Let's Get in Shape

Brief Overview:

In this unit, students will explore geometric solids. Using various hands-on activities, class discussions, literature & art, students will identify the properties of solid geometric figures and analyze the relationship between plane and solid figure surfaces. Students will learn how to identify solid shapes, describe the figures using their attributes, and relate plane figures to the surfaces of solid figures.

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 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

Grade/Level:

Grades 4 – 5

Duration/Length:

Three lessons -- 60 minutes per lesson

Student Outcomes:

Students will:

- Apply the properties of one-, two-, or three-dimensional geometric figures to describe, reason, or solve problems about shape, size, position, or motion of objects;
- Analyze the properties of solid geometric figures;
- Analyze the relationship between plane geometric figures and surfaces of solid geometric figures;
- Identify cones, cylinders, prisms, and pyramids;
- Describe solid geometric figures by the number of edges, faces, or vertices;
- Compare a plane figure to surfaces of solid geometric figure.

Materials and Resources:

Lesson 1

- Captain Invincible and the Space Shapes by Stuart J. Murphy
- What is my name worksheet (Student Resource 1)
- What is my name worksheet (Teacher Resource 1)
- Student Manipulative Solid Figures
- Name that Solid (Student Resource 2)
- 12 x 15 in. white construction paper

Lesson 2

- Tissue box (rectangular prism)
- Poly Constructo Blocks
- Plane Figures worksheet (Student Resource 3)
- Plane Figures worksheet (Teacher Resource 2)
- Geometric faces, edges, vertices worksheet (Student Resource 4)
- Geometric faces, edges, vertices (Teacher Resource 3)
- Geometric faces, edges, vertices worksheet (Student Resource 5)
- Geometric faces, edges, vertices (Teacher Resource 4)
- Brief Construct Response (Student Resource 6)
- Sample Brief Constructed Response (Teacher Resource 5)

Lesson 3

- Pictures of paintings by Wassily Kandinsky -- can be printed from internet
- Name that Plane Worksheet (Student Resources 7)
- Student Manipulative Solid Figures
- Relating Solid and Plane Figures Teacher Worksheet (Teacher Resource 6)
- Relating Solid and Plane Figures Teacher Worksheet (Student Resource 8)
- Netting Solids Teacher Worksheet (Teacher Resource 7)
- Netting Solids Worksheet (Student Resource 9-12)
- Tissue Boxes (rectangular prisms)
- Drawing paper

Development/Procedures:

Lesson 1

Pre-assessment

Students will receive a worksheet asking them to identify the solid geometric shapes (Student Resource 1.) The answers can be found on Teacher Resource 1.

Launch

- Conduct an interactive read aloud of Captain Invincible and the Space Shapes by Stuart J. Murphy introducing students to vocabulary terms and various representations of solid geometric figures.
- Assess student dialog informally based on math-related summation of the events in the selection.

Teacher Facilitation

- Introduce cones, cylinders, prisms and pyramids by visually representing them on a smart board.
- Match the corresponding name of each solid geometric figure with its visual representation on the smart board.
- Highlight and differentiate the various types of pyramids and prisms by defining the key attributes of each (cube, rectangular prism, triangular prism, square pyramid, rectangular pyramid, cone, sphere)

Student Application

- Students will listen to the classical music selection entitled Moonlight Sonata Movement #3 by Beethoven for five minutes as they scour the classroom in order to bring back one example of each solid figure (cube, rectangular prism, triangular prism, square pyramid, rectangular pyramid, cone, sphere) which you have strategically placed throughout the classroom prior to the lesson.
- Students will make their way back to their classroom group assignments and use masking tape in order to label and differentiate the solid figures that they were able to retrieve throughout the classroom.
- Using whole group teacher facilitation, students will hold up their individual solid figures as they are correctly identified by the teacher, which will enable them to assess the accuracy of their own responses.

Embedded Assessment

Assess the students' mastery of solid geometric figure identification through the completion of Student Resource 2.

Reteaching/Extension

Students will use 12 x 15 in. white construction paper to sketch their own examples of a cube, rectangular prism, triangular prism, square pyramid, rectangular pyramid, cone, and sphere

Lesson 2

Pre-assessment

Students will receive a worksheet requiring them to name plane figures and identify the number of corners and sides each has Student Resource 3) . The answers can be found on Teacher Resource 2.

Launch

- Students will recognize their bent elbow as their "vertex," their rib cage as their "edge," and their back as their "face."
- Once students are aware of the aforementioned terms (vertex = bent elbow, edge=rib cage, face= back) they will participate in a teacher led game of "Simon Says".
- In relation to their bodies, only the terms vertex, edge and face will be used in commands given by "Simon".

