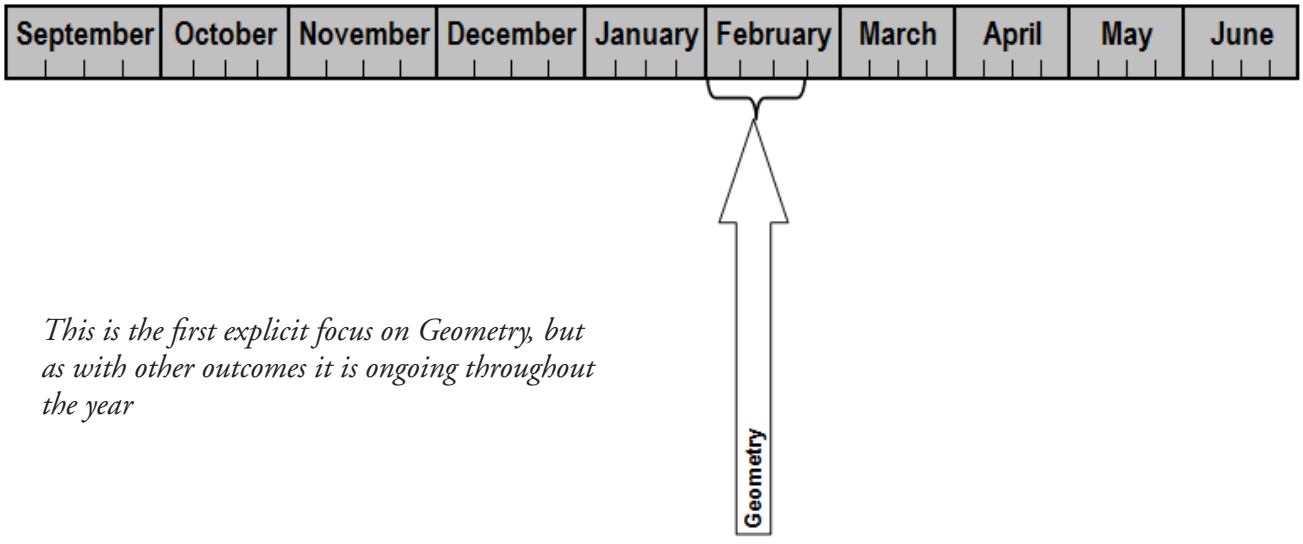
Geometry

Suggested Time: 3 Weeks



This is the first explicit focus on Geometry, but as with other outcomes it is ongoing throughout the year

Unit Overview

Focus and Context

At a very young age, children are engaged in the study of geometry. "When building with blocks, they discover how two-dimensional shapes tile a plane and how three-dimensional forms fill up space, how they stack, and how they fit together. As children work with blocks of various kinds, they examine and analyze them and become more and more discriminating. They learn to identify and sort by knowing attributes of shapes." (*Mathematics Assessment Sampler*, NCTM. 2005. p. 75) Preschool children already possess their own concepts of shape and space, a geometric foundation on which they continue to build throughout their school years. In Grade 2, students have been introduced to identifying, sorting, comparing, describing and constructing 2-D shapes and 3-D objects. In Grade 3, students will continue to develop their knowledge of two and three dimensional shapes by examining their characteristics and analyzing the relationships among them. They will "use more formal language to describe and analyze shapes as, for example, specific polygons based on their number of sides and vertices. Any formal discussion of the classification of geometric shapes typically begins with a discussion of polygons. Many of the shapes that students have previously encountered are polygons, but in grade three, they learn to use the word polygon to describe any closed figure with straight sides that intersect only at their endpoints." *Focus in Grade 3, Teaching With Curriculum Focal Points*, NCTM (2009) p. 55.

Students will explore more attributes and become more familiar with both regular and irregular polygons. An attribute is defined as a property that applies to all the shapes of a certain class. For example, a triangle is a 3-sided shape made up of 3 straight line segments. It is essential that teachers provide hands-on experiences with manipulatives such as pattern blocks, power polygons, toothpicks, twist ties, pipe cleaners, modeling clay, geoboards, technology, tangram pieces, etc., to sort, classify and construct various 2- and 3- dimensional shapes. These experiences provide students with informal analyses that make expressing their ideas about geometric shapes and solids, either orally or written, much easier.

Math Connects

Students are naturally curious about geometry. They are easily engaged in hands-on experiences with geometric shapes and solids. Geometry is a branch of mathematics that is most evident in the world around us.

Development of spatial sense is crucial for helping students understand their own geometric world. Spatial sense connects to a student's everyday life through shapes and objects in their environment, such as architectural designs and artwork. Geometry can easily be incorporated throughout the curriculum in art, science, industrial arts and technology. As well, children's literature can be used as an effective tool to help students make real-life connections to their physical world and as a springboard to help them problem solve.

Through a variety of experiences and concrete exploration of both 2-D shapes and 3-D objects, students gain a deeper understanding of mathematics. They can make connections between their work with combining and decomposing shapes, as well as, "analyzing, describing, comparing and classifying properties of shapes" to more complex concepts in later grades. These concepts may include solving problems related to perimeter, area, symmetry, congruency related to transformations and modeling fractions. *Focus in Grade 3, Teaching with Curriculum Focal Points*, NCTM (2009).

