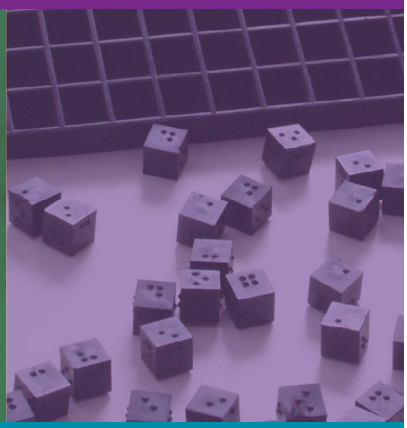
MathBuilders

Geometry



UEB

MathBuilders

Geometry

MathBuilders
Geometry

American Printing House for the Blind
Louisville, KY 40206

American Printing House for the Blind
Resource Services
1839 Frankfort Avenue
Louisville, KY 40206

Credits

Project Leader:
Jeanette Wicker

Mathematics Consultant:
Derrick Smith

Contributors:
Darlene Donhoff, Frank Hayden, Dr. Bill Leibfritz, Betty Modaressi, Eleanor Pester, Karen Poppe, Erica Rucker, and Monica Vaught

Advisory Committee:
Anthony Evancic, Dr. Phillip H.Hatlen, Dr. William E. Leibfritz, Ted Lennox, Mary Mitchell, Andrew S. Papineau, Dr. LeReah Sanford, and Merry Vahala

Field Testers:
Eldre Boggs, Nicole Cooper, John Glenn, Christine May, Rose Stevenson, Joyce Tudor, Laurie Wright, and Rebecca Zajac

Special Acknowledgement goes to Dr. Phillip Hatlen, Superintendent of the Texas School for the Blind and advisory committee member for this project, and to the following members of his staff for providing APH with the conceptual framework upon which much of this program is based: Nancy Levack, Robin Washburn, and Brigitte Starkey.

Table of Contents

Introduction

Children very quickly conclude that whenever they do mathematics in school, they use numbers. The school mathematics experienced by young children tends to be dominated by arithmetic topics. Geometry represents a very small portion of their experiences. One need only look at the mathematics textbooks used in the early elementary years to see the limited focus on geometry.

Geometry, from the Latin *qeometria* which means earth-measure, must be a major component in mathematics programs for young children. Some reasons, as indicated in the Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989) follow:

- Geometry relates to a child's world and is of intrinsic interest.
- Geometry improves spatial ability or spatial sense.
- Geometry is a vehicle for developing other mathematical concepts.
- Geometry is a rich source for mathematical problems and of value in improving overall problem solving ability.

Geometry cannot be applied without children being able to identify the shapes of common objects. Thus, knowledge of geometric shapes is fundamental to all the work in geometry and much of measurement. This program recognizes the importance of understanding geometric shapes and emphasizes the need to develop students' conceptualization of geometric shapes.

Geometry offers children one of the best opportunities to relate mathematics to the real world. Children's initial experiences, as they try to understand the world around them, are to distinguish one object from another and to determine how close or far away an object is. These are geometric and spatial investigations. Even as children learn to move from one place to another, they are using geometric and spatial ideas regularly to solve problems and make decisions in their everyday lives. Geometry also gives children a different view of mathematics. As they explore patterns and relationships of geometric models, they learn about the properties of shapes, and sharpen their intuition and awareness of spatial concepts.

Geometry cannot be discussed without also investigating spatial ability or spatial sense. Spatial sense is an intuitive feel for one's

surroundings and the objects in them. To develop spatial sense, children must have many experiences that focus on geometric relationships and activities such as: the direction, orientation, and perspective of objects in space; the relative shapes and sizes of figures and objects; and how a change in shape relates to a change in size. Before coming to school, most children have already begun using terms for spatial relations, such as their relative position to another person or object. (e.g., I'm in the house. I'm next to mom. I'm on the chair.) Through everyday activity, children can be encouraged to incorporate many more spatial terms (e.g., above, below, between, same side, different side, etc.) into their everyday vocabulary.

The learning of geometry and the improvement of spatial abilities are very interdependent. When concrete models are part of an instructional sequence, the hidden geometric-spatial sense component of these models cannot be ignored. Developing children's concepts of geometry and their spatial sense makes it more likely that they can benefit from the use of models.

Also, mathematics achievement and spatial abilities are positively correlated. Spatial abilities also seem to be related to problem solving ability.

Therefore, geometry activities that improve a student's spatial sense can also improve a student's success in mathematics in general.

Children need to be actively involved when learning geometry. They need to investigate interesting problems using concrete materials in a carefully planned and sequenced program. A framework for this program exists, and is based on the work of Dina and Pierre Marie van Hiele (1984), two Dutch educators. They have identified five sequential levels of understanding of geometric concepts. A brief description of each follows:

- Level 0: Visualization. At this initial stage, the students are aware of space only as something that is around them. They identify a figure, such as a triangle, as a whole, a total entity, not based on its parts or properties. When calling a figure a triangle, the students focus on the total figure, not the relationship of sides or the angles. A child able to function at this level can learn geometric vocabulary, can identify specified shapes, and reproduce a given figure. A child at this level though, would not recognize specific properties of the given shapes (e.g., triangles have three angles). Initial geometric activities

must include opportunities to investigate and sort geometric shapes.

- Level 1: Analysis. At this level, an analysis of geometric concepts begins. Students now begin to focus on specific properties and characteristics of figures through exposure to these shapes. These emerging properties can then be used to identify classes of shapes. In other words, geometric shapes are recognized as having parts, and are recognized by those parts. For example, a student can show that the sides of a square are all the same length, and that the angles are all the same size. The interrelationships among figures are not yet apparent though. For example, a student at this level would not yet realize that a square is actually a special type of rectangle or that rectangles are actually special types of parallelogram. Children working in this level must be given opportunities to investigate common shapes in order to identify common characteristics (e.g., all rectangles have opposite sides that are the same length and angles that are the same size).
- Level 2: Informal Deduction. At this level, a student can establish the

interrelationships both within and among figures (e.g., a square is a rectangle because it has all the properties of a rectangle). They can now use informal and logical reasoning to deduce properties of figures. Most students are able to work in this level until their middle school years.

- Level 3: Deduction and Level 4: Rigor. These levels continue geometric investigation with more formal and abstract study at the high school and college level.

These levels are sequential with success at one level depending on having the geometric thinking characteristics of the preceding levels. If a student's thinking is at one level (e.g., Visualization) and the geometry instruction is focused on a higher level, that student's success is unlikely. Movement from one level to the next is not a natural developmental process based on the child's age and/or maturity. How the geometry instruction is organized will make a significant difference in the student's ability to advance through these levels. This program will encourage students to examine, describe, construct, transform, and identify special properties of shapes and how they relate to one another. Children of preschool, kindergarten,

and early elementary age are generally at Level 0, where they focus on geometric shapes as a whole. Students working at this level must be involved in the manipulation of models of geometric figures – direct and tactile explorations, in which they draw, copy, trace, enlarge, combine, and modify physical objects. This type of geometric knowledge is used to extend investigations to Level 1 thinking, with a focus on specific properties of shapes.

Geometry must become a major component of early childhood mathematics programs. Geometry and spatial sense contribute to a child's success in learning mathematics. Carefully planned geometry and spatial sense development must be an integral part of the mathematical experiences throughout the years of the young child.

The objectives for each lesson were identified by an APH focus group and aligned to the Principles and Standards for School Mathematics (NCTM 2000). Standards are listed with the permission of the National Council of Teachers of Mathematics (NCTM). NCTM does not endorse the content or validity of these alignments.

In addition, some objectives are noted as being a NCTM Curriculum Focal Point. In 2006 the

National Council of Teachers of Mathematics published *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. In this document NCTM provides a "description of the most significant mathematical concepts and skills at each grade level" (NCTM, 2006, p. 1).

Included at the end of this unit is an Assessment Checklist that includes all of the objectives for the unit. This checklist is divided by grade levels. Prior to beginning the activities, review the checklist to determine which objectives your student has mastered and which objectives you will need to teach or review. Because some students have gaps in their skills, you may want to review the objectives for the preceding grade level/levels. Additionally, your school or district may align the math curriculum differently. You may find that you will need to teach lessons that are included at a different grade level or delay some objectives until the next school year.

Some children will need more time and experience with geometric activities than others. The following lessons, as a rule, provide only one worksheet per lesson. If your student needs more practice, less difficult activities or more challenging activities, use products like Picture

Maker, Shape Board, or Focus in Math that will allow you to create problems and activities to meet your child's specific needs.

As you use the worksheets with your students, please note that the directions for Kindergarten will ask the student to "find" the answer. Students may tell the answer, show the answer, or mark the answer in the fashion he or she has been taught. In grades 1-3 the directions will ask the students to "mark" the answer. Some teachers may want the child to color the answer, underline the answer, mark with stickers or Wikki Stix, or designate their answer in another fashion. The directions are not specific in how to "mark" the answer in order to allow for individual differences.

Literature plays an important role in the learning process. There are many good children's books that reinforce math concepts. Following is a list of books you may want to use to introduce or reinforce the concepts of geometry. Not all are available in braille and some are dependent on pictures to convey meaning.

- Abel, Simone. *Shapely sheep.* Connecticut: Millbrook Pr., 1999.
- Brown, Jeff. *Flat Stanley.* New York: Harper & Row Jr. Books, 1964. [braille]

- Burns, Marilyn. *The greedy triangle.* New York: Scholastic, 1995.
- Burns, Marilyn. *Spaghetti and meatballs for all.* New York: Scholastic, 1997.
- Carle, Eric. *The secret birthday message.* New York: HarperCollins, 1971.
- Dodds, Dayle Ann. *The shape of things.* New York: Candlewick Press, 1994.
- Ehlert, Lois. *Color farm.* New York: HarperCollins, 1992.
- Ehlert, Lois. *Color zoo.* New York: HarperCollins, 1989.
- Emberley, Ed. *The wing on a flea: a book of shapes.* New York: Scholastic, 1961. [braille]
- Giles, Jenny. *Here come the shapes.* Barrington, Ill: Rigby Education, 2000. [braille]
- Greene, Rhonda Gowler. *When a line bends….a shape begins.* New York: Houghton Mifflin, 1997.
- Grifalconi, Ann. *The village of round and square houses.* New York: Silver Burdett Ginn, 1986. [braille]

- Hoban, Tana. *Circles, triangles, squares.* New York: Simon & Schuster, 1974.
- Hoban, Tana. *Cubes, cones, cylinders, and spheres.* New York: HarperCollins, 2000.
- Hoban, Tana. *I read signs.* New York: Scholastic, 1983. [braille]
- Hoban, Tana. *Over, under, and through.* New York: Simon & Schuster, 1973.
- Hoban, Tana. *Shapes, shapes, shapes.* New York: HarperCollins, 1986.
- Hoban, Tana. *Spirals, curves, fan shapes, and lines.* New York: HarperCollins, 1992.
- Hutchins, Pat. *Rosie's walk.* New York: Scholastic, 1968. [braille]
- Murphy, Stuart J. *The greatest gymnast of all.* New York: HarperCollins, 1998.
- Onyefulu, Ifeoma. *A triangle for Adaora.* New York: Dutton, 2000.
- Rocklin, Joanne. *Not enough room.* New York: Scholastic, 1998.
- Seuss, Dr. *The shape of me and other stuff.* New York: Random House, 1988.

- Sharratt, Nick. *My mum and dad make me laugh.* Massachusetts: Candlewick Pr., 1994.
- Spurr, Elizabeth. *The Gumdrop tree.* Louisville, KY: American Printing House for the Blind, 1996. [braille]
- Thong, Roseanne. *Round is a mooncake.* New York: Chronicle Books, 2000.
- Wright, Suzette. *Goin' on a bear hunt.* Louisville, KY: American Printing House for the Blind, 2004. [braille]
- Wright, Suzette. *Roly-poly man.* Louisville, KY: American Printing House for the Blind, 1991. [braille]
- Wright, Suzette. *Silly squiggles.* Louisville, KY: American Printing House for the Blind, 1991. [braille]
- Wright, Suzette. *Splish the fish.* Louisville, KY: American Printing House for the Blind, 2003. [braille]

Bibliography

National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence.* Reston, VA: National Councils of Teachers of Mathematics, 2006.

National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics.* Reston, VA: National Council of Teachers of Mathematics, 2000.

Learning Objectives

Kindergarten

G K-1*	Identify relative positions: over, on, in, under, above, behind, below, left, in front of, right, between, next to, same side, different side, inside, outside, top, middle, bottom, open, and closed.
G K-2*	Examine, compare, and name open and closed shapes and lines – straight and curved.
G K-3*	Examine, compare, and sort two-dimensional shapes: circle, square, and triangle.
G K-4*	Investigate, describe, and name common geometric shapes: circle, square, triangle, and rectangle.
G K-5	Construct/reproduce the common geometric shapes: circle, square, rectangle, and triangle and lines – straight and curved.

G K-6 Identify two-dimensional shapes in the environment: circle, square, triangle, and rectangle.

First Grade

G 1-1 Identify and reproduce/construct the common geometric shapes: circle, square, triangle, and rectangle and lines – straight and curved.

G 1-2* Describe the common geometric shapes: circle, square, triangle, and rectangle according to the number of sides and corners (vertices).

G 1-3* Investigate, describe, and name common three-dimensional shapes: sphere, cube, and pyramid.

G 1-4 Examine and relate three-dimensional shapes to two-dimensional shapes: circle to sphere, square to cube, triangle to pyramid.

