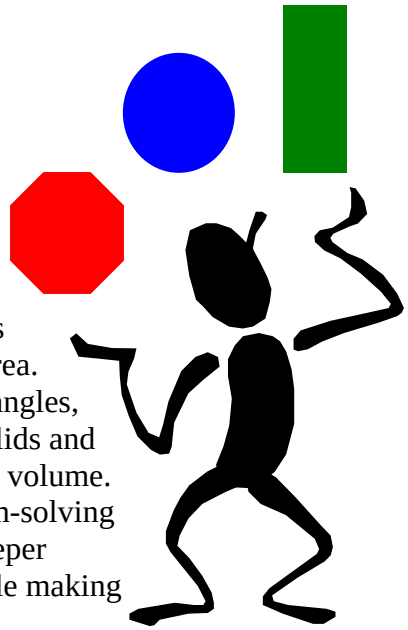

Title: Discovering Geometry Through Problem-Solving

Brief Overview:

This unit provides an interactive look at geometric concepts, specifically, perimeter, area, surface area, and volume. Students begin by investigating the relationship between perimeter and area. They explore and create the area formulas for quadrilaterals, triangles, and circles. They are introduced to 3-dimensional geometric solids and investigate these solids to develop formulas for surface area and volume. Throughout this unit, these concepts are reinforced with problem-solving activities. At the conclusion of the unit, students will have a deeper understanding of perimeter, area, surface area, and volume, while making connections to the world around them.

NCTM Content Standard/National Science Education Standard:

NCTM Content Standards for Grades 6-8: Geometry

- Precisely describe, classify and understand relationships among types of two- and three-dimensional objects using their defining properties;
- Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
- Create and critique inductive and deductive arguments concerning geometric ideas and relationships.

Grade/Level:

Grades 6-8

Duration/Length:

Four 86-Minute Periods

Student Outcomes:

Students will:
Lesson One:

- Identify and understand the relationship between area and perimeter of various rectangles.

Lesson Two:

- Name the properties of different polygons.
- Identify and apply the formulas for finding the area of a square, rectangle, triangle, parallelogram, trapezoid, and circle.

Lesson Three:

- Identify the three-dimensional solids: cubes, rectangular prisms, pyramids, and cylinders.
- Understand and apply their knowledge of the surface area of three-dimensional solids: cubes, rectangular prisms, pyramids, and cylinders.

Lesson Four/Five:

- Identify and apply the formulas for volume of a rectangular prism and a cylinder.
- Use estimation to find the volume of a rectangular prism.

Materials and Resources:

Lesson One:

- 1 cm grid paper, transparency of 1 cm grid paper
- "Quadrilateral Exploration" worksheet
- "Quilt Confusion" Worksheet
- "Sandbox Predicament" homework activity

Lesson Two:

- Geometry Definition Sheet
- "Pass the Problem" Cards and Template
- Sequencing Activity Cards (Laminate-optional)
- Timer (Optional)

Lesson Three:

- Net worksheet
- Surface Area Formula Sheet
- Practice worksheet
- Tag board
- Glue Stick
- Tape
- Ruler
- Scissors
- Roll of Wrapping Paper

Lesson Four/Five:

- Guided notes on volume
- Rulers
- Sugar cubes
- 3 different size boxes
- Sugar Cube Squeeze activity pages

Development/Procedures:

Lesson One

Preassessment – Begin by reviewing with students the definition of perimeter, which is the distance around the outside edge of a closed figure. Have the students give examples of when it would be necessary to determine the perimeter in the real world. (Ex. Building a fence around their property, adding trim to an item of clothing, etc.) Review the definition of area, which is the measurement of the region inside a closed plane figure. Remind students that area is measured in square units.

Launch – Pass out the 1-centimeter grid paper to each student. Explain that in order to review area, they are going to be drawing some quadrilaterals, four-sided closed figures, with various areas. Draw their attention to the 1-centimeter grid paper and ask them some questions:

- What unit of measurement will all of the quadrilaterals be measured in? (cm)
- What is the area of each square? ($1cm^2$)
- What will be the units for the area of each quadrilateral? (cm^2)

Now explain that you are going to test their knowledge. Explain that you will be giving them an area and they
must draw a quadrilateral that has that area. Ask them to first draw a quadrilateral with an area of 6 cm^2.

