

## **Title: Planes to Solids Figures**

### **Brief Overview**

This unit focuses on the identification of the attributes of plane figures. Students will investigate the attributes of various polygons and their relationship to geometric solids. Finally, the students develop geometric vocabulary in order to describe, compare, and contrast two and three dimensional shapes.

### **NCTM Content Standard/National Science Education Standard:**

Analyze characteristics and properties of two- and three- dimensional geometric shapes and develop mathematical arguments about geometric relationships:

- Identify, compare, and analyze attributes of two-and three- dimensional shapes;
- Classify two- and three- dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids;
- Build and draw geometric objects;
- Identify and build a three- dimensional object from two-dimensional representations of that object.

**Grade/Level:** 3-4

### **Duration/Length:**

Three days of 60 minutes lessons

### **Student Outcomes**

The student will be able to:

- Identify, compare, and analyze attributes of two and three-dimensional shapes and develop vocabulary
- Identify and draw plane figures and shapes, both open and closed;
- Describe the characteristics/attributes of plane figures and shapes as polygons;
- Describe the relationship between polygons and solids figures;
- Use appropriate vocabulary to describe geometrical shapes and objects in class in the real world.

## Materials and Resources:

### Day 1

- Black/White board or an Overhead to chart plane figures
- Plain paper and pencils
- Pattern blocks
- Literature by Marilyn Burns, “The Greedy Triangle”
- Exit card with questions and answers

### Day 2

- Creating Polygons
- Prepared baggies of geometrical pattern blocks ( 3 triangles, 2 hexagons, 2 trapezoids, 2 rhombi )
- A set of solid figures

### Day 3

- A set of solid figures
- Student Resource / Polygon Shape Tree
- Student Resource / Nets

### Geometry Vocabulary

- Plane
- Polygons
- Triangles
- Square
- Circle

## Development/Procedures:

### Day 1

- Pre-assessment – Have students count the sides and identify the plane shapes on the prepared worksheet. (Student Resource 1).
- Engagement - Have students list as many shapes as they can think of in 2 minutes.
- Exploration
  - Inform students that the world is made up of many shapes. Distribute pattern blocks to pairs of students, using magazine pictures of everyday objects (buildings, roof tops, doors, windows, tables, plates, sandwich ... etc.). Have student partners discuss and

identify the shapes using pattern blocks. Then inform the students that they will listen to a story about a three sided shape that wants to be another shape (“The Greedy Triangle,” by Marilyn Burns). Tell the students to pay close attention to how many times the three-sided shape becomes a different shape. Have them list or draw the different shapes. At the end of the story, have the students identify all of the shapes from the story.

- Explanation
  - Discuss the definitions of a plane and plane figures. A plane is a flat surface, like the floor, the desk, or a sheet of paper. A plane figure can be open (like an S or scribble) or closed (like a square or triangle). Plane figures are always flat. Closed figures with straight lines are called polygons.
  - Have students draw a triangle. Ask them how many straight sides it has (3). Ask if the triangle is flat. Ask if the triangle is closed. If a triangle is flat, closed and has straight sides then it is a \_\_\_?\_\_\_. (Polygon) Have the students draw a square and check to see if it is a polygon.
- Differentiation
  - Reteach
  - Have the students draw a rectangle and a circle. Then have them check to see if these are polygons, using the three attributes questions listed above. Have the attributes questions on an index card. The students can use the card to help identify polygons.
  - Enrich
  - Use the pattern blocks and identify polygons using the attribute questions.
- Assessment
  - Prepare an exit card with questions and answers about today’s lesson to assess students’ understanding of the geometric concepts presented.
  - Ask: (1) What are the attributes of a polygon? (Polygons are plane shapes that are flat, closed, with straight sides). (2) List at least two polygons (Square, triangle, and a rectangle ...etc.).

