SHAPES, SHAPES EVERYWHERE!

A Second-Grade Geometry Unit Aligned with Mathematics Standards from Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education, 3rd Edition

Regional Educational Laboratory
Contract #ED-01-CO-0006
Deliverable #2002-02

Office of Educational Research and Improvement
U.S. Department of Education
Washington, D.C. 20208

prepared by
Sandra Gilpin

Mid-continent Research for Education and Learning
2550 South Parker Road, Suite 500
Aurora, CO 80014
303.337.0990 (phone)
303.337.3005 (fax)

August 2002

This unit is based in part on a unit developed by Linda Hale, Jennifer Behrens, and Marie Sauvey of the School District of Howard-Suamico, Green Bay, Wisconsin.

To order copies of *Shapes, Shapes Everywhere!*, contact McREL:

Mid-continent Research for Education and Learning
2550 S. Parker Road, Suite 500
Aurora, CO 80014
303.337.0990 (phone)
303.337.3005 (fax)
www.mcrel.org

This document has been funded at least in part with federal funds from the U.S. Department of Education under contract #Ed-01-CO-0006. The content of this publication does not necessarily reflect the views or policies of the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

TABLE OF CONTENTS

ABOUT THE UNIT

Purpose

Geometric shapes are all around us — in the buildings we live and work in, the cars we ride in, even the food we eat. Children recognize these shapes early even if they do not know the technical terms for the different shapes they see.

Geometry in the early elementary grades can build on children's informal knowledge by giving them appropriate vocabulary and opportunities to practice identifying geometric shapes in the classroom and the real world. These learning activities help students make connections between what happens in and out of the classroom. They also help children begin to informally develop their concept of spatial sense through such observations as "close" and "far away." Giving students opportunities to practice developing their spatial sense will increase their awareness and application of geometric concepts in different areas of mathematics and other disciplines, including art, science, and social studies.

Standards and Benchmarks Addressed in this Unit

This second/third grade unit is aligned with the following standard and K–2 benchmarks from *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education* (3rd ed.) (Kendall & Marzano, 2000) and with aspects of one 3–5 benchmark from the same source. Note that this unit also is aligned with the National Council of Teachers of Mathematics's (2000) PreK–2 geometry expectations "recognize, name, build, draw, compare, and sort two- and three-dimensional shapes" and "recognize and create shapes that have symmetry."

Standard: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark	Supporting Knowledge
K–2: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes	Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
	Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
	Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
	Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
	Knows definitions of attributes of shapes (e.g., face, edge, corner)
K–2: Understands the common language of spatial sense (e.g., "inside," "between," "above," "below," "behind")	Uses position vocabulary (e.g., "above," "below," "outside," "between," "near," "to the right of") to describe location
	Understands the concept of relative position
K–2: Understands that geometric shapes are useful for representing and describing real-world situations	Knows basic properties of geometric shapes
3–5: Understands basic properties of figures (e.g., two- or three-dimensionality, symmetry, number of faces, type of angle)	Knows the definition of two-dimensional line symmetry
	Knows the definition of two-dimensional rotational symmetry
	Represents two-dimensional shapes
	Represents three-dimensional shapes

Descriptions of Lessons

This unit is divided into nine lessons:

Lesson 1: Shape Vocabulary
Lesson 2: Let's Go on a Shape Scavenger Hunt!
Lesson 3: How Can Shapes be Classified?
Lesson 4: Are These Shapes Similar or Different?
Lesson 5: Where Can I Find Shapes?
Lesson 6: We're the Same!
Lesson 7: Fun with Symmetry
Lesson 8: Mirror City
Lesson 9: Do You See What I See?

- Lessons 1 and 2 teach students the vocabulary of two- and three-dimensional shapes, their properties, and relative position. The lessons also give students a chance to practice this vocabulary through kinesthetic (hands-on) activities.

- Lessons 3 and 4 help students solidify their knowledge of shapes and properties by giving them the comparison tasks of classifying shapes by their attributes and finding similarities and differences between shapes.

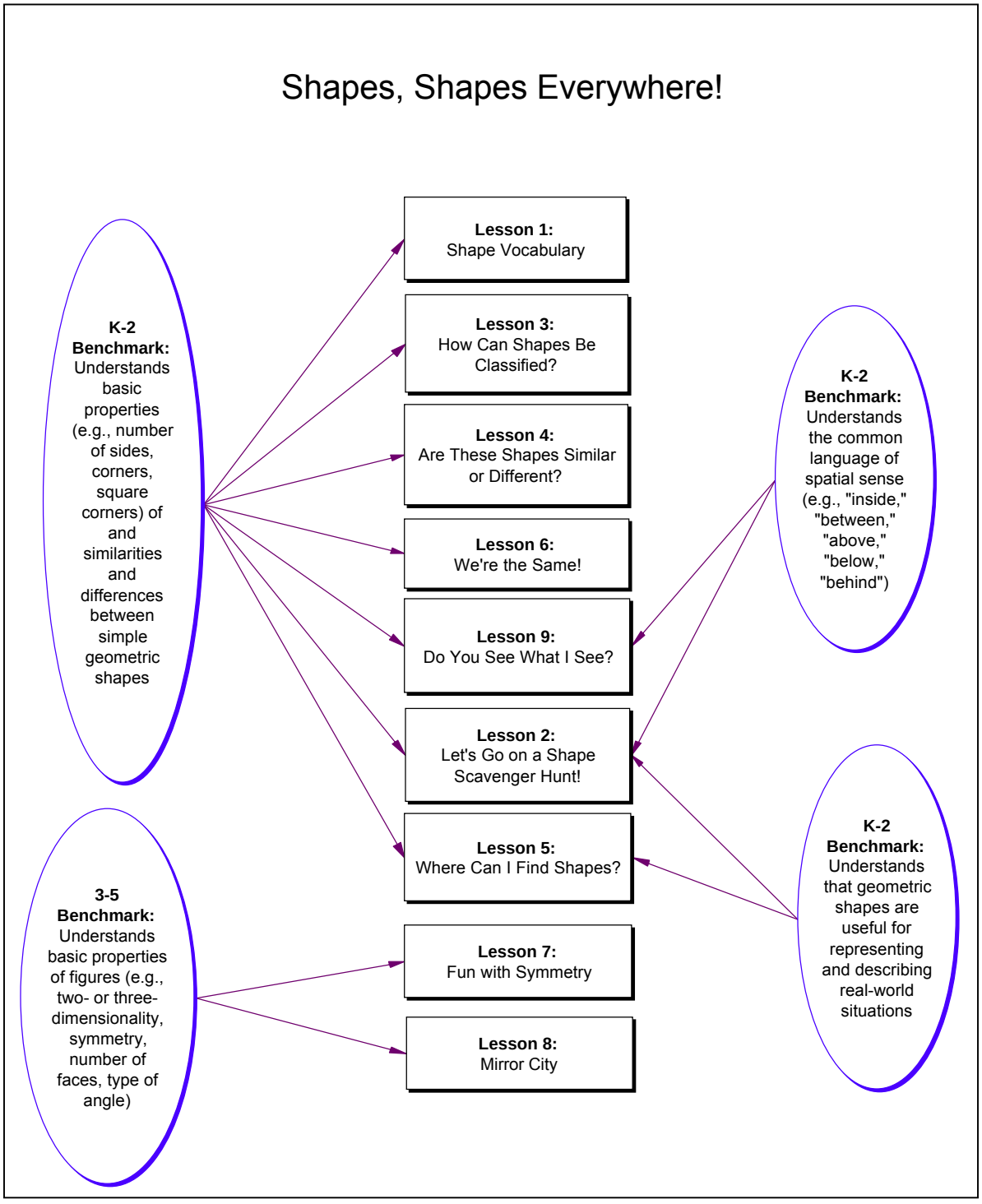
- Lesson 5 encourages students to use technology (if available) to connect what they see in the real world with the geometric shapes they learn about in the classroom.

- Lesson 6 delves deeper into similarities and differences between shapes by addressing the concept of congruency of two-dimensional shapes (figures that are the exact same size and shape). In this lesson students discriminate between congruent shapes and non-congruent shapes; they also create their own congruent shapes.

- Lessons 7 and 8 address the properties of line and rotational symmetry of two-dimensional shapes. Students learn to determine if a shape is symmetrical and create their own symmetrical designs.

- Lesson 9 uses the concepts from the previous lessons in a game students play with partners. The game helps students make connections between the concepts they've learned in the unit; for example, students are better able to identify the attributes of different shapes and more easily recognize the symmetry of a shape.

Visual Map: Lessons and Benchmarks



Assessment

Throughout the unit, students will be assessing their own knowledge through the process of creating and monitoring their own learning goals. As a cumulative assessment for the unit, students will collect their work in a Shapes Book, which is described in more detail at the end of the unit (*to learn more, see the Shapes Book page later in the unit).* Suggested formal and informal assessment activities are included at the end of each lesson. Throughout the unit, you are encouraged to informally assess students' knowledge of the standards and benchmarks through observation or questioning. Formal assessment opportunities, in addition to the Shapes Book, are provided in Lesson 1 (vocabulary), Lesson 3 (classification), Lesson 4 (comparison), and Lesson 5 (shape attributes).

General Guidance

Although no time limit is set for each lesson, the entire unit will take approximately two to three weeks. The specific amount of time needed will vary depending on several factors, including the skill level of the students and the amount of class discussion about each topic. Lesson 1, which introduces all of the vocabulary terms and phrases students will need for the unit, will most likely take several days to complete. Lesson 5 may also take more than one day, especially if technology is used. Lesson 8 may require more than one day, depending on how much time is allotted for the story writing aspect of the lesson.

Students should set their own learning goals. Students who are involved in planning and monitoring their own learning feel more in control of their learning and are generally more successful. At the beginning of the Shapes Book, there is a page for students to write their own learning goals (see page 54). After discussing the standards and benchmarks with students, ask them to turn to their goal-setting sheet (entitled "What Will We Learn in This Unit?"). Ask them to think about what they already know about geometry and then write it in the appropriate place on the worksheet. Ask students to think about something very specific that they would like to know and write that on the worksheet. You may need to model examples of appropriate, specific learning goals. Ask students to think about how they can accomplish their goal(s) and to write this in the appropriate section of the worksheet. Some students may want to write more than one "learning goal." At the end of every lesson, you may want to revisit the "learning goals" page of the Shapes Book and ask students to think and write about the progress they are making toward their learning goals on the sheet entitled "How Am I Doing?" Ask students to write the date(s) of their entry so they can chart their progress.

In addition to worksheets and handouts provided in this unit, Table 1 lists materials needed for each lesson.

Table 1. Materials Needed for Lessons

Materials	Lesson(s)
Two-dimensional shapes (specifically circles, rectangles, squares, and triangles)	1, 3, 4
Three-dimensional solids (specifically cones, cylinders, cubes, pyramids, rectangular prisms, and spheres)	1, 3, 4
Pictures that represent of spatial sense words	2
Digital camera (optional) Computer drawing program (optional)	5
Magazines	5, 7
Geoboards and bands for every pair of students	6
Two-dimensional symmetrical shapes	7
Wide masking tape; large blocks; mirror	8
Pattern blocks for every pair of students	9

Adaptations and Accommodations:
Opportunity to Learn for All Students

Although the following strategies are separated for different populations, certain strategies that work for one population also may work well for other populations or for the entire class.