G 1-5* Compare and combine shapes to make new shapes.

G 1-6* Identify symmetrical figures (lines of symmetry with two matching parts).

G 1-7* Systematically examine and describe a simple drawing or diagram using position and shape words.

Second Grade

G 2-1* Identify and label two-dimensional shapes in drawings, maps, and diagrams.

G 2-2* Compare perimeters of common shapes – larger, smaller, same as.

G 2-3* Recognize and apply slides, flips, and turns of two-dimensional shapes.

G 2-4 Identify and construct symmetrical figures.

G 2-5* Identify and label the following three-dimensional shapes: cube, rectangular prism, sphere, cylinder, cone, and pyramid.

G 2-6 Describe common three-dimensional shapes by characteristics: the number of faces, edges, and vertices.

G 2-7* Compare areas of common shapes – larger, smaller, same as.

G 2-8* Identify lines as vertical, horizontal, and diagonal.

Third Grade

G 3-1* Identify congruent (same shape and size) two-dimensional shapes.

G 3-2* Identify similar (same shape but different size) two-dimensional shapes.

G 3-3* Determine if two-dimensional shapes are congruent (same shape and size) or similar (same shape but different size).

G 3-4* Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.

G 3-5* Find the perimeter of various polygons on which the length of all sides are labeled.

G 3-6* Determine the area of a square.

G 3-7*	Identify two-dimensional shapes: pentagon, hexagon, and octagon.
G 3-8*	Identify geometric representations for points, lines, line segments, and rays.
G 3-9*	Identify lines as parallel, intersecting, and perpendicular.
G 3-10*	Identify, describe, and classify special triangles.
G 3-11*	Identify angles as right angles and determine whether other angles are greater or less than a right angle.

* Worksheet included

Kindergarten

Learning Objectives

Kindergarten

G K-1*	Identify relative positions: over, on, in, under, above, behind, below, left, in front of, right, between, next to, same side, different side, inside, outside, top, middle, bottom, open, and closed.
G K-2*	Examine, compare, and name open and closed shapes and lines – straight and curved.
G K-3*	Examine, compare, and sort two-dimensional shapes: circle, square, and triangle.
G K-4*	Investigate, describe, and name common geometric shapes: circle, square, triangle, and rectangle.
G K-5	Construct/reproduce the common geometric shapes: circle, square, triangle, and rectangle and lines – straight and curved.

G K-6 Identify two-dimensional shapes in the environment: circle, square, triangle, and rectangle.

* Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to supplement, add variety, and to give the child more experiences with objects from the environment.

Box G K-1

DRAFTSMAN Tactile Drawing Board G K-5

Feel ‘n Peel stickers G K-1

Glove G K-1

Pipe cleaners G K-5

Quick-Draw Paper G K-5

Shapes of various sizes G K-3

String G K-2

Toys, 2 small G K-1

Wikki Stix G K-2, G K-5

G K-1
Geometry

Objective: The student will identify relative positions: over, on, in, under, above, behind, below, left, in front of, right, between, next to, same side, different side, inside, outside, top, middle, bottom, open, and closed.

NCTM Standard: Geometry for Pre-K – 2 – Specify locations and describe spatial relationships using coordinate geometry and other representational systems. All students should describe, name, and interpret relative positions in space and apply ideas about relative position.

NCTM Curriculum Focal Point

Suggested Materials:

- Two small toys
- Box
- Glove
- Feel 'n Peel stickers

Worksheet G K-1

Materials: *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: The activities to teach the positional words should be divided into three steps.

Step One: Have the student put on the glove and place the box in front of the child. After allowing her to explore the glove and the box, begin the activity. Using the glove show the student the positional terms “inside” and “outside” the glove. Demonstrate an “open” and “closed” hand. Using the gloved hand and the box show the student the positional terms “inside”, “outside”, “over”, “below”, “on”, “under”, and “above” by having the student place her hand in those positions relative to the box.

Step Two: Using a toy and the box, demonstrate to the student the positional terms “in”, “next to”, “left”, “in front of”, “right”, and “behind”. After the demonstration, have the student place the toy in the correct positions.

Step Three: Using two toys and the box, demonstrate the positional terms “middle”, “same side”, “different side”, “between”, “next to”, “top”, and “bottom”.

With each of these steps, the teacher should demonstrate the positions and then have the student demonstrate understanding of the positional terms. As an assessment activity have the student wear a glove on one hand. Using a game like *Simon Says*, have the student put her hand in positions relative to her body. You may also include the concepts of “out” and “in” when putting the glove on the student’s hand.

> It is important to connect these positional terms to help the student develop body image skills.

Do Worksheet G K-1.

Directions for worksheet: Worksheet G K-1 has two geometric figures, a circle and a square. Have the child explore the worksheet and locate the shapes. Have the student use her finger to locate the following places on the sheet.

Put your finger in the square.

Put your finger above the square.

Put your finger below the square.

Put your finger between the circle and the square.

Put your finger next to the circle.

Put your finger on the top of the page.

Put your finger on the bottom of the page.

Have the student repeat the activity this time placing Feel 'n Peel stickers in the appropriate locations. When all of the stickers have been placed, have the student locate a sticker that she has put on the sheet and tell you the location. (e.g., This sticker is on the top of the page.)

Connections: These geometric terms are closely connected with orientation and mobility, physical education, physical therapy, and occupational therapy. Share with these professionals words that the student needs to practice.

The positional terms explored in this objective are constantly used in movement. It would be appropriate to develop the terminology during play when the student is able to go "inside the playhouse" or "behind the tree".

APH Tactile Treasures, Volume 3, pages 56-79 can be used for students who need more practice.

Read *Going on a Bear Hunt* by Suzette Wright from the APH On the Way to Literacy Series. This book emphasizes movement through space and positional words.

G K-2
Geometry

Objective: The student will examine, compare, and name open and closed shapes and lines – straight and curved.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Any kind of string (yarn, Wikki Stix, etc.)
- Diagramming strips from the kit
- Story Board from the kit

Worksheets G K-2 (a) and G K-2 (b)

Strategies: First, provide examples using string and the Story Board to illustrate the difference between straight and curved lines. Provide the student an opportunity to make straight and

curved lines using the string. Then provide the student examples of open and closed shapes using the string. Have the student take a piece of string and make shapes that are connected and some that are not. You may want to have him glue the work down to a piece of paper.

Next, using the diagramming strips and the Story Board, provide examples of straight lines and curved lines. Create shapes that demonstrate the concepts of open and closed shapes. Show the student a shape where all the sides, straight and curved, are connected to the end of each side (thus creating a closed shape such as a square). Then, create shapes where one of the side's ends do not touch another side (thus creating an open shape).

After the student is familiar with open and closed shapes, develop the concept that some figures are made up of straight lines (square and triangle) while others are made up of curved lines (circle).

As an assessment activity, have the student use the diagramming strips and the Story Board from the kit to create various shapes using both straight and curved lines. Have the student discuss whether the shapes are open or closed and what types of lines are used to create the shape.

Do Worksheets G K-2 (a) and G K-2 (b).

Connections: APH Tactile Treasures, Volume 1, pages 9 & 10 can be used for students who need more practice.

Straight and curved lines are important to orientation and mobility. Have the student explore different sidewalks and determine if they are straight or curved.

Read *Silly Squiggles* by Suzette Wright from the APH On the Way to Literacy Series. Have the student identify curved and straight lines in the story.

G K-3
Geometry

Objective: The student will examine, compare, and sort two-dimensional shapes: circle, square, and triangle.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Basic shapes: circles, squares, and triangles of various sizes
- Basic shapes from the kit

Worksheet G K-3

Strategies: The student should holistically understand the shape of the three basic geometric figures (circle, square, and triangle). This activity should begin with an introduction to tactile manipulatives of each shape. Allow the

student the opportunity to examine each shape and discuss some of its basic features.

During the discussion, ask the student questions such as:
Does the shape have curved sides or straight sides?
How many sides does the shape have?
Can you count the sides for me?
Is the shape an opened or closed shape?
What is the name of this shape?
How are the square and triangle similar?
How are the square and triangle different?
How is the circle different from the square and triangle?

Using circles, squares, and triangles of various sizes, colors, or textures, have the student sort the shapes into groups based on shape.

Do Worksheet G K-3.

Connections: APH Tactile Treasures, Volume 1, pages 1-8 can be used for students who need more practice in identifying shapes.

For students who need additional practice in sorting shapes use APH MathBuilders, Unit 1, Matching, Sorting, and Patterning, exercise MA K-3.

G K-4
Geometry

Objective: The student will investigate, describe, and name common geometric shapes: circle, square, triangle, and rectangle.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Basic shapes: circle, square, triangle, and rectangle from the kit

Worksheet G K-4

Strategies:

Please note that the rectangle is introduced during this activity. The student will need to develop an understanding of the difference between the square and the rectangle. Both have four sides; however, the square's sides are all congruent or equal. The rectangle is different because only the opposite sides are congruent.

The student should be able to use the terms circle, square, triangle, and rectangle to name shapes and to incorporate these terms into his mathematical vocabulary. Provide the student with examples of the four shapes and discuss the attributes of each (e.g., the square has four sides). Move from the square, to the rectangle, to the triangle, to the circle.

In order to make sure that the student can identify each shape by name, place the four shapes in front of the student and ask him to name the shapes from right to left. Upon completion, rearrange the shapes and ask him to repeat the exercise.

Do Worksheet G K-4. Provide the student a basic shape and have the student match the shape to the tactile drawing. After the student has matched all of the shapes to the tactile drawing, ask the student to name the shapes using only the tactile drawings.

Connections: Review with the student shapes made up of straight lines and ones made up of curved lines.

APH IntelliTactiles Pre-Braille Concepts can be used for students who need more practice in identifying the basic shapes.

Read the *Gumdrop Tree* by Elizabeth Spurr from the APH On the Way to Literacy Series. This special tree grows gumdrops. The gumdrops are shown as the child places them in a row, circle, square, and other shapes.

G K-5
Geometry

Objective: The student will construct/reproduce the common geometric shapes: circle, square, triangle, and rectangle and lines – straight and curved.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Diagramming strips from the kit
- Story Board from the kit
- Basic shapes: circle, square, triangle, and rectangle from the kit
- Quick-Draw Paper
- APH DRAFTSMAN Tactile Drawing Board
- Wikki Stix
- Pipe-cleaners

Strategies: The student should have the experience of actually constructing the basic shapes. Listed below are three options that you may choose from based on your student's needs and abilities.

Option 1: Have the student use the basic shapes and DRAFTSMAN or Quick-Draw Paper to trace the geometric figures.

Option 2: Use any of a number of materials including Wikki Stix, pipe-cleaners, or any other string-like material to create a tactile stencil of the shapes. Have the student use one of these materials to form the outline of the figure. Using the shapes as a template guide may work best for students with multiple disabilities.

Option 3: Use the diagramming strips and the Story Board to have the student construct a square, a rectangle, and a triangle. Using the same materials, have her construct a circle using the curved lines.

Connections: Read the book *I Read Signs* by Tana Hoban. This book, available in braille, introduces the concept of familiar signs to pre-readers.

Use the APH Puzzle Form Kit for students who need additional practice with basic shapes.

G K-6
Geometry

Objective: The student will identify two-dimensional shapes in the environment: circle, square, triangle, and rectangle.

NCTM Standard: Geometry for Pre-K – 2 – Use visualization, spatial reasoning, and geometric modeling to solve problems. All students should recognize geometric shapes and structures in the environment and specify their location.

NCTM Curriculum Focal Point

Suggested Materials:

- Items found in the student's natural environment that are one of the four basic shapes.
- Basic shapes: circle, square, triangle, and rectangle from the kit

Strategies: Have the student explore his environment and find examples of shapes. Make sure to have ample examples of tactual shapes throughout the classroom. An activity such as a "shape scavenger hunt" is an enjoyable way

to explore the classroom environment to find shapes.

Review the basic shapes and their names. Discuss the idea that shapes are all around us. As you say the following chant with the student, give him the shape to hold and examine. Then explore the classroom or school building to find the shape in the environment.

Shape Hunt Chant
(adapted from the traditional children's song *Going on a Picnic*)

Going on a shape hunt,
Leaving right away.
If it doesn't rain,
We'll stay all day.
Teacher: Can you find a circle?
Students: Yes, I (we) found a circle.
Going on a shape hunt,
Here we go.

Continue the activity substituting the names of other shapes into the chant. When the "Shape Hunt" has concluded review with the student the shape, the object that he found that matches the shape, and where he found the shape.

Connections: This may provide an opportunity for a homework project. Have the student bring shapes from his home environment to the classroom and share them with the other students.

Read *Here Come the Shapes* by Jenny Giles. This book, available in braille, introduces the concept that geometric forms can be found all around us.

Exploring the environment is an opportunity to teach and reinforce room familiarization skills.

* ReadWriteThink.org is a nonprofit website maintained by the International Reading Association and the National Council of Teachers of English, with support from the Verizon Foundation. The site publishes free lesson plans, interactive student materials, Web resources, and standards for classroom teachers of reading and the English language arts.

First Grade

Learning Objectives

First Grade

G 1-1	Identify and reproduce/construct the common geometric shapes: circle, square, triangle, and rectangle and lines – straight and curved.
G 1-2*	Describe the common geometric shapes: circle, square, triangle, and rectangle according to the number of sides and corners (vertices).
G 1-3*	Investigate, describe, and name common three-dimensional shapes: sphere, cube, and pyramid.
G 1-4	Examine and relate three-dimensional shapes to two-dimensional shapes: circle to sphere, square to cube, triangle to pyramid.
G 1-5*	Compare and combine shapes to make new shapes.
G 1-6*	Identify symmetrical figures (lines of symmetry with two matching parts).

