Title: Geometric Solids: Get In Shape

Brief Overview:

The students will use their understanding of geometry to create a three-dimensional figure and be able to explain the attributes of the three-dimensional solid. They will be comparing shapes by identifying the faces, vertices, and edges.

NCTM Content Standard:

Geometry

Grade/Level:

Grades 3-4

Duration/Length:

Three days (50 minutes each day)

Student Outcomes:

Students will:

- Identify, compare, and analyze attributes of two-and three-dimensional shapes and develop vocabulary to describe the attributes.
- 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.

Materials and Resources:

- Overhead pattern blocks (if not available, regular pattern blocks)
- The Greedy Triangle by Marilyn Burns
- Three dimensional solids-a set for each student pair
- Chart paper
- Opaque bag
- 'Compare the Pair' worksheet
- 'Picture pages' #1-4
- Toothpicks (variety of sizes)
- Several bags of gumdrops at least 20 per student
- Gumdrop rubric

Development/Procedures:

Lesson 1

Preassessment

Using pattern blocks for the transparency, (if not available use regular pattern blocks) place the shapes one at a time to have the students name the attributes of that shape. For example, a square is on the overhead and the students should be able to name the number of sides, tell if there are equal sides, describe the angles, identify the number of vertices? This could be done orally to give the teacher an informal assessment of how well the students remember the attributes of the shapes.

Launch

To motivate the students into discussing the attributes of each shape, read the story, The Greedy Triangle, by Marilyn Burns. As you come to each shape, read the page and then have the students think of other places they see the shape in everyday life.

Teacher Facilitation

To introduce three-dimensional shapes, give each pair of students a three-dimensional shape and have the students identify the polygons that make up the faces of the three-dimensional figure. For example, if the students are given a pyramid, they should be able to find the polygons such as a square and triangles.

Have the students work for five to seven minutes and then list their findings on paper. Then have the students report what they found to the rest of the class. Ask the pair if they know what the three-dimensional shape is called. If they know the shape, write it on chart paper. If they do not know what the shape is called, they could ask the class.

After the three-dimensional shape is written on chart paper, review that faces are the flat surfaces, the edges are where the faces meet, and the vertices are the point at which the edges meet. Together with the class, write the number of faces, edges, and vertices each three-dimensional shape has. As they explore various solid figures, help them realize that the faces of a solid figure are in the shape of plane figures.

When the activity is completed all of the three-dimensional shapes should be listed on chart paper so they could remain up in the classroom during this unit.

Student Application

Have the students work in pairs to identify an unknown three-dimensional shape. Each pair will receive a set of the different three-dimensional shapes. One of the students will pick a shape and hide it behind a folder or on their lap. The other student will then have to ask yes or no questions to guess the shape. The number of questions could be limited or not, depending on teacher preference. Model the activity for the class with another student. Each student should have at least two turns guessing and answering. Have directions listed on chart paper or the board. For example, some questions could be: Does your shape have more than four faces? Does it have at least one vertex?, and Does your shape have any edges? Overall this activity should take approximately 15 to 20 minutes.

Embedded Assessment

Visit each pair and observe to ensure that the pairs are using the proper vocabulary and that an overall understanding is occurring.

Reteaching/Extension

- For those who have difficulty identifying the polygons within the three-dimensional shapes, have the students use the pattern solids so they could compare the two- dimensional shapes to the faces on the three-dimensional shape.
- For the students who have understood the lesson and need some extension challenge them to guess the shape with only asking two questions.

Lesson 2

Preassessment

Play "Guess the Three-Dimensional Shape." Place a three-dimensional solid on the overhead so that the shape of one face is displayed on the projector screen. Be sure that the students cannot see the shape on the overhead and are only able to see the screen. The students will then name the polygon whose face is seen on the screen. Have the students guess what the three-dimensional shape could be by knowing the shape of one of the faces. If students have a set of three-dimensional shapes on their desk, they can sort those that have the face shown. As different faces are shown, they can eliminate those that don't match and identify the three-dimensional shape displayed. List all of the possibilities named. Now, turn the shape so that a different face is shown on the overhead. Cross off the three-dimensional shapes that are no longer possible and place a check on the three-dimensional shapes that are still possible. If more than one shape is still possible then repeat the above process. Continue with at least three or four shapes.