## Day 2

- Engagement
  - Geometry Vocabulary
    - Quadrilateral
    - Cube
    - Sphere

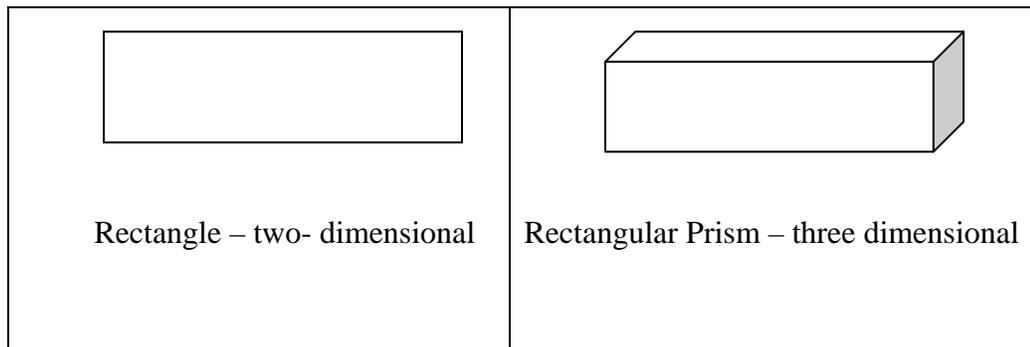
- Rectangle
- Cylinder
- Triangular pyramid
- Rectangular prism

Have students list as many shapes as they can think of in 2 minutes.

- Complete the pattern using pattern blocks.



- Exploration
  - Four sided polygons are called quadrilaterals. Have students and their partners discuss and identify with pattern blocks as many quadrilaterals as they can in two minutes.
- Explanation
  - Show students a group of solid figures. Analyze and differentiate plane figures from solid figures. Plane figures are flat and are called two-dimensional shapes. Solid figures are called three-dimensional shapes. You can use the following examples to name some of the three-dimensional shapes: a ball is a sphere, a block is a cube, a cereal box is a rectangular prism, a can of soda is a cylinder, a party hat is a cone, and a tent can be a pyramid. Draw on the board a rectangle and a rectangular prism to compare the differences between a plane figure and a solid figure.



Two-dimensional figures are measured by their length and height; where as three- dimensional figures are measured by their length, height, and width.

Distribute a solid figure to each group of four students to discuss and instruct students to describe the attributes of the solid figures. Then students will share their findings by writing their descriptions on a class attribute chart.

- Differentiation
  - Re-teach - Have the students draw and label two examples of two-dimensional and three-dimensional figures.
  - Enrich - Have partners sort and match attributes to two-dimensional and three-dimensional figures using geometry concentration cards (Teacher Resource 1A-D).
- Assessment
  - Prepare an exit card with questions and answers about today's lesson to assess student understanding.
  - Ask: (1.) What are the attributes of two solid figures? (2.) Compare and contrast: rectangle and rectangular prism; triangle and triangular pyramid; and square and cube.

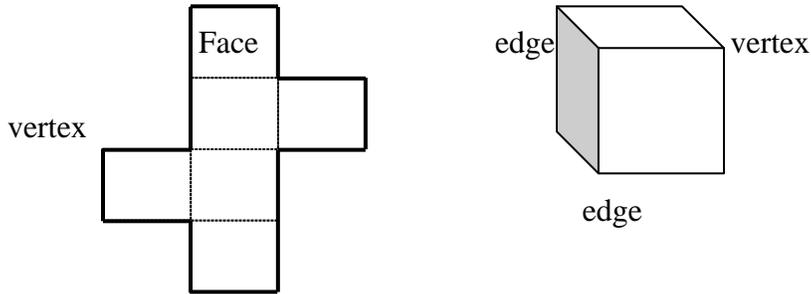
### Day 3

- Engagement
  - Geometry Vocabulary
    - Vertex / Vertices
    - Faces
    - Edges
    - Rectangle
    - Cylinder
    - Triangular pyramid
    - Rectangular prism

Distribute a copy of Polygon Shape Tree (Student Resource 2) to each student. Have the students match the shape to its name.

- Exploration
  - Distribute the solid figures with nets (Student Resource 3) to pairs of students to investigate and discuss the relationship between the net and the solid figure.
- Explanation
  - Discuss the vocabulary words in order to have a better understanding of the concept about the form of the solid figures.

Tell students that solid figures have vertex/vertices, edges, and faces.