G 1-7* Systematically examine and describe a simple drawing or diagram using position and shape words.

* Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to add variety and to give the child more experiences with objects from the environment.

APH Puzzle Form Board Kit G 1-5

Balls G 1-3

Box G 1-3

Building blocks G 1-3

Globe G 1-3

Glove G 1-6

Graphic art tape G 1-7

Gumdrops G 1-1

Hat G 1-6

Orange G 1-3

Puff paint G 1-7

Shapes of various sizes G 1-5

Shoe G 1-6

Toothpicks G 1-1

Wikki Stix G 1-6

G 1-1
Geometry

Objective: The student will identify and reproduce/construct the common geometric shapes: circle, square, triangle, and rectangle and lines – straight and curved.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Diagramming strips from the kit
- Story Board from the kit
- Basic shapes: circle, square, triangle, and rectangle from the kit
- Toothpicks
- Gumdrops (or marshmallows)

Materials: *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: This is a review of material covered in the Kindergarten lessons G K-2, G K-4, and G K-5. If the student is having trouble with these concepts you may want to review these lessons.

Give the student the diagramming strips and the Story Board. Review straight lines and curved lines by placing examples of each on the Story Board and having the student identify the different types of lines. Have the student create a shape with only straight lines, only curved lines, and with both straight and curved lines.

Give the student the circle, square, triangle, and rectangle. Let the student examine and identify the solid shapes. It is important that the student can identify the shapes by the correct name and can distinguish between the shapes.

Provide the student with gumdrops (or marshmallows) and toothpicks. Have her construct the basic shapes of square, rectangle, and triangle using these materials. This activity

will reinforce the distinction between a side (the toothpicks) and the corner/vertices (the gumdrops).

Connections: Read *The Greatest Gymnast of All* by Stuart J. Murphy or *Rosie's Walk* by Pat Hutchins, available in braille, to review positional words with the student.

G 1-2
Geometry

Objective: The student will describe the common geometric shapes: circle, square, triangle, and rectangle according to the number of sides and corners (vertices).

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should describe attributes and parts of two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Basic shapes: circle, square, triangle, and rectangle from the kit

Worksheet G 1-2

Strategies:

It is important to introduce the student to the mathematical terms of “vertex” and “vertices”. Take the opportunity to teach the student the correct terminology for the corners.

Provide the student with a square. Review with the student the number of sides of a square. Introduce the term “vertex.” Explain to the student that the vertex means the corner where two sides meet and that the plural of vertex is vertices. Ask the student to demonstrate his understanding of each by having him point out the number of sides and vertices of the square. Ask the student to identify the number of sides and vertices of a rectangle, a triangle, and a circle.

The circle may puzzle your student because it does not have sides and vertices. In the discussion, explain to your student that the circle is a special shape (or polygon). It is important that he understands that a circle is special and does not have these features.

Ask the student to identify the pattern associated with the number of sides and the number of

vertices (e.g., Four-sided figures will have four vertices.). Ask the student to make predictions on the number of sides a figure would have given the number of vertices.

Do Worksheet G 1-2.

Connections: Provide common construction toys (such as “tinker-toys” that connect sticks to a “node”) to build shapes. Have the student identify the number of sides and vertices in the figure he built.

G 1-3
Geometry

Objective: The student will investigate, describe, and name common three-dimensional shapes: sphere, cube, and pyramid.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Basic 3-D shapes: sphere, cube, and pyramid from the kit
- Real-world examples of spheres, cubes, and pyramids

Worksheets G 1-3 (a) and G 1-3 (b)

Strategies: Begin by exploring the difference between a two-dimensional (flat) drawing and a three-dimensional shape. The introduction of the

terminology of two-dimensional (2-D) and three-dimensional (3-D) is important.

Introduce the student to the three most common 3-D shapes: the sphere, the cube, and the pyramid. Provide the student with 3-D models to explore and investigate. Have the student name the shapes and explain what makes them different.

Provide the student with real world examples of the shapes.

Sphere: different sized balls, globe, orange
Cube: a box (make sure it is a cube and not a rectangular prism), building blocks
Pyramid: the Egyptian pyramids, Mayan temples

> The student will later learn that these 3-D shapes are called polyhedrons.

Do worksheets G 1-3 (a) and G 1-3 (b). The student has already compared 2-D shapes to 3-D shapes in the lesson. Introduce the worksheets and have the student explore the tactile drawings of a 2-D shape and a tactile drawing of a 3-D shape.

Connections: Have the student explore the class (or school) environment to look for these 3-D shapes. Reinforce the difference between 2-D and 3-D shapes found in the environment.

During play, make sure to remind the student that a ball is a sphere, that a box is a cube, etc.

G 1-4
Geometry

Objective: The student will examine and relate three-dimensional shapes to two-dimensional shapes: circle to sphere, square to cube, triangle to pyramid.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- Geometro forms from the kit
- Basic 3-D shapes: sphere, cube, and pyramid from the kit
- Basic shapes: square, circle, and triangle from the kit

Strategies: Have the students explore and discover the relationship between the 2-D shapes and their respective 3-D shapes:

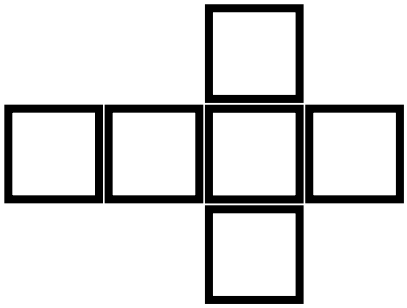
Circle to sphere
Square to cube
Triangle to pyramid

This activity begins the development of the concepts of faces and edges and will lead to an understanding that the surface area of a geometric 3-D shape is made up of 2-D shapes.

Provide the student a cube and a square. Have the student examine each and note similarities and differences. Help the student discover that squares are used to make the sides or faces of a cube.

Provide the student with one of the square shapes from the Geometro kit. Help the student note that each side of the square has a hook and a loop fastener. Demonstrate for the child how to join two squares together.

Connect six of the Geometro squares in a flat configuration that can be folded into a cube, such as:



Explain to the student that you are going to join six squares to make a cube. Have the student examine the configuration you have made noting that there are indeed six squares. Using hand-over-hand, demonstrate how the figure can fold to make a cube. Provide the student an opportunity to fold and unfold the figure as well as to disconnect the figure and attempt to build the cube without assistance.

Have the student note that the solid cube and the cube he built each have six sides or faces.

Repeat the procedure with the triangular pyramid. Have the student note the similarities between the triangle and the pyramid and the number of sides or faces needed to make the pyramid. Have the student use four triangles from the Geometro kit to build a pyramid.

Using a circle and a sphere help the student explore the relationship of the 2-D figure and the 3-D figure.

Connections: Read *Flat Stanley* by Jeff Brown. This story, available in braille, is about a little boy who was flattened when a bulletin board fell on him.

Provide the student an opportunity to build different geometric forms using the Geometro kit. Introduce the concept of using a square base to build a pyramid. Ask the student to see how many different shapes he can build using the pieces provided.

G 1-5
Geometry

Objective: The student will compare and combine shapes to make new shapes.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should investigate and predict the results of putting together and taking apart two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- APH Puzzle Form Board Kit
- Assortment of geometric shapes in varying sizes

Worksheets G 1-5 (a) and G 1-5 (b)

Strategies:

Puzzles are an excellent way to develop the concept that shapes can be combined to make bigger shapes.

Have the student use pre-made shapes to construct new shapes that are common to her environment (e.g., a triangle and a square to construct a house).

Take available shapes (from the APH puzzle board or other manipulatives) and help the student construct some simple objects using the shapes. Using worksheet G 1-5 (a) have the student determine what the tactile figure represents and what geometric shapes she would need to build the shape. Then have the student use shapes to build the figure.

A house: square and triangle
Snowman: 3 circles in graduated sizes
Christmas tree: large triangle and small square
An arrow: rectangle and triangle

Do Worksheet G 1-5 (b). Prior to giving the student this worksheet, trace the "T" pattern on a sheet of heavy paper or cardboard. Cut the "T" figure into rectangles, squares, and triangles to form puzzle pieces for the student. Begin with a simple puzzle of two rectangles to help the student develop the concept of this activity. As the student gains understanding, increase the difficulty by giving the student rectangles and squares. Finally, have the student build the figure using rectangles, squares, and triangles.

Connections: Provide the student with simple tangram puzzles to explore and complete.

Read the *Roly-poly man* by Suzette Wright from the APH On the Way to Literacy Series. In this story a child makes a "roly-poly man" from different shapes.

G 1-6
Geometry

Objective: The student will identify symmetrical figures (lines of symmetry with two matching parts).

NCTM Standard: Geometry for Pre-K – 2 – Apply transformations and use symmetry to analyze mathematical situations. All students should recognize and create shapes that have symmetry.

NCTM Curriculum Focal Point

Suggested Materials:

- Accessible objects such as gloves, shoes, hats, etc.
- Basic shapes: circle, square, triangle, and rectangle from the kit
- Wikki Stix

Worksheets G 1-6 (a) and G 1-6 (b)

Strategies: To begin to develop the concept of symmetry, use the human body as a starting guide. Show the student that he has two ears, one on each side of his head, two arms, two

legs, etc. The intent is to develop the concept that each side of his body is the same. Ask the student to determine an imaginary dividing line on his body that would result in two halves that are the same. Introduce the word symmetry.

> An interesting way to teach symmetry is to take an object and literally cut in half to demonstrate the concept. An example would be to take a piece of fruit such as an orange and cut it in half.

Next, have the student explore accessible objects in his environment such as gloves, hats, shoes, etc. Have the student determine if the objects have symmetry.

Provide the student with basic shapes cut from construction paper. Have the student determine if these shapes are symmetrical by folding the shapes in half so that each side is equal.

Using the basic shapes and Wikki Stix (or any other type of string) demonstrate the symmetry of the basic shapes by placing the Wikki Stix appropriately across the basic shape. Have the student examine the placement of the Wikki Stix to aid in his understanding of a line of symmetry. Then divide the basic shape in an

asymmetrical fashion using the Wikki Stix and have the student examine this division. Have the student compare a symmetrical division and an asymmetrical division.

Now provide the student with the Worksheet G 1-6 (a) of the butterfly tactile graphic. Have the student explore the idea that each side of the butterfly is the same. Have the student use a Wikki Stix to divide the butterfly symmetrically.

Do Worksheet G 1-6 (b).

Connections: Look for things in the environment that are not symmetrical (asymmetrical). It is important to develop the mathematical vocabulary as well as the concept during this activity.

Having the student develop an understanding that his body has a midline will aid with orientation and mobility. Share with the Orientation and Mobility Specialist that the student is discussing symmetry and the midline of the body in math class.

G 1-7
Geometry

Objective: The student will systematically examine and describe a simple drawing or diagram using position and shape words.

NCTM Standard: Geometry for Pre-K – 2 – Specify locations and describe spatial relationships using coordinate geometry and other representational systems. All students should find and name locations with simple relationships such as "near to" and in coordinate systems such as maps.

NCTM Curriculum Focal Point

Suggested Materials:

- Graphic art tape
- Puff paint

Worksheet G 1-7 (a) and G 1-7 (b)

Strategies: Create simple raised-line drawings or diagrams with graphic art tape, puff paint, or other similar material. Let the student examine the drawing or diagram and describe it by identifying the position and the shape. Repeat the activity with other drawings or diagrams.

Here are some suggestions for the drawings and diagrams:

- a clock face without numbers
- a large box and a small box
- small, medium, and large circles
- a rectangle within a rectangle

Using Worksheet G 1-7 (a) have the student examine the diagram of different shapes. Ask the student positional questions such as:

"Which shape is above the rectangle?" (circle)
"Which shape is to the right of the square?" (circle)
"Which shape is below the square?" (triangle)
"Which shape is to the left of the circle?" (square)
"Which shape is beside the triangle?" (rectangle)

Do Worksheet G 1-7 (b). This activity develops the prerequisite skills needed for coordinate graphing. Help the student explore the worksheet to discover the grid formation, the various shapes, and the star in the middle of the grid. Begin at the star in the center of the grid to answer all questions.

1. Move two spaces to the left and then one down. What shape have you found? (triangle)
2. Move two spaces down and one space to the left. What shape have you found? (rectangle)
3. Move two spaces to the right and two spaces down. What shape have you found? (triangle)
4. Move one space to the right, two spaces up, and one space to the left. What shape have you found? (square)
5. Move one space up and two spaces to the right. What shape have you found? (rectangle)
6. Move two spaces down, one space to the right, and two spaces up. What shape have you found? (circle)
7. Move one space up and two spaces to the left. What shape have you found? (circle)

Connections: Read *The Secret Birthday Message* by Eric Carle. It is Tim's Birthday. Instead of a package, Tim gets a mysterious letter written in code.

Second Grade

Learning Objectives

Second Grade

G 2-1*	Identify and label two-dimensional shapes in drawings, maps, and diagrams.
G 2-2*	Compare perimeters of common shapes – larger, smaller, same as.
G 2-3*	Recognize and apply slides, flips, and turns of two-dimensional shapes.
G 2-4	Identify and construct symmetrical figures.
G 2-5*	Identify and label the following three-dimensional shapes: cube, rectangular prism, sphere, cylinder, cone, and pyramid.
G 2-6	Describe common three-dimensional shapes by characteristics: the number of faces, edges, and vertices.
G 2-7*	Compare areas of common shapes – larger, smaller, same as.