Teacher Facilitation

- Introduce and define the terms vertex, edge, and face using a tissue box in the shape of a rectangular prism as a point of reference.
- In whole group with teacher facilitation, students will use Poly Constructo Blocks to create a rectangular prism with their groups. Subsequent to the completion of the solid geometric figures, students will complete a data table in which they will correctly identify the faces, vertices and edges of their corresponding created rectangular prism (Student Resource 4). The answers can be found on Teacher Resource 3.

Student Application

- Students will use Poly Constructo Blocks in order to assemble a triangular prism, triangular pyramid and rectangular pyramid.
- Upon completion of the aforementioned solid geometric figures, students will use blue tape to label each vertex, red tape to label each face, and black tape to label each edge.
- Students are then required to complete a data table noting the accurate number of vertices, edges and faces of their created solid geometric figures (Student Resource 5).
- Using whole group teacher facilitation, students will assess the accuracy of their data tables as they are correctly defined by the teacher. The answers can be found on Teacher Resource 4.

Embedded Assessment

The teacher will assess the students' understanding of the terms edges, faces and vertices through the completion of a brief constructed response (Student Resource 6). The answers can be found on Teacher Resource 5.

Reteaching/Extension

- Students that have shown mastery of the lesson skills will work individually with the Poly Constructo Blocks in order to create and label the faces,

vertices, and edges for solid geometric figures other than those that have been previously identified in class.

- Students that exhibit difficulty with mastery of the lesson's skills will work in a small group where they may participate in activities that reinforce the skill of identifying edges, faces and vertices..They will correctly label the geometric figures using the white board..

Lesson 3

Pre-assessment

Each student will receive a plane shape worksheet, (Student Resource 7) which has pictures of various shapes to identify. Additional discussion questions ask the student to identify the sides and angles of each shape. The discussion will be used to informally assess student knowledge of various shapes.

Launch

- Show students paintings by Wassily Kandinsky.
- Give teams of three or four students a painting and have students work together to identify the various geometric shapes found in the painting.
- Groups will present to the class giving a description of the shapes, color schemes, and mood of their painting.

Teacher Facilitation

- Review key vocabulary (line, side, angle, vertex)
- Explain how the plane figures form the surface or base of 3-D shapes.
- Define 3-D or solid using length, width and height as compared to 2-D or plane shapes having only length and width..
- Display several plane shapes and solid figures that use that shape as their surface (e.g. square – cube, pyramid).
- Provide each team with several geometric solids.
- Model tracing the surface of the shape using Teacher Resource 6.
- Distribute Relating Solid and Plane Figures Worksheet (Student Resource 8).
- Give students the Netting Solids Worksheet (Student Resources 9-12). Each team of 3 or 4 should be given a different net. Worksheets may be enlarged and reproduced onto 11 x 14 (legal sized) paper.
- Model how to label the shape (plane figures, edges, sides, vertices). Then cut out the net, and construct the solid figure using Teacher Resource 7.

Student Application

- Record the names of plane shapes and geometric solids on the Relating Solid and Plane Figures Worksheet.
- Trace the faces of the each solid displaying the related plane shape

- Label the plane shape created by each segment of the net.
- Cut the net from the worksheet
- Create the geometric solid using the net.
- If time permits, teams will report the properties of each solid created.

Embedded Assessment

The teacher will informally assess the students' understanding and progression towards mastery through observation during group discussion, student application, and successful completion of net assignment.

Reteaching/Extension

- Students that have shown difficulty mastering the lesson's concepts will meet in a small group with the teacher. Key vocabulary will be reviewed using Student Resource 7. Student will deconstruct (tear apart) solids found in everyday life to reveal the net pattern. (Ex. Tissue box, cereal box)
- Students who have understood the lesson students will apply what they have learned in previous lessons to design their own art. Student may use the Kandinsky's style of art and their own creativity to reflect their understanding of plane shapes.

Summative Assessment:

Students will take an assessment (Student Resource 13) consisting of five open ended questions and one brief constructed response. The questions will cover the following concepts: identifying solid figures, describing solid figures, and relating plane figures to solid figures. The assessment will be used to measure student mastery of the covered concepts and skills. See Teacher Resource 8 for assessment answers.

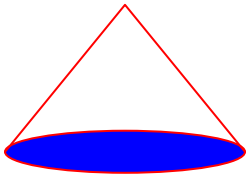
Authors:

Samaria Jackson
North Forestville Elementary School
Prince George's County Public Schools

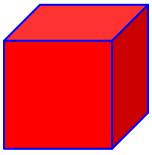
Marcus D. Lampkin
Magnolia Elementary School
Prince George's County Public Schools

What is my name ?

