

Geometric Treats

Big Ideas

Unit of Instruction

Trick or Treat Geometry (Original Idea from LaRon Smith. Used with permission)*

Using commonly available candy or treats, the student will correctly identify, define, draw, and shade the geometric form. The student will also speculate on the reason the form was chosen for the candy, related words, and other examples of objects that also have the same general shape. They will present this to the teacher for a grade. Afterwards the students will ingest their new knowledge by eating it!

Geometry Concept

Geometric forms/polyhedra identification, classification, and relations

Rationale

This is a fun activity that introduces students to the concept of two-dimensional geometric shapes and three-dimensional geometric forms. Students enjoy the process of analyzing different shapes and forms and gain concrete knowledge by drawing them. The project is both fun and informational.

NCTM 9-12 Standards

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Use visualization, spatial reasoning, and geometric modeling to solve problems.
- Select and use various types of reasoning and methods of proof.
- Build new mathematical knowledge through problem solving.
- Solve problems that arise in mathematics and in other contexts.
- Recognize and apply mathematics in contexts outside of mathematics.

Idaho Content Standards

- G.4.1.1 Analyze properties and determine attributes of two- and three-dimensional objects.
- G.4.1.2 Explore congruence and similarity among classes to two-dimensional objects and solve problems involving them.
- 9-12.VA.3.1.1 Select and apply media, techniques, and processes effectively and with artistic intention.
- 9-12.VA.3.1.4 Present convincing or accurately rendered subjects that demonstrate refined observational skills.

Background	
Vocabulary	
Cones	Prismatoidal Polyhedra
Cylinders	Shape
Disc	Spheres
Form	Torus
Frustra	Truncated Prism
Parabaloid	Vanishing Point
Perspective	
Math Instruction (pre- or post-project)	
<p>Students should already be familiar with the following terms: cylinders, pyramids, cones, and spheres.</p> <p>The students should also be familiar with value and how to draw and shade geometric forms. A short review of 2-D/3-D shapes and forms is provided, see page 13.</p>	

Driving Question
Project Objective
<p>Using candy or other treats, the student will correctly identify, classify, define, draw and shade the geometric form. The student will also speculate on the reason the form was chosen for the candy, any related words, and any other examples of objects that also have the same general shape.</p>
Questions to be Answered
<p>How can polyhedra be classified from general to specific?</p> <p>What is a frustum?</p> <p>How can frustra be applied to polyhedra?</p> <p>Can frustra be applied to non-polyhedra forms?</p> <p>In what ways? Are there limits?</p> <p>What is truncation?</p> <p>How can truncation be applied to polyhedra?</p> <p>Can truncation be applied to non-polyhedra forms?</p> <p>In what ways? Are there limits?</p> <p>Can rules of classification be applied to non-polyhedra forms?</p> <p>Do the non-polyhedra forms have to be regular?</p> <p>How does it relate to axis of symmetry?</p> <p>What is the difference between a shape and a form?</p>

Materials

Materials Required

- Handout: prismatic polyhedra (see page 10).
- Handout: geometric treat student worksheet (see page 11).
- Example of geometric treat student worksheet completed to hang on wall (see page 12).
- Small paper bags to hold the treats (one for each student)
- Candy treats (students sign up to bring these)
- Drawing paper and pencils for drawing 3-D forms

Reference Materials

Mathematics Dictionary
Mathematics Encyclopedia

Lesson Outline

Description of Activity

Introduction: Day One

Introduce homework assignment, due date, and give student worksheet
Discuss handout
Pass around sign up sheet for treats

Student Presentation: Day Two

Hand out paper sacks to each student as they enter the class
Students distribute treats
Students in groups classify geometric forms of candy
Student presentation
Students eat the treats

Day One

Introduction 20-50 minutes

- Introduce the homework assignment and due date.
- Next discuss geometric forms. If students have not already done so, have them draw 2-D and 3D shapes and forms, using proper shading on 3-D forms.
- Give the handout on prismatic polyhedra, page 10, with a brief explanation.
- Finally, have students sign up for treats, see pages 8-9. Each student will bring one of their treats for each person in the classroom. Caution students not to lose the handout as they will be using it again later.

Day Two

Student Presentation: 45 minutes

- As each student comes through the door, hand them a paper sack to place at their desk.
- Have each student place one of their treats into each paper sack.
- In partners or small groups, have students list each kind of candy in their sacks.
- Using their prismatoidal polyhedra handout, have each student identify the geometric form of each candy in its most specific form. List answers next to candy names.
- Then have each student stand up and present their Geometric Treat Student Worksheet. The students may make corrections of their candy lists.
- The teacher will collect the Geometric Treat Student Worksheet to grade.
- Finally, have the students ingest their knowledge (eat the treats)!