G 2-8* Identify lines as vertical, horizontal, and diagonal.

* Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to add variety and to give the child more experiences with objects from the environment.

Doll, small G 2-3

Geobands G 2-2

Geoboards G 2-2

Graph Sheets, embossed G 2-7

Paper, construction G 2-4

Scissors G 2-4

Shapes of various sizes G 2-2, G 2-7
- cut from paper G 2-4
- letters G 2-3
- tactile G 2-3

String G 2-2

Wikki Stix G 2-4

G 2-1
Geometry

Objective: The student will identify and label two-dimensional shapes in drawings, maps, and diagrams.

NCTM Standard: Geometry for Pre-K – 2 – Specify locations and describe spatial relationships using coordinate geometry and other representational systems. All students should find and name locations with simple relationships such as "near to" and in coordinate systems such as maps.

NCTM Curriculum Focal Point

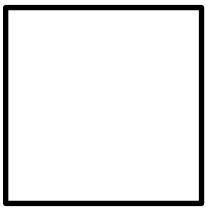
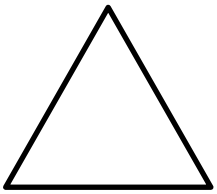
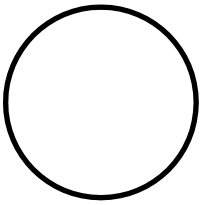
Suggested Materials:

Worksheet G 2-1

> ***Materials:*** *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: Make two-dimensional drawings of circles, squares, rectangles, and triangles with puff paint or white glue and give the shapes to

the child to examine (or if you wish, you may use thermoform examples of the shapes). Give the child labels with the word circle, square, rectangle, or triangle in braille. Have the child label each drawing. You may wish to introduce the Nemeth or UEB symbol for each of these shapes.

Shape Symbols:	Nemeth	UEB
 Square	⠫	⠪
 Triangle	⠞	⠹
 Circle	⠉	⠨
 Rectangle	⠗	⠻

Note: there is no official UEB symbol for rectangle. The UEB symbol below is a transcribers recommended use.

Supply maps and diagrams that contain the above shapes and have the student identify the shapes within the maps or diagrams. Using simple drawings, maps, or diagrams have the student explore the graphic and introduce/ review the concept of using a key (geometric representation).

Do Worksheet G 2-1.

Connection: Read *The Wing on a Flea: a Book of Shapes* by Ed Emberley. This book, available in braille, introduces the concept that geometric forms can be found in the everyday world that surrounds us.

G 2-2
Geometry

Objective: The student will compare perimeters of common shapes – larger, smaller, same as.

NCTM Standard: Geometry for Pre-K – 2 – Use visualization, spatial reasoning, and geometric modeling to solve problems. All students should relate ideas in geometry to ideas in number and measurement.

NCTM Curriculum Focal Point

Suggested Materials:

- Basic shapes: circles, squares, triangles, and rectangles of various sizes
- String
- Geoboards
- Geobands

Worksheet G 2-2

Strategies: Introduce the term perimeter and the definition of perimeter as the distance around a shape.

To develop an understanding of perimeter, begin with an activity comparing the perimeter of two large areas. Count with the student the number of steps it takes to go around the perimeter of the classroom. Compare this measure to the number of steps it takes to go around the perimeter of the gymnasium. Help the student realize that the larger the size of the figure, the greater the perimeter.

Next, take common geometric shapes and have the student compare similar shapes to determine which shape has the greater perimeter. The student can use string to measure the distance around the shape and then cut the string. Lengths of string can be compared to each other to determine which similar shapes have the larger perimeter, the smaller perimeter, or the same perimeter.

Another option is to use Geoboards. Have the student construct different sized polygons with Geobands and compare the number of pegs it takes to go around a shape. Have the student determine which similar shapes have the larger perimeter, smaller perimeter, or the same perimeter.

Do Worksheet G 2-2.

Connections: Have the students find the perimeter of the classroom using objects of varying sizes.

Find the perimeter of geometric figures drawn/embossed on graph paper.

G 2-3
Geometry

Objective: The student will recognize and apply slides, flips, and turns of two-dimensional shapes.

NCTM Standard: Geometry for Pre-K – 2 – Apply transformations and use symmetry to analyze mathematical situations. All students should recognize and apply slides, flips, and turns.

Suggested Materials:

- Object in the shape of a letter (B, C, D, E, G, J, K, L, R)
- Tactile shapes
- Small doll

Worksheet G 2-3

Strategies: Begin by introducing the words: slide, turn, and flip. Have the student stand to the right of the desk. Ask the student to slide one step over to the right. Ask the student how her orientation to the desk and in the room has changed. Have the student go back to the original position and slide one step diagonally to the right. Make sure the student's body does

not change orientation just position. The student should still be facing in the same direction. Continue having the student slide from different points around the desk.

Introduce the word turn/rotate. Have the student stand to the right of her desk. Have the student place her hand on the desk and without removing her hand walk two to four steps forward. Discuss how her body's position is different than with the slide. Have the student rotate around her desk. Make sure she keeps her hand on the desk as she walks or rotates around the desk.

The flip is best introduced using manipulatives. Provide the student with a small doll. Review a slide and a rotation using the doll. Introduce the term flip. Demonstrate a flip using the doll. Place the doll face up on a flat surface and flip the doll over a ruler or pencil. Ask the student how the orientation of the doll has changed.

Construct a manipulative in the shape of a letter (possibly foam paper). Using the letter manipulative, have the student slide (translation), turn (rotation), and flip (reflection) the object in order to develop the concepts. The flip will require having a line (a ruler or pencil will do) that the figure can flip over.

Repeat this activity using various tactile shapes. To help a student who may have difficulty with this exercise using tactile shapes, place an "indicator" in the top right hand corner of the shape to provide the student with a point of reference. The indicator can be a dot of glue, tactile stickers, etc. Then move the shape using the different transformations and have the student determine the type of transformation using the "indicator" as a reference.

Do Worksheet G 2-3.

Connections: Arrange students in groups of four or five and have them act out the movement of a pinwheel or a windmill. Ask students if they were sliding, turning, or flipping.

Several dances incorporate the movements of slides and rotations. Discuss with the student any dances she knows. Does she slide or rotate in any of these dances?

G 2-4
Geometry

Objective: The student will identify and construct symmetrical figures.

NCTM Standard: Geometry for Pre-K – 2 – Apply transformations and use symmetry to analyze mathematical situations. All students should recognize and create shapes that have symmetry.

NCTM Curriculum Focal Point

Suggested Materials:

- Any type of paper (construction, poster, embossing, etc.)
- Scissors
- Basic shapes: circles, squares, triangles, and rectangles cut from paper
- Wikki Stix
- Diagramming strips from the kit
- Story Board from the kit

Strategies: Review the term symmetry introduced in lesson G 1-6. Provide the student with a sheet of paper. Have the student fold the

sheet in half and cut out a shape of any type (similar to the old-fashioned way of making a heart). Have the student unfold the paper and examine the whole figure. The student should identify the line of symmetry and the two symmetrical sides. Allow the student to cut any shape he wishes because once he unfolds it, the shape will still have a line of symmetry at the fold.

Have the student take any pre-made shape and use Wikki Stix to show the line of symmetry. Then, have the student cut the shape in half by cutting next to the Wikki Stix. The student should then explore the shapes to ensure that he understands that both halves are the same.

Using the diagramming strips and the Story Board from the kit, create a shape such as a square and allow the student to explore the shape. Next, create half of a square using varying lengths of diagramming strips and have the student use the diagramming strips to complete the symmetrical shape.

Connections: Investigate symmetry in the content areas of science, art, and language arts:

Science: symmetry in animals, insects, and fish
Art: architecture, pottery, quilts, and music

Language arts: palindromes such as deed, kook, noon, peep, and sees

G 2-5
Geometry

Objective: The student will identify and label the following three-dimensional shapes: cube, rectangular prism, sphere, cylinder, cone, and pyramid.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.

Suggested Materials:

- 3-D shapes: cube, sphere, pyramid, cylinder, cone, and rectangular prism from the kit

Worksheet 2-5

Strategies: Review with the student the terms 2-D and 3-D introduced in lesson G 1-3. Review the shapes and the names for the following 3-D shapes introduced in lesson G 1-3: cube, sphere, and pyramid.

Introduce the student to new 3-D shapes: cylinder, cone, and rectangular prism. Have the student examine each new shape and distinguish the features that make the shape distinct. Have the students relate the shapes to real-world examples.

Rectangular prism: boxes of various types (ex. tissue, shoe, gift, etc.)
Cone: water-cooler cups, waffle ice cream cones
Cylinder: cans, paper towel rolls, drum

A cube is actually a special type of rectangular prism because each of its faces are squares. A student may recognize the difference between the cube and a rectangular prism while exploring the 3-D shapes.

Do Worksheet G 2-5.

Connections: Take the student on a shape hunt to find examples of each of these 3-D shapes in the school environment.

Have the student work with her parents to find examples of these 3-D shapes at home.

G 2-6
Geometry

Objective: The student will describe common three-dimensional shapes by characteristics: the number of faces, edges, and vertices.

NCTM Standard: Geometry for Pre-K – 2 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should describe attributes and parts of two- and three-dimensional shapes.

NCTM Curriculum Focal Point

Suggested Materials:

- 3-D shapes: cube, sphere, pyramid, cylinder, cone, and rectangular prism from the kit
- Geometro forms from the kit
- Basic shapes: square, circle, triangle, and rectangle from the kit

Strategies: In this lesson the student will identify the faces, edges, and vertices of the 3-D shapes. Review with the student the names of

each of the 3-D shapes. Review with the student the term vertex (vertices) and side (sides). Have the student demonstrate an understanding of the terms by identifying a vertex and a side of a square. Review with the student the number of vertices and sides of a square.

Provide the student with a cube. Introduce the terms edge and face. Demonstrate for the student an example of the faces of the cube and the edges of the cube. The student may find it helpful to use a cube built from the Geometro kit. Help the student determine the number of faces of the cube. The student may take the figure apart to check his answer. Have the student identify the number of vertices and edges on the cube. Have the student develop a plan for counting the faces, edges, and vertices so that he will not be continually counting the same faces, edges, or vertices. It may be necessary to number the faces of the 3-D shape in order to help students identify the number of faces and edges.

Have students explore the remaining 3-D shapes and identify the faces, edges, and vertices.

Have the student develop a chart with the following columns:

a. Name of 3-D shape
b. Number of faces
c. Number of edges
d. Number of vertices

Examine each 3-D shape and complete the chart.

Connections: Build 3-D shapes out of tinker toys or use gumdrops and toothpicks. It is important to create a "skeleton" 3-D shape. This will help to develop the concepts of edges and vertices.

G 2-7
Geometry

Objective: The student will compare areas of common shapes – larger, smaller, same as.

NCTM Standard: Geometry for Pre-K – 2 – Use visualization, spatial reasoning, and geometric modeling to solve problems. All students should relate ideas in geometry to ideas in numbers and measurement.

NCTM Curriculum Focal Point

Suggested Materials:

- Basic shapes: squares and rectangles of various sizes
- Embossed Graph Sheets

Worksheet G 2-7

Strategies: Review the term perimeter and the definition of perimeter as the distance around a shape as introduced in lesson G 2-2. Introduce the term area and the definition of area as the surface space that is enclosed by the sides of the shape or the space in the interior of the figure.

Provide the student with a square shape. Help

the student identify the surface that would be measured to determine the perimeter of the square and the surface that would be measured to determine the area of the square.

Remind the student that we used string to measure and to compare the perimeter of similar shapes. Discuss with the student how she might measure the area of a square.

Provide the student with a square of embossed graph paper cut to the same size as the square shape. Have the student count the number of square units in the piece of embossed graph paper. Explain that we measure area in square units, square inches, square feet, etc.

Provide the student with squares of varying sizes cut from embossed graph paper and have her compare the area of the shapes by counting the embossed squares to determine which shapes have areas that are larger, smaller, or the same size.

The student can also "tile" figures or shapes using squares of embossed graph paper or any type of tiles.

Do Worksheet G 2-7.

Connections: Read *Spaghetti and Meatballs* by Marilyn Burns. This humorous story about a family reunion, explores area and perimeter as the Comfort family tries to arrange seating for their thirty-two guests.

G 2-8
Geometry

Objective: The student will identify lines as vertical, horizontal, and diagonal.

NCTM Standard: Geometry for Pre-K – 2 – Specify locations and describe spatial relationships using coordinate geometry and other representational systems. All students should describe, name, and interpret direction and distance in navigating space and apply ideas about direction and distance.

Suggested Materials:

- Diagramming strips from the kit
- Story Board from the kit

Worksheet G 2-8

Strategies: Provide the student with the diagramming strips and the Story Board from the kit. Introduce the words horizontal, vertical, and diagonal.

Place a diagramming strip in a horizontal position on the Story Board. Many elementary students associate the word horizontal with horizon.

Review the term horizon and note that horizontal lines are flat or level and run from side to side. Ask the student to place another diagramming strip on the Story Board in the horizontal position. Help the student identify horizontal lines in the classroom.

Replace the horizontal diagramming strip with one in a vertical position. Explain that vertical lines run up and down. Have the student place another diagramming strip on the Story Board in the vertical position. Help the student identify vertical lines in the classroom.