Launch

Find a match. Fill an opaque bag with several three- dimensional shapes. Be sure that two of the shapes are congruent. By feeling in the bag without looking, students should try to find two identical solids. Before pulling out the two objects, have the student try to name the three- dimensional shapes. Then the students could pull out the objects to see if they are correct. If they are correct, have the student explain the similarities between the two objects. If the student is incorrect have them explain what made them choose the two objects. Also the student could explain the differences between the two shapes.

Teacher Facilitation

Explain to the students that they are going to list the similarities and differences between two shapes. Begin by drawing two-dimensional shapes on the board or overhead such as a rectangle and a parallelogram. Model by explaining and writing how the two shapes differ and what they have in common. For example, the rectangle and the parallelogram are similar because they both have four sides and they both have four angles. They are different because the rectangle is made up of all right angles and the parallelogram is made up of acute and obtuse angles.

Pass out **Compare the Pair** worksheet to the students (Student Resource 1). Each student will receive a sheet. The students could then work in pairs to complete the sheet. Before the students begin to work on the sheet, model the first two problems on the overhead (If an overhead projector is not available you may want to draw on the

chalkboard). The students should be writing with you as you model the problems. Answer key can be found on Teacher Resource 1.

Student Application

For practice and application the students will complete the worksheet, **Compare the Pair.** Before the students begin the worksheet, review the directions with the students. The students will then look at each pair of three- dimensional shapes and name at least two similarities and differences for those shapes.

Embedded Assessment

The students will then share with the rest of the class their answers to review and reflect. The class could then be checkers and either agree or disagree with the students' answers. If the majority of the class agrees with the answer, give the pair thumbs up and if the majority of the class disagrees, then thumbs down is necessary. Students need to explain why they disagree with what the pair had said.

Reteaching/Extension

- Students who have difficulty in looking at the abstract shapes on the worksheet **Compare the Pair** could take the three-dimensional solids to their seat to determine the similarities and differences between the two shapes.
- For an extension activity have the students use the back of their worksheet and pick one or two three-dimensional shapes and draw a type of building or an everyday object with those shapes.

Lesson 3

Preassessment

Play Famous Figure with the students. Place the three-dimensional solids somewhere students could easily see. Use clues to identify the famous figures.
For the triangular prism the clues can be as follows:

- I have an odd number of faces.
- I have an even number of vertices.
- Two of my faces are equilateral triangles
- What am I?

For a cylinder the clues can be as follows:

- I have a circular base.
- I do not have a vertex.
- I have a circular edge.
- Who am I?

For a cube the clues can be as follows:

- I have half as many faces as edges.
- My faces are all the same shape.
- Who am I?

For a sphere the clues can be as follows:

- I have no vertex.
- I have no edges.
- I do not have a face.
- Who am I?

Launch

Show the class pictures of real life objects. See how many three-dimensional shapes could be identified from the picture. See Student Resource2-5 and corresponding answer sheets (TR 2-5).

Teacher Facilitation

Model for the students how to build a geometric three-dimensional shape by using toothpicks and gumdrops. Explain to the students that the toothpicks will be the edges of the shape and the gumdrops will be the vertices. Now pass out the materials to the students. Be sure to supply extra gumdrops so the students could have a snack.

Student Application

Allow students approximately 20 minutes to build and describe their three-dimensional geometric shape. The students will need to write a paragraph about their created shape. They need to include in their description the proper name of their three-dimensional figure, the number of vertices, faces, and edges, and at least one polygon in their shape. The students should use math language and write in complete sentences using correct capitalization, punctuation, and grammar.

Embedded Assessment

Collect all of the students' descriptions of their three-dimensional shape. This will be graded using the attached rubric (Teacher Resource 6).

Reteaching/Extension

- If any students have difficulty when making the three- dimensional shapes have the students use the three- dimensional solids concretely to see where the vertices and edges are located.
- For an extension provide extra gumdrops and toothpicks on a side table to enable students to create an object. This object should consist of more than one three-dimensional shape.

Summative Assessment:

The summative assessment consists of five selected response questions and a brief constructed response. This assessment is formatted to be similar to the Maryland State Assessment (MSA) (Student Resource 6). The students will apply their knowledge of three-dimensional geometric shapes. This will include knowing the number of faces, vertices, and edges along with the proper name for each three-dimensional solid. Answer Key is on Teacher Resource 7.