Assessment

Rubric

Set up a direct point value for each portion of the student worksheet worth a total of 35 points (with a possibility of six points extra credit):

- 1 point – name
- 1 points – date
- 1 points – name of geometric treat
- 3 points – geometric form
- 3 points – definition
- 3 points – brought treat for everyone on due date
- 6 points – accurately drawn in 3-D
- 2 points – shaded correctly
- 6 points – Cross section drawing
- 3 points – Why the shape was chosen
- 3 points – Related words
- 3 points – Other examples
- 35 points Total

Ideas for Further Independent Student Project

Students could construct the geometric form out of cardboard on a larger scale.

Students could create large scale drawings of geometric shapes with proper shading.

Students could create a poster of hand-drawn candies, labeled with geometric shapes.

Students could calculate the surface area and volume of the treat.

Students could theorize on possible wrapping ideas.

Students could suggest other forms that would appear to give the same or greater volume when actually using less material. Then students could discuss other cost and marketing factors that may make the new form more or less desirable. As a further extension they could submit their findings to the candy company for their review.

Knowledge and research could be applied to cereal shapes.

An understanding of geometric forms could be applied to aerodynamics and spy planes.

Treats Geometric Form (Teacher Resource)

Andes Mint	Prismoid
Bonkers	Rectangular prism
Carmello	Rectangular prism & square pyramidal frustum
Candy Nickel	Cylinder, disc
Carmel	Cube
Cupcake	Concave 40-agonal frustum
Chocolate Kiss	Cone
Dots	Parabaloids
Donut	Ring of Torus
Dixie Cup	Circular frustum
Good & Plenty	Cylindresphere
Gum drop	Parabaloid
ICE candy	Prismoid or spherical cap
Ice cream cone	Cone
Jaw breaker	Sphere
Kit Kat	Prismoid
Laffy Taffy	Square Prism
Life Savers	Ring of Archimedes or Torus
Malted milk ball	Sphere
M&M candy	Ellipsoid
Muffin	Circular frustum
Necco Wafer	Cylinder, disc
Pizza	Cylinder
Pizza slice	Sector
Pringles chip	Hyperbolic parabaloid
Reese's cup	Concave 40-agonal frustum
Rolo candies	Circular frustum
Snickers	Prism
Stick of gum	Rectangular prism
Sugar cookie	Cylinder or disc
Sunburst candy	Square prism
Tootsie Roll	Cylinder
Wax lips	Lipzoids

Treats Sign Up Sheets

Andes Mints	<hr/>
Bonkers	<hr/>
Carmello	<hr/>
Candy Nickels	<hr/>
Carmel	<hr/>
Cupcakes	<hr/>
Chocolate Kisses	<hr/>
Dots	<hr/>
Donuts	<hr/>
Dixie Cup	<hr/>
Good & Plenty	<hr/>
Gum Drops	<hr/>
ICE candy	<hr/>
Ice cream Cone	<hr/>
Jaw Breaker	<hr/>
Kit Kat	<hr/>
Laffy Taffy	<hr/>
Life Savers	<hr/>
Malted Milk Balls	<hr/>
M&M candy	<hr/>
Muffins	<hr/>
Necco	<hr/>

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Treats Sign Up Sheets (continued)

Pizza	_____
Pizza pieces	_____
Pringles Chips	_____
Reese's Cups	_____
Rolo candies	_____
Snickers	_____
Stick of Gum	_____
Sugar Cookie	_____
Starburst candy	_____
Tootsie Roll	_____
Wax Lips	_____

PRISMATOIDAL POLYHEDRA

Properties of each classification

Prismatoid: The bases of a prismatoid are polygons in parallel planes, and all of the vertices of the prismatoid lie in one or the other of these two planes. The lateral faces are triangles, trapezoids, or parallelograms.

Prismoid: A prismatoid whose bases are polygons having the same number of sides. The lateral faces are trapezoids or parallelograms.

Frustum: A special prismoid formed between the base of a pyramid and a plane parallel to that base. The lateral faces are often isosceles trapezoids, and the bases are often regular polygons.

Prism: A prismoid whose bases are congruent polygons. Lateral faces are parallelograms. Right prisms have bases perpendicular to the lateral edges. Lateral faces of a right prism are rectangles. Oblique prisms have bases that are NOT perpendicular to the lateral edges. The lateral faces are parallelograms.

Parallelepiped: A prism whose bases are parallelograms. (All six faces are parallelograms.)

Rectangular Prism: A parallelepiped whose bases are rectangles.