Gifted and Talented Students

Gifted and talented students are sometimes ridiculed by other students because of unusual perceptions; likewise, gifted students are sometimes intolerant of other students. Partners should be matched for what each can contribute to the group activity. For the comparison activity (Lesson 4), it might be wise to pair students of similar abilities to complete the task. Since finding similarities and differences is a critical thinking activity, students of similar abilities will offer each other appropriate challenges.

Several books and websites are provided as resources at the end of this unit. Encourage students to extend their learning by reading or exploring the websites.

Students with Learning Disabilities

If there are students in the class who have learning disabilities, it may be helpful to have available an overview of the unit, listing each of the assignments, the date they are due, the number of points each assignment or assessment is worth (or, if another evaluation strategy used, how students' performance will be measured), and a space to check off each assignment when it is finished. This sheet provides an overview and conceptual organizer for students who need help keeping track of their progress. It models and teaches students how to use an organizational strategy. Depending on the structure of the class, this sheet could be a sheet given to each individual student, or a large sheet posted for the entire class that you review before each lesson.

Provide examples of different assignments incorporated into the Shapes Books, or provide a number of completed Shapes Books so students better understand what is expected of them.

Limited Language Proficiency (LLP) Students

Using the five-step method to teach vocabulary gives LLP students a chance to think about definitions on their own terms, using words and pictures that are meaningful to them.

Remember that many LLP students bring different cultural perspectives with them to the classroom. Be flexible in judging students' written and pictorial definitions in their Shapes Books. If you are not clear about what a student wrote or drew (especially if the student wrote his or her own definitions in the student's native language), a conference with the student may help clear up confusion. During class discussions, encourage and validate ideas students may communicate.

It is important to remember that LLP students have varying levels of proficiency and literacy in English and the content areas. Some of these students may be gifted and talented students or be

in need of special education services. Whatever their skills or needs, be sure to assess LLP students on their knowledge of content material, not just their English proficiency. Kidspiration™ is a graphic organizer program that speaks words and directions. This program has a geometry template that includes various two- and three-dimensional shapes. Students click on the shape, and the program displays and says the word. Students may also type in their own words and the program will speak what was typed. Giving LLP students opportunities to practice this program or another vocabulary program may help improve their English skills.

LESSON 1: SHAPE VOCABULARY

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Purpose

The purpose of this lesson is to provide students with vocabulary needed for the unit and to give them opportunities to practice using this vocabulary.

Getting Ready

- Prepare a Shapes Book for each student.
- Make copies of the handouts at the end of this lesson (family letter, "What Do I Know?" chart, two- and three-dimensional shapes).
- In a conspicuous area of the classroom, post all of the standards and benchmarks students will learn in this unit.
- Provide physical models of shapes at students' desks.
- Prepare stations around the room that have physical models of one type of shape (e.g., pyramids, cubes, squares) and/or several different types of shapes.

Procedures

1. You may want to read a story to students that incorporates geometric shapes. Several suggestions are given in the Resources section at the end of this unit.

2. Tell students they will be starting a unit on geometry, and explain the standards and benchmarks posted in the classroom. Tell students this is the knowledge they will learn in this unit and that throughout this unit they will be completing activities to help them master the standards and benchmarks. During each lesson, refer students to the standards and benchmarks that are the focus of that lesson. These benchmarks also are included in

the Shapes Book students will compile. A more detailed description of the content of the Shapes Book and black-line masters are found at the end of this unit. Pass out the Shapes Books to students, and give them time to personalize their books by drawing on the cover.

3. Explain to students that their family members can help them with this unit. Read the letter that students will take to their families. You may want to modify the letter to include specific times and dates for the lessons.

4. Before introducing the vocabulary needed for this unit, you may want to pre-assess students' prior knowledge of shapes and their properties, using the Knowledge Rating Scale entitled "What Do I Know?" Tell students they may already know some information about the geometry they will learn in this unit.

5. Model the process, using the first word or two, by performing a Think-Aloud, for example: "Circle. Hmmm, let's see. I have heard of this word and think it means something round, but I'm not sure I really know if that's all the word means. So I'll check 'Heard It/Seen It.'" For less proficient readers, pronounce the list of words so they do not have a problem decoding.

6. Tally how many students know (or think they know) each word and encourage discussion.

7. Given the number of vocabulary terms and phrases, this lesson may need to be divided over several days, depending on students' prior knowledge. To give students an opportunity to become more familiar with these shapes, have the actual shapes at students' desks.

8. Once students have written the vocabulary in their Shapes Books, send them to stations set up around the room to give them a chance to practice the new vocabulary. Several stations might have physical models of one type of shape (e.g., pyramids, cubes); at these stations, students would label the parts (e.g., faces, edges) of the shape in their Shapes Book. Other stations might be set up with several types of shapes; students would label all the *faces* on their shapes at one station, all the *edges* at another station, and so on.

Carefully and consciously teaching vocabulary is critical to students' understanding of a subject. To teach vocabulary, use an instructional sequence that gives students multiple exposures to the words. The following process could be used:

Step 1: Present students with a brief explanation or description of the new term or phrase. So that writing is not an issue, have pre-typed definitions that students cut and paste into their Shapes Book.

Step 2: Present students with a nonlinguistic representation (e.g., picture, drawing) of the new term or phrase. For the shapes, this could mean having an actual model of the shape, as well as pictures that the students cut out and paste into their Shapes

Book near the definition. A page of computer-generated shapes follows this lesson; this may be used throughout the unit.

Step 3: Ask students to generate their own explanations or descriptions of the term or phrase and write it in their Shapes Book.

Step 4: Ask students to create their own nonlinguistic representation of the term or phrase and write it in their Shapes Book.

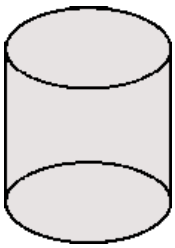
Step 5: Periodically, throughout this unit and over the course of the year, have students review the accuracy of their explanations and representations.

Assessment(s)

- You may informally assess students' knowledge about shapes while they are completing their Knowledge Rating Scale on page 12.

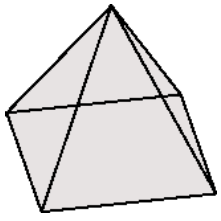
- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

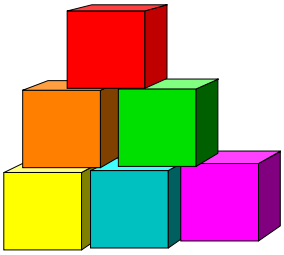
- As a formal assessment, or a vocabulary review, have the students complete the sheet entitled "Shape Match Up."



What Do I Know?

	Know the Word Well	Have Heard It/ Seen It	Don't Know It
circle			
rectangle			
square			
triangle			
cone			
cylinder			
cube			
pyramid			
rectangular prism			
sphere			
circumference			
corner			
diameter			
edge			
face			
radius			
congruency			
symmetry			





Dear Second-Grade Families,

Our class is beginning a unit on geometric figures. Throughout the course of the unit, we will be addressing the following standards and benchmarks:

Mathematics Standard 5: Understands and applies basic and advanced properties of the concepts of geometry

Related Benchmarks:

- Understands basic properties of (e.g., number of sides, corners, square corners) and similarities and differences between simple geometric shapes
- Understands the common language of spatial sense (e.g., "inside," "between," "above," "below," "behind")
- Understands that geometric shapes are useful for representing and describing real-world situations
- Understands basic properties of figures (e.g., two- or three-dimensionality, symmetry)

We will be mastering these benchmarks over the course of a unit consisting of nine lessons, which will last approximately two or three weeks.

Lessons 1 and 2 teach students about two- and three-dimensional shapes. Students will learn vocabulary to describe the shapes and their properties. Students also will learn how to describe location using words such as "near" and "behind."

Lessons 3 and 4 teach students how to classify shapes into general categories and discover similarities and differences between shapes.

Lesson 5 encourages students to use technology (if available) to find geometric shapes in the real world.

Lesson 6 teaches students the concept of congruency of two-dimensional shapes (figures that are the exact same size and shape).

Lessons 7 and 8 teach students about the property of line symmetry (shapes that match up evenly when folded in half) and rotational symmetry (shapes that match up evenly when rotated) of two-dimensional shapes.

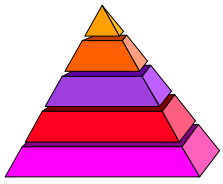
Lesson 9 uses the concepts from the previous lessons in a game students play with partners. In order to successfully play the game, students need to know the vocabulary from previous lessons and the concepts of symmetry and congruency.

Throughout this unit, I encourage you to discuss the lessons and learning with your child. You may want to engage in the following extension activities:

Look for Figures
Go on a "figure search" with your child. Look for items that are figures, such as spheres (a ball), cones (a funnel), cylinders (paper towel roll), rectangular prisms (a shoebox), and cubes (block of notepaper). Encourage other family members to join in the search and see who can find the most figures!

Trace a Face
Trace the faces (flat surfaces) of three-dimensional figures you find around your house. Have your child sort the items based on the faces traced, for example, figures with square faces and those without. Then, challenge your child and other family members to think of different ways to sort the figures.

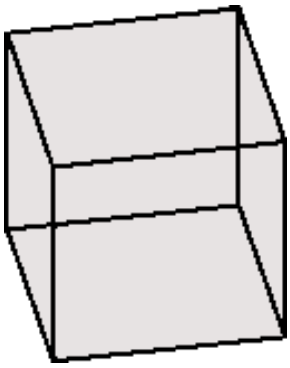
Take a Good Look
As you're driving in the car or taking a walk, have your child look for structures shaped like the figures explained above. Can he or she find a house or an apartment building shaped like a rectangular prism? What are the shapes for a telephone pole, mailbox, and stop sign?



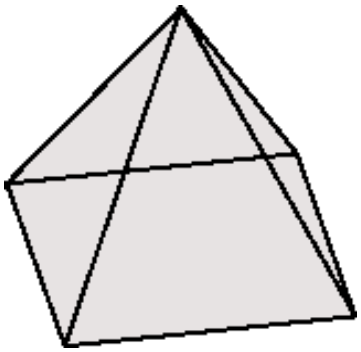
Throughout the unit, your child will be completing a Shapes Book that may be brought home to share with you. I look forward to any questions you may have.