Replace the vertical line with a diagonal line. Explain that a diagonal line moves in a slanted or sloping direction. Have the student place another diagramming strip on the Story Board in a diagonal position. Help the student identify examples of diagonal lines in his environment.

Provide practice for the student by placing the diagramming strips in different directions and have the student identify the proper name of the type of line represented. Then reverse the procedure by naming a direction and having the student place the diagramming strip in the proper orientation.

Do worksheet G 2-8.

Connections: Creating a tactile map of the school hallways is another way to teach vertical, horizontal, and diagonal lines. Have the student explore the tactile map and name the hallways that are vertical, horizontal, or diagonal.

Help students locate vertical, horizontal, and diagonal lines on the hundreds board.
Horizontal: counting by ones to ten
Vertical: counting by tens to one hundred, numbers ending in five
Diagonal: multiples of eleven to ninety-nine

Third Grade

Learning Objectives

Third Grade

G 3-1*	Identify congruent (same shape and size) two-dimensional shapes.
G 3-2*	Identify similar (same shape but different size) two-dimensional shapes.
G 3-3*	Determine if two-dimensional shapes are congruent (same shape and size) or similar (same shape but different size).
G 3-4*	Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.
G 3-5*	Find the perimeter of various polygons on which the length of all sides are labeled.
G 3-6*	Determine the area of a square.
G 3-7*	Identify two-dimensional shapes: pentagon, hexagon, and octagon.

G 3-8*	Identify geometric representations for points, lines, line segments, and rays.
G 3-9*	Identify lines as parallel, intersecting, and perpendicular.
G 3-10*	Identify, describe, and classify special triangles.
G 3-11*	Identify angles as right angles and determine whether other angles are greater or less than a right angle.

* Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to add variety and to give the child more experiences with objects from the environment.

Feel 'n Peel stickers G 3-4

Glue G 3-4

Graph Sheets, embossed G 3-6

Puff paint G 3-4

Ruler, braille with caliper G 3-6

Shapes of various sizes G 3-1, G 3-2, G 3-3

letters G 3-4

Wikki Stix G 3-10

G 3-1
Geometry

Objective: The student will identify congruent (same shape and size) two-dimensional shapes.

NCTM Standard: Geometry for 3 – 5 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should explore congruence and similarity.

NCTM Curriculum Focal Point

Suggested Materials:

- Assorted geometric shapes in varying sizes
- Triangles from the kit

Worksheet G 3-1

Materials: *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: Introduce the term congruent and the definition of congruent as two figures

that are the same size and shape. Introduce the Nemeth and UEB symbol for congruent:
Nemeth: ⠈⠱ ⠨⠅   UEB: ⠐ ⠸⠔

> Later, students will learn that congruence for polygons means that all the angles and sides have equal measurements.

Congruence is a vital concept in geometry. To develop an understanding of this concept, have the student compare shapes and determine if the shapes are or are not congruent. Begin with squares, rectangles, and circles. Have the student place the shapes on top of each other to determine if they are congruent.

Introduce the triangles that are included in the kit. The student will later learn the names of these special triangles in lesson G 3-10. The student should determine that all the shapes are triangles and are approximately the same size but they are quite different in shape. Have the student place the shapes on top of each other to determine that they are <u>not</u> congruent.

Do Worksheet G 3-1.

Connections: Using a Geoboard and Geobands, construct a simple figure such as a square. Have

the student construct a square that is congruent to the square you made. Have the student explain how she knows the figure is congruent. Continue this exercise using different geometric figures.

G 3-2
Geometry

Objective: The student will identify similar (same shape but different size) two-dimensional shapes.

NCTM Standard: Geometry for 3 – 5 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should explore congruence and similarity.

NCTM Curriculum Focal Point

Suggested Materials:

- Assorted geometric shapes in varying sizes
- Triangles from the kit

Worksheet G 3-2

Strategies: Introduce the term similar and the definition of similar as two figures that are the same shape but are different in size. Introduce the Nemeth and UEB symbol for similar:

Nemeth:  UEB: 

Later, the students will learn that similarity actually means that the polygons have congruent angles and the sides are proportional.

Similarity is another important concept in geometry. To develop an understanding of this concept, have the student compare shapes to determine if the shapes are or are not similar. Give the student various geometric shapes to examine. When you give the student two similar rectangles, rotate one rectangle so that its orientation is different. Help the student understand that the rectangles are similar even though they may be oriented differently.

Introduce the triangles that are included in the kit. The student will later learn the names of these special triangles in lesson G 3-10. The student should determine that all the shapes are triangles but they are quite different in shape. Have the student place the shapes on top of each other to determine that they are not similar even though they are all triangles.

Do Worksheet G 3-2.

Connections: Using a Geoboard and Geobands, construct a simple figure such as a square. Have the student construct a square that is similar to the square you made. Have the student explain how he knows the figure is similar. Continue this exercise using different geometric figures.

G 3-3
Geometry

Objective: The student will determine if two-dimensional shapes are congruent (same shape and size) or similar (same shape but different size).

NCTM Standard: Geometry for 3 – 5 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should explore congruence and similarity.

NCTM Curriculum Focal Point

Suggested Materials:

- Assorted geometric shapes in varying sizes

Worksheet G 3-3

Strategies: Review the terms congruent and similar. It is imperative that students are able to differentiate between shapes that are congruent and shapes that are similar. Have students compare shapes to determine if they are congruent or similar. This can be done with tactile graphics or concrete shapes.

Do Worksheet G 3-3.

Connections: Using a Geoboard and Geobands, have the student construct a simple figure such as a square. Construct another square and have the student determine if the figure you built is congruent or similar. Continue this exercise having the student construct different geometric figures.

G 3-4
Geometry

Objective: The student will predict and describe the results of sliding, flipping, and turning two-dimensional shapes.

NCTM Standard: Geometry for 3 – 5 – Apply transformations and use symmetry to analyze mathematical situations. All students should predict and describe the results of sliding, flipping, and turning two-dimensional shapes.

Suggested Materials:

- Object in the shape of letter (B, C, D, E, G, J, K, L, R)
- Rectangle from the kit
- Right triangle from the kit
- Feel ‘n Peel stickers
- Puff Paint or glue

Worksheet G 3-4

Strategies: Review with the student the terms slide, turn, and flip introduced in lesson G 2-3. Use the letter object created for lesson G 2-3 and have the student demonstrate an understanding of these concepts by sliding, turning, and flipping the letter appropriately.

Introduce the term quarter turn. Demonstrate for the student a quarter turn using the letter object. Use the same procedure with half turn, vertical flip, and horizontal flip.

Provide the student with the rectangle. It may help the student to mark a corner with a Feel `n Peel sticker, a dot of glue, or a dot of puff paint. This will provide the student with a reference point or "indicator" as the student moves the geometric figure through the transformations. Have the student perform the following transformations using the rectangle: slides in various directions, quarter turn, half turn, vertical flip, and horizontal flip.

Repeat the procedure with the right triangle. Before the student performs the transformation ask him to predict where the triangle will be after the transformation and how it will be oriented. Have the student perform the transformation and check the accuracy of his prediction.

Do Worksheet G 3-4.

Connections: To reinforce this concept, have the students engage in a marching drill activity. After putting the students in "formation", have them complete movements such as:

About face: half turns (180 degrees)
Right and left turns: quarter turns (90 degrees)
Slide to the right or left

G 3-5
Geometry

Objective: The student will find the perimeter of various polygons on which the length of all sides are labeled.

NCTM Standard: Geometry for 3 – 5 –
Use visualization, spatial reasoning, and geometric modeling to solve problems. All students should use geometric models to solve problems in other areas of mathematics such as number and measurement.

NCTM Curriculum Focal Point

Suggested Materials:

Worksheets G 3-5 (a), G 3-5 (b), and G 3-5 (c)

Strategies: Review the term perimeter and the definition of perimeter as the distance around a shape. Provide the student with the first worksheet, G 3-5 (a), that contains two triangles. Have the student examine the first triangle on the sheet and determine that it has three sides. Have the child find the label on each side. Explain that the perimeter, or distance around the triangle, can be found by adding the

lengths of the sides together. Ask the student how many numbers she should add to determine the perimeter. Have the child find the perimeter of the polygon. Ask the student to find the perimeter of the second triangle on the sheet.

Repeat the procedure with worksheets G 3-5 (b) and G 3-5 (c) to find the perimeter of a square and a rectangle.

For students who need additional practice construct a sheet that contains polygons with the lengths of the sides labeled. Have the child examine the different polygons and determine the perimeter.

Connections: Construct a sheet with polygons that do not have the measurement of the sides labeled. Have the student use a ruler to determine the length of each side and then the perimeter.

G 3-6
Geometry

Objective: The student will determine the area of a square.

NCTM Standard: Geometry for 3 – 5 –
Use visualization, spatial reasoning, and geometric modeling to solve problems. All students should use geometric models to solve problems in other areas of mathematics such as number and measurement.

NCTM Curriculum Focal Point

Suggested Materials:

- Square from the kit
- Braille ruler with caliper
- Embossed Graph Sheets

Worksheet G 3-6

Strategies: Review with the student the definition of area as the surface space that is enclosed by the sides of the shape or the space in the interior of the figure. Review with the student the process of using tiled squares and embossed graph sheets to determine the area of

a figure. Discuss with the student the difficulty of using this method to measure large areas.

Use embossed graph sheets to create squares of various sizes. Have the students label the measurement of the length and the width in tiles, and then count the number of squared tiles. Try to allow the students to discover the multiplication rule for determining area.

Provide the student with the square shape. Have the child use a ruler to measure the length of the square and have the student record the measurement. Have the student measure the width of the square and write this measurement. Remind the student that the area of the square is the whole surface of the square. Tell the student that to find the area of the square he should multiply the width measurement by the length measurement. Ask the student which numbers he should multiply to get the area of the square, and have the child write and solve the number sentence (e.g., 5x5 = 25).

Continue the procedure with squares of other sizes.

The actual formula for the area of a square is $A = s^2$ where s is the length of the side.

Do Worksheet G 3-6.

Connections: Read *Not Enough Room* by Joanne Rocklin. This is a story about two sisters who share the same bedroom. They use tape to divide the room into different shapes so that each one can have her own space.

For homework have the student determine the area of his bedroom at home.

G 3-7
Geometry

Objective: The student will identify two-dimensional shapes: pentagon, hexagon, and octagon.

NCTM Standard: Geometry for 3 – 5 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids.

NCTM Curriculum Focal Point

Suggested Materials:

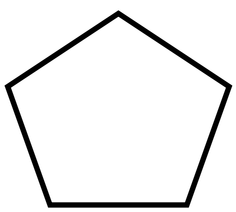
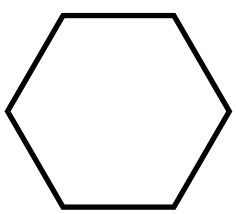
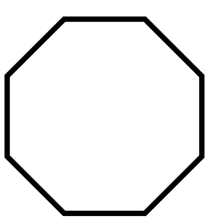
- 2-D Geometric shapes: pentagon, hexagon, and octagon from the kit

Worksheet G 3-7

Strategies: Provide the student with the three new polygons to examine. As you introduce each figure by name, have the student identify the

number of sides and the number of vertices of each shape. When all of the shapes have been introduced ask the student to determine the differences in the three shapes. Introduce the Nemeth or UEB symbol for each shape.

Provide the student an opportunity to practice identifying the shapes by placing them in one group and asking the student to find a particular shape. Rearrange the shapes and ask the student to find a different shape.

Shape Symbols:		Nemeth	UEB
	Pentagon	⠫⠢	⠫⠼⠑
	Hexagon	⠫⠖	⠫⠼⠋
	Octagon	⠫⠦	⠫⠼⠓

Help the student identify these three shapes in her environment.

Pentagon: buildings, school crossing road sign, design on a soccer ball, cap on a fire hydrant
Hexagon: pencil, quilt patterns, honeycombs
Octagon: stop sign, rugs, ceramic tiles, stones in jewelry

Do Worksheet G 3-7.

Connections: Read the *Greedy Triangle* by Marilyn Burns. This is the humorous story of a triangle who got tired of doing the same old things. It was sure if it had one more side and one more angle, its life would be far more interesting.

Introduce the 3-D shapes that correspond to the pentagon, hexagon, and octagon. Allow the student to explore the 3-D shape and match it to the corresponding 2-D shape.

G 3-8
Geometry

Objective: The student will identify geometric representations for points, lines, line segments, and rays.

NCTM Standard: Geometry for 3 – 5 – Specify locations and describe spatial relationships using coordinate geometry and other representational systems. All students should identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attribute.

Suggested Materials:

Worksheets G 3-8 (a) and G 3-8 (b)

Strategies: While these terms may already be a part of the student's mathematical vocabulary the student needs to be able to identify the tactile geometric representations for points, lines, line segments, and rays. Review with the student each of the following terms and introduce/review the tactile representation of each using worksheet G 3-8 (a).

Point: an exact location in space

Line: extends forever in both directions
Ray: begins at a certain point and extends forever in one direction
Line segment: does not extend forever, but has two distinct end points

Do worksheet G 3-8 (b).

Connections: Have the student find examples of points, lines, and segments in his natural environment. The Orientation and Mobility Specialist could introduce/reinforce these concepts through tactile maps.

G 3-9
Geometry

Objective: The student will identify lines as parallel, intersecting, and perpendicular.