Right Rectangular Prism: A rectangular prism whose bases are perpendicular to the lateral edges. All six faces are rectangles. (Also called a rectangular solid or a rectangular parallelepiped.)

Cube: A right rectangular prism whose six faces are squares.

Related Solids

Truncated Prism: That portion of a prism lying between two nonparallel planes which cut the prism and have their line of intersection outside the prism. The lateral faces may be trapezoids as well as parallelograms

Right Truncated Prism: A truncated prism in which one of the two nonparallel planes is perpendicular to a lateral edge. The lateral faces are either rectangles or right trapezoids.

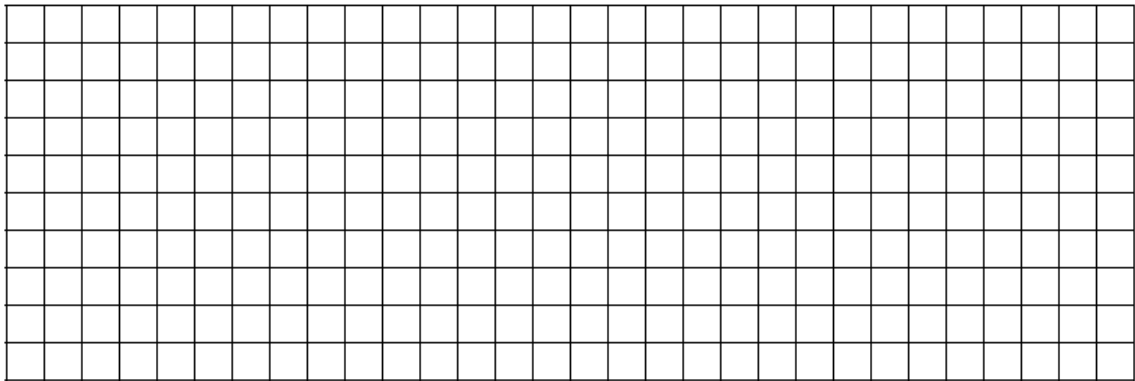
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GEOMETRIC TREAT _____

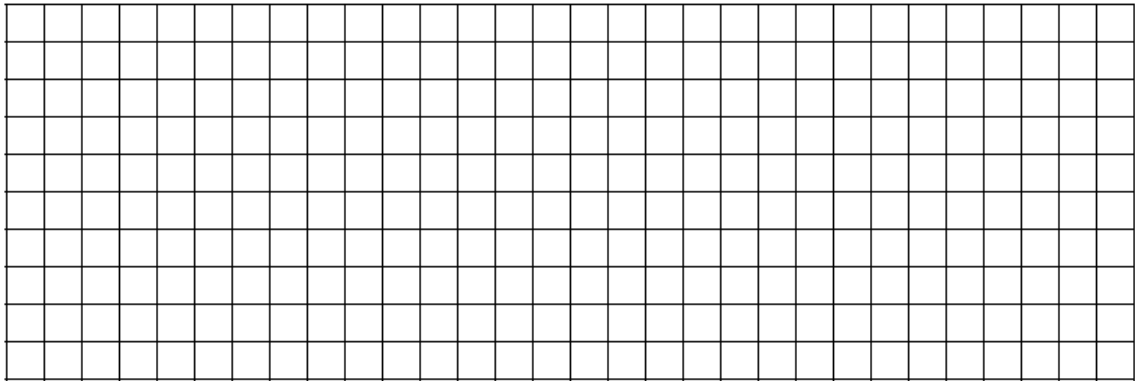
Geometric Shape _____

Definition: _____

Three Dimensional Drawing:



Cross Section or Graph Drawing:



Why was this shape chosen for this object: _____?

Related words that are similar (from Thesaurus) _____

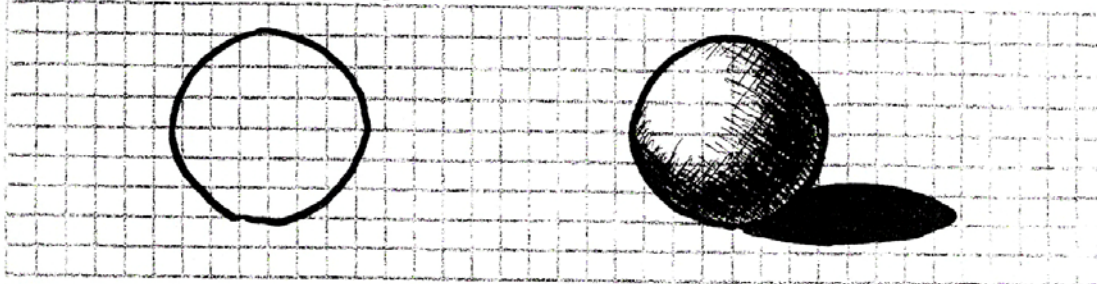
Examples of objects that also have this same general shape: _____