1. Ask someone to come up to the overhead and draw what they have on their paper.

2. Ask if any other students have a different way of showing an area of $6cm^2$.

3. Ask them how many different ways are there of showing this area?

4. Ask: What do you notice about the dimensions of the quadrilaterals? (They are all the factors of 6: 1, 2, 3. 6).

Have the students draw on the back of their grid paper all the possible dimensions of quadrilaterals with an area of 24 cm^2. Discuss the answers as a class:

1 x 24
2 x 12
3 x 8
4 x 6
6 x 4

8 x 3
12 x 2
24 x 1

Teacher Facilitation – Tell the students now that we have reviewed area and perimeter, we are going to investigate relationships between perimeter and area. Have them break into partners and determine the perimeters of all of the listed dimensions, by completing the "Quadrilateral Exploration" worksheet. Then, tell them to try and find a relationship between the perimeter and area. Monitor their progress and after giving them time to work, discuss the relationships they discovered as a class.

Student Application – Pass out the "Quilt Confusion" worksheet and have them work with their partners to determine a solution to the problem. Remind them that they must show all their work and are encouraged to use tables and charts to help support their explanation when writing to Grandma Rhombus. As they work in groups, make sure students notice that the trim is measured in inches, while the rest of the problem is in feet. Discuss the answers as a class.

Embedded Assessment – Collect the letters to Grandma Rhombus to determine if students grasped the concept and then have a discussion about the relationship between perimeter and area to reinforce understanding.

Also, the next day the teacher can check over the "Sandbox Predicament" homework activity to see if they understood the concept.

Reteaching/Extension – For any students that finish early ask them to make a list of real life examples when you would need to know the relationship between area and perimeter. (Ex. Tiling a floor and adding a bordering edge, building a sandbox by finding the area which can hold the sand as well as how much wood you would need to create the actual sandbox., etc.) Have these students share their examples at the end of class. You can also ask these students what would be the most trim you would need for the quilt.

For students that are having trouble with the concept, help them through the problem by referring back to the example we did in the beginning of the lesson with the 24 cm^2 and tell them to go through the same process. You may also have to remind them that they need to change the trim units into feet.

All students will reinforce this concept by completing the "Sandbox Predicament" activity for homework.

Lesson Two

Preassessment – Students are familiar with the area and perimeter of a rectangle as it was taught the previous day. The teacher will review the homework, "The Sandbox Predicament" with the students.

Launch – The teacher will review the definitions of quadrilaterals and triangles by playing "I am." For example, "I am a shape with four right angles and four congruent sides, what am I." Students will volunteer to give the answer to these questions. The teacher will do about 6 of these. (See attached examples.)

Teacher Facilitation - The teacher will pass out the "Geometry Definition Sheet" to the students. The teacher will guide the students to write a definition and find a formula for the area of different quadrilaterals, triangles, and circles. (The teacher can determine how they want to present these definitions. The students need to have prior knowledge of these definitions.)

Student Application – After completing the "Geometry Definition Sheet," the students will practice the properties of polygons by playing, "The Sequencing Activity." Each student will get a card with a property of a polygon. The first student reads their card to the class. The student who has the matching card will then read their card to the class. The student who then has the polygon to match that card will read their card. This continues until all cards have been used. Twenty-five cards are provided.

The students will practice the different area formulas by playing "Pass the Problem." The students will be in heterogeneous groups of four or five students. Each student will get a sheet of paper divided into six sections. At the top of the paper each student will write their name and all other group members' names. Each group member will also choose a letter for his or herself, letters A – E depending on how many people are in the group. At the end of the activity the teacher will collect one paper from each group, each group member will receive that grade. The papers are chosen based on the letters. For example, the teacher can say, "I am collecting letter B." Each group member gets the same grade as the letter B person. Each group will get one problem to start with. Students will have three minutes to complete each problem. A timer can be set. At the end of three minutes each group passes their problem on to the next group. This continues until all groups have done six problems. At the end of the activity the teacher chooses a letter to collect.

Embedded Assessment – Students will be assessed based on their work from pass the problem.