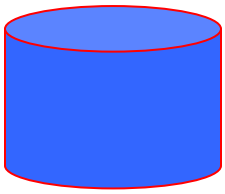
1. figure name: cone



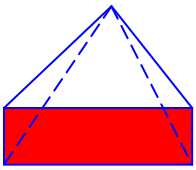
2. figure name: cube



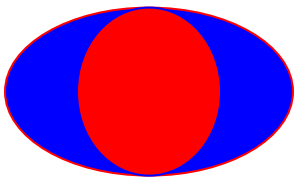
3. figure name: cylinder



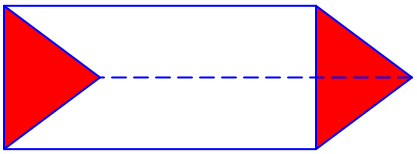
4. figure name: rectangular pyramid



5. figure name: sphere

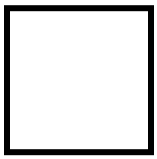


6. figure name: triangular prism



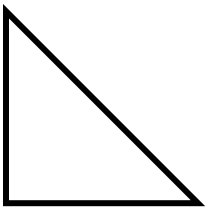
Plane Figures

Directions: Record the correct number of corners and sides for each plane figure on the lines below.

1. 

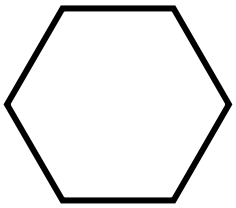
Corners: four

Sides: four

2. 

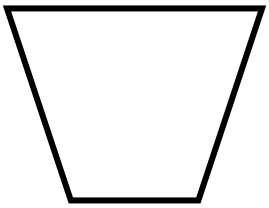
Corners: three

Sides: three

3. 

Corners: six

Sides: six

4. 

Corners: four

Sides: four

Geometric faces, edges & vertices

SOLID FIGURE NAME	NUMBER OF FACES	NUMBER OF EDGES	NUMBER OF VERTICES
Rectangular Prism	6	12	8

Geometric faces, edges & vertices

SOLID FIGURE NAME	NUMBER OF FACES	NUMBER OF EDGES	NUMBER VERTICES
Triangular Pyramid	4	6	4
Triangular Prism	5	9	6
Rectangular Pyramid	5	8	5

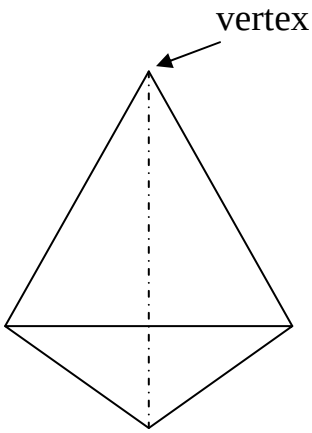
Brief Constructed Response

Part (A) Which geometric figure has more vertices, a square pyramid or triangular pyramid?

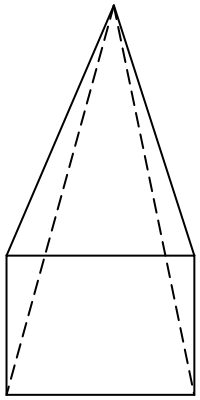
square pyramid

Part (B) Justify your response.

A triangular pyramid only has (4) vertices. However, a square pyramid has (5) vertices. This is because the bottom face of the square pyramid has more vertices than the bottom face of the triangular pyramid.

