

PATTERNS AND FUNCTIONS

K-2 ASSESSMENT

How will I determine my student's needs and how will I know which activities are appropriate for addressing those needs?

Two tools are available to help you determine the needs of your student: Assessments and Teacher Inventories.

Assessments are provided for each grade band within a content strand, for example, there is a K-2 Number & Operation Assessment, a 3-5 Number & Operation Assessment, etc. They can be used each time you begin a new content strand or change grade bands within a strand. Assessments are designed to help you target your student's areas of conceptual strengths and difficulties. Each question on the Assessment addresses one or more mathematical concepts and is correlated to one or more activities in the unit. Begin by using the grade band Assessment that corresponds to your student's current grade level. Have available the Assessment for the grade band below the one you are administering and for the grade band above. If the student quickly and easily answers all of the questions on the Assessment, move up to the next level. If the student has difficulty with several of the questions on the Assessment, begin by simplifying the question, if possible. For example, if the question asks students to *use a calculator to find whole numbers that divide evenly into 156*, the question could be simplified by asking students to do the same for the number 56, or simpler still, 16. If your student struggles with most of the questions, move down a grade band level.

When possible, also seek the assistance of your student's classroom teacher in assessing the student's current needs. The Teacher Inventory, to be completed by the student's classroom teacher, provides another lens for determining your student's areas of difficulty. For each mathematical strand, there is a K-5 Teacher Inventory that covers the K-2 unit and the 3-5 unit for that mathematical strand, and a 6-8 Teacher Inventory. These inventories contain a list of concepts associated with the mathematical strand, and next to each concept is a place for the teacher to give information regarding the student's mastery of those concepts. For your reference, there is a column in the Teacher Inventory that lists the activities within the grade band where each concept is practiced.

Using the information you have gathered from the Assessment, and information from the Teacher Inventory (if available), create an informal mentoring plan for the up-coming weeks. Determine which activities you will use and approximately how much time you will allocate to each activity, but remember, be flexible!

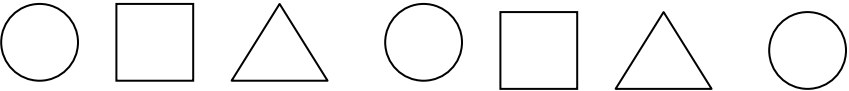
Patterns and Functions

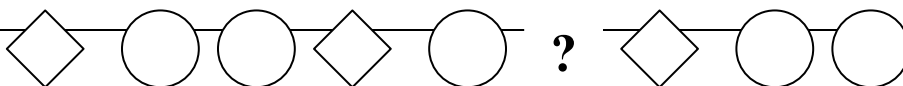
K-2 Assessment

The questions below are designed to help you assess your student’s current needs. During the first mentoring session, spend some time working through the questions. After each question, determine whether the student seems to have a good understanding of the concept or whether he or she would benefit from additional help. Keep in mind that the student may be able to complete some of the questions on the Assessment, but he or she may still need work in that area—watch to see how long it takes the student to do a task or whether he or she does the task with ease. Based on your determination, circle *yes* or *no* in the *Understands the Concept* column. Each question indicates one or more activities in the unit that can be used to explore and develop the mathematical concepts listed if you feel that the student has not yet mastered them.

For the activities below, you will need:

- Shapes cut out from Student Page 1: Shape Pieces
- Student Page 5: Grid Sheet
- Black and white tiles cut out from Student Page 6: Tiles
- Student Page 11: 0-99 Chart (2 copies)
- 10 counters (pennies, paperclips, beans, etc.)
- 1 can or piece of paper for covering counters

	Understands the concept
<p>1. Use shapes cut out from Student Page 1: Shape Pieces to make the pattern shown below. Ask students:</p> <ul style="list-style-type: none"> • <i>What are the different pieces in this pattern?</i> • <i>What group of pieces repeats in the pattern?</i> • <i>What shape should come next? How do you know?</i> <p>Ask students to continue the pattern by placing more shape pieces after the ones that are already in front of them. As they work, ask students to explain how they figure out what shape to place next.</p> <div style="text-align: center;">  </div> <p>Mathematical concepts: extension and creation of repeating patterns, cores of patterns Concepts explored in Activity 1</p>	<p style="text-align: center;">Yes No</p>
<p>2. Make the pattern shown below out of shape pieces from Student Page 1: Shape Pieces. Ask students:</p> <ul style="list-style-type: none"> • <i>What shape piece is missing in the empty spot? How do you know?</i> • <i>What group of pieces repeats in this pattern?</i> 	<p style="text-align: center;">Yes No</p>