Net- the cube figure is open and flat      Cube – as a solid figure

- A cube figure is formed with following attributes: Each flat surface is a face, and each cube's face is a square, and there are 6 faces. A vertex, is where 3 or more edges meet. A cube has 8 vertices. An edge is a line segment where two faces meet. There are 12 edges on each cube.
  - Display a cube's net on the over head to support discussion. A net is a flat plane shape of a solid figure. Once the net is folded properly it will take on the shape of a solid figure.
  - Distribute geometric figures and their nets to student partners to count the vertices, faces, and edges. They will record this information on a geometric solid attribute chart (Student Resource 4A-B).
- Differentiation
- Re-teach - Using the net of a cube, have the students fold and create the cube shape. Have students feel the faces, vertex (vertices) and edges as they count each attribute on this solid figure. This should help identify faces, edges and vertices in order to complete the attribute chart.
  - Enrich - Have students do a scavenger hunt in the classroom to find solid figures with a given number of faces, edges, and vertices.

**Summative Assessment:**

Use the Summative Test (Student Resource 5A-B). Answer key can be found on Teacher Resource 2A-B.

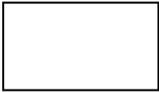
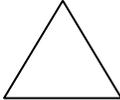
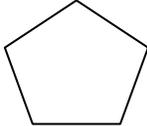
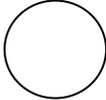
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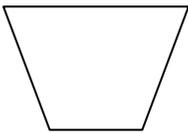
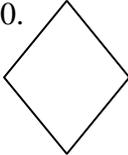
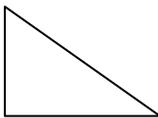
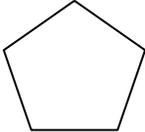
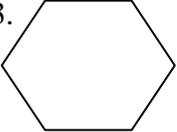
**Pre-Assessment**

A. Name the following shapes.

1.  2.  3.  4.  5. 

\_\_\_\_\_

B. Write the number of sides each shape has.

9.  10.  11.  12.  13. 

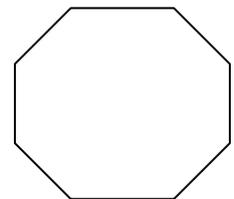
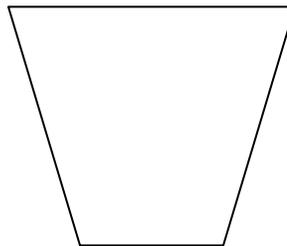
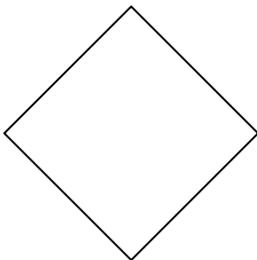
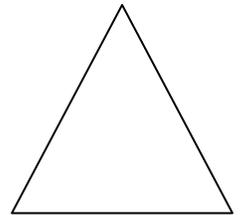
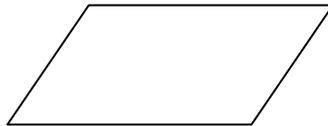
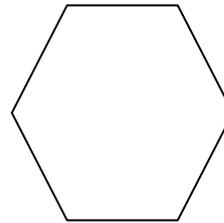
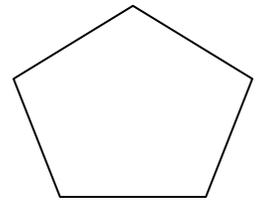
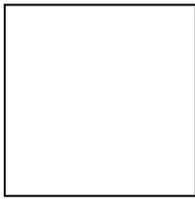
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Polygon Tree

