

# Algebra/Geometry Institute Summer 2007



**Faculty Name:** Charmaine Lau  
**School:** Coleman Middle, Greenville, MS  
**Grade Level:** 7

## 1. Teaching Objective

- Classify and compare three-dimensional shapes using their properties (3a)

## 2. Instructional Activities

- Bell-ringer (5 minutes): “Write a brief description explaining what three-dimensional figures are. Provide examples of three-dimensional figures.” Allow 3 students to read their descriptions and examples aloud.
- Ask students if they have studied pyramids in social studies. Call on the students whose hands are raised to describe what pyramids are (who made them, when they were made, what they were made of, what they look like, etc.) Explain to students that there are also special names for other types of three-dimensional figures. Tell students that today they will learn about different types of three-dimensional figures. (5 minutes)
- Notes (15 minutes): Distribute “Three-Dimensional Figures” guided notes to students
  - a. Use an overhead transparency copy of the guided notes and, as explanations are given to students, notes are revealed on the overhead.
  - b. Tell students that *polyhedra* are special three-dimensional figures that have flat faces. (hold up a cube) Ask students if the figure is a polyhedron based upon the definition. Call on a student to explain why a cube is a polyhedron. Repeat this process when holding up a triangular prism, triangular pyramid, cylinder, sphere, rectangular prism, rectangular pyramid, cone, and pentagonal pyramid. For the example, students should draw a picture of a cube. Tell students the definitions for face, edge, and vertex:
    - A *face* is a flat side of a solid figure
    - An *edge* is where two faces intersect
    - A *vertex* is where three or more edges intersect
  - c. Show students the pictures, but not the definitions, of the cube, triangular prism, rectangular prism, triangular pyramid, rectangular pyramid, and pentagonal pyramid and ask them to sketch a drawing of each in the appropriate places on their worksheet

- Activity (30 minutes)
  - a. Pass out the “Geometric Solids” worksheet to each student. Divide the students into groups of four. Provide each group with a zip-lock bag filled with a variety of spaghetti noodles and marshmallows.
  - b. Explain to students that each group is responsible for making one set of the six different polyhedra listed on their note sheets. As students create their figures, they must fill in the “Geometric Solids” worksheet with the correct names and number of faces, vertices, and edges. After building the polyhedra and filling in the chart, they must then discover the relationship at the bottom of the page (faces + vertices = edges + ?). Groups that finish early may then generate possible definitions for prisms and pyramids by comparing the figures they have created and identifying common characteristics. Students should also work to complete the “Three-Dimensional Figures” note sheet.
- Post- activity discussion (15 minutes): Call on a representative from each group to share one of the figures that they created. Student representatives should point out and count the number of faces, vertices, and edges aloud to the class. After all six figures have been presented, volunteers should complete Euler’s relationship (Faces + Vertices = Edges + 2) and be prepared to give examples with the figures they created. Also, the teacher should lead a discussion regarding the similarities between the triangular and rectangular prism (“What do the triangular and rectangular prism have in common?” “What is a good definition of a prism based upon the similarities?”) as well as between the triangular, rectangular, and pentagonal pyramids (“What do the pyramids have in common?” “What is a good definition of a pyramid based upon the similarities?”). By this point, students should have finished filling in their “Three-Dimensional Figures” note sheet. If not, provide the answers from the overhead transparency. If time permits, ask students to predict the names of prisms and pyramids when the base(s) has/have a given number of sides (ex. 6 sides = hexagonal prism and hexagonal pyramid, 7 sides = heptagonal prism and heptagonal pyramid).

### 3. Materials and Resources

- Materials
  - a. Bell-ringer
  - b. “Three-Dimensional Figures” guided notes
  - c. Overhead transparency of “Three-Dimensional Figures”
  - d. Set of geometric solids (cone, sphere, cylinder, cube, triangular prism, rectangular prism, triangular pyramid, rectangular pyramid, pentagonal pyramid)
  - e. “Geometric Solids” worksheet
  - f. “Quiz on Benchmark 3a” worksheet

- g. 1 quart zip-lock bags
- h. Spaghetti noodles (broken in half)
- i. Marshmallows
- Resources
  - a. *JBHM 7<sup>th</sup> Grade Math, Teacher's Edition* (JBHM Education Group, 2005)
  - b. "Three-Dimensional Figures" worksheet created by Charmaine Lau
  - c. "Geometric Solids" worksheet adapted from *JBHM 7<sup>th</sup> Grade Math, Teacher's Edition*
  - d. "Quiz on Benchmark 3a" worksheet created by Charmaine Lau

#### 4. Assessment

- Observation of student participation during bell-ringer, introduction, and post-activity discussion
- Grade "Geometric Solids" worksheet
- Grade "Quiz on Benchmark 3a" worksheet

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Block: \_\_\_\_\_

### Three-Dimensional Figures

**Polyhedra** (polyhedron- singular form): \_\_\_\_\_

Example: \_\_\_\_\_ Face: \_\_\_\_\_

Edge: \_\_\_\_\_

Vertex: \_\_\_\_\_

**Cube:** \_\_\_\_\_

-How many faces does a cube have? \_\_\_\_\_

-Name the edges of the cube

\_\_\_\_\_

\_\_\_\_\_

-Name the vertices:

\_\_\_\_\_

**Prism:** \_\_\_\_\_

Triangular Prism

Rectangular Prism

**Pyramid:** \_\_\_\_\_

Triangular Pyramid

Rectangular Pyramid

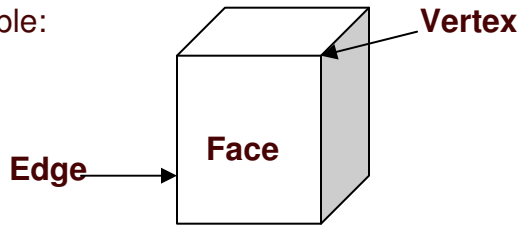
Pentagonal Pyramid

## Three-Dimensional Figures (Overhead)

**Polyhedra** (polyhedron- singular form): geometric solids with flat surfaces

shaped like polygons

Example:



Face: flat side of a solid figure

Edge: segments where 2 faces intersect

Vertex: where 3 or more edges intersect

**Cube:** all faces are squares

-How many faces does a cube have? 6

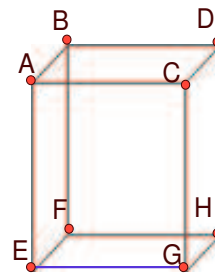
-Name the edges of the cube

AB, BD, CD, AC, EF, FH

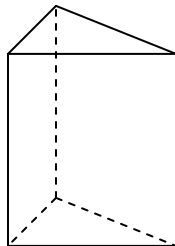
EG, GH, AE, BF, CG, DH,

-Name the vertices:

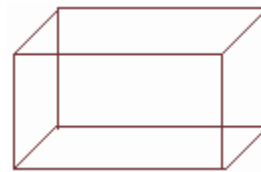
Points A, B, C, D, E, F, G, and H



**Prism:** 2 faces are parallel and congruent

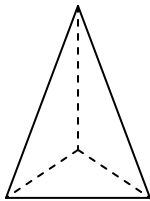


Triangular Prism

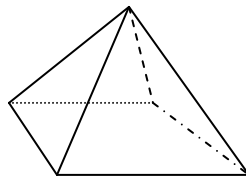


Rectangular Prism

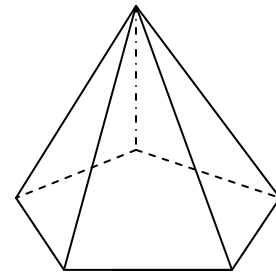
**Pyramid:** 1 base, all other faces are triangles



Triangular Pyramid



Rectangular Pyramid



Pentagonal Pyramid

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Block: \_\_\_\_\_

### Geometric Solids

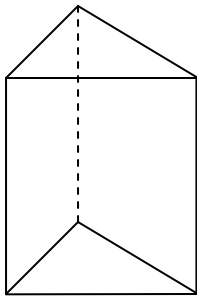
Name of Solid	Number of Faces	Number of Vertices	Number of Edges

A mathematician named Euler (pronounced "Oiler") discovered a relationship between the sum of the faces and vertices and the number of edges in all polyhedron. What relationship do you see?

**Faces + Vertices = Edges + \_\_\_\_ (What number?)**

### Quiz on Benchmark 3a

Use the figure below to answer questions 1 -3.



- 1) The bases are made up of what polygons?
  - a) Rectangles
  - b) Triangles
  - c) Segments
  - d) Vertices
  
- 2) How many faces does the prism have?
  - a) 3
  - b) 4
  - c) 5
  - d) 6
  
- 3) How many of the faces of the prism are rectangular?
  - a) 0
  - b) 1
  - c) 2
  - d) 3

- 4) How many edges does the figure below contain?

- a) 6
- b) 8
- c) 10
- d) 12



- 5) If a pyramid has 5 faces and 5 vertices, how many edges must it have?

- a) 8
- b) 10
- c) 12
- d) 14

- 6) If a triangle is the base of a pyramid, how many edges would the pyramid have?
- a) 3
  - b) 4
  - c) 5
  - d) 6
- 7) What is the difference in the number of vertices in a square prism and a square pyramid?
- a) 1
  - b) 2
  - c) 3
  - d) 4
- 8) Which of the following are true about a cube?
- I It has 6 faces.
  - II It has 8 vertices.
  - III It has 10 edges.
- a) I and II
  - b) II and III
  - c) I and III
  - d) I, II, and III
- 9) How many vertices does a pentagonal pyramid contain?
- a) 4
  - b) 5
  - c) 6
  - d) 7
- 10) A prism has a hexagon as base. Which of the following is true?
- a) The prism has 7 vertices and 12 edges.
  - b) The prism has 12 vertices and 18 edges.
  - c) The prism is made of 6 rectangles and one hexagon.
  - d) The prism is made of 4 rectangles and two hexagons.