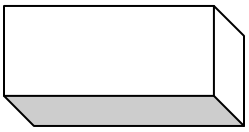


Triangular Pyramid



Square Pyramid

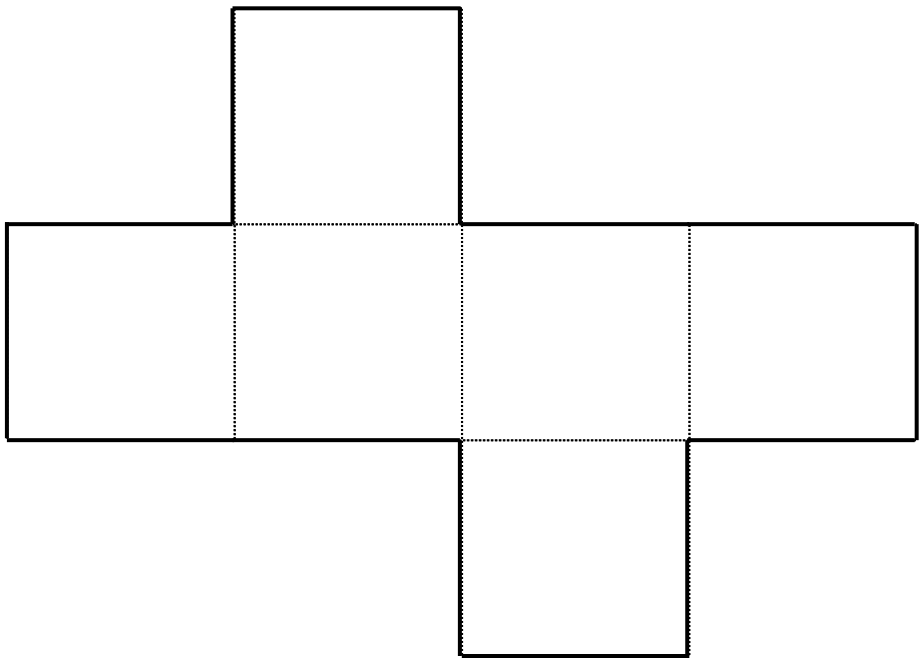
Relating Solid and Plane Figures

Solid	**Surface**	**Surface**
rectangular prism 		

Name_____ Date_____

Subject _____ Mod_____

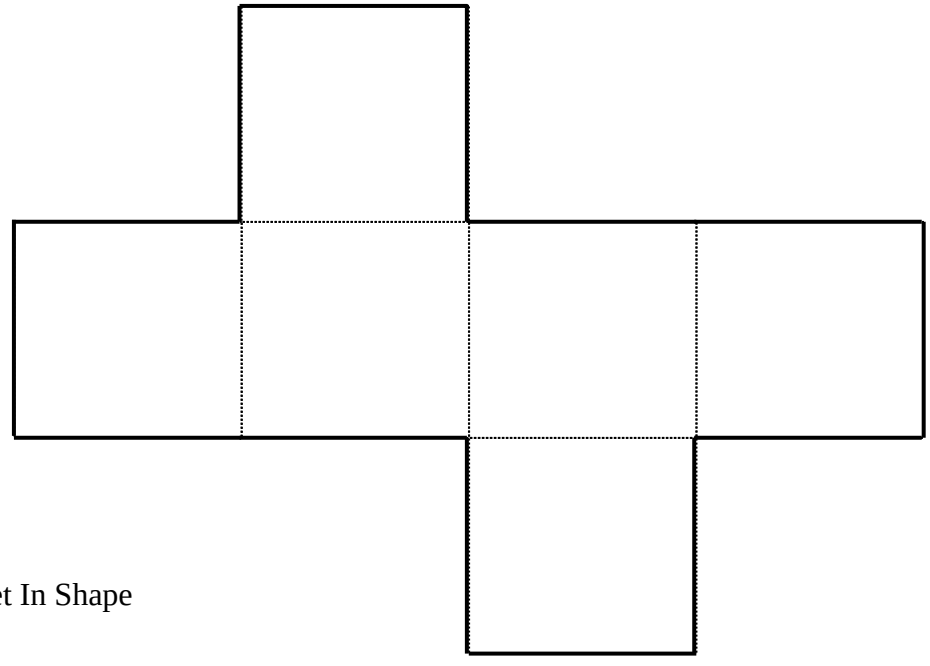
Netting Solid



Which solid will this net create? _____

Find the faces, edges, and vertices of the shape and label them. Label each plane shape.

Cut out the shape along the bolded lines. Then fold the net along the pale black line to create a solid shape.

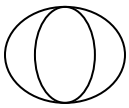
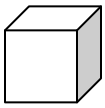


Name_____ Date_____

Subject _____ Mod_____

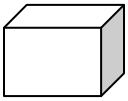
Let's Get in Shape
Unit Assessment – Answer Key

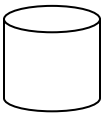
1. **Name each solid shape found below.**

a.  **b.**  **c.** 

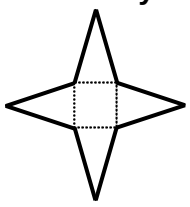
cone **sphere** **cube**

2. **Identify the number of sides, vertices, and edges for each shape below.**

a.  **sides ___6_____, vertices ___12_____, edges ___8____**

b.  **sides ___0_____, vertices ____0____, edges ____0____**

3. **Identify the solid shape that can be created by the net found below.**



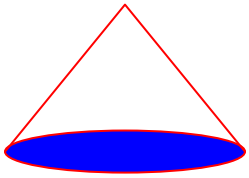
___square pyramid_____

Use what you know about the relationship of plane figures to geometric solids to explain your answer.

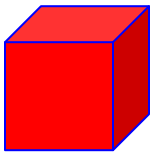
The net has four triangle surfaces and one square surface. I know that pyramids have triangle surfaces. So, I know it is a pyramid. The pyramid has a square base,so I know it is a square pyramid.

What is my name ?