Process Standards Key

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[ME]	Mental Mathematics and Estimation	[T]	Technology
		[V]	Visualization

Curriculum Outcomes

STRAND	OUTCOME	PROCESS STANDARDS
Shape and Space (3-D Objects and 2-D Shapes)	3SS6 Describe 3-D objects according to the shape of the faces and the number of edges and vertices.	[C, CN, PS, R, V]
Shape and Space (3-D Objects and 2-D Shapes	3SS7 Sort regular and irregular polygons, including: • triangles • quadrilaterals • pentagons • hexagons • octagons according to the number of sides.	[C, CN, R, V]

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS7 Sort regular and irregular polygons, including:

- **triangles**
- **quadrilaterals**
- **pentagons**
- **hexagons**
- **octagons**

according to the number of sides.

[C, CN, R, V]

Achievement Indicator:

3SS7.1 Identify given regular and irregular polygons that have different dimensions.

Elaborations—Strategies for Learning and Teaching

Geometry is an important branch of mathematics that involves shapes, spatial sense, symmetry and proportion.

"Children need experiences with a rich variety of both 2- and 3-dimensional shapes. It is useful for students to be able to identify common shapes, notice likenesses and differences among shapes, become aware of the properties that different shapes have, and eventually use these properties to further define and understand their geometric world" (*Teaching Student-Centered Mathematics K-3*, Van de Walle, 2006, p. 193).

A polygon is a closed plane (2-D) figure having three or more straight sides that intersect only at the vertices. Polygons have the same number of sides as vertices. Polygons are identified by their number of sides.

Numbers of sides	Regular Polygon	Irregular Polygon
3 sides (triangle)		
4 sides (quadrilateral)		
5 sides (pentagon)		
6 sides (hexagon)		
8 sides (octagon)		

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Follow the Polygons - This task can be repeated in a mathematics routine as a way to revisit this concept throughout the year. Ask students to find various polygons in their environment and explain why each is a polygon. (3SS 7.1, 3SS 7.2, 3SS 7.3)

- Make a polygon on a geoboard. Ask students to replicate this polygon on their own geoboards in different dimensions. An overhead geoboard is useful for this task. This task can be repeated in a mathematics routine as a way to revisit this concept throughout the year. (3SS 7.1)

- Place a variety of polygons in a bag. Ask students to feel these 2-D shapes and describe them according to the number of sides. This task can be repeated in a mathematics routine as a way to revisit this concept throughout the year. (3SS 7.1, 3SS 7.2)

Portfolio

- Using a variety of magazines, newspapers, pictures, etc., ask students to create a poster of a 2-D object of their choice that includes a variety of dimensions. This task can be repeated in a mathematics routine as a way to revisit this concept throughout the year. (3SS 7.1)

Resources/Notes

Math Makes Sense 3

Launch: Under Construction

TG pp. 2 - 3

Lesson 1: Naming Polygons

3SS7

TG pp. 4 - 7

Additional Activity:

Sensational Shapes

TG: p. v and 41

Additional Reading (provided)**:**

Van de Walle, John A. and Lovin, LouAnn H. (2006). *Teaching Student-Centered Mathematics K-3*, p. 193.

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS7 Continued

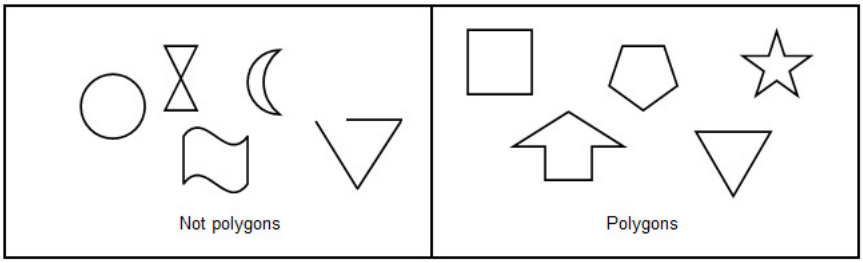
Achievement Indicator:

3SS7.1 Continued

Elaborations—Strategies for Learning and Teaching

A regular polygon is a polygon with all sides the same length and all angles the same measure. An irregular polygon is a polygon whose sides are not all the same length. A circle is not a polygon because it does not have straight line segments. In an irregular polygon, all the sides are not the same length and all the angles are not the same size.

The word "regular" sometimes creates confusion for students, since they may think of something "regular" as something that is "ordinary." From that perspective, students may view common shapes such as circles or rectangles as "regular" but this is not the mathematical definition. (*Making Math Meaningful for Canadian Students K-8*, (Small 2008), p. 296)



When introducing polygons, write the word 'polygon' on the board and ensure students understand it is a closed, plane shape bound by three or more straight line segments. Help students realize a plane figure is a flat figure or a 2-D shape. Measurements of two-dimensional shapes include only width and height, whereas three-dimensional shapes include width, height and depth. Ask students to work in groups of 4 to physically create various polygons. Create the figure by using their bodies on the floor. (A good idea would be to bring mats in the classroom ahead of time.) Ask students what polygons they could form if 2 groups (8 students) got together. Let the students demonstrate. Also, ask students to physically form a triangle by placing their hands on their hips and tracing the triangle inside their arms.

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Resources/Notes

Math Makes Sense 3

Lesson 1 (Cont'd): Naming Polygons

3SS7

TG pp. 4 - 7

Additional Reading (provided)**:**

Small, Marion (2008). *Making Math Meaningful for Canadian Students K-8*, p. 296

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

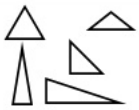
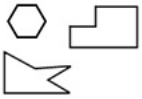
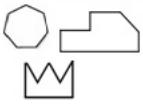
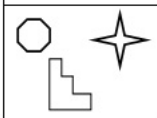
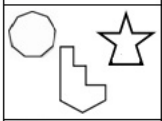
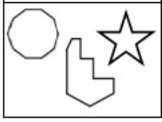
3SS7 Continued

Achievement Indicator:

3SS7.1 Continued

Elaborations—Strategies for Learning and Teaching

Together, brainstorm the names of various polygons. Create an organized table similar to the one below as a visual aid.