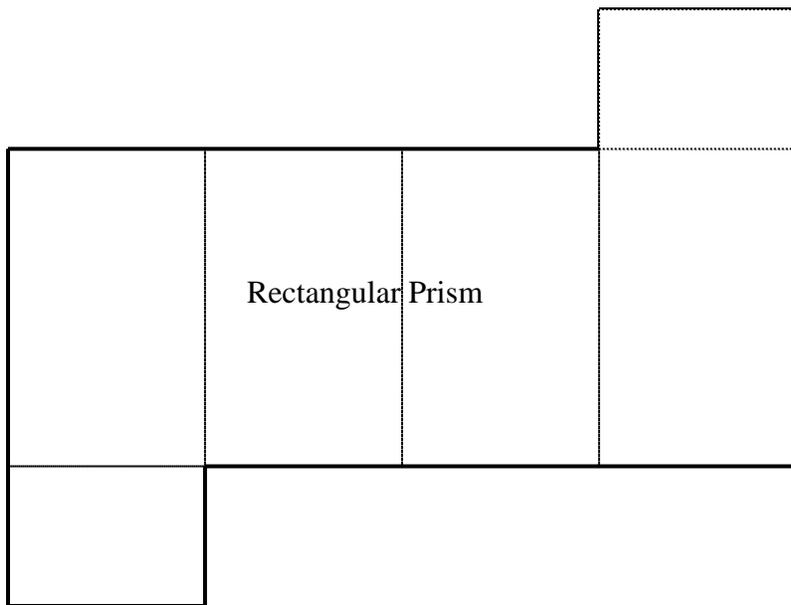
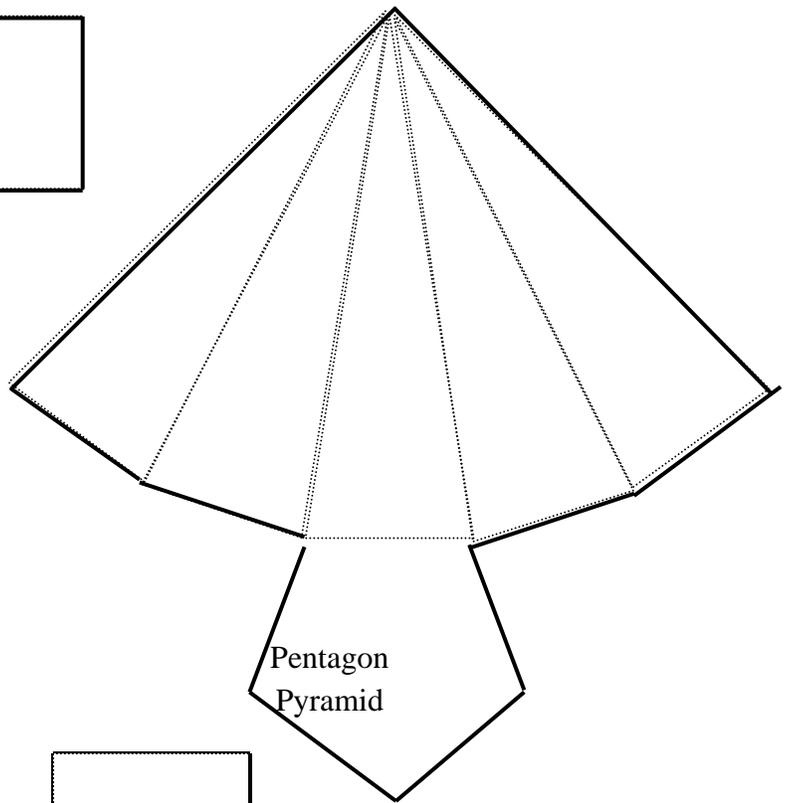
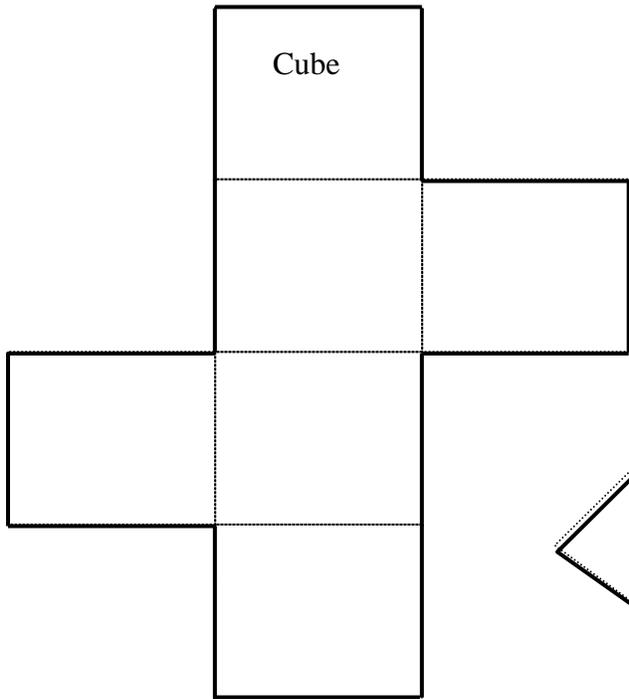
Directions: Label the shapes correctly.