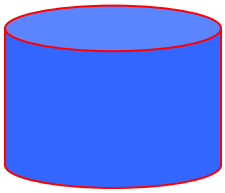
1. figure name: _____



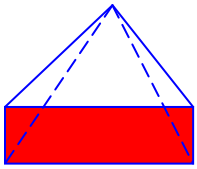
2.figure name: _____



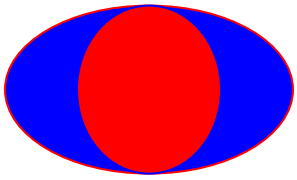
3. figure name: _____



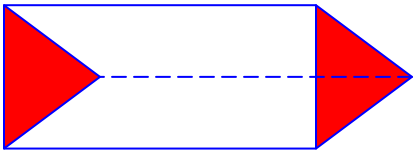
4. figure name: _____



5. figure name: _____



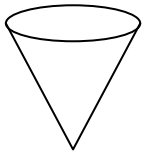
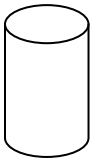
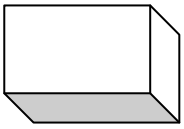
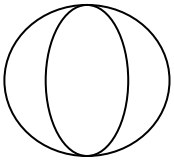
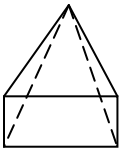
6. figure name: _____



Name_____ **Date** _____
Subject_____ **Mod**_____

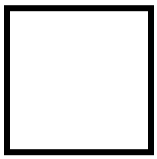
Name that Solid

Look at the picture of the solid in column one. Write its name in column two. Then draw a picture of an object you find in everyday life that has the same shape.

Solid	Name	Everyday Object
		
		
		
		
		

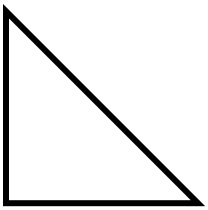
Plane Figures

Directions: Record the correct number of corners and sides for each plane figure on the lines below.

1. 

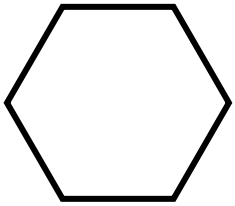
Corners: _____

Sides: _____

2. 

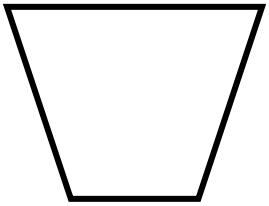
Corners: _____

Sides: _____

3. 

Corners: _____

Sides: _____

4. 

Corners: _____

Sides: _____

Geometric faces, edges & vertices

SOLID FIGURE NAME	NUMBER OF FACES	NUMBER OF EDGES	NUMBER OF VERTICES

Geometric faces, edges & vertices

SOLID FIGURE NAME	NUMBER OF FACES	NUMBER OF EDGES	NUMBER OF VERTICES
Triangular Pyramid			
Triangular Prism			
Rectangular Pyramid			

Brief Constructed Response

Part (A) Which geometric figure has more vertices, a rectangular pyramid or triangular pyramid?

_____

Part (B) Justify your response.

_____

_____

_____

_____

_____

_____

_____

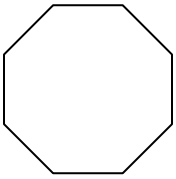
Name_____ Date_____

Subject _____ Mod_____

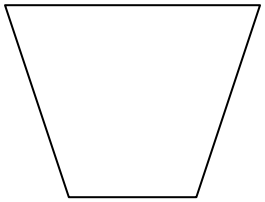
Name the Plane

Directions: Write the name of the shape pictured on the line provided. Think about the attributes of the shapes to prepare for class discussion.

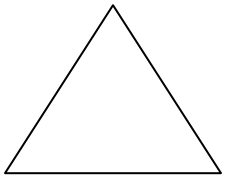
Shape



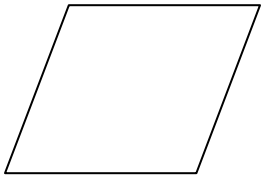
_____



_____



_____

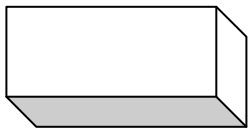
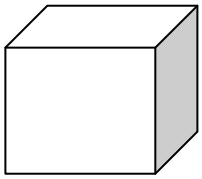
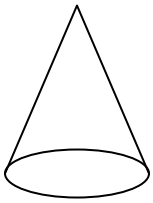
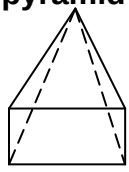
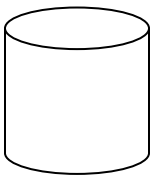


