips means. Ask the student what the 4 white chips mean. Ask the student if you could have used 34 white chips to make the number. Ask why he/she chose not to use 34 white chips. Ask the students what number on the board represents the blue chip. Students should respond the 3. Ask students what number represents the white chips. Students should respond the 4. Ask the students if they notice a pattern between the chips and the columns.

6. Tell the students that we use columns to represent the value of numbers in our number system. Write the number 45 on the board. Point to the 4 and explain that the number is a 4 but it doesn't mean 4. Instead it means 4 groups of 10 or 4 blue chips or 40. Explain that this is the tens column. It is similar to the blue chip we have previously used. Point to the 5 and tell the students that this number means 5 ones or 5 white chips or 5. Explain that this is the ones column.

7. Write several numbers on the board and ask the students what the numbers mean (represent). Each time stress that the position of the numeral tells us the value of the number. Ask the students if they notice any patterns between the columns and the colored chips. The blue chip represents 10, so if you have 3 blue chips you have 30. The tens column represents 10, so if you have the number 3 in the tens column the value is 30. Whereas, the white chip represents 1, so if you have 5 white chips you have 5. The ones column represents 1, so if you have the number 5 in the ones column the value is 5.

The crucial point that you want to highlight is that in place value a certain column represents a certain size group. The digit in that group tells you how many of those certain size groups you have.

Pattern Assessment Questions

Look at the pattern of shapes below.



If the pattern continues in the same way, what will the next shape look like?



Look at the pattern of leaves below.



If the pattern continues in the same way, what will the next leaf in the pattern look like?



Look at the pattern of shapes below.

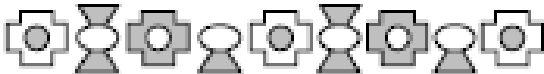


If the pattern continues in the same way, what will be the next shape?

- A
- B
- C
- D

Pattern Assessment Questions

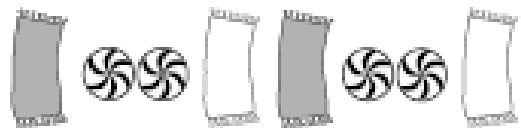
Look at the pattern of shapes below.



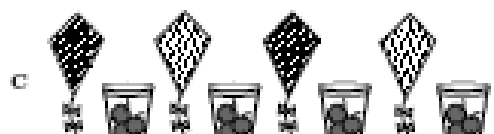
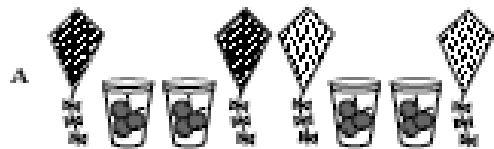
If the pattern continues in the same way, what will be the next shape?

- F
- G
- H
- J

i Look at this pattern.



Which of the following shows the same kind of pattern?



Which of the patterns below is