NCTM Standard: Geometry for 3 – 5 – Specify locations and describe spatial relationships using coordinate geometry and other representational systems. All students should describe locations and movements using common language and geometric vocabulary.

NCTM Curriculum Focal Point

Suggested Materials:

- Diagramming strips from the kit
- Story Board from the kit

Worksheet G 3-9

Strategies: Provide the student with the diagramming strips and the Story Board from the kit. Introduce the words parallel lines. Define the words as meaning two lines that go in the same direction at an equal distance from each other and never cross. Introduce the Nemeth and UEB symbol for parallel lines: Nemeth: ⠸⠸ UEB: ⠐⠶

Provide the student examples of parallel lines using the diagramming strips and the Story Board. Have the student construct a set of parallel lines.

Introduce the words intersecting lines. Define intersecting lines as two lines that meet or cross each other. Provide the student examples of intersecting lines using the diagramming strips and the Story Board. Have the student construct a set of intersecting lines.

Introduce the words perpendicular lines. Define perpendicular lines as two lines that meet or cross each other to form a perfect corner (right angle). Introduce the Nemeth and UEB symbol for perpendicular lines: Nemeth: ⠫⠏ UEB: ⠼⠤

It is very important that students understand that perpendicular lines are a special kind of intersecting lines. Perpendicular lines are represented by a “box” at the point of intersection to show that the lines form a right angle. Show the student that she can measure the angle of intersection with the corner of a sheet of braille paper to verify that it is a right angle. Provide the student examples of perpendicular lines using the diagramming strips and the Story Board. Have the student construct

a set of perpendicular lines and check the accuracy of her construction.

Provide the student several examples of the three types of lines and have the student determine which type of lines you have created.

Do Worksheet G 3-9.

Connections: Have the student find examples of parallel lines in her environment. Examples might include: notebook paper, railroad tracks, shelves on bookcases, and parallel/opposite edges of doors, windows, and books.

Have the student identify parallel and intersecting hallways in the school or streets around the school.

G 3-10
Geometry

Objective: The student will identify, describe, and classify special triangles.

NCTM Standard: Geometry for 3 – 5 – Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. All students should identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.

NCTM Curriculum Focal Point

Suggested Materials:

- Triangles from the kit: equilateral, isosceles, and right triangle
- Diagramming strips from the kit
- Story Board from the kit
- Wikki Stix

Worksheet G 3-10

Strategies: Provide the student with one of the special triangles from the kit. Introduce the new

term and the definition of each to the student as you provide the example. Help the student identify the unique characteristics of each triangle as it is introduced.

Equilateral triangles: a triangle where each side is congruent
Isosceles triangles: a triangle with two congruent sides
Right triangles: a triangle with a right angle as one of its vertices

When all the figures have been introduced, provide the student an opportunity to practice identifying the correct triangle from the group of triangles.

Using the diagramming strips and the Story Board, provide the student with multiple examples of these triangles with various lengths of sides. The student should be able to identify and describe the special triangles.

Next, have the students create examples of the triangles using either the diagramming strips and Story Board or Wikki Stix.

Do Worksheet G 3-10.

Connections: Read *A Triangle for Adaora* by Ifeoma Onyefulu, a story of a young African girl searching her village for shapes.

Visit the NCTM Illuminations web site for additional activities with triangles in the four part lesson entitled *Building with Triangles*.

G 3-11
Geometry

Objective: The student will identify angles as right angles and determine whether other angles are greater or less than a right angle.

NCTM Standard: Geometry for 3 – 5 – Specify locations and describe spatial relationships using coordinate geometry and other representational systems. All students should describe locations and movements using common language and geometric vocabulary.

NCTM Curriculum Focal Point

Suggested Materials:

- Diagramming strips from the kit
- Story Board from the kit

Worksheet G 3-11

Strategies: Review the concept of a right angle. Remind the student that we represent a right angle by drawing a small "box" at the point of intersection to show that the lines form a right angle.

Using the diagramming strips, provide the student with an example of a right angle. Remind the student that she can measure the angle with the corner of a sheet of braille paper to verify that the angle is a right angle. Then, provide the student with multiple examples of angles that are greater or lesser than the right angle. The student should be able to compare the angles and determine whether they are greater or lesser through investigation.

> In may be appropriate to introduce new vocabulary in the lesson. Angles that are less than a right angle are called acute angles while angles that are greater are called obtuse angles.

Do Worksheet G 3-11.

Connections: Explore the classroom to find examples of right angles.

Using a Geoboard and Geobands, have the student construct geometric figures and determine if the angles in the figures are right angles, less than a right angle (acute), or larger than a right angle (obtuse).

Assessment Check List

Objective	Date/Rating Notes
Kindergarten	
G K-1 Identify relative positions: over, on, in, under, above, behind, below, left, in front of, right, between, next to, same side, different side, inside, outside, top, middle, bottom, open, and closed.	
G K-2 Examine, compare, and name open and closed shapes and lines – straight and curved.	
G K-3 Examine, compare, and sort two-dimensional shapes: circle, square, and triangle.	
G K-4 Investigate, describe, and name common geometric shapes: circle, square, triangle, and rectangle.	

Objective	Date/Rating Notes
G K-5 Construct/reproduce the common geometric shapes: circle, square, rectangle, and triangle and lines – straight and curved.	
G K-6 Identify two-dimensional shapes in the environment: circle, square, triangle, and rectangle.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance

2 = Developing level of performance

3 = Accomplished/Mastery level of performance

Objective	Date/Rating Notes
First Grade	
G 1-1 Identify and reproduce/ construct the common geometric shapes: circle, square, triangle, and rectangle and lines – straight and curved.	
G 1-2 Describe the common geometric shapes: circle, square, triangle, and rectangle according to the number of sides and corners (vertices).	
G 1-3 Investigate, describe, and name common three-dimensional shapes: sphere, cube, and pyramid.	
G 1-4 Examine and relate three-dimensional shapes to two-dimensional shapes: circle to sphere, square to cube, triangle to pyramid.	
G 1-5 Compare and combine shapes to make new shapes.	

Objective	Date/Rating Notes
G 1-6 Identify symmetrical figures (lines of symmetry with two matching parts).	
G 1-7 Systematically examine and describe a simple drawing or diagram using position and shape words.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance
2 = Developing level of performance
3 = Accomplished/Mastery level of performance

Objective	Date/Rating Notes
Second Grade	
G 2-1 Identify and label two-dimensional shapes in drawings, maps, and diagrams.	
G 2-2 Compare perimeters of common shapes – larger, smaller, same as.	
G 2-3 Recognize and apply slides, flips, and turns of two-dimensional shapes.	
G 2-4 Identify and construct symmetrical figures.	
G 2-5 Identify and label the following three-dimensional shapes: cube, rectangular prism, sphere, cylinder, cone, and pyramid.	

Objective	Date/Rating Notes
G 2-6 Describe common three-dimensional shapes by characteristics: the number of faces, edges, and vertices.	
G 2-7 Compare areas of common shapes – larger, smaller, same as.	
G 2-8 Identify lines as vertical, horizontal, and diagonal.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance
2 = Developing level of performance
3 = Accomplished/Mastery level of performance

Objective	Date/Rating Notes
Third Grade	
G 3-1 Identify congruent (same shape and size) two-dimensional shapes.	
G 3-2 Identify similar (same shape but different size) two-dimensional shapes.	
G 3-3 Determine if two-dimensional shapes are congruent (same shape and size) or similar (same shape but different size).	
G 3-4 Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.	
G 3-5 Find the perimeter of various polygons on which the length of all sides are labeled.	
G 3-6 Determine the area of a square.	

Objective	Date/Rating Notes
G 3-7 Identify two-dimensional shapes: pentagon, hexagon, and octagon.	
G 3-8 Identify geometric representations for points, lines, line segments, and rays.	
G 3-9 Identify lines as parallel, intersecting, and perpendicular.	
G 3-10 Identify, describe, and classify special triangles.	
G 3-11 Identify angles as right angles and determine whether other angles are greater or less than a right angle.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance
2 = Developing level of performance
3 = Accomplished/Mastery level of performance

Appendix A

Appendix A
Related Math Materials available from American Printing House for the Blind

Geometry	Catalog Number
DRAFTSMAN Tactile Drawing Board	1-08857-00
Game of Squares	1-08430-00
Geometry Tactile Graphics Kit	1-08841-00
Graph Sheets, embossed	1-04059-00
Graphic Aid for Mathematics	1-00460-00
Peg-A-Circle Set	1-08550-00
Shape Board	1-03710-00
Small, Medium, and Large Circles, Sets I	1-08590-00
Textured Matching Blocks	1-08950-00
Wheatley Tactile Diagramming Kit: Picture Maker	1-08838-00

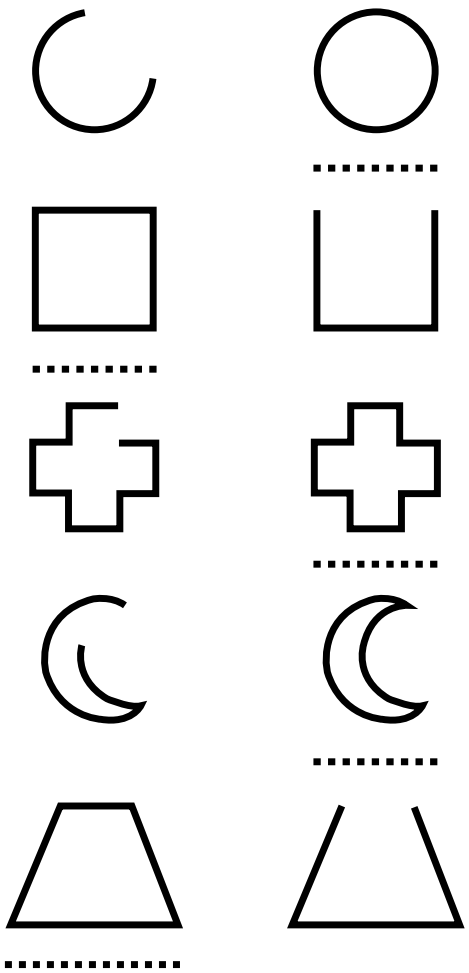
Answer Key for Worksheets

The following worksheets do not have an answer key included. These worksheets are teacher directed and answers will vary from classroom to classroom.

G K-1
G K-4
G 1-3 (a)
G 1-3 (b)
G 1-5 (a)
G 1-5 (b)
G 1-6 (a)
G 1-7 (a)
G 1-7 (b)
G 3-8 (a)

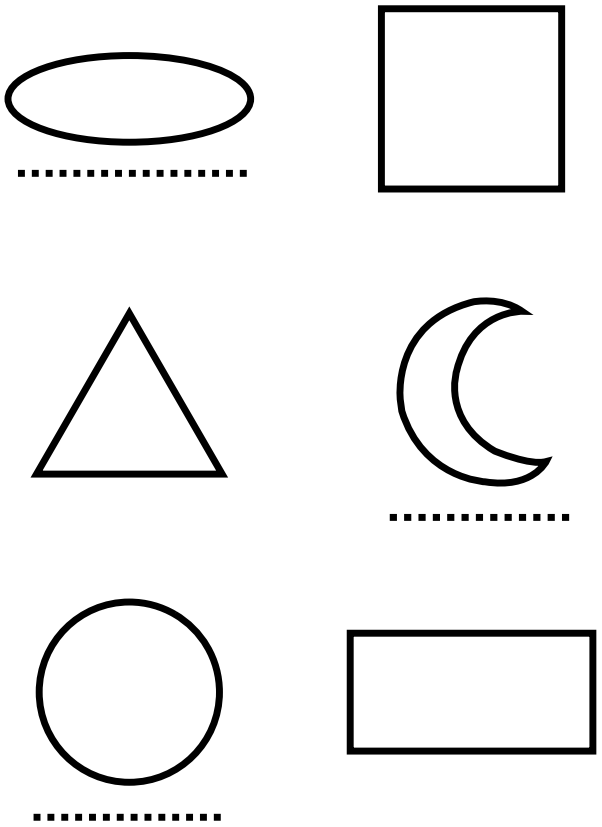
G K-2(a) Geometry

In each row find the shape that is closed.



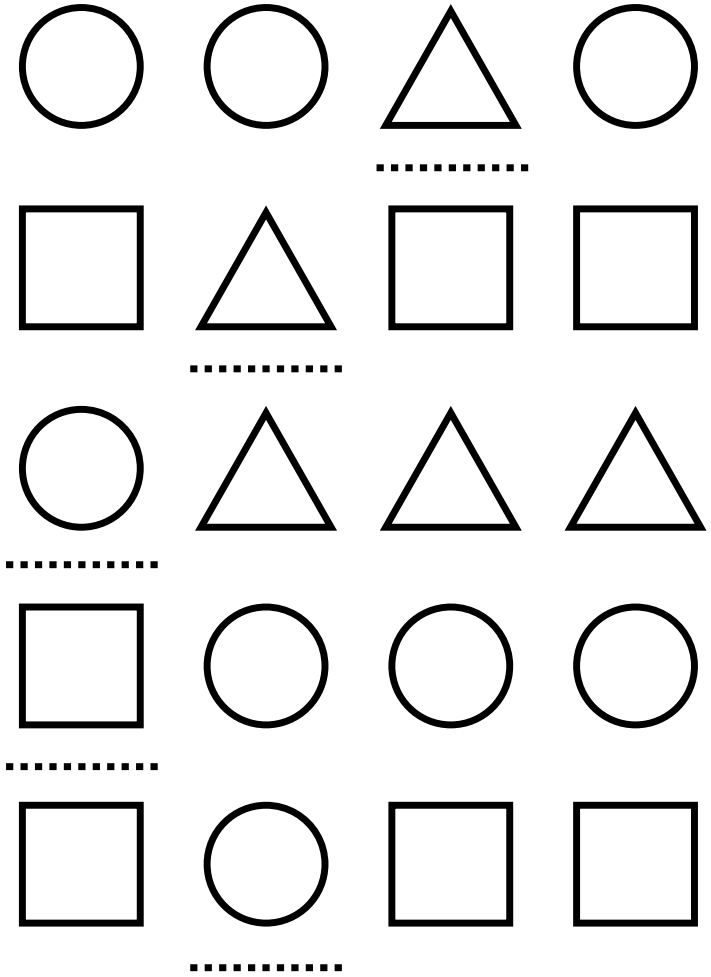
G K-2(b) Geometry

Find the shapes that are made with curved lines.