Sincerely,

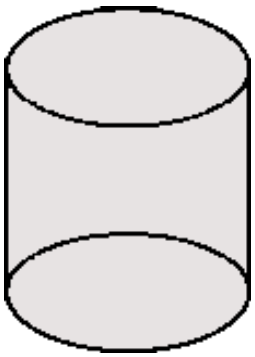
Two- and Three-Dimensional Shapes



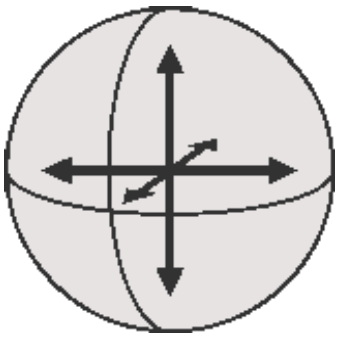
cube



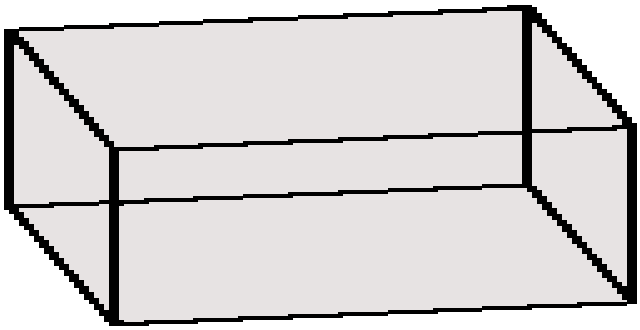
pyramid



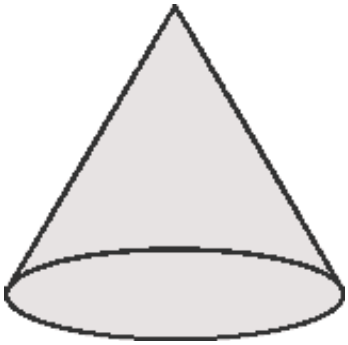
cylinder



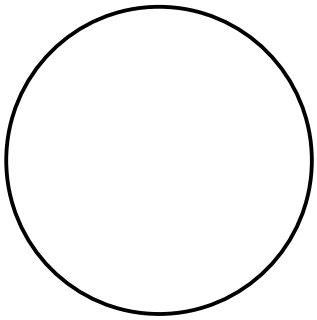
sphere



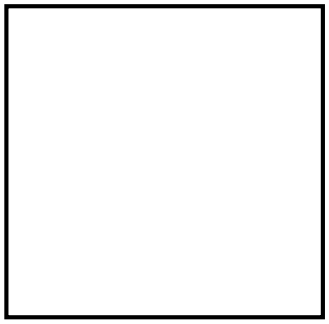
rectangular prism



cone

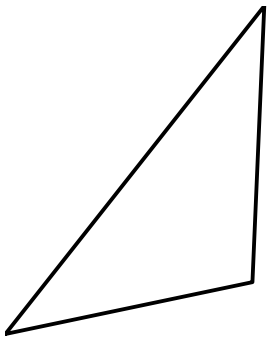


circle



square

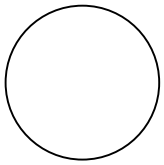
rectangle



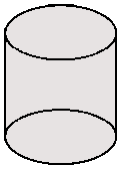
triangle

Shape Match Up

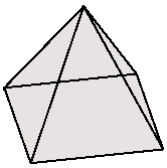
Draw a line from the picture to the word:



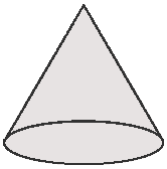
cylinder



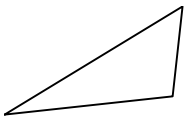
triangle



cone



pyramid



circle

LESSON 2: LET'S GO ON A SHAPE SCAVENGER HUNT!

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Benchmark: Understands the common language of spatial sense (e.g., "inside," "between," "above," "below," "behind")

Supporting Knowledge:

- Uses position vocabulary (e.g., "above," "below," "outside," "between," "near," "to the right of") to describe location
- Understands the concept of relative position

Benchmark: Understands that geometric shapes are useful for representing and describing real-world situations

Supporting Knowledge:

- Knows basic properties of geometric shapes

Purpose

The purpose of this lesson is to help students identify geometric shapes in the world (classroom) around them and use positional language to describe the location of the objects.

Getting Ready

- Make copies of the "Let's Go on a Shape Scavenger Hunt!" worksheet.
- Make copies of the handout "Two-and Three-Dimensional Shapes" so students may cut them out.

Procedures

1. Brainstorm with students what types of position words they know. As the students say them, write the words on a large piece of chart paper and then post the chart for reference. Pictures depicting the spatial sense words could also be added to the chart paper.

2. Once the list is finished, model with students the different spatial sense vocabulary words. For example, you could demonstrate with a student, "I am 'in front of' Karen." Students could also model with each other.

3. Once students are familiar with the spatial sense words, explain that they will be going on a scavenger hunt in pairs and that each pair will be given a shape to find in the classroom.

4. Explain that students are to cut out the shape they will find and paste it on their Scavenger Hunt worksheet. A Scavenger Hunt template and sample Scavenger Hunt worksheet sample (partially completed) follow this lesson.

5. Using the overhead, model for students what belongs in each box. Explain that students will need to find three examples of the shape, but that they are to give clues only about the shape's location. (In other words, they are not to say, "The globe is a sphere," rather "There is a sphere in the corner on top of the bookshelf.")

6. Send students on the scavenger hunt.

7. After they have found three examples of shapes, ask students to switch and find new partners. The new partners should try to guess what shape the partner found. Make sure both students have a chance to guess each other's shapes.

8. At the end of the scavenger hunt, have partners engage in a Think-Pair-Share in which they answer questions such as, "What was your funniest location for a shape? Most unusual location for a shape?" You might ask students to share their answers with the entire class.

Assessment(s)

- As an informal assessment while students are finding shapes, monitor the discussion and use questions to uncover students' knowledge.

- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

Let's Go on a Shape Scavenger Hunt!

My shape to find is a _____

It looks like:

I found my shape:

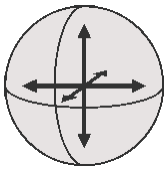
in front of behind on top of under over to the left of to the right of above below beside	in front of behind on top of under over to the left of to the right of above below beside	in front of behind on top of under over to the left of to the right of above below beside
My object is a:	My object is a:	My object is a:

Let's Go on a Shape Scavenger Hunt!

Example

My shape to find is a *Sphere*

It looks like:



I found my shape:

in front of behind on top of under over to the left of to the right of above below beside the teacher's desk	in front of behind on top of under over to the left of to the right of above below beside	in front of behind on top of under over to the left of to the right of above below beside
My object is a: Globe	My object is a:	My object is a:

LESSON 3: HOW CAN SHAPES BE CLASSIFIED?

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Purpose

The purpose of this lesson is to give students a deeper understanding of the characteristics of shapes by classifying them.

Getting Ready

- Make copies of the "Classification of Shapes" worksheet.
- Provide physical models of shapes at students' desks.
- Make copies of the worksheet "Two-and Three-Dimensional Shapes" so students may cut them out.

Procedures

1. Explain to students that today they will be engaging in a process called "classification."

2. Model how to use the process of classification using objects that are familiar to students (e.g., toys, books, games, clothes, kitchen items).

3. Discuss how the sample items are generally arranged (e.g., books by author) and whether it is a beneficial arrangement or not. You might want to have the physical items present (e.g., books, games) for students to classify.

4. Discuss other ways to arrange the sample items and whether these classifications are useful or not.

5. As a class, decide what categories (preferably two or three) students will use for their classification system and why these categories are useful. Think about the categories in terms of attributes of the figures. A sample graphic organizer for classification follows this lesson on page 23.

6. Provide shapes for the students to cut out and arrange on their classification sheets. You also may want to allow students to use the physical models from Lesson 1 at their tables.

7. Once students have classified their shapes, discuss how well the classification scheme worked. Use questions such as, "Was it hard to classify? Easy? Did you have any shapes that didn't seem to fit anywhere?"

8. After the discussion, ask students to reclassify their shapes. Depending on the class, students may decide on new categories together or individually. Students should choose which system they think is the most useful and paste their shapes on the sheet in the system they chose.

9. Ask students to write at the bottom of the page the answer to the question, "What did I discover?"

Assessment(s)

- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

- You may want to formally assess students' ability to classify. For a general classification rubric, see Rubric for the Classifying Process on page 24.

Classification of Shapes

Category:	Category:	Category:

What did I discover? _____

_____

Rubric for the Classifying Process

4	The student uses important, as well as some less obvious, characteristics to compare the items. The student accurately identifies the similarities and differences and explains his or her conclusions in a way that shows a complete and detailed understanding of the items.
3	The student uses important characteristics to compare the items. The student accurately identifies the similarities and differences and explains his or her conclusions.
2	The student uses characteristics to compare the items, but not the most important characteristics. The students' comparisons and conclusions show some misconceptions about the items.
1	The student uses insignificant characteristics to compare the items. The student's comparisons and conclusions show many misconceptions that indicate the student does not understand the items.
0	There is not enough information to make a judgment.

LESSON 4: ARE THESE SHAPES SIMILAR OR DIFFERENT?

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Purpose

The purpose of this lesson is to give students a deeper understanding of the characteristics of shapes by comparing them, finding similarities and differences.

Getting Ready

- Make copies of the "Shape Comparison" worksheet.
- Assign students specific shapes to compare.
- Provide physical models of shapes at students' desks.

Procedures

1. Explain to students that in this lesson they will be engaging in a process called "comparing" or finding "similarities and differences" and that they will focus on only a small number of shapes.

2. Model with students at least one example of how to find similarities and differences; also model the process of arriving at a conclusion as a result of doing this comparison. Assign two shapes (they could be a two-dimensional and a three-dimensional shape, or any other combination) to each student for the activity.

3. Have students work in pairs to list similarities and differences.

4. At the bottom of the worksheet, students should list the conclusion they make from comparing. An example of a similarities and differences chart follows this lesson.

5. After students finish the comparison task, tell them they are going to play a game. Students will need physical models of the shapes at their desks. One student sets out four shapes — three that are the "same," and one that is "different." Other student(s) have to decide which one is "different" and justify their decision.

Assessment(s)

- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

- You may want to formally assess students' ability to find similarities and differences. For a general comparison rubric, see Rubric for the Comparing Process on page 28.

Shape Comparison

What did I discover? _____

_____

Rubric for the Comparing Process

4	The student organizes the items into meaningful categories and thoroughly describes the defining characteristics of each category. The student provides insightful conclusions about the classification.
3	The student organizes the items into meaningful categories and describes the defining characteristics of each category.
2	The student organizes the items into categories that are not very meaningful but addresses some of the important characteristics of the item.
1	The student organizes the items into categories that do not make sense or are unimportant.
0	There is not enough information to make a judgment.

LESSON 5: WHERE CAN I FIND SHAPES?

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Benchmark: Understands that geometric shapes are useful for representing and describing real-world situations

Supporting Knowledge:

- Knows basic properties of geometric shapes

Purpose

The purpose of this lesson is to help students identify geometric shapes in the world around them. If technology is used, students also become more adept at using a digital camera and a drawing program on a computer.

Getting Ready

- If students have not had have much practice using a computer, they may need some before they are able to complete this lesson.
- Prepare digital cameras for student groups.
- If technology will not be used, collect markers and magazines for students to use.

Procedures

1. Explain to students that they will be going out into the world (e.g., to the playground, to the cafeteria) to find shapes in their environment. Divide students into groups, and give each group a digital camera. Ask students to take pictures of different objects that have

geometric shapes in them (e.g., tires for circles). Explain that each picture may have many different shapes in it.

2. Once students have taken their pictures, use a drawing program such as KidPix™ so that students can outline the shapes they found. Each student should then print out his or her pictures and paste them in their Shapes Books on the appropriate pages for real-world examples. They may need to print out multiple copies of a picture if it has more than one shape in it.

3. If a drawing program is not available, students (or you) can print out the pictures and then outline the shapes with markers.

4. If a digital camera is not available, you might have students look through magazines and cut out pictures. Some students may want to draw their "real-world" shapes.

Assessment(s)

- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

- The following formal assessment may be used at the conclusion of this lesson:

    - To promote success for all students, give each student a copy of the rubric for the assessment (see page 33), or post it in the room, and read through it with them, illustrating key points.

    - Have students use two of their own real-world shapes (from this lesson) and list their attributes in part 1.

    - After they have completed part 1 of the activity, ask students to pair up to exchange shapes. Students should find two shapes that are different from the shapes used in part 1.

    - Once students have exchanged shapes, ask them to individually complete part 2 of the activity by describing how the shapes are "similar" and how the shapes are "different."