_____

Name_____ Date_____

Subject _____ Mod_____

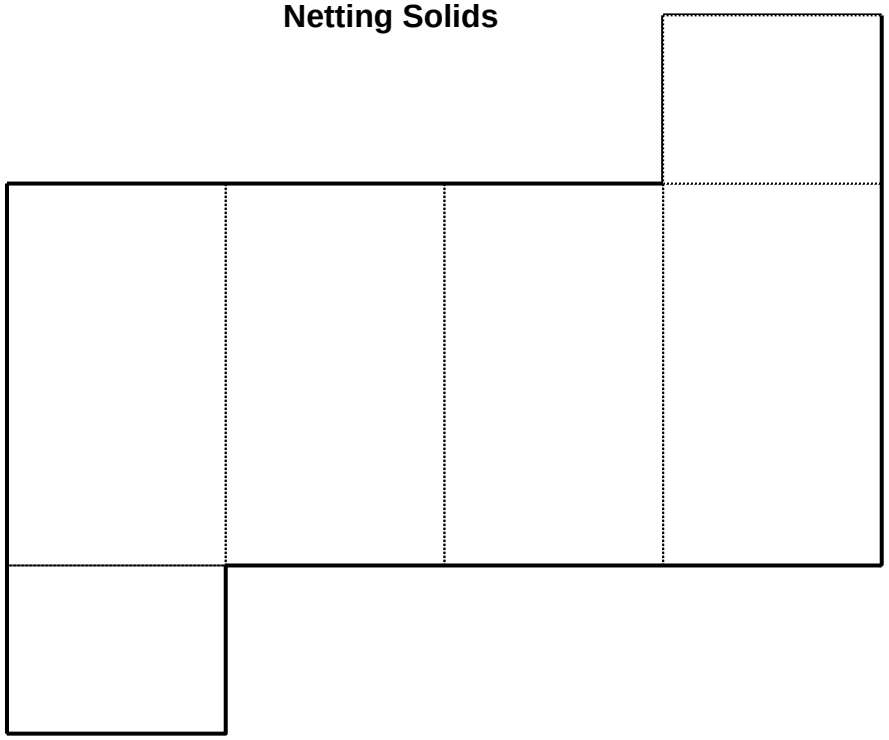
Relating Solid and Plane Figures

Solid	Surface	Surface
rectangular prism 		
cube 		
cone 		
square pyramid 		
cylinder 		

Name_____ Date_____

Subject _____ Mod_____

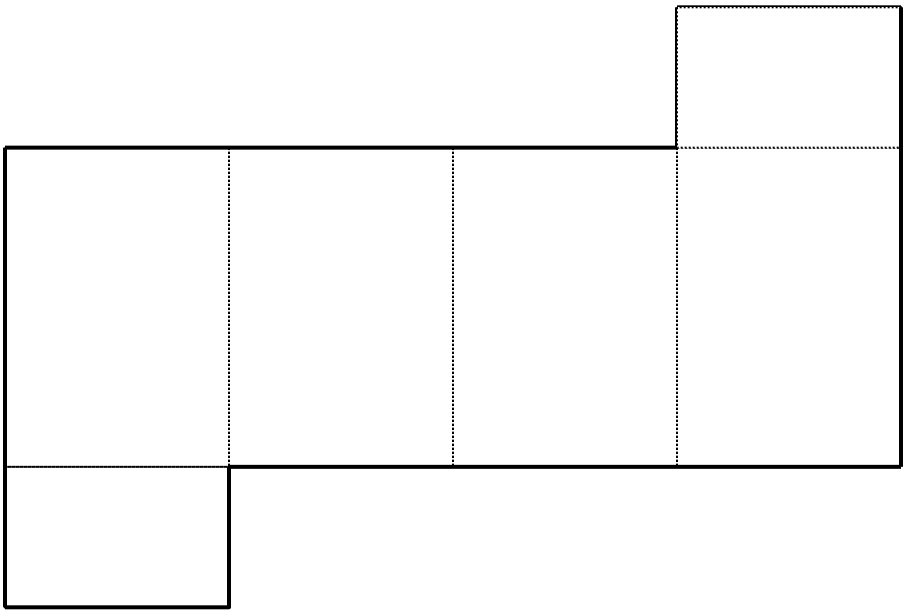
Netting Solids



Which solid will this net create? _____

Find the faces, edges, and vertices of the shape and label them. Label each plane shape.

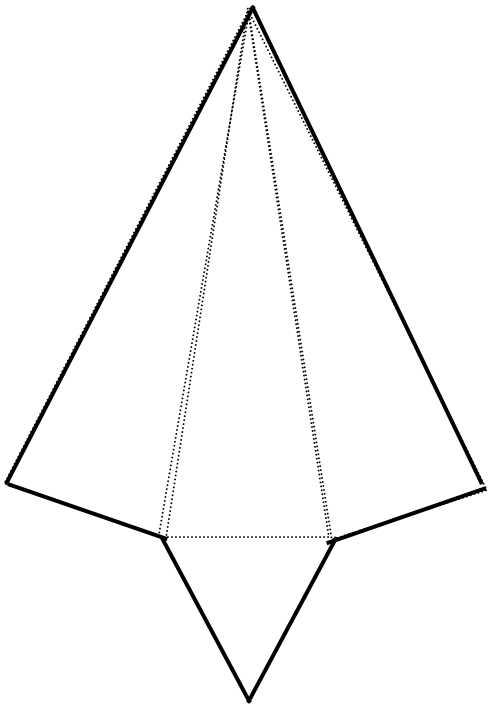
Cut out the shape along the bolded lines. Then fold the net along the pale black line to create a solid shape.