GEOMETRIC TREAT Gum Ball

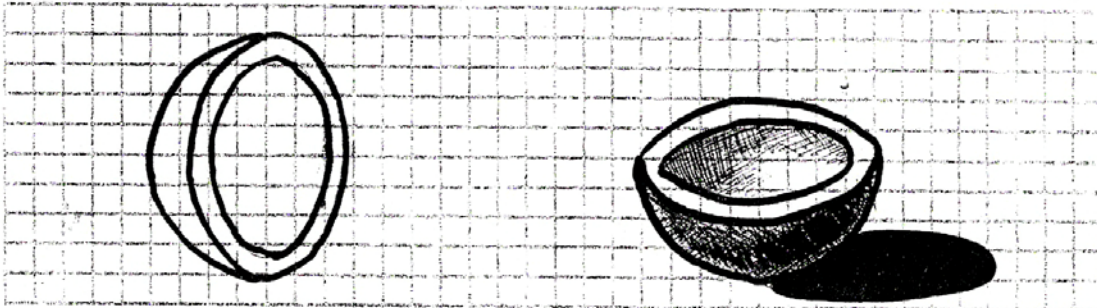
Geometric Shape Sphere

Definition The locus of points in space having a given fixed distance from a given point

Three Dimensional Drawing



Cross Section or Graph Drawings



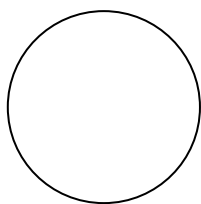
Why was this shape chosen for this object? easy to produce in large quantities, consumer feels he is getting more because of the larger size thus increases of sales

Related words that are similar. (from Thesaurus) spherical, ball, globe, orb, ampullaceous

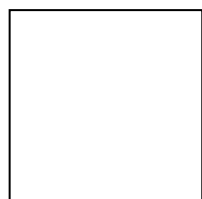
Examples of objects that also have this same general shape cannon ball, golf ball, baseball, celestial body, fish bowl, eyeball, ball-and-socket joints