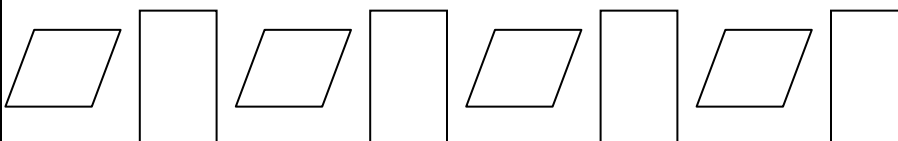
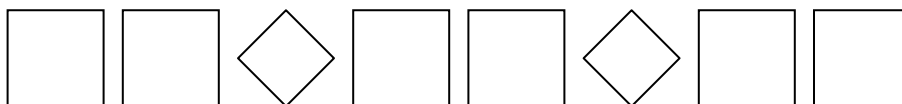


Ask students to build their own patterns for you to complete.

Mathematical concepts: extension and creation of repeating patterns, cores of patterns
 Concepts explored in Activity 1

3. Make the following patterns out of shape pieces from Student Page 1: Shape Pieces. Ask students:

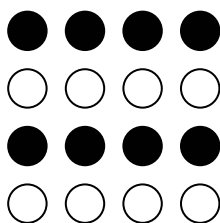
- *What group of shapes repeats in each of these patterns?*
- *Which of these patterns are similar? Which are different? Explain why they are similar or different.*
- *Are there two patterns which are the same because they repeat in the same way?*



Mathematical concepts: similarities in repeating patterns, pattern families
 Concepts explored in Activity 2

Yes No

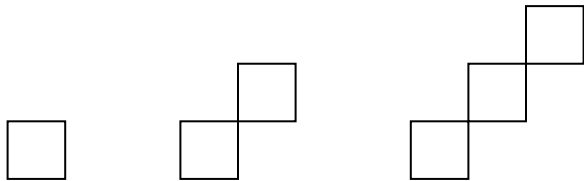
4. Place tiles from a copy of Student Page 6: Tiles on a copy of Student Page 5: Grid Sheet so that they look like the pattern pictured below:



Ask students to copy the grid pattern, but stop them when they have filled in most of the grid sheet. Ask:

- *What repeats in this pattern?*
 - *Circle a group of tiles that repeats on the grid sheet.*
 - *Can you find a different group of tiles that repeats on the grid sheet?*
- Cover up the original, point to a blank space on the student's grid, and ask:
- *How could you figure out what piece goes in this space?*

Yes No

<ul style="list-style-type: none"> • <i>How do you know to put that piece there?</i> <p>Mathematical concepts: Two-dimensional repeating patterns. Concepts explored Activity 3</p>	
<p>Note to mentors: This assessment item and the activity it points to are more appropriate for second graders and some first graders. They should probably be skipped for kindergarten students and most first graders.</p> <p>5. Make the following pattern out of shape pieces from Student Page 1: Shape Pieces, and show it to students. Ask:</p> <ul style="list-style-type: none"> • <i>What changes between each picture in the pattern?</i> • <i>What would the next term look like?</i> <div style="text-align: center;">  </div> <p>Mathematical concepts: growing and shrinking patterns Concepts explored in Activity 4</p>	<p>Yes No</p>
<p>6. Show students a copy of Student Page 11: 0-99 Chart. Ask students to begin at 0, and color in each number that they hit as they count by two's. When they have shaded in part of the chart, stop them and ask:</p> <ul style="list-style-type: none"> • <i>Do you see any pattern that the shaded and unshaded boxes make?</i> • <i>Could you use this pattern to decide whether other boxes will get shaded or not?</i> <p>Point at some boxes further along the chart and ask students whether the box should be shaded or not and how they know.</p> <p>Take a new copy of the 0-99 chart and shade in all of the odd numbers. Ask students:</p> <ul style="list-style-type: none"> • <i>What types of numbers did I shade?</i> • <i>What pattern do the shaded numbers make on the chart?</i> <p>Mathematical concepts: two-dimensional patterns, number patterns, patterns from rules Concepts explored in Activities 3, 5, 7</p>	<p>Yes No</p>
<p>7. Draw a blank number line with 15 marks where numbers should be. Write a 1 under the first mark on the line, then ask students what number would go under the next mark on the line. Continue to point at other marks on the line, skipping around a bit. Have the students tell what number would go under each mark that you point at and explain why. Also ask questions such as the following (make sure to help students with what direction is left and what is right):</p> <ul style="list-style-type: none"> • <i>What number would go two spots to the right of 4?</i> 	<p>Yes No</p>