Sample polygons	Numbers of sides	Name
	3	triangle
	4	quadrilateral
	5	pentagon
	6	hexagon
	7	heptagon
	8	octagon
	9	nonagon
	10	decagon

While it is natural for students to be curious about the names of other polygons and it is appropriate to expose them to correect mathematical terminology for other polygons, naming specific polygons is limited to triangle, quadrilateral, pentagon, hexagon and octagon in this outcome.

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Resources/Notes

Math Makes Sense 3

Lesson 1 (Cont'd): Naming Polygons

3SS7

TG pp. 4 - 7

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

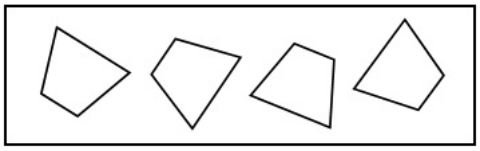
3SS7 Continued

Achievement Indicator:

3SS7.2 Identify given regular and irregular polygons that have different orientations.

Elaborations—Strategies for Learning and Teaching

"Through many experiences with identifying shapes in a variety of orientations, students begin to realize that shapes can be the same, regardless of their position." (Focus in Grade Three, Teaching With Curriculum Focal Points, NCTM, p. 51) Realizing that orientation has no effect on the type of shape is crucial in later grades when working with transformations and congruency.



A quadrilateral in different orientations

When introducing orientation, provide students with a 2-D shape (from the power polygons or pattern blocks sets, etc.) to trace as they experiment with different orientations by turning (rotating), flipping (reflection) and sliding (translations). This type of "early geometric exploration is valuable in developing their spatial reasoning and again solidifies their understanding of the concept that orientation does not change the basic characteristics of a shape." (Focus in Grade Three, Teaching With Curriculum Focal Points, NCTM, p. 54).

'You Are A Square' (Glyph Activity) - Use paper pattern block shapes to represent your family members. You are the square. If you are a girl, add one blue rhombus to the square. If you are a boy, add one tan rhombus to the square. Represent each adult with a yellow hexagon. Represent each of your siblings with a trapezoid and each pet with a triangle. Use all of the shapes to create a polygon, making sure that your blocks are connected along matching sides. Glue the polygon to a sheet of paper. Use the back of your paper to write additional family details. Share your creation with a classmate. (based on Teaching Children Mathematics, August 2008, p. 33)

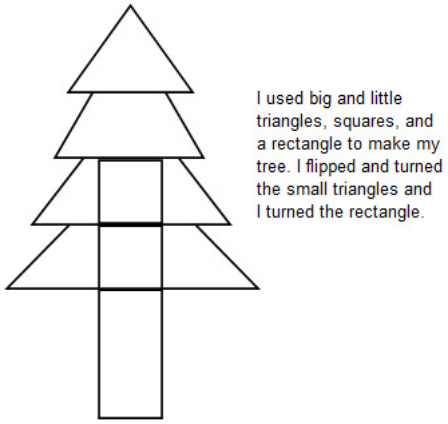
(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Journal

- "Tree-rific" Puzzles: Provide students with a green puzzle pieces template as shown below. Ask them to cut out the pieces to flip and turn as needed to create a pine tree. It is not necessary to use all of the pieces. After the tree is created glue pieces to a sheet of white construction paper. Students may create a background scene for their tree using crayons and various craft materials. Journal: Ask students to include a brief description of the shapes they used next to their tree. Encourage the use of geometric terms such as triangle, quadrilateral, slide, flip and turn.



(3SS7.2)

Portfolio

- Ask students to create a shape collage using their favourite polygon. Students would be required to represent their collage using a variety of materials, sizes and positions. (3SS 7.1, 3SS 7.2)

- Provide students with two of each of the six pattern blocks. Ask them to investigate how many new polygons can be made by using two of the same block (equal sides should be matched). Trace to record the different polygons. Which of the blocks could make one of the polygons? Which could make the most different polygons? Observe that the students recognize the same shape in different positions or orientations. (3SS 7.2)

Resources/Notes

Math Makes Sense 3

Lesson 1 (Cont'd): Naming Polygons

3SS7

TG pp. 4 - 7

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS7 Continued

Achievement Indicator:

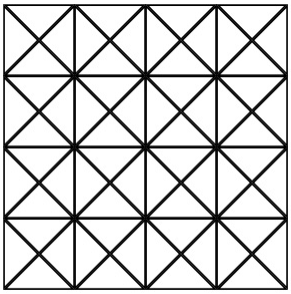
3SS7.2 Continued

Elaborations—Strategies for Learning and Teaching

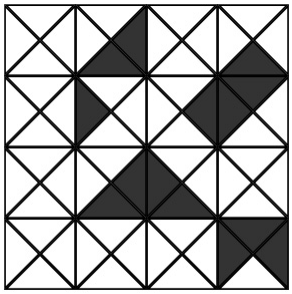
Provide students with a playing grid as shown below and two different colors of crayons or pencil leads.

Game Directions:

1. Player 1 colors any single small triangle on the grid.
2. Player 2 colors any other small triangle on the grid.
3. Players continue to take turns coloring small triangles anywhere on the grid.
4. When the grid is completely colored the game is over.
5. Points are given for the shapes below; each shape is made up of four triangles.
   - Parallelogram = 4 points
   - Rectangle = 3 points
   - Triangle = 2 points
   - Square = 1 point



Game Template



Sample

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Show the students a polygon on a geoboard. Ask them to make a slide, flip or rotated image of it on their own geoboard. This activity is best modelled on an overhead geoboard. (3SS7.2)

Paper and Pencil/Journal

- Provide students with a green triangle, a blue rhombus and a red trapezoid from the pattern blocks. Ask students to:

  (i) create a parallelogram using all three blocks. Trace your parallelogram in your journal.