    - Have students cut out pictures of their shapes (or draw them) and write the shape name on the worksheet. Encourage students to use the vocabulary from this unit, especially the attribute words. Also encourage students to think about the most important attributes, similarities, and differences of their chosen shapes.

    - As a self-assessment opportunity, you might ask students to grade their own assessment using the rubric before handing it in.

What Do I Really Know About My Shapes?

Part 1

Find two of your own real-world shapes.

My shape is a: (words and picture)	My shape is a: (words and picture)
It looks like a:	It looks like a:
It has these attributes:	It has these attributes:

What Do I Really Know About My Shapes?

Part 2

With your partner, choose 2 shapes.

We used these 2 shapes to answer the second part:
These 2 shapes are similar because:
These 2 shapes are different because:

What did I learn by comparing these 2 shapes? _____
_____
_____
_____
_____
_____
_____
_____
_____

Rubric for "What Do I Really Know About My Shapes?"

Part 1

4	The student correctly identifies his or her shapes using pictures and vocabulary. The student lists important attributes of the shapes and uses attribute vocabulary when describing the shapes.
3	The student correctly identifies his or her shapes and lists attributes using vocabulary, but not the most important attributes.
2	The student makes errors when identifying his or her shapes or makes errors when listing attributes.
1	The student makes errors when identifying his or her shapes, makes errors when describing the shapes, and does not use attribute vocabulary.
0	There is not enough information to make a judgment.

Part 2

4	The student uses important characteristics to compare the shapes. The student accurately identifies the similarities and differences and explains his or her conclusions in a way that shows a complete and detailed understanding of the shapes.
3	The student uses important characteristics to compare the shapes. The student accurately identifies the similarities and differences and explains his or her conclusions.
2	The student uses characteristics to compare the shapes, but not the most important characteristics. The student's comparisons and conclusions show some misconceptions about the shapes.
1	The student uses insignificant characteristics to compare the shapes. The student's comparisons and conclusions show many misconceptions that indicate the student does not understand the shapes.
0	There is not enough information to make a judgment.

LESSON 6: WE'RE THE SAME!

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangle
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Purpose

The purpose of this lesson is to help students understand the basic idea of congruency through the process of identifying examples and non-examples of congruent figures. Students also create their own congruent figures using geoboards and bands.

Getting Ready

- Assemble enough geoboards and bands for students to work in pairs.
- Copy and cut out sets of congruency cards for students.

Procedures

1. Remind students about the comparison activity (identifying similarities and differences) that they completed earlier. Explain that in this lesson they will be doing a special type of comparing in which they will determine if shapes are "exactly the same size and shape."

2. Have students sort the congruency cards into "exactly the same size and shape" and "not exactly the same size and shape." Students may need to think about flipping, turning, or sliding the shapes. (*Note:* If the vocabulary for transformations has already been taught, or the district requires it to be taught in second grade, the words *reflection*, *rotation*, and *translation* may be used. If the vocabulary is taught, this lesson may require more time.)

3. Once students are comfortable sorting their cards, explain that there is a special word for "exactly the same size and shape, " which is *congruent.*

4. Instruct students to turn to the definition pages in their Shapes Book and write the teacher definition for *congruent*. Provide students with a picture to help illustrate the definition of *congruent*. Have students write their own definition for *congruent.* They also should draw a picture that will help them remember what the word means.

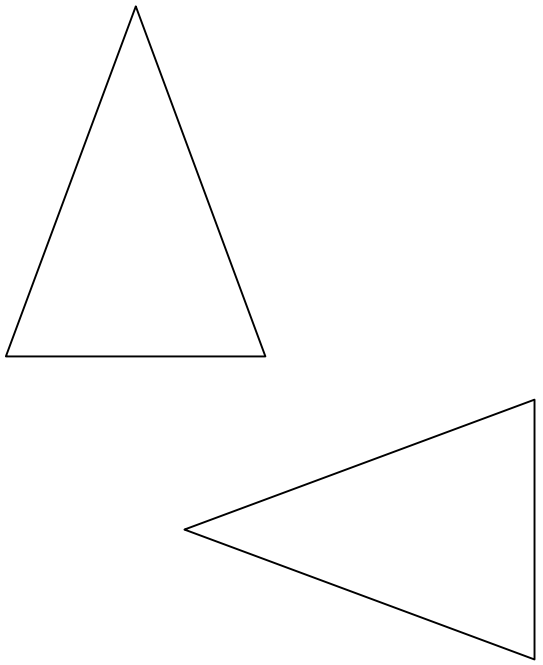
5. Students may also work in pairs using geoboards. Students can make a shape, switch boards, and try to make an "exactly the same size and shape" figure.

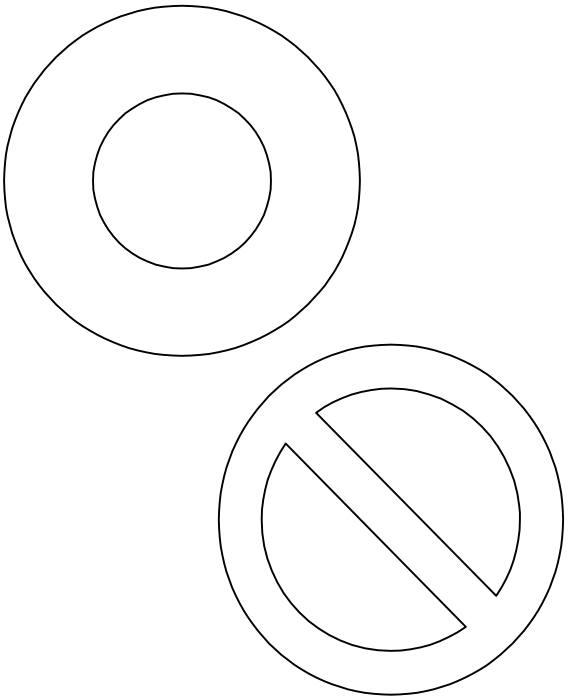
6. As an extension activity, encourage students to use geoboards and make congruent shapes that are flipped, slid, or turned.

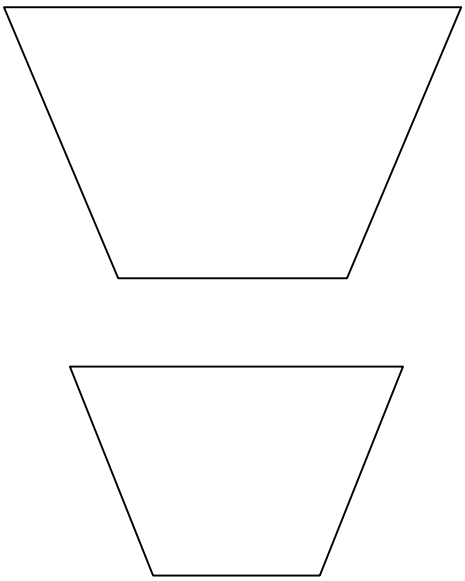
Assessment(s)

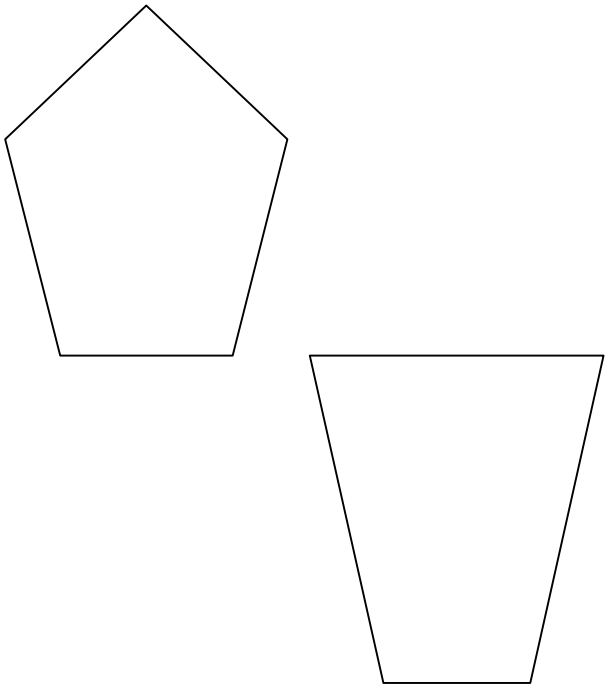
- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