Name_____ Date_____

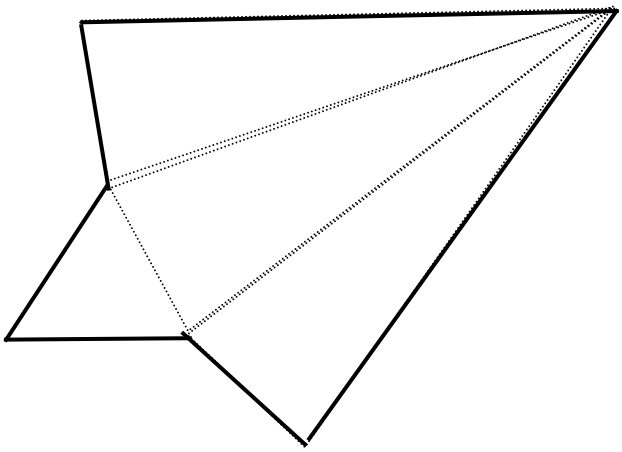
Subject _____ Mod_____

Netting Solids



Which solid will this net create? _____
Find the faces, edges, and vertices of the shape and label them. Label each plane shape.

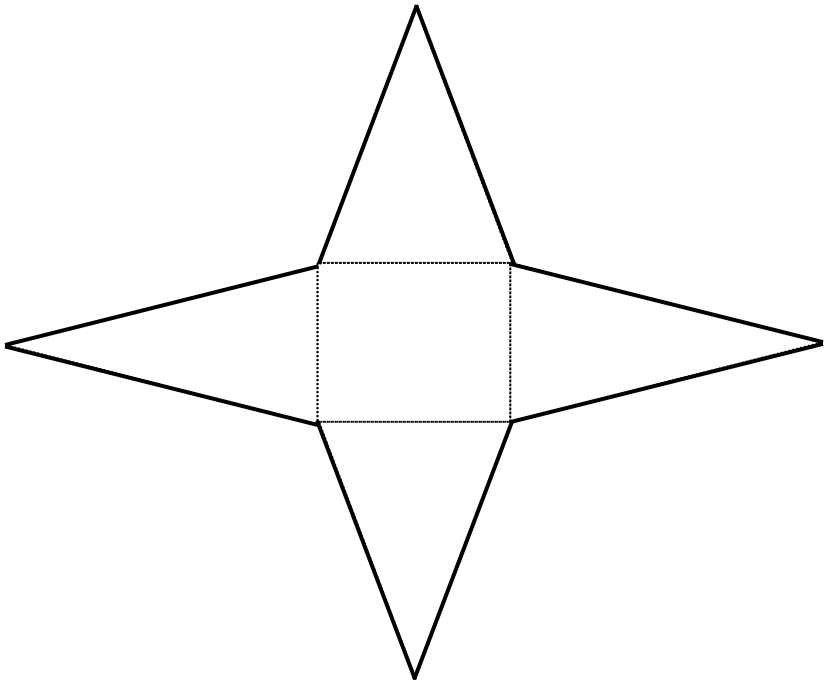
Cut out the shape along the bolded lines. Then fold the net along the pale black line to create a solid shape.



Name_____ Date_____

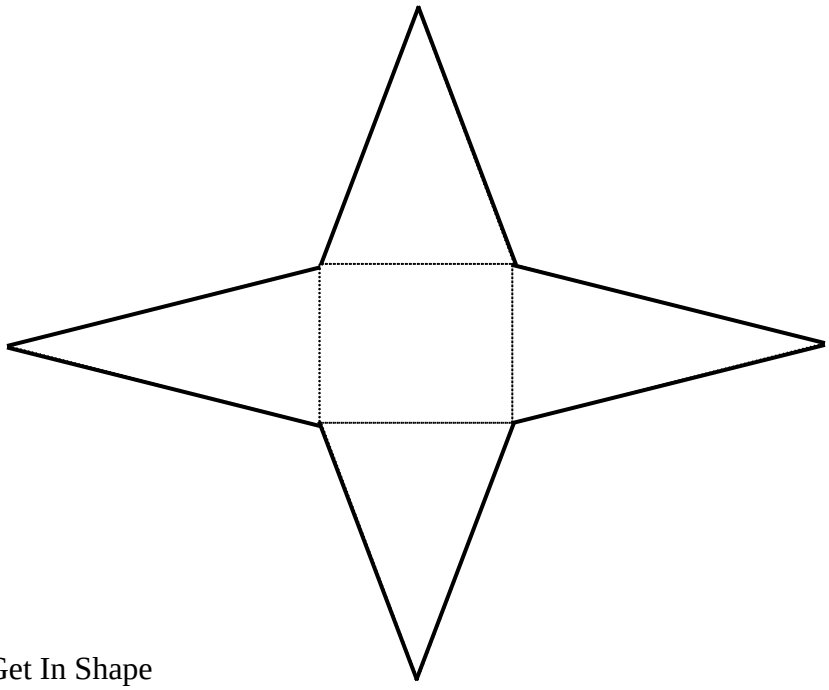
Subject _____ Mod_____

Netting Solids



Which solid will this net create? _____
Find the faces, edges, and vertices of the shape and label them. Label each plane shape.