  (ii) create a pentagon using all three blocks. Trace your pentagon in your journal.

  (iii) create a polygon of your own choice using any pattern blocks you wish. Trace it in your journal.

  Extension: Create a polygon where the number of yellow blocks used, is one-half the number of red blocks. (3SS7.2)

Resources/Notes

Math Makes Sense 3

Lesson 1 (Cont'd): Naming Polygons

3SS7

TG pp. 4 - 7

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS7 Continued

Achievement Indicator:

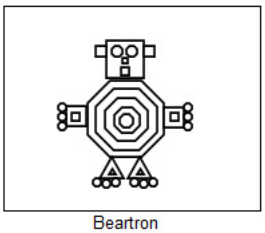
3SS7.2 Continued

Elaborations—Strategies for Learning and Teaching

Geometry Gallery - In this activity students create imaginary polygon animals and use geometric vocabulary to write a story about their creations. Provide various writing tools (pencils, pens, acrylic paints, crayons, etc.) and drawing paper for the students. Make a list of geometry terms such as:

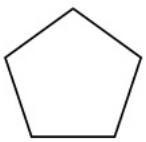
- Polygon
- Quadrilateral
- Trapezoid
- Hexagon
- Octagon
- Rhombus
- Pentagon
- Triangle

Ask students to draw a geometric imaginary animal and using some of the geometry terms from the given list, describe the animal on a separate sheet of paper. Ask them to include its appearance, behaviour and habitat and give their polygon animal a name. Encourage them to be creative! Display all animals on a class gallery wall. E.g.,



Beartron

Stained Glass Window Project – Tell students that you have been hired to design a stained glass window for a church in your community. Ask them to draw many different geometric shapes (trapezoid, kite, triangle, square, rectangle, rhombus, hexagon, etc.) within the window frame provided below and color them with various colors. Students may trace pattern blocks for this activity. If there are any spaces left between shapes, students may color these spaces grey.



(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Portfolio

- Read *The Quiltmaker's Gift*. Look at and discuss the patterns on the inside cover and throughout the book. Discuss the shape and orientation of the different polygons in the quilt squares. Give each child a blank quilt square template and ask them to create their own quilt square using pattern blocks, tangrams, attribute blocks or pentominoes. Trace and colour the designs and put all the squares together to create a class quilt. (3SS7.2)

Resources/Notes

Math Makes Sense 3

Lesson 1 (Cont'd): Naming Polygons

3SS7

TG pp. 4 - 7

Children's Literature (provided):
Brumbeau, Jeff. *The Quiltmaker's Gift*

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS7 Continued

Achievement Indicator:

3SS7.3 Classify a given set of regular and irregular polygons according to the number of sides.

Elaborations—Strategies for Learning and Teaching

"After students establish that some shapes are polygons and some are not polygons, they begin a more formal process of sorting and classifying two-dimensional shapes by examining their characteristics, such as the number of sides in, or the kinds of angles related to, a shape, as well as, the number of vertices (the point or intersection of two sides). By sorting polygons according to the number of sides, students can learn the names for polygons, for example, triangle (three-sided polygon), quadrilateral (four-sided polygon), pentagon (five-sided polygon), and hexagon (six-sided polygon)." (*Focus in Grade 3, Teaching With Curriculum Focal Points*, NCTM, p. 56).

Ask students to find examples of polygons in the world around them, perhaps even collect as many types of a shape as they can find. Sort them according to the number of sides. Help students recognize that shapes such as the one below is a hexagon (six-sided polygon).

Example of a Hexagon

When classifying, it is important for students to realize that every 2-D (and 3-D) object has many attributes. These may include straight sides, vertices and length of sides. "Opportunities to work with concrete and pictorial representations, as well as technology, guide students to understand that the "sides" of a shape are the straight line segments that form the shape and that a "point" or "corner" is where the sides come together, or intersect, at a vertex."… "Even in early explorations of geometric properties, students are introduced to the embeddedness of the categories of geometric shapes. For example, they learn that a square is a "special kind of rectangle" in which all sides have the same length." (*Focus in Grade 3 Teaching With Curriculum Focal Points*, NCTM, p. 51)

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Student-Teacher Dialogue

- Show students two groups of sorted polygons. Ask, "What might the sorting rule have been?" This allows students to recognize properties of shapes. Some examples of groupings could be regular/irregular polygons, 4-sided/3-sided, quadrilaterals/polygons that are not quadrilaterals, etc. (3SS7.3)

Journal

- Ask students to create a rectangle and a triangle on a geoboard. Examine the shapes carefully to find ways they are alike and ways they are different. Repeat for other polygons such as, various quadrilaterals, pentagons, hexagons and octagons. Record findings in a T-chart as shown below.

Polygon	Number of Sides

  Note: This chart can also be extended to show another attribute such as the number of vertices. (3SS7.3)

Performance

- What Do You Know About_____? - Students work in pairs. One student chooses a shape and tells his/her partner one true thing about it. Continue until the partner guesses the shape.