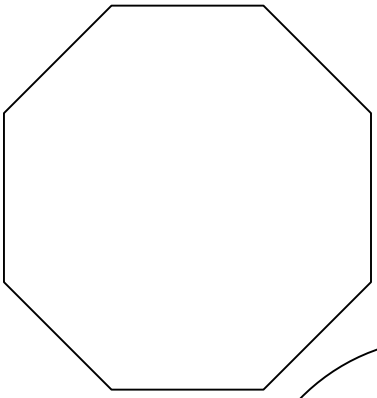
Congruence Cards

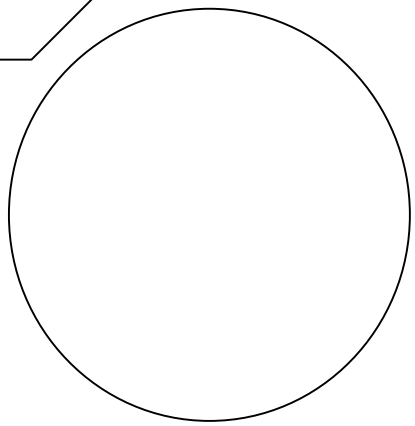


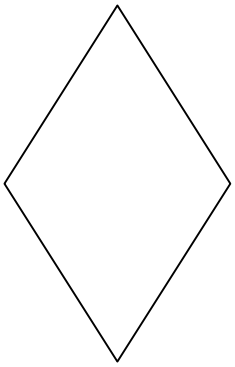


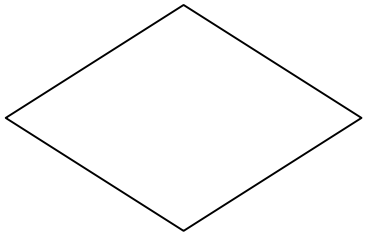


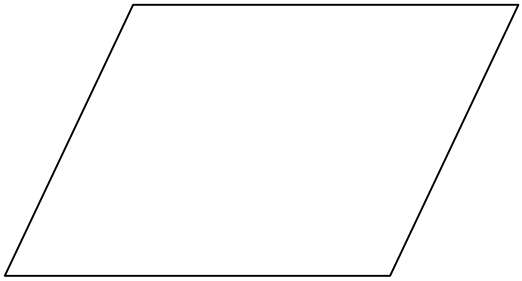


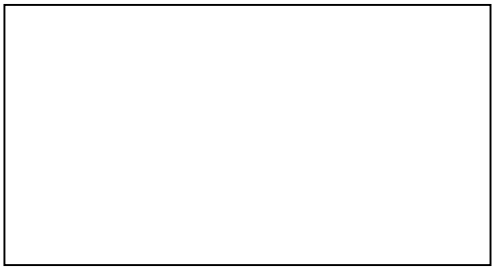


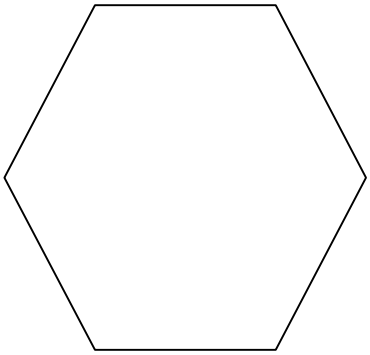


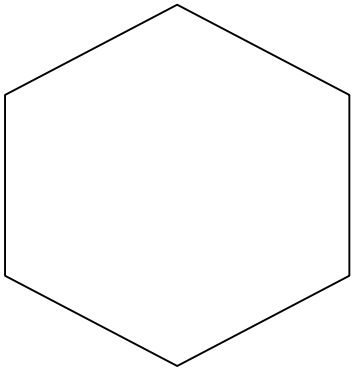


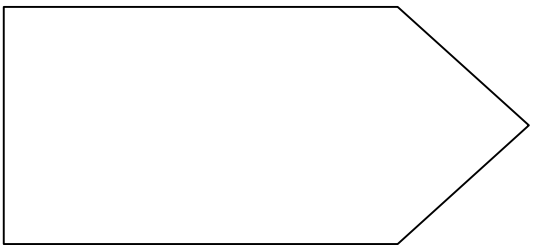


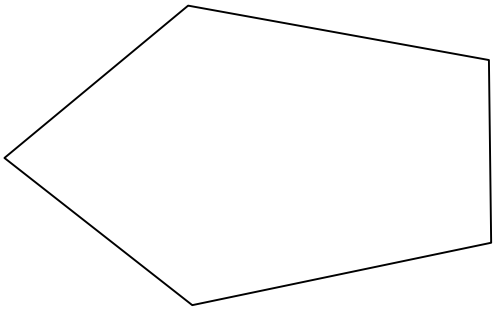


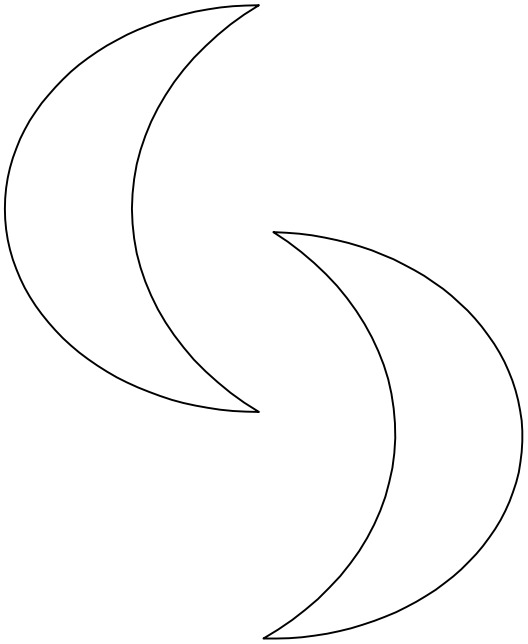












LESSON 7: FUN WITH SYMMETRY

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties of figures (e.g., two- or three-dimensionality, symmetry, number of faces, type of angle)

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Purpose

The purpose of this lesson is to help students understand the basic idea of line and rotational symmetry through the process of identifying examples and non-examples of symmetrical figures. Students also draw their own symmetrical figures, trace them, or find them in magazines.

Getting Ready

- Copy one set of symmetry cards (you may want to enlarge them).
- On the board, create a T-chart with the headings "(Teacher's name) LIKES:" and "(Teacher's name) DOES NOT LIKE:"
- Collect magazines for students to use.

Procedures

1. Explain to students that they are going to learn about another property of some shapes. Also explain that the class is going to play a game and that during this game it is very important that no one speaks.

2. On the board, have two columns — one column with the heading "(Teacher's name) LIKES:" and the other column with the heading "(Teacher's name) DOES NOT LIKE:" Using the symmetry cards, place the first example (while saying, "I like these kinds of shapes") on the board. Place the first non-example (while saying "I do not like these kinds of shapes") on the board.

3. Remind students that they need to be absolutely quiet. Ask for a show of hands of how many students think they could make a rule for the types of things you like and the types of things you do not like.

4. Place another set on the board, and ask again how many students think they could identify the rule for each side of the board. Continue until all students' hands are raised.

5. Ask a student to describe the two rules.

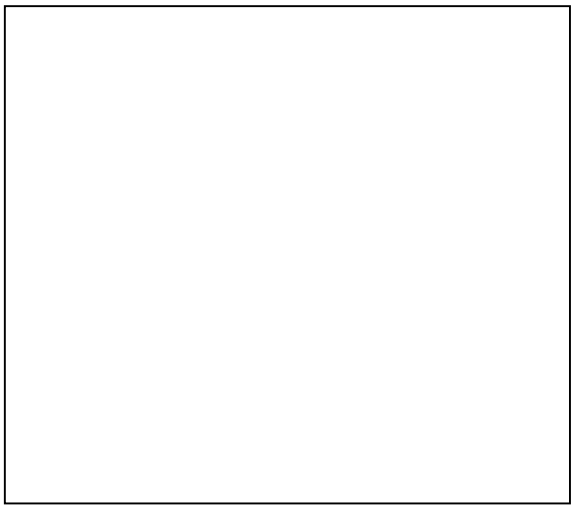
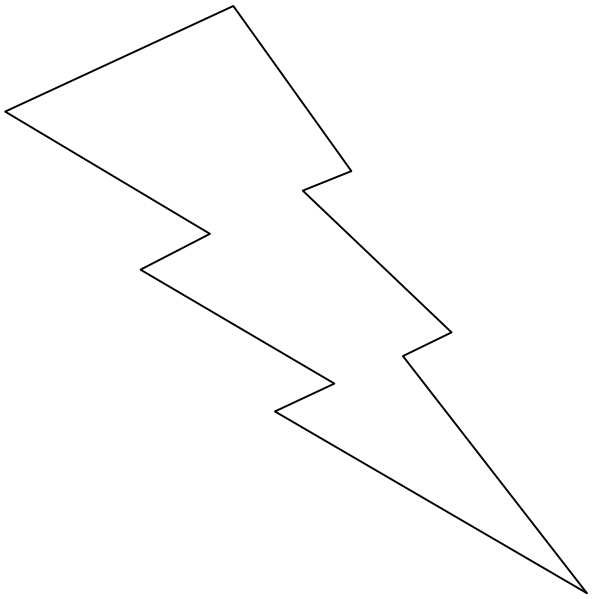
6. As a class, decide on a definition for *symmetry* and have students write this definition in their Shapes Books. Provide students with a picture to help them remember the definition of *symmetry*. Ask students to write a definition in their own words and draw a picture to help them remember what *symmetry* means.

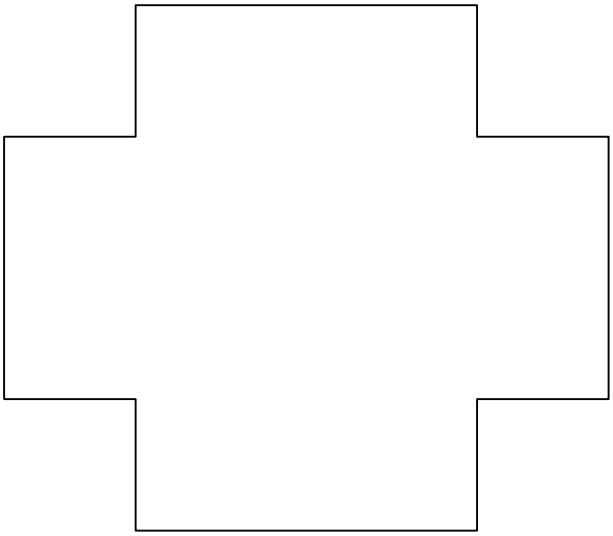
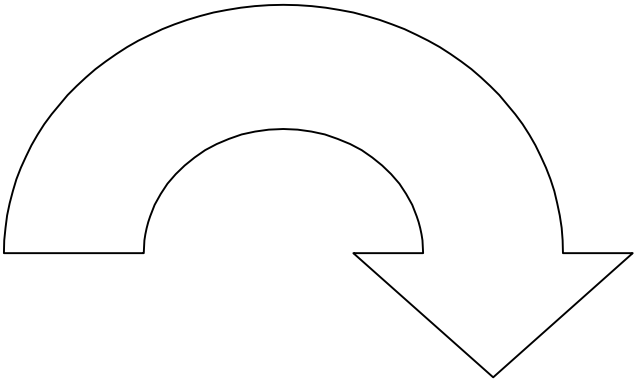
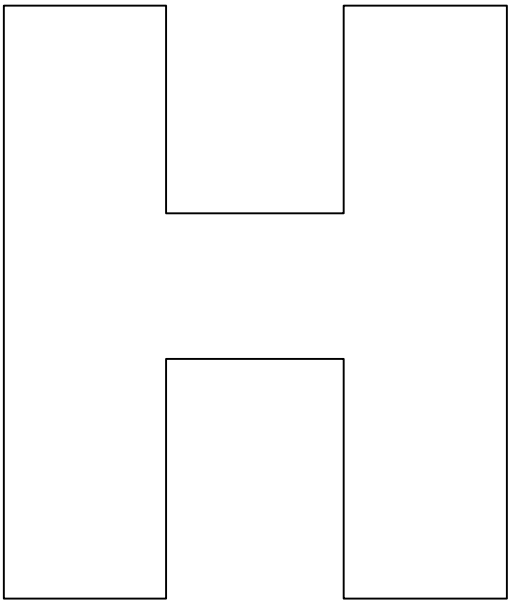
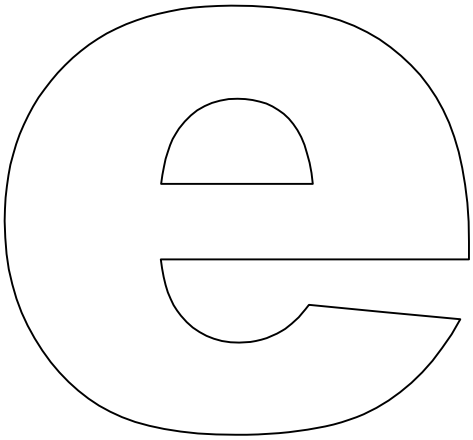
7. On the facing page in their Shapes Books, have students draw or trace around shapes that have symmetry or cut out symmetrical shapes from magazines and paste them in.