Word Bank

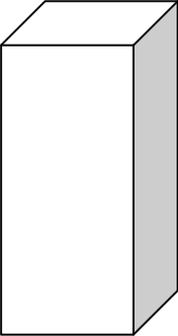
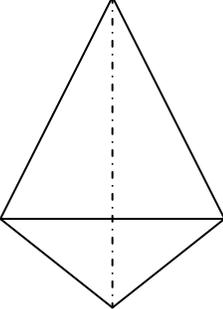
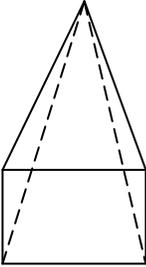
Triangle   Rectangle   Square   Quadrilateral   Parallelogram   Pentagon   Hexagon  
Pentagon   Rhombus   Trapezoid

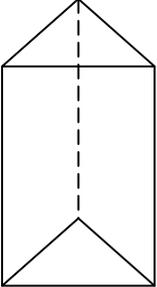
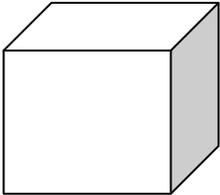


# Nets



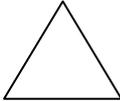
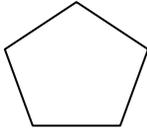
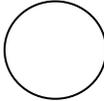
Geometric Solid Attribute Chart

Solid Figures	Number of Faces	Shape(s) of Face(s)	Number of Vertices	Number of Edges
<p data-bbox="362 464 519 527">Rectangular Prism</p> 		<p data-bbox="773 569 946 632">rectangle and square</p>		
<p data-bbox="370 953 511 1016">Triangular Pyramid</p> 		<p data-bbox="808 1026 911 1058">triangle</p>		
<p data-bbox="337 1373 540 1404">Square Pyramid</p> 		<p data-bbox="808 1415 911 1520">triangle and square</p>		

<p>Triangular Prism</p> 		<p>rectangle and triangle</p>		
<p>Cube</p> 		<p>square</p>		

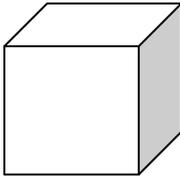
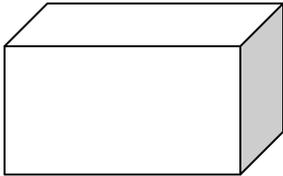
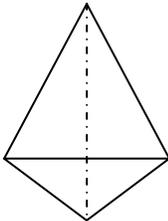
Summative Test

A. Name the following shapes.

1.  2.  3.  4.  5. 

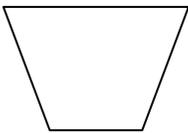
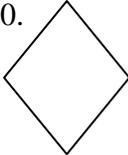
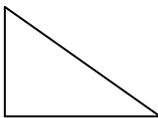
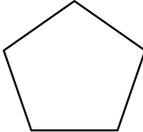
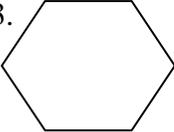
\_\_\_\_\_

B. Write the number of faces for each figure.

6.  7.  8. 

\_\_\_\_\_

C. Write the number of sides for each shape.

9.  10.  11.  12.  13. 