- Provide several shapes. Ask one student to pick a shape and show to the class. The student then proceeds to find others that are like it in some way. See if students can guess why you picked your group of shapes. (3SS7.3)

Resources/Notes

Math Makes Sense 3

Lesson 2: Sorting Polygons

3SS7

TG pp. 8 - 11

Strand: Shape and Space (3-D Objects and 2-D Shapes)

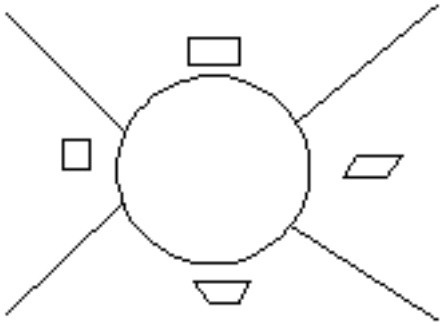
Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **3SS7 Continued** **Achievement Indicator:** *3SS7.3 Continued*	Secret Rules Game: Divide the class into two or three teams. In your team, pick a shape. Find others that are like it in some way – but don't tell the other team your secret sorting rule. Now share your sorted group with another team. Can you guess their rule? What made it hard? What made it easy? Ask students to build different basic shapes from two triangles of the same size and paste on a sheet of paper. Label each new shape by the number of sides. Encourage students to build a square, parallelogram or even a bigger triangle. Extension: Ask students to build new shapes but this time with three or more triangles. Provide students with a long rope. Tie the ends of the rope together. Ask students to form geometric shapes with the rope. To make a square, for example, ask students to stand equal distances apart forming right angles at each corner. Ask them to change the shape into a triangle, rectangle, etc. Note the number of sides for each shape.
Problem Solving Strategy: **Guess and Check**	"Problem solving is an integral part of all mathematics learning, and as such it should not be an isolated part of the mathematics program. When problem solving is integrated into all aspects of the mathematics curriculum, teachers and students can experience the energy and excitement of learning mathematics. Problem solving and problem posing, when students are pushed beyond simply finding a right answer to questioning the answer, can be one of the most pleasurable and powerful ways to learn mathematics. Learning to question the answers by posing additional questions when solving the original problem is one way that teachers and students can develop mathematical power." (*Principles and Standards for School Mathematics.* NCTM (2006) p. 79) Guess and Check strategy has been a previous focus. Spend some time reviewing this strategy and practice it throughout the year. Use Ann Tompert's *Grandfather Tang's Story* to complete the study of 2-D shapes while problem solving. Grandfather Tang and Little Soo play a game with tangrams. Grandfather tells a story about shape-changing fox fairies. He rearranges tangram pieces into the various animals the foxes decide to turn into. *(continued)*

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Paper and Pencil

- Using the graphic below, students are to identity the shape in each section and list its characteristics in the area provided. Next ask students to list the characteristics that they all have in common in the center circle.



(3SS7.3)

Journal/ Portfolio

- Ask students to write their own story and illustrate it with tangrams.

(3SS7.2)

Resources/Notes

Math Makes Sense 3

Lesson 2 (Cont'd): Sorting Polygons

3SS7

TG pp. 8 - 11

Math Makes Sense 3

Lesson 3: Strategies Toolkit

TG pp. 12 - 13

Children's Literature (provided): Tompert, Ann. *Grandfather Tang's Story*

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
Problem Solving Strategy: **Guess and Check**	Display the words 'quadrilateral' and 'triangle'. Ask students to discuss the characteristics of each. Brainstorm some examples of quadrilaterals such as a square, rectangle, parallelogram and trapezoid. Show students the cover and ask them to predict what the story is going to be about. Ask students what they know about tangrams. Use their responses to make a chart. Go to the second last page of the book entitled, 'Tangrams'. Read this page together with the students. Make sure students understand that tangrams are ancient Chinese puzzles that are still used today. It's important that students know that a tangram begins with a square, which is cut into seven standard pieces. The pieces are made up of triangles, a parallelogram and a trapezoid. These shapes can be combined to form other shapes such as a trapezoid. Read *Grandfather Tang's Story* to the students. Give each student a tangram puzzle and ask them to identify each shape. Ask students to rearrange their own tangram pieces into the animals as Grandfather Tang did.
3SS6 Describe 3-D objects according to the shape of the faces and the number of edges and vertices. **[C, CN, PS, R, V]**	Literature Connection - Use *The Greedy Triangle* by Marilyn Burns to help students make the connection between 2-D shapes and 3-D objects. In this story, the triangle becomes dissatisfied with its shape and continuously makes trips to the 'shapeshifter' to add angles and lines. Finally, it can hardly recognize itself and realizes it was happier in its original form. Read and discuss the story. Give each student a geoboard and geodot paper. Ask students to make a triangle on the geoboard and record it on their geodot paper. As you read, predict what will happen to the triangle, before the 'shapeshifter' makes the requested change. (Cover up each 'Poof!' page) Ask students to make the predicted shape on their geoboards and use geodot paper to draw the predicted shape. Next discuss the concept of 2-D versus 3-D. In the story, there are some pictures of 3-D triangles. Ask students if there is another name for these figures. (prisms and solids) Show examples. Have a Shape Hunt in the classroom, looking for the different shapes mentioned in the book. Ask students to sort the plane and solid figures into the two categories. Ask students: As the triangle continues to add one side at a time, how does it change? What happens to its angles? Finally consider having students use mini-marshmallows and toothpicks to form plane (2-D shapes) or solid geometric figures (3-D objects) from the story.

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Shape Teasers - copy the template below and give one to each student or pairs of students to cut apart. Students then use the cut apart shapes to solve the following:

  Puzzle #1: Using one complete set, can you make a large square?

  Puzzle #2: Use two A's to make a triangle.

  Use two A's to make a square.

  Use two A's to make a four-sided figure that is not a square.

  Puzzle #3: Use four of one kind of shape and one of another kind of shape to make a rectangle.

  Puzzle #4: Use two of one kind of shape, two of another shape and one of another to make a rectangle.