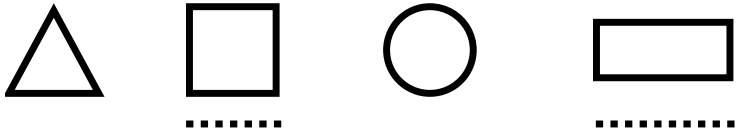
G K-3 Geometry

In each row find the shape that is different.

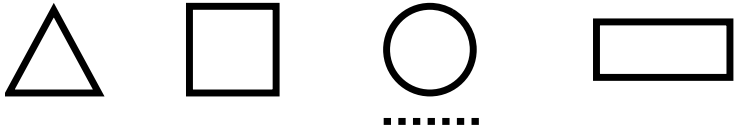


G 1-2 Geometry

Mark the shapes with four sides and four corners.

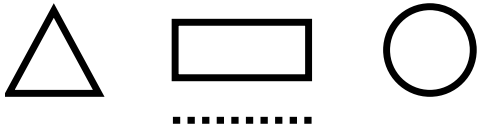


Mark the shapes with no sides and no corners.



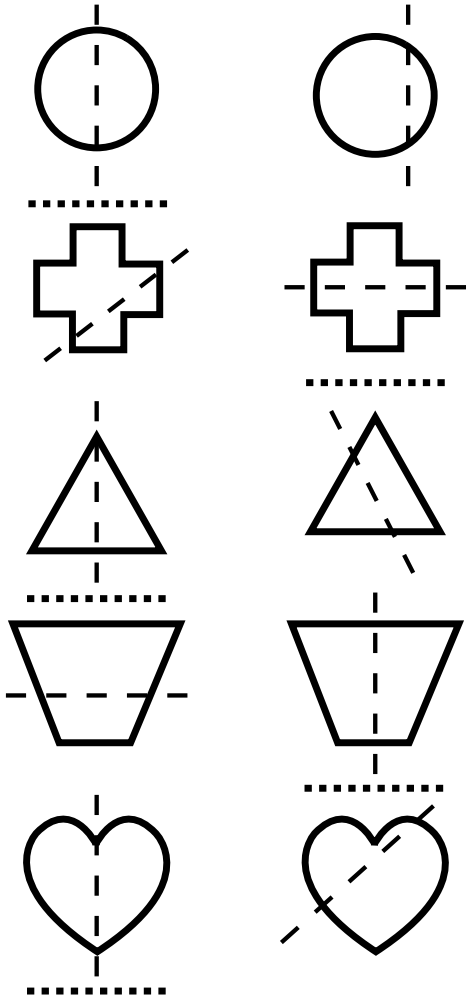
Mark the shapes with three sides and three corners.

Lee drew a shape with 4 sides. Which shape did he draw?



G 1-6(b) Geometry

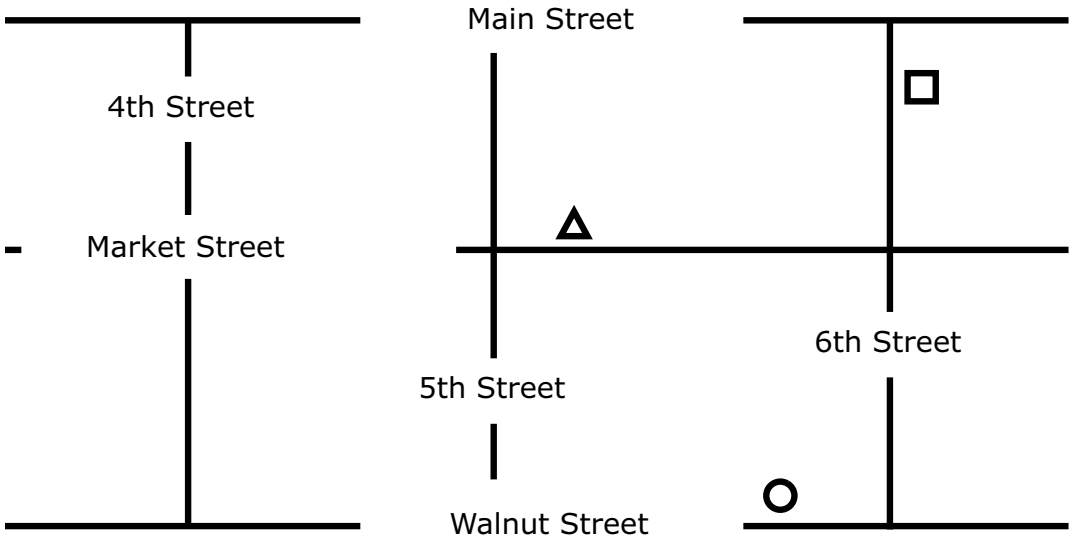
Mark the shapes that show symmetry.



G 2-1 Geometry

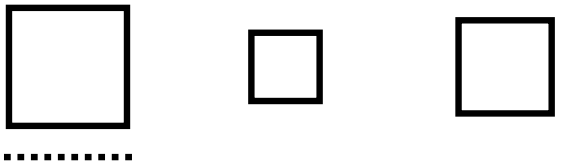
Examine the map below. On what street will you find Lincoln Elementary? On what street will you find Washington Park? On what street will you find city hall? Write your answers on a separate sheet of paper.

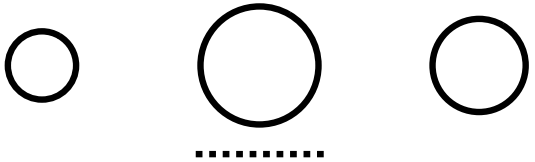
□ Lincoln Elementary	(6th Street)
△ Washington Park	(Market Street)
○ City Hall	(Walnut Street)

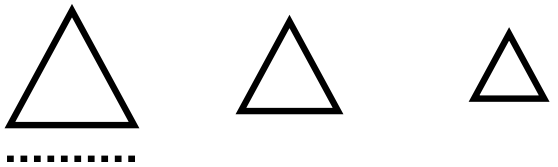


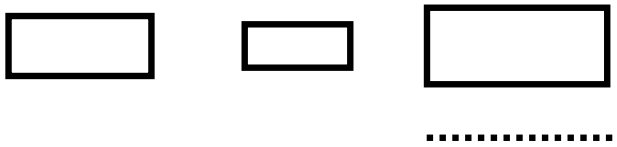
G 2-2 Geometry

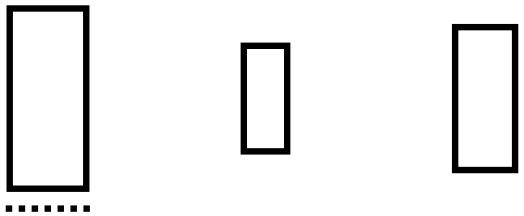
Mark the shape that has the largest perimeter.

1. 

2. 

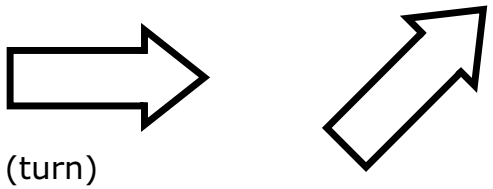
3. 

4. 

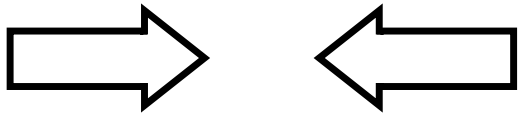
5. 

G 2-3 Geometry

Examine each pair of shapes and determine if the transformation of the second figure is a slide, a turn, or a flip. Write your answer on a separate sheet of paper.

1. 

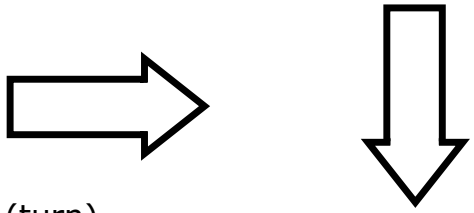
(turn)

2. 

(flip)

3. 

(slide)

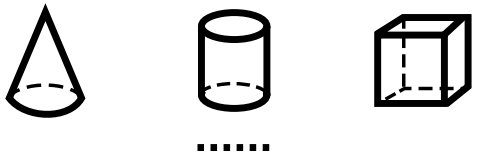
4. 

(turn)

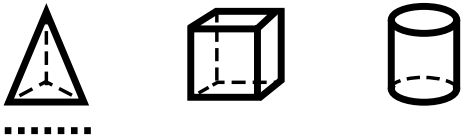
G 2-5 Geometry

Mark the correct shape.

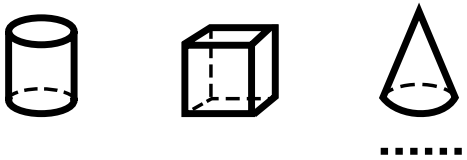
1. Cylinder



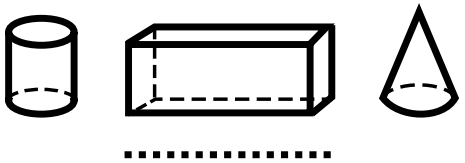
2. Pyramid



3. Cone

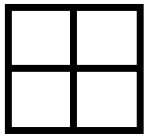


4. Rectangular prism

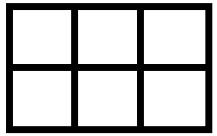


G 2-7 Geometry

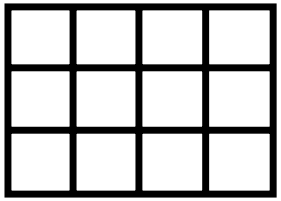
What is the area of each of these shapes? Write your answer on a separate sheet of paper.

1. 

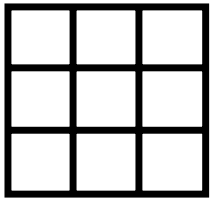
(4 square units)

2. 

(6 square units)

3. 

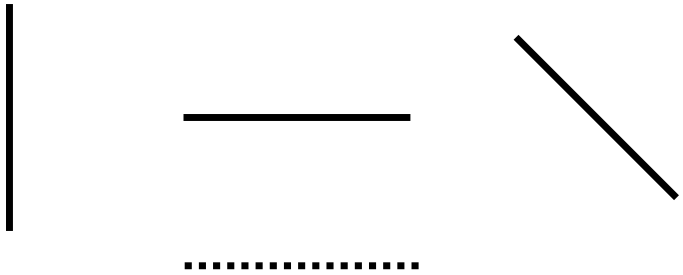
(12 square units)

4. 

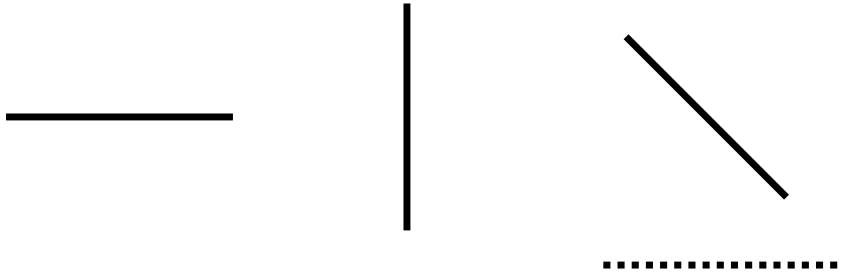
(9 square units)

G 2-8 Geometry

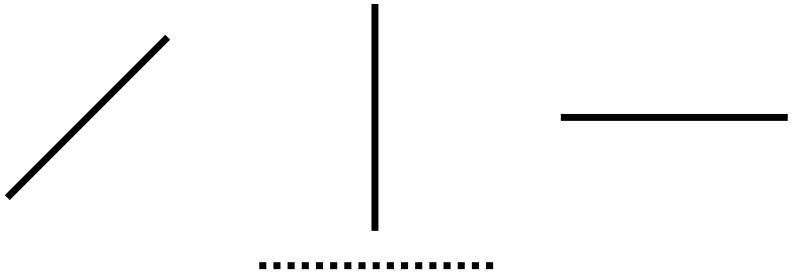
1. Mark the line that is horizontal.



2. Mark the line that is diagonal.



3. Mark the line that is vertical.

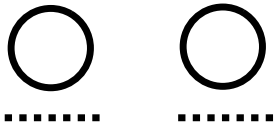


G 3-1 Geometry

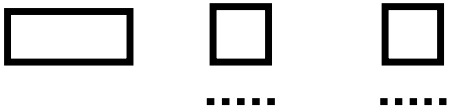
In each row mark the shapes that are congruent.

1. 

2. 

3. 

4. 