\_\_\_\_\_

14. How many edges and vertices does a cube have? Edges \_\_\_\_\_ Vertices \_\_\_\_\_

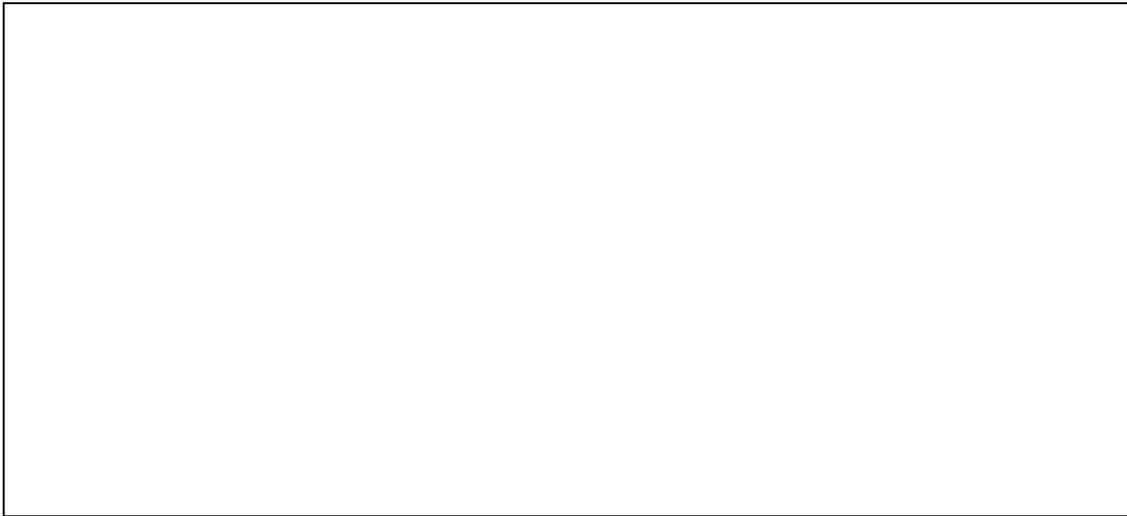
15. Draw two real-world objects that look like a cone.

Brief Constructed Response  
Solid Figures

- A. Name a solid figure that has 6 non equal faces, 8 vertices, and 12 edges.

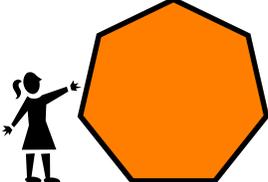
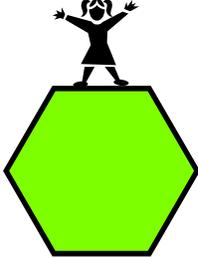
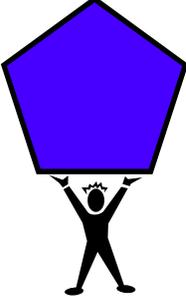
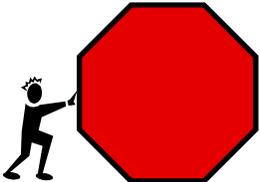
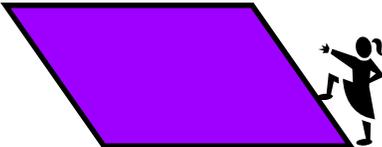
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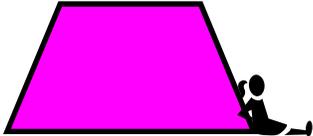
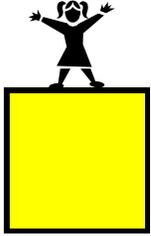
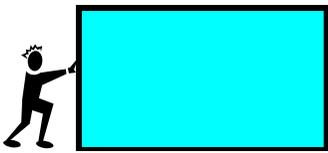
- B. Draw and label the figure you named in A.

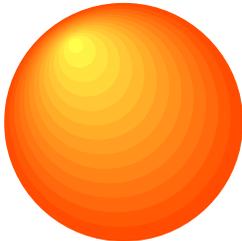
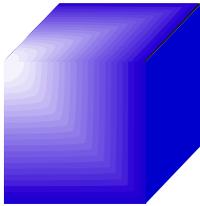
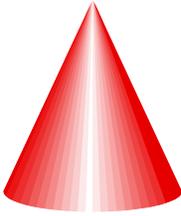
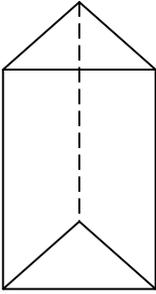


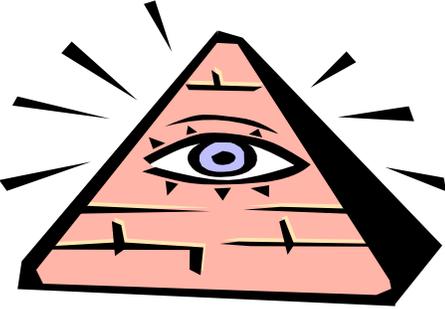
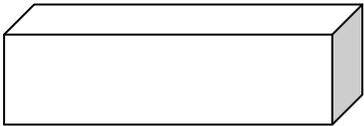
## Geometry Concentration Cards

Directions: Cut each card and spread them face down on a table. Then match each shape to its attribute.