  Puzzle #5: Use four A's. If each A costs 1¢ make a four-sided figure that costs 3¢.

  Puzzle #6: Use four A's If each A costs 1¢ make a three-sided figure that costs 4¢.

  Puzzle #7: Use four A's. If each A costs 1¢ make a five-sided figure that costs 3¢.

  Puzzle #8: Use four A's. If each A costs 1¢ make a five-sided figure that costs 4¢.

Resources/Notes

Math Makes Sense 3

Lesson 3 (Cont'd): Strategies Toolkit

TG pp. 12 - 13

Math Makes Sense 3

Lesson 4: Describing Prisms and Pyramids

3SS6

TG pp. 14 - 17

Children's Literature (provided):

Tompert, Ann. *Grandfather Tang's Story*

Burns, Marilyn. *The Greedy Triangle*

Additional Activity:

It's a Match

TG: p. v and 42

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicators:

3SS6.1 Identify the faces, edges and vertices of given 3-D objects, including cubes, spheres, cones, cylinders, pyramids and prisms.

3SS6.2 Identify the shape of the faces of a given 3-D object.

Elaborations—Strategies for Learning and Teaching

For now, students will work with pyramids and prisms (including cubes). Work with spheres, cones and cylinders will occur later.

Show students models and real-life objects that represent various pyramids and prisms. Show students the faces, edges and vertices of each solid. Brainstorm what each term means.

A face is a flat surface on a geometric object. An edge occurs when two faces of a 3-D object meet. A vertex is a point where three or more edges meet or, on a cone, a vertex is the highest point above a base.

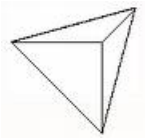
A 3-D object with flat faces that are polygons is called a polyhedron. Prisms and pyramids are polyhedra. Cylinders, cones and spheres are not.

It is not necessary that students know the terms polyhedron and polyhedra.

A pyramid has 1 base. The base is a special face that determines the name of the pyramid. The remaining faces in a pyramid are always triangles that meet at one point or vertex.

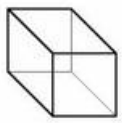
E.g., A pyramid with a square base is a square pyramid.

A pyramid with a triangular base is a triangular pyramid.

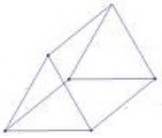


A prism has 2 bases that are matching polygons. Again, the 2 bases are special faces that determine the name of the prism.

E.g., A prism with 2 rectangular bases is a rectangular prism.



A prism with 2 triangular bases is a triangular prism.



The other faces are rectangles. Make sure students know that a cube is a special rectangular prism just like a square is a special rectangle.

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- I Spy Game: Small Group/Whole Class - Ask students to take turns identifying objects (pyramids and prisms) by listening to clues, such as, "I spy with my little eye something that has 4 rectangular faces and 2 square faces." Students can get three guesses before another clue is provided. Ask the student who guessed correctly to explain how he/she knew what object was spied. That student then takes a turn. (3SS6.1, 3SS6.2)

Resources/Notes

Math Makes Sense 3

Lesson 4 (Cont'd): Describing Prisms and Pyramids

3SS6

TG pp. 14 - 17

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **3SS6 Continued** **Achievement Indicators:**	
3SS6.1 Continued	Possible or Impossible Activity: Whole Class - Show a model or real-life object of a prism or a pyramid. Give any two attributes, and challenge students to decide if the combination is possible or impossible. For example, hold up a square-based pyramid and say, "I can stack. I have 5 faces." Ask students to do a thumbs-up signal if this combination is possible or a thumbs-down signal if it is impossible.
3SS6.2 Continued	Overhead Activity – Guess the Solid (Whole Class) - Have a set of 3-D objects (models or real-life) hidden from view. Place a 3-D object on the overhead projector. Ensure that the students can only see the image projected on the screen and not the actual 3-D object. Looking only at the shadow on the screen, have volunteers guess the name of the 3-D object and give reasons for their choice. For example, "I think the object is a cube because the shape has a square and I know a cube has all square faces." If students need another hint, turn the object to show another face.
3SS6.3 Determine the number of faces, edges and vertices of a given 3-D object.	Headband Game - Guess My Solid: Put students in pairs or small groups. Choose one member of the group to wear a headband. Have another person put a cut-out solid on the headband. (Don't let the person wearing the headband see the solid.) The person with the headband can ask questions to the other members of the group to figure out what 3-D object he or she is wearing. Sample Questions: Is my solid a prism? Does my solid have 1 vertex? Does my solid have 12 edges? Are all faces of my solid squares? Take turns wearing the headband.

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Place a variety of 3-D objects in a bag. Ask students to feel the objects in the bag and describe them; have other students try to name them.

  (3SS6.1, 3SS6.2, 3SS6.3)

- Place a hexagonal prism and hexagonal pyramid, for example, beside one another. Ask the students to name them. Ask them to tell you some things that are the same about them; some things that are different. (3SS6.1, 3SS6.2, 3SS6.3)

Journal

- Ask students to examine a collection of 3-D solids to find ones that have faces that are regular polygons. Ask them to record the ones they find by tracing them in their journals. (3SS6.2)

Student-Teacher Dialogue

- Ask students the following 'Three-Dimensional Shape Questions':

  (i) In my hand I have an object that is able to roll. What might it be?

  (ii) I can see a box-shaped object in this room. What object can I see?

  (iii) We stacked some objects to make a wall. What objects might we have used?

  (iv) In a bag I can feel that an object has flat faces, sharp vertices and straight edges. What might this object be?

  (v) I traced around one of the faces of an object. The shape I drew was a circle. What might the object have been?