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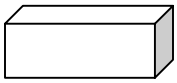
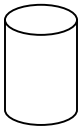
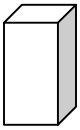
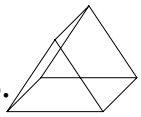
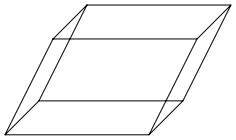
Student Resource 1

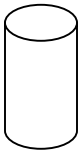
Compare the Pair

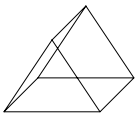
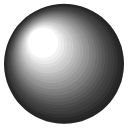
Directions: For each pair of three-dimensional shapes, state at least two ways in which the shapes are the same and at least two ways in which they are different. List as many as you can for each.

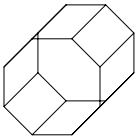
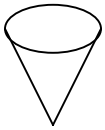
1.  Versus  Same Different

2.  Versus  Same Different

3.  Versus  Same Different

4.  Versus  Same Different

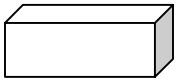
5.  Versus  Same Different

6.  Versus  Same Different

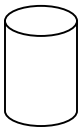
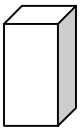
Teacher Resource 1

Compare the Pair-Answer Sheet

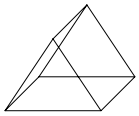
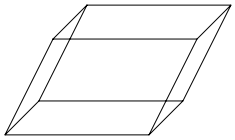
Directions: For each pair of three-dimensional shapes, state at least one way in which the shapes are the same and at least one way in which they are different. List as many as you can for each.

1.  Versus 

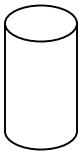
Same	Different
Number of Faces Number of Edges	Shape of Faces

2.  Versus 

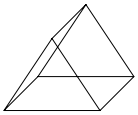
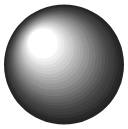
Same	Different
At least two faces	# of faces, vertices

3.  Versus 

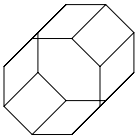
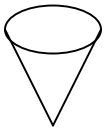
Same	Different
One face is a parallelogram	# of faces, edges vertices

4.  Versus 

Same	Different
One face is a circle	# of vertices

5.  Versus 

Same	Different
three dimensional	# of edges

6.  Versus 

Same	Different
at least one vertex	# of edges

Student Resource 2

PICTURE ONE

Teacher Resource 2

PICTURE ONE-ANSWER SHEET

CYLINDER
TRIANGULAR PRISM
RECTANGULAR PRISM

PICTURE TWO

PICTURE TWO ANSWER SHEET

HALF OF A SPHERE
RECTANGULAR PRISM
CUBE
TRIANGULAR PRISM

PICTURE THREE

PICTURE THREE-Answer Sheet

RECTANGULAR PRISM
SPHERE
CYLINDER
TRIANGULAR PRISM

PICTURE FOUR

PICTURE FOUR ANSWER SHEET

RECTANGULAR PRISM
CYLINDER

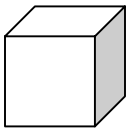
Teacher Resource 6

GUMDROP RUBRIC

Student Name: _____

CATEGORY	3	2	1	0
Grammar & spelling (conventions)	Writer makes no errors in grammar or spelling.	Writer makes 1-2 errors in grammar and/or spelling.	Writer makes 3-4 errors in grammar and/or spelling	Writer makes more than 4 errors in grammar and/or spelling.
Capitalization and Punctuation	Writer makes no errors in capitalization and punctuation.	Writer makes 1-2 errors in capitalization and punctuation.	Writer makes 3-4 errors in capitalization and punctuation.	Writer makes more than 4 errors in capitalization and punctuation.
Ideas	Ideas were expressed in a clear and organized fashion.	Ideas were expressed in a pretty clear manner, but the organization could have been better.	Ideas were somewhat organized, but were not very clear.	The paragraph seemed to be a collection of unrelated sentences.
Math Language	Includes the correct amount of vertices, edges, and faces. Names at least one polygon that is correct.	Includes the number of vertices, edges, and faces with 1-2 errors. Names at least one polygon.	Includes the number of vertices, edges, and faces with 3-4 errors. Names at least one polygon.	Information provided in the description is not correct. No polygon in named.