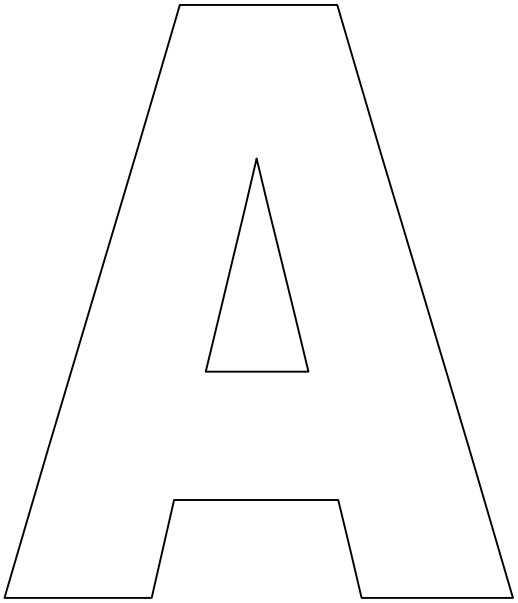
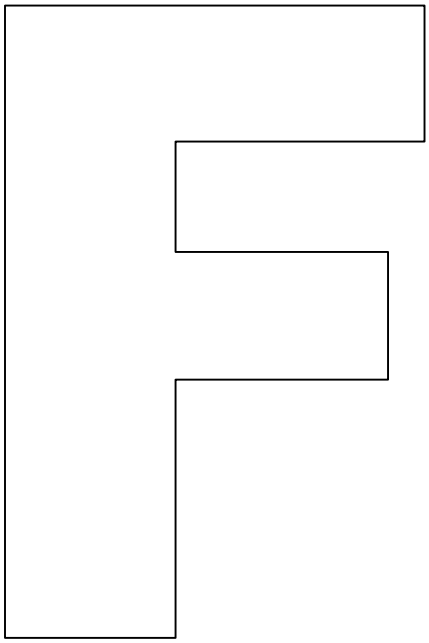
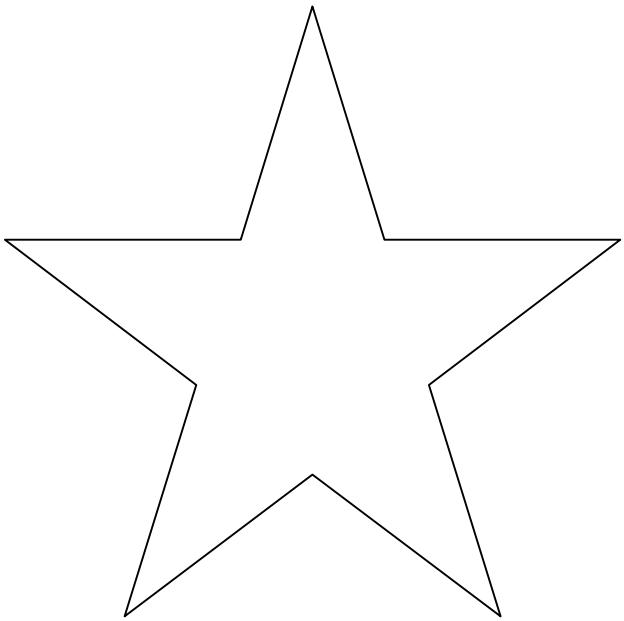
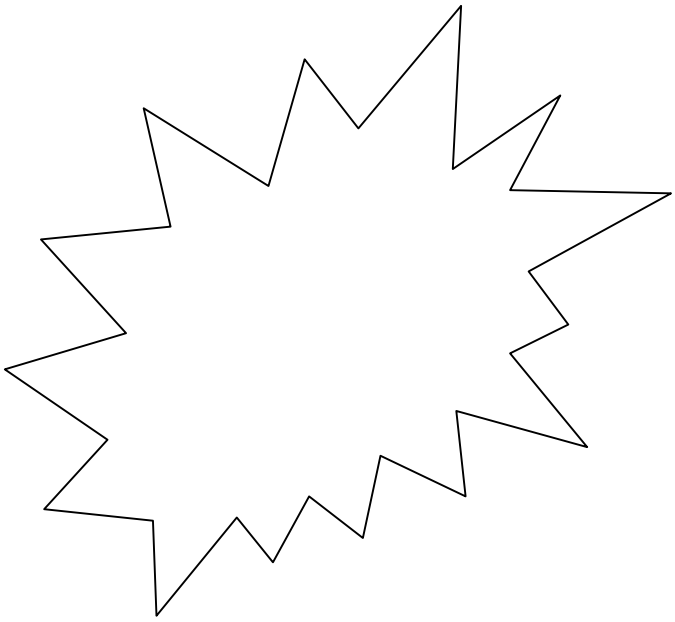
Assessment(s)

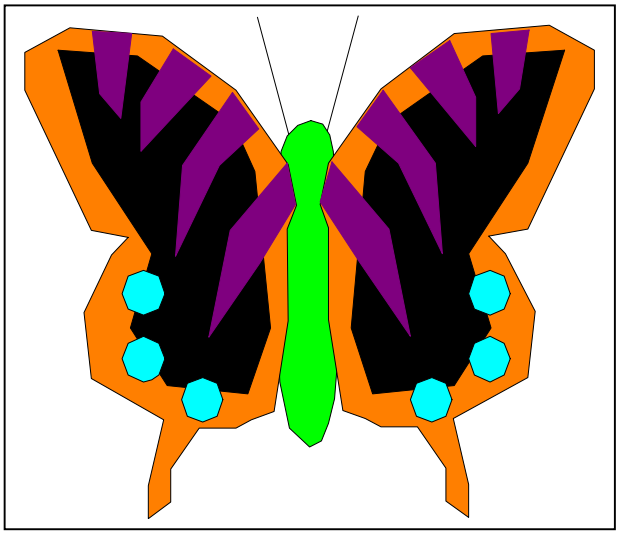
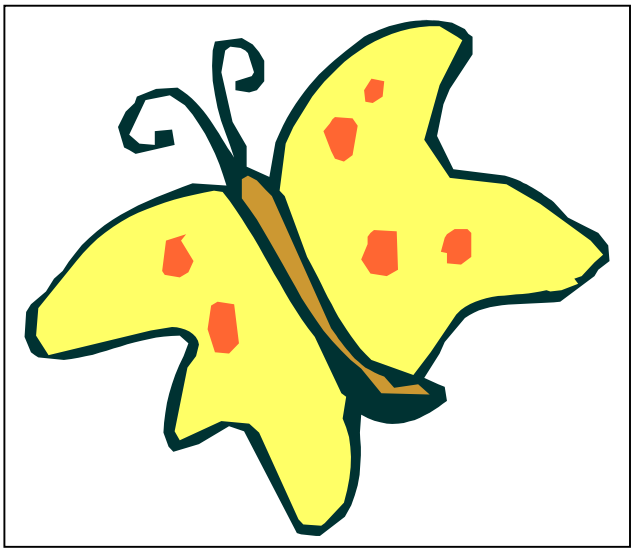
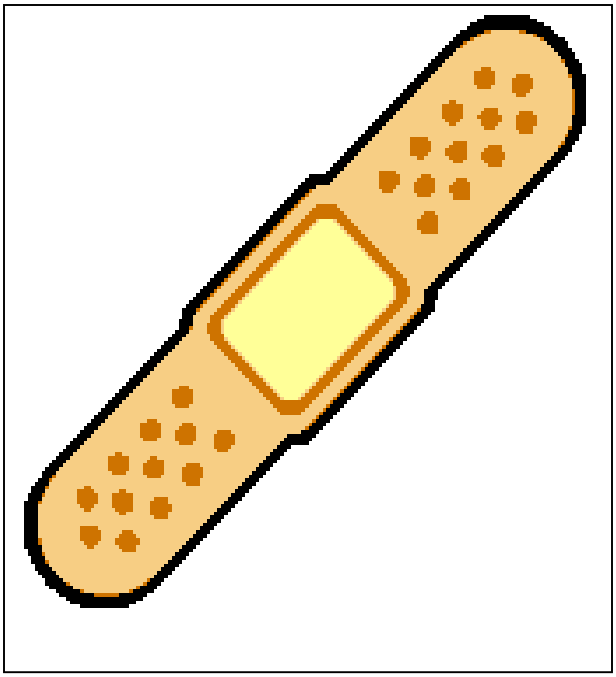
- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

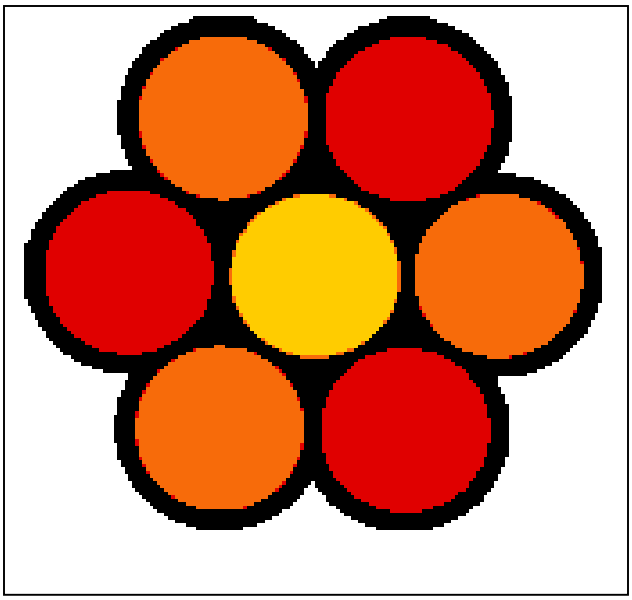
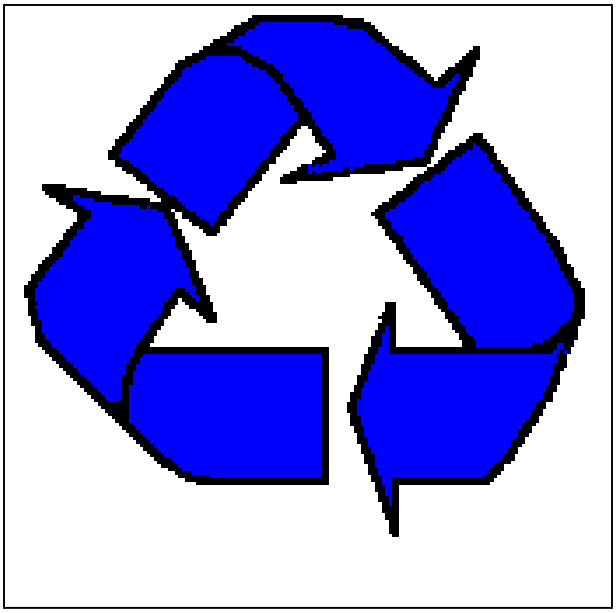
Symmetry Cards