  (3SS6.1, 3SS6.2., 3SS6.3)

Resources/Notes

Math Makes Sense 3

Lesson 4 (Cont'd): Describing Prisms and Pyramids

3SS6

TG pp. 14 - 17

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS6 Continued

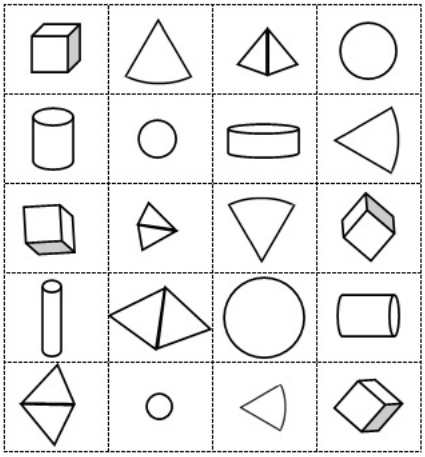
Achievement Indicators:

3SS6.3 Continued

3SS6.1 Continued

Elaborations—Strategies for Learning and Teaching

3-D Bingo - Provide students with a copy of a handout similar to the one shown below and an empty gameboard.



Sample 3-D Objects

Ask students to cut out the objects and randomly glue them to their own empty bingo gameboard. Describe an attribute of a solid and have each student place a counter on any one solid that has that attribute. The first student with 4 counters in a row, column, or diagonal wins.

Students previously worked with prisms and pyramids. Now the focus will be on cylinders, cones and spheres.

A cylinder is a 3-D object with 3 faces, 2 edges and 0 vertices.

A cone is a 3-D object with 1 face, 1 edge and 1 vertex.

A sphere is a 3-D object with 0 faces, 0 edges and 0 vertices.

Show students models and real-life objects of cylinders, cones and spheres. Ask students what the difference is between these solids and the prisms and pyramids already studied. Show students the faces, edges and vertices of each solid. Brainstorm, with the students, what each term means.

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Who Am I? - by giving clues based on faces, edges, and vertices. (For example: "I have 5 faces. I have 6 vertices. What prism or pyramid am I?) (3SS6.1)

Extension – Paper and Pencil

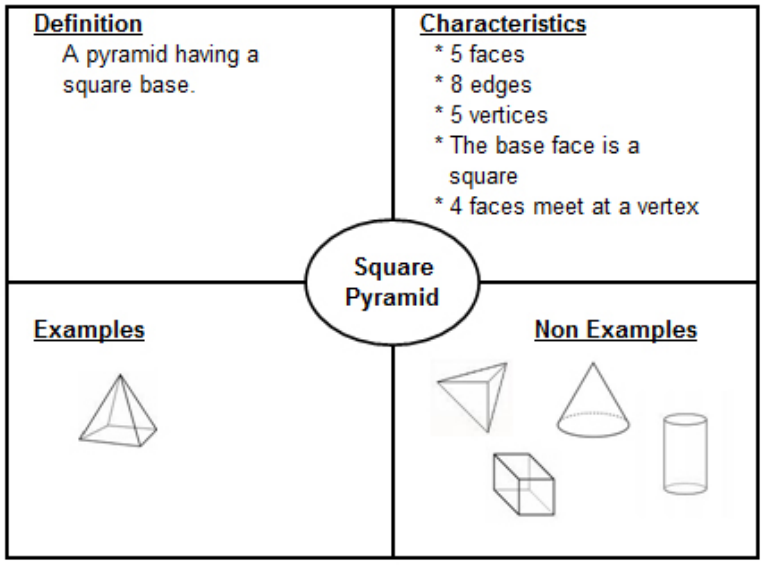
- Ask students to make up their own 3-D Who Am I? Riddles and place them in a class book. (3SS6.1, 3SS6.2, 3SS6.3)

Journal

- Give students 2 solids, such as a cylinder and a cone. Ask them to write a comparison between them on the basis of edges, faces and vertices. Ask them to sketch real-life objects to match. (3SS6.1)

Portfolio

Ask students to create Frayer models for a given 3-D solids. E.g.,



(3SS6.1)

Resources/Notes

Math Makes Sense 3

Lesson 4 (Cont'd): Describing Prisms and Pyramids

3SS6

TG pp. 14 - 17

Math Makes Sense 3

Lesson 5: Describing Cylinders, Cones and Spheres

3SS6

TG pp. 18 - 20

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicators:

3SS6.1 Continued

3SS6.2 Continued

Elaborations—Strategies for Learning and Teaching

I Spy - Ask students to take turns identifying objects (cylinders, cones, spheres) by listening to clues, such as, "I spy with my little eye something that has 2 circular faces and 0 vertices." Students are allowed 3 guesses before another clue is provided. Ask the student who guessed correctly to explain how he knew what object was spied. That student then takes a turn.

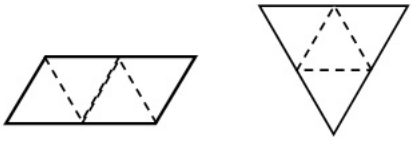
Possible or Impossible? - Show a model or real-life object of a sphere, cylinder or cone. Give any two attributes, and challenge children to decide if the combination is possible or impossible. E.g., hold up a cylinder and say, "I can stack. I have 2 faces." Ask students to do a thumbs-up signal if this combination is possible or a thumbs-down signal if it is impossible.

A net can be described as a 'jacket' for a geometric solid that can be folded to cover or create the surface of the solid. A net is a two-dimensional figure with indicated lines for folding to create a three-dimensional solid. While students are not expected to match nets to a 3-D object, they will explore nets to identify the shape of the faces of 3-D objects.