	<p style="text-align: center;">Heptagon</p> <p>A polygon formed with 7 sides or line segments.</p>
	<p style="text-align: center;">Hexagon</p> <p>A polygon formed with 6 sides or line segments.</p>
	<p style="text-align: center;">Pentagon</p> <p>A polygon formed with 5 sides or line segments.</p>
	<p style="text-align: center;">Octagon</p> <p>A polygon formed with 8 sides or line segments.</p>
	<p style="text-align: center;">Parallelogram/Rhombus</p> <p>A polygon formed with 4 sides or line segments. A quadrilateral having 2 sets of parallel lines.</p>

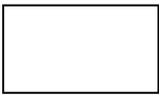
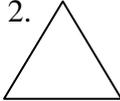
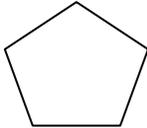
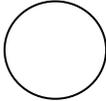
	<p style="text-align: center;">Triangle</p> <p>A polygon formed with 3 sides or line segments.</p>
	<p style="text-align: center;">Trapezoid</p> <p>A polygon formed with 4 sides or line segments. (Quadrilateral)</p>
	<p style="text-align: center;">Circle</p> <p>A plane / Circular shape</p>
	<p style="text-align: center;">Square</p> <p>A polygon formed with 4 sides or line segments. A quadrilateral having all sides equal.</p>
	<p style="text-align: center;">Rectangle</p> <p>A polygon formed with 4 sides or line segments. A quadrilateral having 2 opposite sides equal.</p>

	<p style="text-align: center;">Sphere</p> <p>A three- dimensional figure with no straight lines or line segments.</p>
	<p style="text-align: center;">Cube</p> <p>A three- dimensional figure that is measured by its length, height, and width. It has 6 faces, 8 vertices, and 12 edges.</p>
	<p style="text-align: center;">Cylinder</p> <p>A three- dimensional figure having 2 circular faces.</p>
	<p style="text-align: center;">Cone</p> <p>A three- dimensional figure having one face.</p>
	<p style="text-align: center;">Triangular Prism</p> <p>A three-dimensional figure having 5 faces, 6 vertices, and 9 edges.</p>

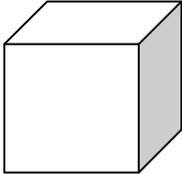
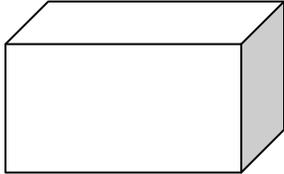
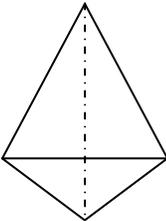
	<p>Rectangular Pyramid</p> <p>A three-dimensional figure having 5 faces, 5 vertices, and 8 edges.</p>
	<p>Rectangular Prism</p> <p>A three-dimensional figure having 6 faces, 8 vertices, and 12 edges.</p>

Summative Test

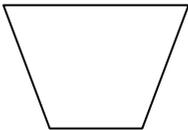
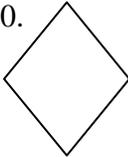
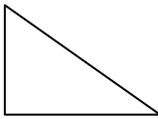
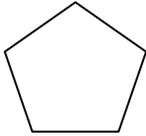
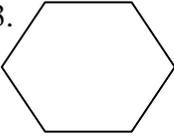
A. Name the following shapes.

1.  2.  3.  4.  5.   
Rectangle      Triangle      Pentagon      Circle      Square

B. Write the number of faces for each figure.

6.  7.  8.   
\_\_\_\_\_6\_\_\_\_\_      \_\_\_\_\_6\_\_\_\_\_      \_\_\_\_\_4\_\_\_\_\_

C. Write the number of sides for each shape.

9.  10.  11.  12.  13.   
\_\_\_\_\_4\_\_\_\_\_      \_\_\_\_\_4\_\_\_\_\_      \_\_\_\_\_3\_\_\_\_\_      \_\_\_\_\_5\_\_\_\_\_      \_\_\_\_\_6\_\_\_\_\_

14. How many edges and vertices does a cube have? Edges 12 Vertices 8

15. Draw two real-world objects that look like a cone.

Brief Constructed Response  
Solid Figures

A. Name a solid figure that has 6 equal faces, 8 vertices, and 12 edges.

rectangular prism or cube

B. Draw and label the figure you named in A.