<ul style="list-style-type: none"> • <i>What number would go three spots to the left of 10?</i> <p>Mathematical concepts: number lines, relationships between numbers Concepts explored in Activity 6</p>	
<p>Note to mentors: This assessment item and the activity it points to are more appropriate for second graders and some first graders, they should probably be skipped for kindergarten students and most first graders.</p> <p>8. Draw a calendar with five weeks that go from Sunday to Saturday. Write a 1 in the box for the first Sunday, label each column with what day of the week it represents, and then ask students some of the following questions:</p> <ul style="list-style-type: none"> • <i>What number would go in the box for the first Monday?</i> • <i>Can you fill in the rest of the first week with the correct numbers? Show me.</i> • <i>Now where would the number 8 go? How do you know?</i> <p>Continue to point at different spots on the calendar and ask what numbers should go in those spots. Also ask how students can determine what number goes on the next Tuesday if you look at the number in one of the Tuesdays.</p> <p>Mathematical concepts: number lattices, number relationships Concepts explored in Activity 7</p>	<p>Yes No</p>
<p>9. Give students five to ten counters of some sort (pennies, paperclips, beans, etc.) and ask them to count how many they have. Place a can or a piece of paper or some other cover over some of the beans. Ask students to count how many beans are left uncovered. Ask: <i>Can you figure out how many beans are covered up by looking at the number of beans that are uncovered and by remembering how many beans there were total? Explain your thinking.</i></p> <p>Repeat this activity a few times with different starting numbers of beans and by covering up different numbers of beans.</p> <p>Mathematical concepts: variables as representations of unknowns, variables in problem-solving situations Concepts explored in Activity 8</p>	<p>Yes No</p>

Teacher Inventory: Patterns and Functions (Grades K-5)

(Have your student's teacher fill out this page, if possible)

Concept		Teacher Rating: Has the student mastered the concept? (Circle yes, no, or unknown for each concept.)	Grades K-2 Patterns and Functions Activities where the concept is explored:	Grades 3-5 Patterns and Functions Activities where the concept is explored:
One-Dimensional Repeating Patterns	Extension and creation of repeating patterns	Yes No Unknown	1, 2	1, 3
	Repeating cores	Yes No Unknown	1, 2	1, 3
	Regularities in shapes, designs, events, numbers	Yes No Unknown	1, 2	1, 3
	Pattern families	Yes No Unknown	2	
	Alphabetic representation	Yes No Unknown	2	
Two-dimensional Repeating Patterns	Extension and creation of two-dimensional repeating patterns	Yes No Unknown	3, 5, 7	
	Grid patterns with shapes and colors	Yes No Unknown	3	
	Visual patterns	Yes No Unknown	3, 4, 5	
	Number patterns on 0-99 chart	Yes No Unknown	5	3
	Relationship between visual and number patterns	Yes No Unknown	5, 7	3
	Rules for patterns	Yes No Unknown	5, 7	1, 3
Growing and Shrinking Patterns	Number lattices (base 7, base 10, other bases)	Yes No Unknown	5, 7	3
	Creation and extension of growing and shrinking patterns	Yes No Unknown	4	1
	Rules for growing and shrinking patterns	Yes No Unknown		1
Functions, Operations, and Variables	Tables for representing and recording data about patterns	Yes No Unknown		1, 2
	Symbolic representations of operations on numbers	Yes No Unknown	6	4, 5, 7
	Patterns of relationships between numbers	Yes No Unknown	6	7
	Equivalence, commutativity, and inverse relationships	Yes No Unknown		4, 5, 7
	Variables	Yes No Unknown	8	4, 5, 6
	Tables for representing and recording patterns	Yes No Unknown		1, 2

	Input/output rules for functional relationships	Yes	No		2
	Use of range of problem-solving strategies	Yes	No		7
		Unknown			

Additional Comments:

Mentoring Plan

Based on your assessment of your student's needs, and the teacher's inventory (if available), check the K-2 Patterns and Functions activities on which you will concentrate the most time in the coming weeks:

- Activity 1: A World of Patterns
- Activity 2: Pattern Families
- Activity 3: Grid Patterns
- Activity 4: Growing and Shrinking Patterns
- Activity 5: Patterns on a 0-99 Chart
- Activity 6: Inchworms on Arrow Paths
- Activity 7: Calendar Patterns
- Activity 8: Shape Frames