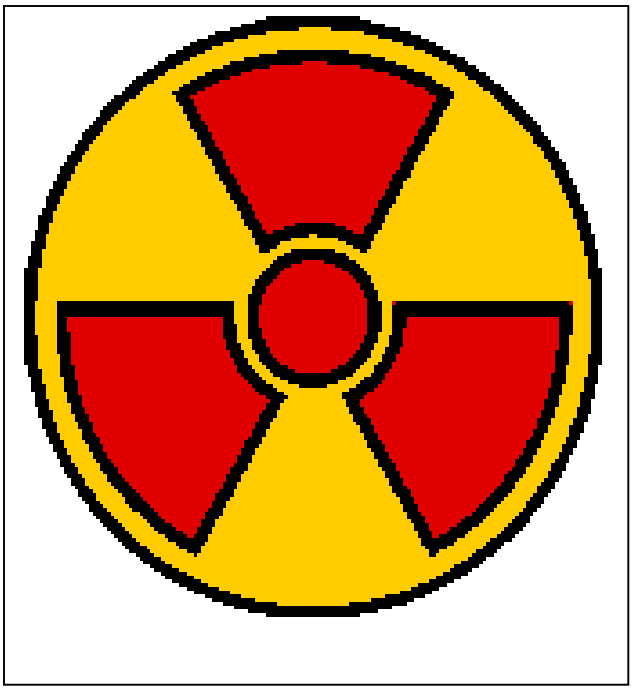
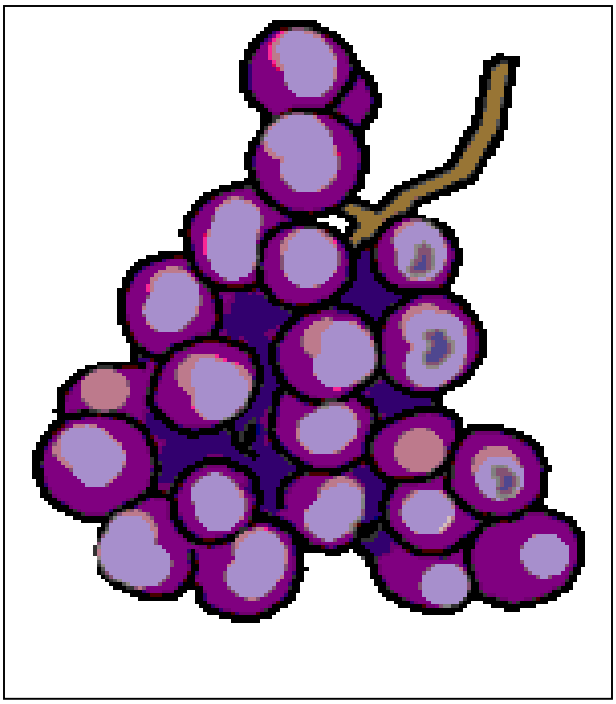
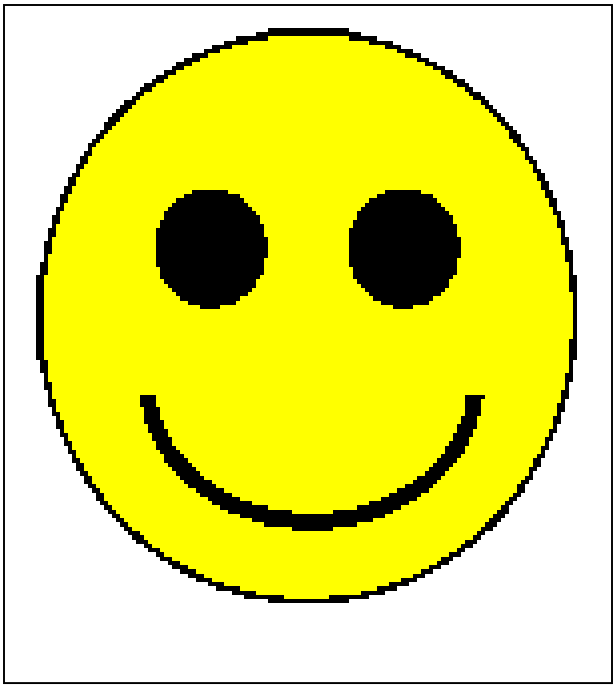
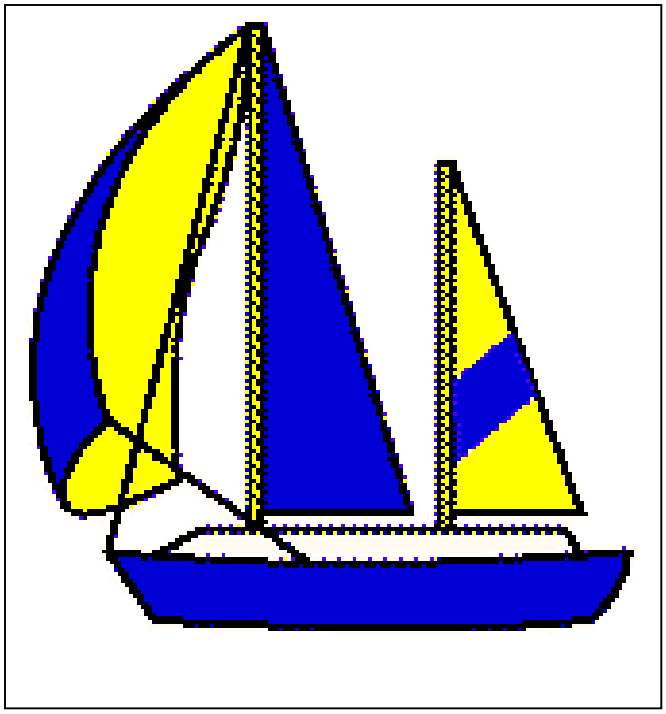
Example	Non–example
	

Example	Non-example
	
Example	Non-example
	

Example	Non-example
	
Example	Non-example
	

Example	Non-example
	
Example	Non-example
	

Example	Non-example
	
Example	Non-example
	

Example	Non-example
	
Example	Non-example
	

LESSON 8: MIRROR CITY

Note: This lesson is adapted from Comprehensive School Mathematics Program materials (see Heidema, 1992).

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties of figures (e.g., two- or three-dimensionality, symmetry, number of faces, type of angle)

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Purpose

The purpose of this lesson is to extend students' understanding of symmetry. By physically creating symmetrical landscapes, students will acquire a more comprehensive view of symmetry.

Getting Ready

- Place a line of wide masking tape on a table or the floor. Leave space on both sides of the line to place blocks.
- Collect enough pairs of blocks for each group to have several different types.

Procedures

1. Tell the class a story about a funny place called Mirror City where the streets are like mirrors. When you walk down a street, whatever building you see on one side has an identical building facing it on the other side.

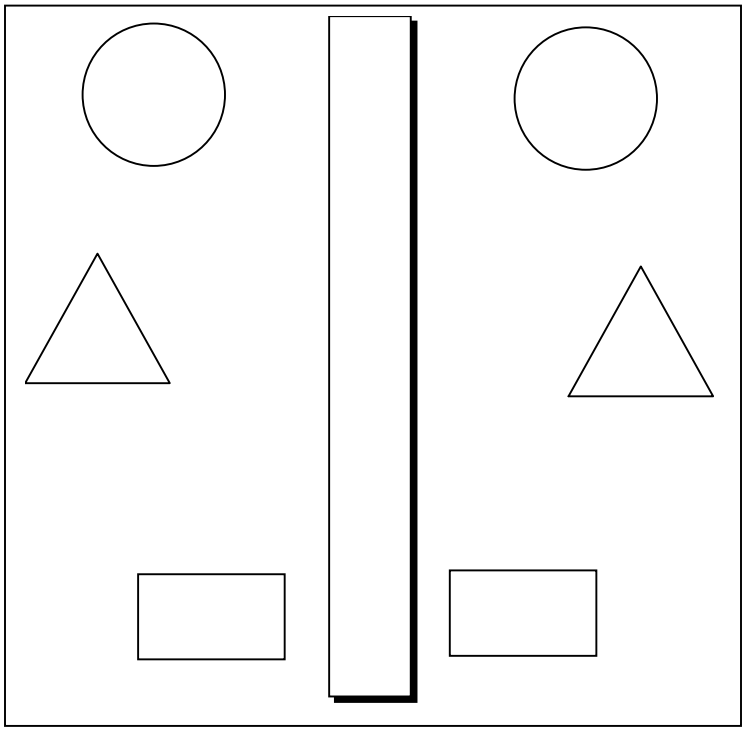
2. Model this idea using large blocks. Place a block on one side of the masking tape "street"; then place an identical block opposite it on the other side of the street. Invite students to help make the buildings. Keep in mind that Mirror City should have three-dimensional symmetry as well as two-dimensional symmetry.

3. As the class places blocks, discuss how the buildings are mirror images of each other and notice that they need to be placed the same distance from the street. A mirror could be used to check the placement of buildings. Extend students' knowledge by incorporating positional language such as "to the right of," "behind," and "above."

4. In groups, give each table a set of blocks and a masking tape "street" along the table. Have students build their own Mirror City. A mirror could be provided to help them check the placement of their buildings.

5. When students are finished building their city, allow them to look at other groups' cities and discuss them.

6. Have students write a story in their Shapes Book about Mirror City. Encourage them to draw pictures to illustrate their story.



Assessment(s)

- As an informal assessment, listen to students' conversations as they create their Mirror City.
- Using the sheet entitled "How Am I Doing?" in their Shapes Books, students may informally reflect on their progress toward learning the standard and benchmarks, as well as their progress toward their own learning goal(s).

LESSON 9: DO YOU SEE WHAT I SEE?

STANDARD: Understands and applies basic and advanced properties of the concepts of geometry

Benchmark: Understands basic properties (e.g., number of sides, corners, square corners) of and similarities and differences between simple geometric shapes

Supporting Knowledge:

- Understands the concepts of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows attributes (e.g., number of sides, number of faces) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Understands the basic concept of congruence (i.e., same size and shape) of two-dimensional shapes
- Knows parts (e.g., faces, edges, vertices) of circles, squares, rectangles, cones, cylinders, cubes, pyramids, rectangular prisms, spheres, triangles
- Knows definitions of attributes of shapes (e.g., face, edge, corner)

Benchmark: Understands the common language of spatial sense (e.g., "inside," "between," "above," "below," "behind")

Supporting Knowledge:

- Uses position vocabulary (e.g., "above," "below," "outside," "between," "near," "to the right of") to describe location
- Understands the concept of relative position

Purpose

The purpose of this lesson is to help students solidify their knowledge of shape vocabulary, position words, and the concepts of congruency and symmetry.

Getting Ready

- Collect pattern blocks for each pair of students.

Procedures

1. Explain to students they will be playing a game. They will need to use their knowledge from the previous lessons, shape vocabulary, position words, and the concepts of congruency and symmetry.

2. Have students work in pairs, with one student facing the overhead (Student #1) and one student facing away (Student #2). Student #2 may not turn around to view the overhead.

3. Using pattern blocks, make a design on the overhead.

4. Explain that Student #1 should now describe how to recreate the design to his or her partner, Student #2. Encourage the describers to use as many math words as possible.

5. Make it clear that Student #1 may not move any pieces for Student #2, but can give feedback about whether Student #2 is correctly placing the pieces.

6. Tell the class that Student #1 may ask questions of Student #2.

7. Once students have made their picture, have everyone turn around and compare their picture with yours.

8. This is a good opportunity to challenge students to think more deeply by asking such questions as, "What were you thinking? How did you know to . . . ? What was challenging during this exercise?"

9. Once students have given feedback, have them switch places and play the game again.

10. As an extension activity, challenge Student #1 to not look at the design Student #2 is creating with the following variations: Student #2 not talking at all; Student #2 being allowed to only ask 3 questions.

Assessment(s)

- As an informal assessment, ask students to read through their learning goal(s) and their reflections on their learning goal(s) on the next page ("How Am I Doing?"). Ask students to complete the sentence on the "How Did I Do?" page, as well as the follow-up question.

CULMINATING ASSESSMENT

Information on the Shapes Book

This unit was written with the expectation that all student work will be completed and compiled in a Shapes Book. What follows are some templates for the Shapes Book and a suggested order of assembly. It is recommended that these books be handed out to students as a complete packet (rather than giving students individual sheets as the unit progresses).

You may want to copy the Shapes Book onto colored paper or card stock.

Before the Shapes Book is evaluated, provide students with a checklist and allow them to check each other's books.

Suggested Order of Assembly for Shapes Book:

- The following shapes should be present, with the definition template on the left-facing page, and the real-world examples template on the right-facing page:

  - circle
  - rectangle
  - square
  - triangle
  - cone
  - cylinder
  - cube
  - pyramid
  - rectangular prism
  - sphere

- vocabulary of properties/attributes
- congruency definition/examples
- symmetry definition/examples
- scavenger hunt (Lesson 2)
- classification of shapes (Lesson 3)
- comparison of shapes (Lesson 4)
- shapes assessment (after Lesson 5)
- Mirror City story (Lesson 8)

Do I Have Everything?

Place a check (√) in the correct box below:

Assignment	I have it completed ☺	I have it, but it's not finished 😐	I don't know where it is ☹
Vocabulary (teacher definitions and picture and my definitions and picture)			
Let's go on a Shape Scavenger Hunt!			
Shape Classification			
Shape Comparison			
Pictures of real-world shapes (with traced shapes)			
Mirror City story			

Shapes, Shapes Everywhere!