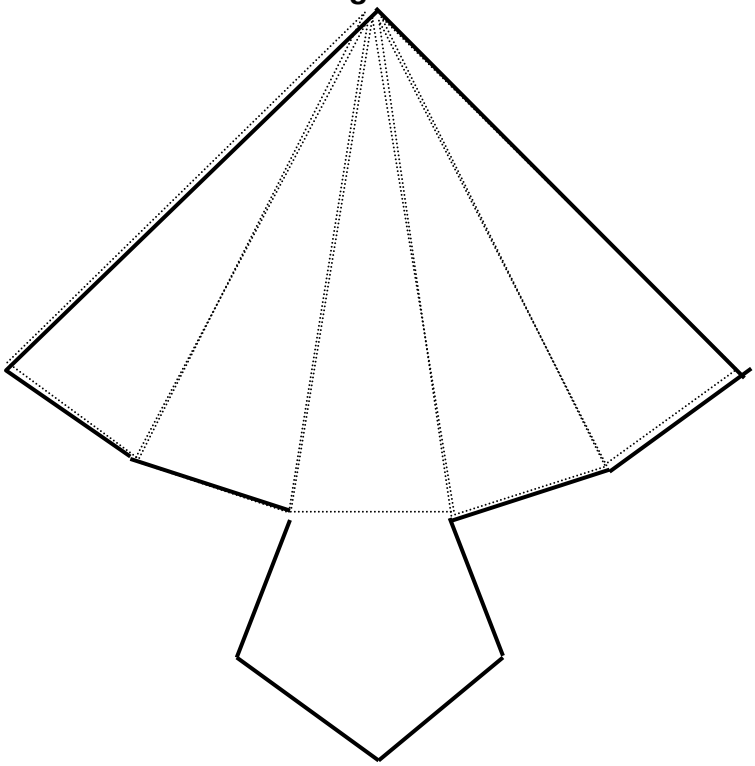
Cut out the shape along the bolded lines. Then fold the net along the pale black line to create a solid shape.



Name_____ Date_____

Subject _____ Mod_____

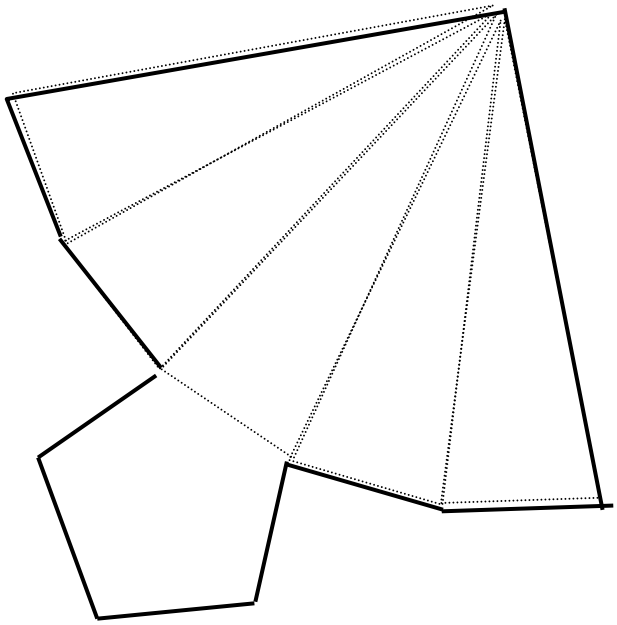
Netting Solids



Which solid will this net create? _____

Find the faces, edges, and vertices of the shape and label them. Label each plane shape.

Cut out the shape along the bolded lines. Then fold the net along the pale black line to create a solid shape.



Name_____ Date_____

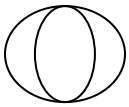
Subject _____ Mod_____

Let's Get in Shape
Unit Assessment

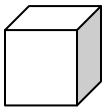
4. Name each solid shape found below.

a. 

_____

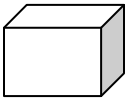
b. 

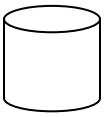
_____

c. 

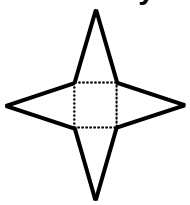
_____

5. Identify the number of sides, vertices, and edges for each shape below.

a.  **sides _____, vertices _____, edges _____**

b.  **sides _____, vertices _____, edges _____**

6. Identify the solid shape that can be created by the net found below.



_____

Use what you know about the relationship of plane figures to geometric solids to explain your answer.