BASIC STEPS TO DRAWING GEOMETRIC FORMS

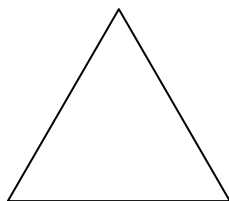
2-Dimensional Shapes



Circle



Square



Triangle

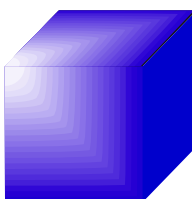


Rectangle

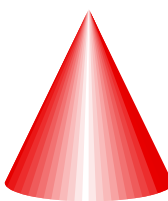
3-Dimensional Forms



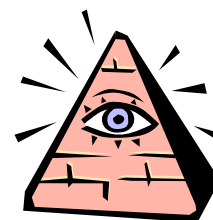
Sphere



Cube



Cone



Pyramid



Cylinder

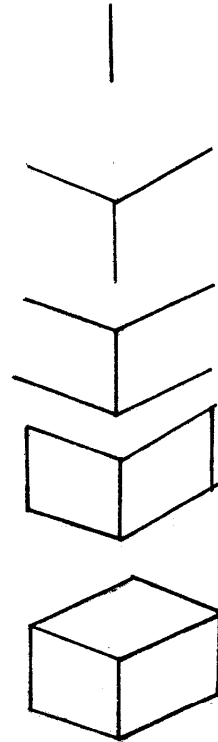


Slab

FORM DRAWING

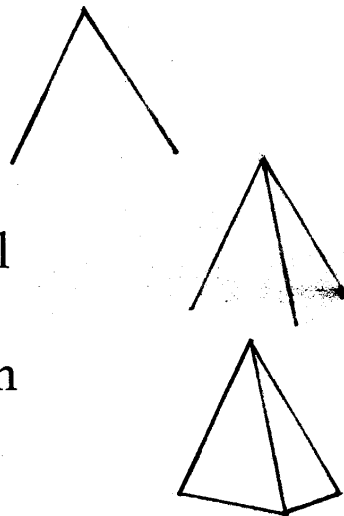
RECTANGULAR PRISM

1. Vertical line
2. "V" shape on top
3. "V" shape on bottom
4. Two vertical lines for sides
5. Inverted "V" shape On top



PYRAMID

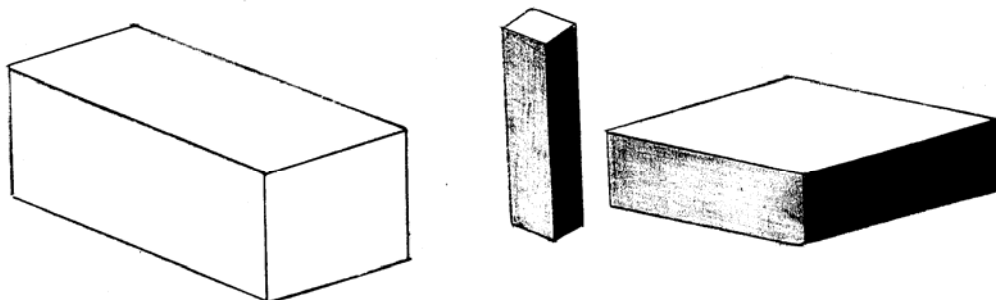
1. Inverted "V" shape
2. Longer interior diagonal
3. Connect the bottom with Straight lines



VALUE FORMS (Shading)

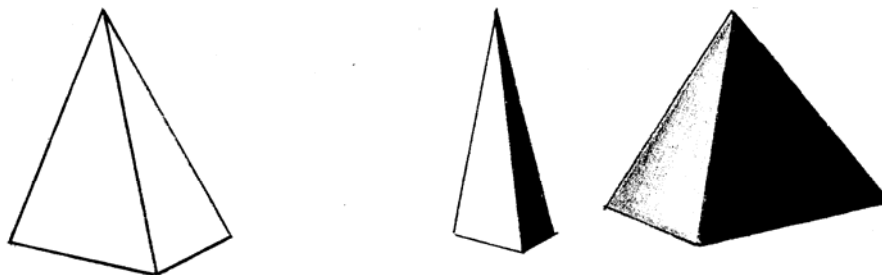
RECTANGULAR PRISM

Has three values: a light side (nearest the light source), a medium side, and a dark side



PYRAMID

Has two values: a lighter side and a darker side



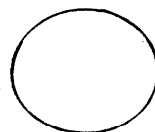
CONE

1. Inverted "V" shape
2. Flat smile along bottom
(No straight bottoms)



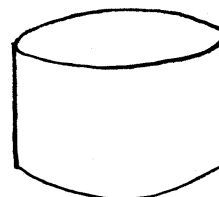
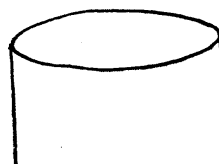
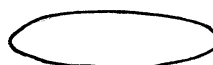
SPHERE

1. Draw a circle



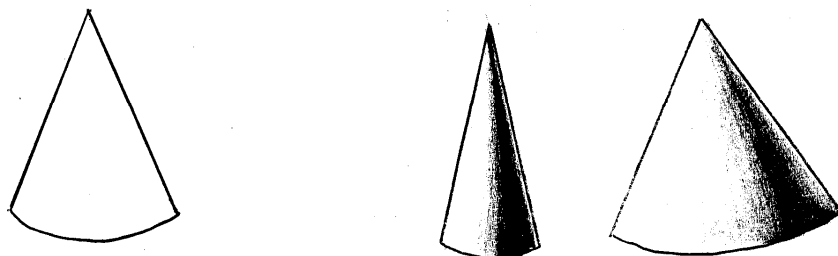
CYLINDER

1. Flat oval for top
2. Two vertical lines
(The same length)
3. Flat smile along bottom
(No straight bottoms)



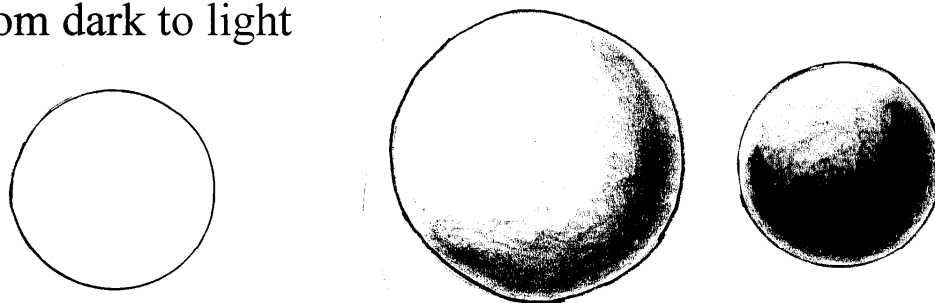
CONE

Has a value gradation in triangular shapes from dark to light



SPHERE

Has a value gradation in crescent or “C” shapes from dark to light



CYLINDER

Has a value gradation from dark to light