Show Me - Provide students with a variety of nets for 3-D objects. Ask students to cut and fold to make a model of these 3-D objects. Using these manipulatives, ask students to play a "Show Me" game to familiarize them with the correct geometric terms for the solids. For example, the teacher says, "Show me a cylinder." Wait for all students to hold up their cylinders. Continue with various other solids. Explain to students that they have various prisms and pyramids. For example, some models may be a square-based pyramid or a triangular-based pyramid (tetrahedron), or students may have a triangular prism or a rectangular prism. Pyramids and prisms are named according to their base.

Provide students with any two nets. Pose the following question to students:

- What shape are the faces of this 3-D solid?
- Look at these two nets. What 3-D solid will they make?



Sample nets for triangular pyramids

(continued)

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Portfolio

- Shape Art - Provide a variety of 3-D objects (models or real-life), such as cans, tubes, cones, boxes, etc. Ask students to trace the faces of different 3-D objects to make a picture of their own design. Ask them to decorate the shapes and write the names of the shapes somewhere on their page. (3SS6.1, 3SS6.2)

Resources/Notes

Math Makes Sense 3

Lesson 5 (Cont'd): Describing Cylinders, Cones and Spheres

3SS6

TG pp. 18 - 20

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicators:

3SS6.3 Continued

3SS6.4 Sort a given set of 3-D objects according to the number of faces, edges or vertices.

Elaborations—Strategies for Learning and Teaching

Dashers - Provide each student with a 3-D object. In the gym or on the playground, select one student to act as the leader of the game. The leader stands on 1 side of the playing area and calls out 2 attributes (i.e., "Curved parts and flat faces!") Students who have an object with curved parts and flat faces should run to a designated spot and then back to the starting point. Name a new leader to call a new set of attributes for the next "dashers." Challenge students to come up with a set of attributes where many students are running. Challenge them to find a grouping where very few students are running.

3-D Object Chart - Ask students to examine models or real-life 3-D objects and complete a table similar to the one below:

Solid	Number of edges	Number of verticies	Number of faces
Rectangular Prism			
Cube			
Pyramid			
Sphere			
Cone			
Cylinder			

Shape Scavenger Hunt - Name a 3-D shape and ask students to take part in a scavenger hunt in which they have to locate solid objects in the classroom that have a face with that shape. Ask students to list their findings on a sheet of paper.

Target Match (Pair Activity) - Place a variety of 3-D objects in a bag. Player 1 takes an object from the bag. This object becomes the "Target". Player 1 takes another object from the bag. If he/she can name 2 attributes it shares with the "Target", he/she keeps the object. If not, the object is placed back into the bag. Players take turns until all objects are removed from the bag. The player with the most objects at the end of the game wins.

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Paper and Pencil

- After discussion and completion of the' Object Chart' on the previous page, ask students to place a barrier between them and a partner. Ask them to choose a 3-D object and pretend they are speaking with their classmate on the telephone. They are not allowed to use the name of the object but they must describe it to help the other person guess what 3-D object they are holding.
  1. Pyramid
  2. Cylinder
  3. Rectangular Prism
  4. Sphere
  5. Cone
  6. Cube (3SS 6.3)

Portfolio

- Ask students to look through various catalogues, magazines and books to find pictures of 3-D objects. Ask them to sort the objects in groups according to the number of faces, edges or vertices. Ensure that students label their groups and glue pictures to poster board. (3SS6.4)

Resources/Notes

Math Makes Sense 3

Lesson 5 (Cont'd): Describing Cylinders, Cones and Spheres

3SS6

TG pp. 18 - 20

Math Makes Sense 3

Lesson 6: Sorting Objects

3SS6

TG pp. 21 – 24

Game: Guess My Object

TG p. 24

Additional Activity:

Sort it Out!

TG: p. v , 43 and 44

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicator:

3SS6.5 Construct a skeleton of a given 3-D object, and describe how the skeleton relates to the 3-D object.

Elaborations—Strategies for Learning and Teaching

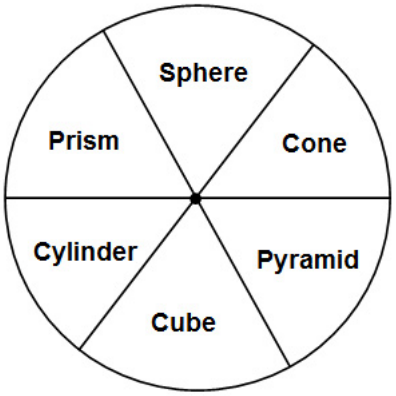
A skeleton is the frame of an object. It shows the edges and vertices of 3-D objects.

Bubble Geometry Activity - Create various shaped bubble wands (square, triangular, circular, etc.) out of straws, pipe cleaners, strawberry baskets, etc. and have your own bubble festival! Ask students to describe the geometric solid created.

Constructing Solids - Gather construction tools such as coffee stirrers, twist ties, straws, pipe cleaners, toothpicks, gumdrops, etc. Students work with a partner and construct one or more of the geometric solids. (Gumdrops can be used for the corners or vertices.)

Building Robots (Small Group) - Provide students with 3-D objects and a spinner as shown below.

Students take turns spinning the spinner 6 times and select the 3-D solids that the pointer lands on. Have each group work together to build a robot, from these solids, that lies flat on the table.



General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Journal

- Building Robots - After completing the Building Robots task, described on the previous page, ask students to name and describe each object used to build their robot, in their journals.

(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.5)

Resources/Notes

Math Makes Sense 3

Lesson 7: Constructing Skeletons

3SS6

TG pp. 25 - 27

Additional Activity:

Riddle, Riddle

TG: p. v and 45