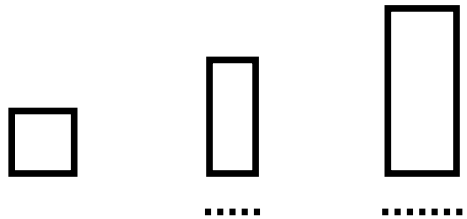
5. 

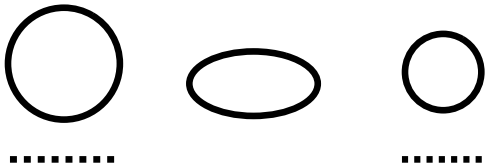
6. 

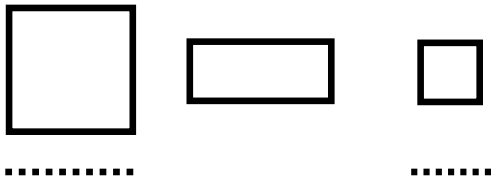
G 3-2 Geometry

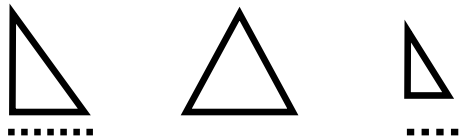
In each row mark the shapes that are similar.

1. 

2. 

3. 

4. 

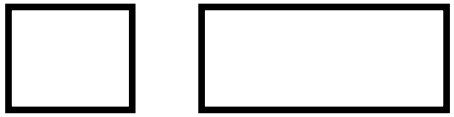
5. 

G 3-3 Geometry

Examine each pair of shapes and determine if they are congruent, similar, or neither. Write your answers on a separate sheet of paper.

1. 

(similar)

2. 

(neither)

3. 

(congruent)

4. 

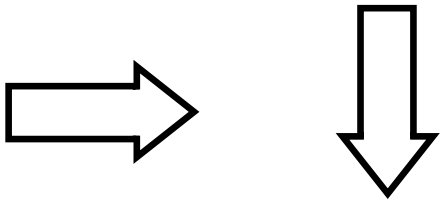
(similar)

5. 

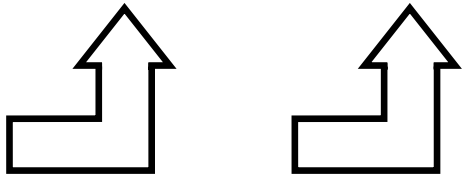
(congruent)

G 3-4 Geometry

Examine each pair of shapes and determine if the transformation of the second figure is a slide, a turn, or a flip. Write your answer on a separate sheet of paper.

1. 

(turn)

2. 

(slide)

3. 

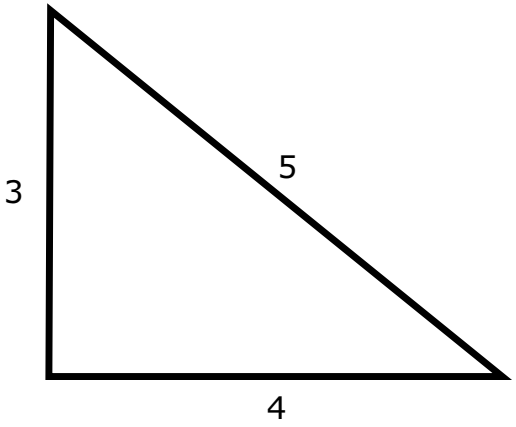
(flip)

4. 

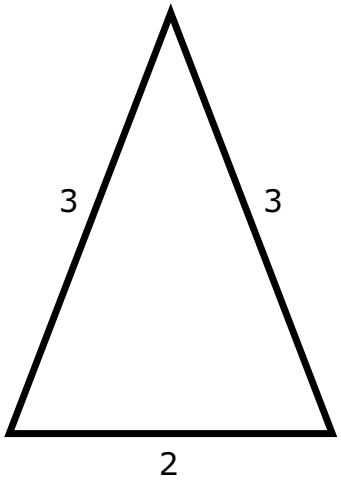
(turn)

G 3-5(a) Geometry

Find the perimeter of each shape. The numbers represent a measurement in inches.



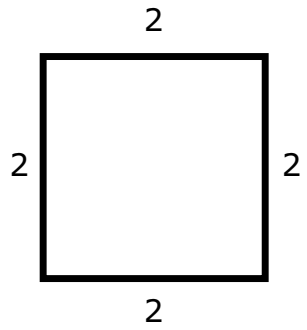
(12 inches)



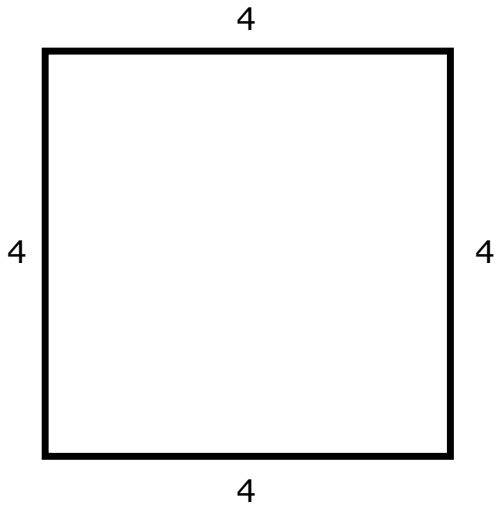
(8 inches)

G 3-5(b) Geometry

Find the perimeter of each shape. The numbers represent a measurement in inches.



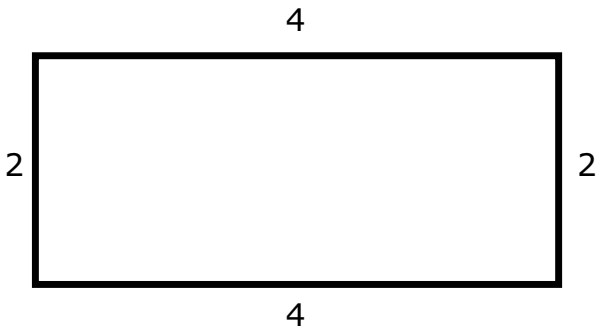
(8 inches)



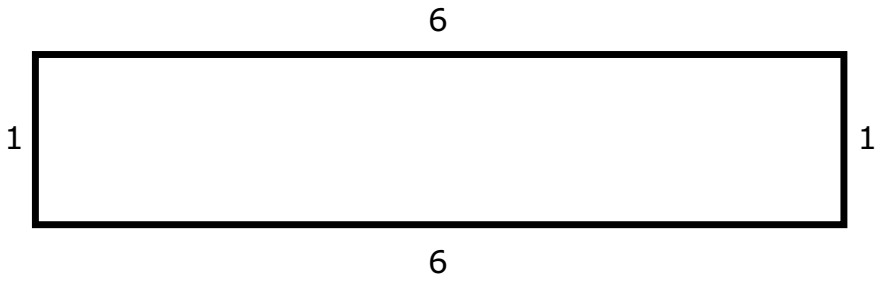
(16 inches)

G 3-5(c) Geometry

Find the perimeter of each shape. The numbers represent a measurement in inches.



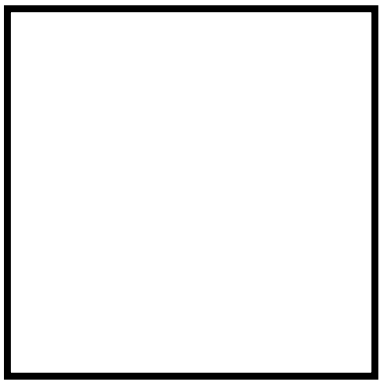
(12 inches)



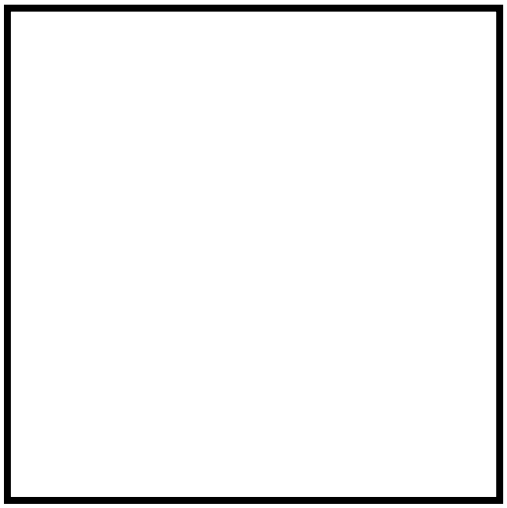
(14 inches)

G 3-6 Geometry

Use a ruler to find the area of the squares.



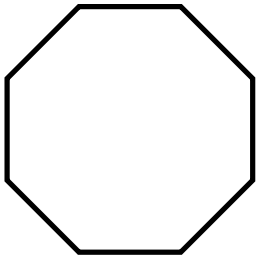
(9 square inches)

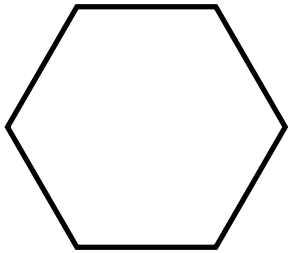


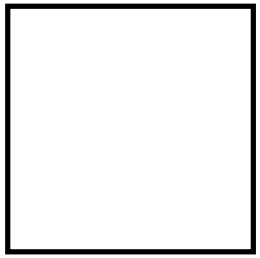
(16 square inches)

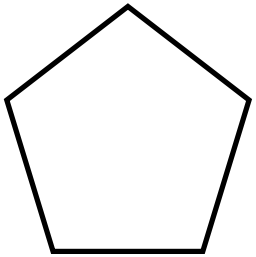
G 3-7 Geometry

Put one line under the pentagon. Put two lines under the octagon.

1. 

2. 

3. 

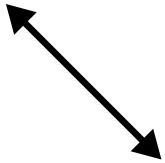
4. 

G 3-8(b) Geometry

Examine each figure and determine if it is a line, line segment, ray, or point. Write your answer on a separate sheet of paper.

1. 

(ray)

2. 

(line)

3. 

(point)

4.

(line segment)

5. 

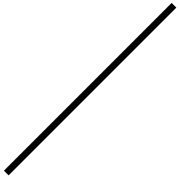
(ray)

6. 

(point)

7. 

(line)

8. 

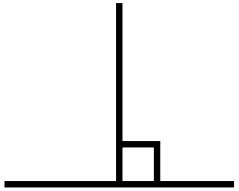
(line segment)

G 3-9 Geometry

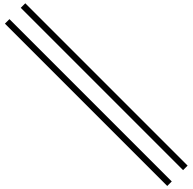
Examine each set of line segments and determine if they are parallel, perpendicular, or intersecting. Write your answer on a separate sheet of paper.

1. 

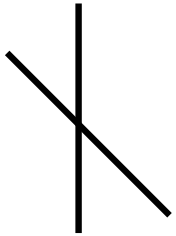
(parallel)

2. 

(perpendicular)

3. 

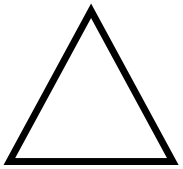
(parallel)

4. 

(intersecting)

G 3-10 Geometry

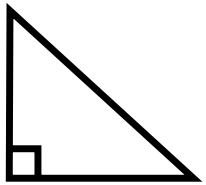
Examine each triangle and determine if it is an equilateral triangle, isosceles triangle, or a right triangle. Write your answer on a separate sheet of paper.

1. 

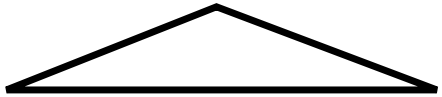
(equilateral)

2. 

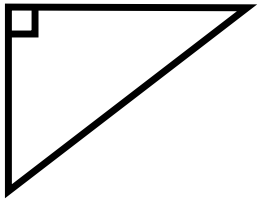
(isosceles)

3. 

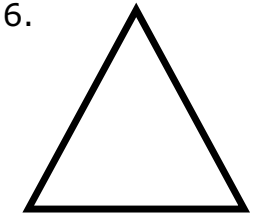
(right)

4. 

(isosceles)

5. 

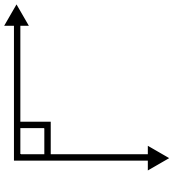
(right)

6. 

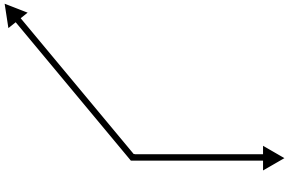
(equilateral)

G 3-11 Geometry

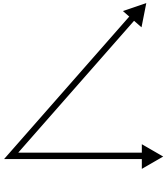
Examine each angle and determine if it is a right angle, greater than a right angle, or less than a right angle. Write your answer on a separate sheet of paper.

1. 

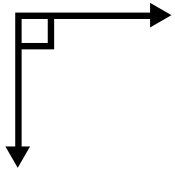
(right)

2. 

(greater than – obtuse)

3. 

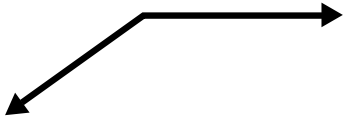
(less than – acute)

4. 

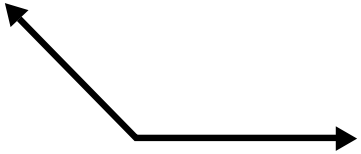
(right)

5. 

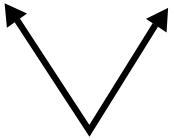
(right)

6. 

(greater than – obtuse)

7. 

(greater than – obtuse)

8. 

(less than – acute)

Notes

American Printing House for the Blind
Louisville, Kentucky
2025

Catalog No. 1-42100-00