By _____

What Will We Learn in This Unit?

- I will . . . understand basic properties of (e.g., number of sides, corners, square corners) and similarities and differences between simple geometric shapes

- I will . . . understand the common language of spatial sense (e.g., “inside,” “between,” “above,” “below,” “behind”)

- I will . . . understand that geometric shapes are useful for representing and describing real-world situations

- I will . . . understand basic properties of figures (e.g., two- or three-dimensionality, symmetry)

What Do I Want To Learn in This Unit?

I know_____

_____

_____

I want to know _____

_____

_____

I think I can make this goal by_____

_____

_____

_____

How Am I Doing?

Now I know _____

I still want to know _____

How Did I Do?

I did did not meet my goal because _____

What can I do next time to try and meet my goal? _____

circle

Teacher definition	Teacher picture
My definition	My picture

rectangle

Teacher definition	Teacher picture
My definition	My picture

triangle

Teacher definition	Teacher picture
My definition	My picture

cone

Teacher definition	Teacher picture
My definition	My picture

cube

Teacher definition	Teacher picture
My definition	My picture

cylinder

Teacher definition	Teacher picture
My definition	My picture

pyramid

Teacher definition	Teacher picture
My definition	My picture

rectangular prism

Teacher definition	Teacher picture
My definition	My picture

sphere

Teacher definition	Teacher picture
My definition	My picture

Here are some real-world examples:

congruency

Teacher definition	Teacher picture
My definition	My picture

symmetry

Teacher definition	Teacher picture
My definition	My picture

circumference

Teacher definition	Teacher picture
My definition	My picture

corner

Teacher definition	Teacher picture
My definition	My picture

diameter

Teacher definition	Teacher picture
My definition	My picture

edge

Teacher definition	Teacher picture
My definition	My picture

face

Teacher definition	Teacher picture
My definition	My picture

radius

Teacher definition	Teacher picture
My definition	My picture

Rubric for Shapes Book

	4	3	2	1	0
Is the attribute vocabulary accurate? Are attributes of shapes labeled?	The student correctly identifies attributes using pictures and vocabulary.	The student correctly identifies his or her shapes and lists attributes using pictures and vocabulary, but not the most important attributes.	The student makes errors when identifying his or her shapes or makes errors when listing attributes.	The student makes errors when identifying his or her shapes, makes errors when describing the shapes, and does not use attribute vocabulary.	There is not enough information to make a judgment.
Are similarities and differences clearly stated?	The student uses important characteristics to compare the shapes. The student accurately identifies the similarities and differences and explains his or her conclusions in a way that shows a complete and detailed understanding of the shapes.	The student uses important characteristics to compare the shapes. The student accurately identifies the similarities and differences and explains his or her conclusions.	The student uses characteristics to compare the shapes, but not the most important characteristics. The student's comparisons and conclusions show some misconceptions about the shapes.	The student uses insignificant characteristics to compare the shapes. The student's comparisons and conclusions show many misconceptions that indicate that he or she does not understand the shapes.	There is not enough information to make a judgment.
Do the real-world pictures have geometric shapes identified?	The student accurately and completely identifies geometric shapes from his or her real-world pictures.	The student accurately identifies most of the geometric shapes from his or her real-world pictures.	The student identifies some geometric shapes from his or her real-world pictures or makes some errors in identification.	The student makes significant errors when identifying the geometric shapes from his or her real-world pictures.	There is not enough information to make a judgment.
(**Optional**) Is symmetry apparent in the student's drawings?	The student draws accurate depictions of symmetrical figures that incorporate both rotation symmetry and reflection (line) symmetry.	The student draws accurate depictions of symmetrical figures that incorporate rotation symmetry or reflection (line) symmetry.	The student makes some errors when drawing symmetrical figures.	The student's drawings show many misconceptions that indicate that he or she does not understand the concept of symmetry.	There is not enough information to make a judgment.
(**Optional**) Is understanding of symmetry apparent in the student's stories?	The student demonstrates a complete understanding of the concept of rotation and reflection (line) symmetry.	The student demonstrates a basic understanding of the concept of rotation and reflection (line) symmetry.	The student demonstrates a basic understanding of the concept of rotation or reflection (line) symmetry.	The student makes errors that indicate that he or she does not understand the concept of symmetry.	There is not enough information to make a judgment.

REFLECTIONS

As a teacher, reflect on your teaching and learning during this unit.

- What worked well in this unit?
    - Why?

- What needs to be changed in this unit?
    - Why?

- Suggestions for improving this unit:
    - Was the amount of time I set aside for the unit adequate?
    - Do I need more/less time for certain lessons?
    - Which ones?

- I think my students really understand _____, because _____ _____ _____.
- I think my students do not understand _____ at all, because _____ _____ _____.

RESOURCES

Internet Resources

http://ccins.camosun.bc.ca/~jbritton/jbsymteslk.htm
Lists activities students may complete about symmetry. This is also a good resource for tessellation activities.

---

http://mathforum.org/varnelle/kgeo.html
Lists lesson plans aligned with NCTM geometry standards for primary grades. There is an applet where students can play with pattern blocks online.

---

http://www.sbgmath.com/gr1/chapter5/start/index.html
Links to quilt pictures on the Internet.

---

http://www.learner.org/teacherslab/math/geometry/space/shadows/index.html
This activity asks students to predict what shadows a cube could cast.

---

http://bright-productions.com/kinderweb/
Interactive website that talks to students. They may play a shapes recognition game. This is a good site for LLP students or students who need extra help recognizing two-dimensional shapes.

---

http://mathcats.com/explore/polygons.html
Students may make designs on the “polygon playground.”

---

http://www.amathsdictionaryforkids.com/
An interactive math dictionary

---

http://www.skyscraperpicture.com/
Lists pictures of cityscapes for 29 cities and 13 countries.

---

http://www.pics4learning.com/
A database of copyright-friendly pictures. Different categories may be useful to illustrate basic shapes or symmetry.

Shapes Reading

Afro-Bets Book of Shapes (1991), by Margery W. Brown. Culverson Blair (Illustrator). Just Us Books.

Ages four–eight

This is a culturally conscious book of shapes with colorful pictures.

Big Shapes for Little Kids (1999), by Susan Mascall & Bob Mascall. Carlton Lynn (Illustrator). Fundangles.

Ages four–eight

Cartoon-shaped characters describe what makes them unique. Plastic shapes are included that students can compare with the printed descriptions in the book.

Captain Invincible and the Space Shapes: Level 2:Three Dimensional Shapes (Mathstart) (2001), by Stuart J. Murphy. Remy Simard (Illustrator). HarperCollins Children's Books.

Ages six and up

This cartoon-formatted book is a good introduction to three-dimensional shapes. Captain Invincible must use three-dimensional shapes to return to Earth.

The Greedy Triangle (1995), by Marilyn Burns. Gordon Silveria (Illustrator). Scholastic.

Prekindergarten–first grade

This is the story of a triangle who wants one more side and one more angle. Once acquired, the triangle continues to desire one more side and one more angle, becoming almost circular.

Math Fair Blues (2001), by Sue Kassirer. Jerry Smath (Illustrator). Kane Press.

First–third grade

A group of students decides to make t-shirts. This story is a good introduction to two-dimensional shapes. Activities are included at the end of the book.

Pieces: A Year in Poems and Quilts (2001), by Anna Grossnickle Hines. Greenwillow Books.

Ages four–eight

Short poems (not math related) are illustrated by pictures of quilts, some of which have geometric designs.

Round is a Mooncake: A Book of Shapes (2000), by Roseanne Thong. Chronicle Books.

Ages four–eight

A girl discovers round, square, and rectangular objects in her urban neighborhood and is reminded of her Chinese-American culture.

The Shape of Things (1994), by Dayle Ann Dodds. Julie Lacome (illustrator). Candlewick Press.

Ages three and up

This story is a good introduction to six basic shapes. It describes the shape and combines them to form "real-world" pictures.

The Shapes Game (1990), by Paul Rogers. Sian Tucker (Illustrator). Henry Holt.

Kindergarten–third grade

This book is filled with "I spy" riddles and pictures of shapes.

Shapes, Shapes, Shapes (1986), by Tana Hoban. Greenwillow Books.

Ages four–eight

No words, just photographs, and students may find shapes in them. This could be a good book for LLP students.

The Silly Story of Goldie Locks and The Three Shapes (1996), by Grace MacCarone. Anne Kennedy (illustrator). Scholastic.

Kindergarten–second grade

This book relates the story of Goldilocks with a twist. Includes math activities to engage children as the story is being read.

Taking a Walk/Caminando: A Book in Two Languages (1990), by Rebecca Emberley. Little, Brown.

Ages four–eight

This book is written in Spanish and English on the same page. It describes the sorts of items children might see on a walk.

Symmetry Reading

Let's Fly a Kite: Level 2: Symmetry (Mathstart) (2000), by Stuart J. Murphy. HarperCollins Children's Books.

Ages six and up

Story about symmetry and cooperation. Two children like everything divided evenly. When it comes to flying a kite, they learn they have to cooperate.

The Mirror Puzzle Book (1986), by Marion Walter. Tarquin Publications.

Ages four–eight

There are no words in this book, just designs and a small mirror. When the mirror is placed a certain way, the designs look symmetrical.

Extension Reading

Flatland: A Romance of Many Dimensions (1998), by Edwin A. Abbott. Penguin USA.

This story, written at the end of the 19th century, is the story of a two-dimensional world and the shapes that inhabit it. Gifted students may enjoy reading different chapters and tackling the challenge of this fairly advanced novel.

A Cloak for the Dreamer (1995), by Aileen Friedman. Kim Howard (Illustrator). Scholastic.

Kindergarten–third grade

This story is about how geometric shapes fit together. A tailor has three sons and the sons each sew a cloak for the Archduke out of different shapes.

Three Pigs, One Wolf, and Seven Magic Shapes (1997), by Grace MacCarone & Marilyn Burns. David Newhaus (Illustrator). Scholastic.

Second–third grade

This book uses the story of the three little pigs and incorporates tangrams. There are math activities at the end of the story.

REFERENCES

Heidema, C. (1992). *CSMP mathematics for the first grade*. Aurora, CO: Mid-continent Research for Education and Learning.

Kendall, J. S., & Marzano, R. J. (2000). *Content knowledge: A compendium of standards and benchmarks for K–12 education* (3rd ed.) Aurora, CO: Mid-continent Research for Education and Learning and the Association for Supervision and Curriculum Development.

Marzano, R. J., Norford, J., Paynter, D. E., Pickering, D., & Gaddy, B. (2001). *A handbook for classroom instruction that works*. Alexandria, VA: Association for Supervision and Curriculum Development. Aurora, CO: Mid-continent Research for Education and Learning.

Marzano, R. J., & Pickering, D. J. (with Arredondo, D. E., Blackburn, G. J., Brandt, R. S., Moffett, C. A., Paynter, D. E., Pollock, J. E., & Whisler, J. S.). (1997). *Dimensions of learning teacher's manual* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development. Aurora, CO: Mid-continent Research for Education and Learning.

Marzano, R. J., Pickering, D., & Pollock, J. (2001). *Classroom instruction that works*. Alexandria, VA: Association for Supervision and Curriculum Development. Aurora, CO: Mid-continent Research for Education and Learning.

National Council of Teacher of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

Stahl, S., & Kapinus, B. (2001). *Word power: What every educator needs to know about teaching vocabulary* .Washington, DC: National Education Association.