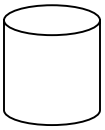
Summative Assessment

1.  How many faces are on a cube?

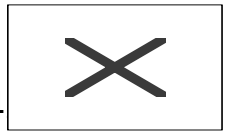
a) 8 faces
b) 4 faces
c) 12 faces
d) 6 faces

2. _____ is the term for when two faces meet on a three-dimensional solid.

a) a corner
b) an edge
c) a vertex
d) none of the above

3.  What is the correct mathematical term for this shape?

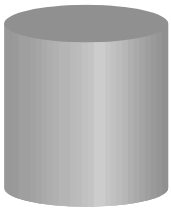
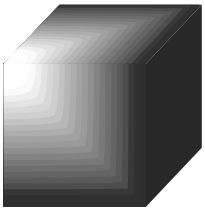
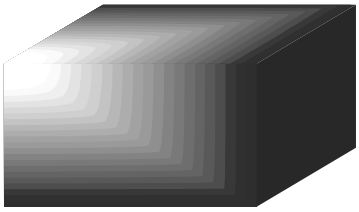
a) a cone
b) a cylinder
c) a sphere
d) a can

4  Name the different polygons that make up the faces of a pyramid.

a) a circle and a rectangle
b) a triangle and a circle
c) a rectangle and a triangle
d)a square and a circle

5. What are three attributes for a three-dimensional solid?
a) corner, side, edge
b) straight, vertex, side
c) point, edge, face
d) face, edge, vertex

6. Brief Constructed Response

_____ _____ _____

Part A
Question?
Name the three-dimensional shapes above. Which of the two shapes above have the same number of faces?

_____

Part B
Use what you know about geometric shapes to explain why your answer is correct. Use number and/or words in your explanation.

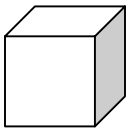
_____
_____
_____
_____
_____

MSA Brief Constructed Response "Kid Speak" Mathematics Rubric

Grades 1 through 8

Score	
2	**My answer shows I completely understood the problem and how to solve it:** • **I used a very good, complete strategy to correctly solve the problem.** • **I used my best math vocabulary to clearly explain what I did to solve the problem. My explanation was complete, well organized and logical.** • **I applied what I know about math to correctly solve the problem.** • **I used numbers, words, symbols or pictures (or a combination of them) to show how I solved the problem.**
1	**My answer shows I understood most of the problem and how to solve it:** • **I used a strategy to find a solution that was partly correct.** • **I used some math vocabulary and most of my reasons were correct to explain how I solved the problem. My explanation needed to be more complete, well organized or logical.** • **I partly applied what I know about math to solve the problem.** • **I tried to use numbers, words, symbols or pictures (or a combination of them) to show how I got my answer, but these may not have been completely correct.**
0	**My answer shows I didn't understand the problem and how to solve it:** • **I wasn't able to use a good strategy to solve the problem.** • **My strategy wasn't related to what was asked.** • **I didn't apply what I know about math to solve the problem.** • **I left the answer blank.**

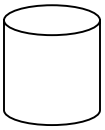
Summative Assessment-Answer Sheet

1.  How many faces are on a cube?

a) 8 faces ANSWER D
b) 4 faces
c) 12 faces
d) 6 faces

3. _____ is the term for when two faces meet on a three-dimensional solid.

a) a corner ANSWER B
b) an edge
c) a vertex
d) none of the above

3.  What is the correct mathematical term for this shape?

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b) a cylinder
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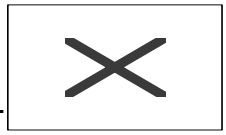
4  Name the different polygons that make up the faces of a pyramid.

a) a circle and a rectangle ANSWER C
b) a triangle and a circle
c) a rectangle and a triangle
d)a square and a circle

5. What are three attributes for a three-dimensional solid?

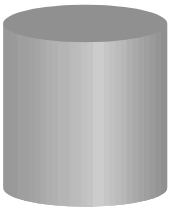
a) corner, side, edge ANSWER D

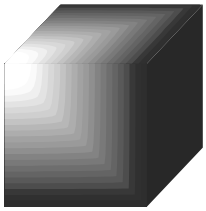
b) straight, vertex, side

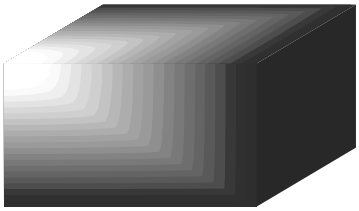
c) point, edge, face

d) face, edge, vertex

6. Brief Constructed Response







__CYLINDER_____ __CUBE_____ RECTANGULAR PRISM_____

Part A

Question?

Name the three-dimensional shapes above. Which of the two shapes above have the same number of faces?

_THE CUBE AND THE RECTANGULAR PRISM

_____

Part B

Use what you know about geometric shapes to explain why your answer is correct. Use number and/or words in your explanation.

I chose the cube and the rectangular prism because they both have 6 faces. A face is the flat surface on the outside of the shape. I did not choose the cylinder because it only has two faces.