Reteaching – Students who have trouble with "The Sequencing Activity" can use their textbooks to study the properties of polygons.

Extension – As a homework assignment, students will identify different polygons in the world around us. They will make a list naming the polygon as it relates to math and the application in the world. For example a student could say a window is an example of a rectangle.

Lesson Three:

Preassessment – Students should have prior knowledge of finding the areas and perimeters of squares, rectangles, triangles, parallelograms and trapezoids as learned in the previous lessons. They should also have prior knowledge of using pi to find the area of a circle.

Launch – Students will create solid figures using nets. Nets are flat shapes that fold up to create a solid figure. Hand out the Net worksheet. As a class, have the students cut out the net of the cube, and paste it on to the tag board. Next students will cut out the shape on the tag board. Students will then create the cube, but they do not tape it yet. Once the students have made the cube, have them unfold it again. Ask students to find the area of one of the squares that make up the cube. Next ask the students how they would find the surface area of the entire cube. Elicit from the students that they need to add up the areas of all the squares that make up the cube, therefore the formula would be $6s^2$. Next, let the students create the remaining solid figures using the nets. Students should then begin to develop the surface area formulas for rectangular prisms, pyramids, and cylinders. After students have figured out the formulas, they can then tape the figures closed.

Teacher Facilitation – Ask student why they think using nets is a good way to figure out the surface area formulas of solid figures. Elicit from the students that using nets allows you to see each shape that makes up the solid figure. The teacher will begin a discussion of how to find the surface area of a cube, a rectangular prism, a cylinder, and pyramid. Hand out the study sheet and go over each formula with the students. On the practice sheet, do the first two problems as a class, for the remaining problems, have the students work with a partner to complete. Students will use the study sheet in order to complete the practice problems on surface area. Go over all answers with the students, making sure students understand correct answers.

Student Application – (Wrap it up Activity)
In this activity, students will utilize their knowledge of surface area by wrapping gifts of various shapes. The class will be divided into four groups. Each group will have their own particular shape that they must wrap. The shapes consist of a cylinder, and pyramid, a rectangular prism

and a cube. Students will work together on the "Wrap it up!" worksheet that goes along with their shape. On this sheet they will figure out the formula and measure the dimensions of their shape and decide how much wrapping paper they will need to wrap the gift. Remind students to write the units by their answers. Once students are done with their calculations, they will get the amount of wrapping paper they feel they need. Then they will wrap their gift. When students are done wrapping their shapes, have them answer discussions questions on the worksheet as a group.

Embedded Assessment–The teacher as well as the other groups should assess all wrapped gifts. When all groups are done wrapping their gifts and answering their questions, facilitate a discussion of the questions with the entire class. Students should discuss any difficulties or challenges they had with the activity.

Reteaching/Extension– For students who need further review on how to find the surface area of solid figures, have the students review the formulas using teacher-made flashcards. Discuss how the formulas were created. Students can also take apart the nets they made earlier to emphasize that surface area is the combined area of each face of the solid figure.

For students who understood the concept of calculating surface area, give students the nets of some non-standard solid figures such as triangular pyramids or prism with odd shapes and surfaces. Have students try to figure out the surface area of these figures and then put them together.

Lesson Four/Five:

Preassessment – This lesson should be used after students can recognize and find the surface area of rectangular prisms, cubes, and cylinders. Students should be familiar with the area of quadrilaterals and triangles and have a little prior knowledge of volume. They should also understand that volume is the amount contained in an object.

Launch – The teacher will activate students' prior knowledge of volume by posing a problem to the students: "Suppose I want to find the amount of sand contained in a sandbox with dimensions: 1 foot, 5 feet, and 6 feet." The teacher will then lead the students in a discussion of volume, specifically that the volume of an object is the amount contained inside the object.

Teacher Facilitation – The teacher will lead the students in the guided notes about volume. The teacher will make overhead transparencies of the worksheets to lead the students through the worksheets. The teacher will guide the students through a rectangular prism volume problem with the students.

The students will then complete two problems by themselves on rectangular prisms. The teacher will then lead the students through the volume of a cylinder problem. They will then complete two problems by themselves.

Student Application – The students will complete the project "Sugar Cube Squeeze." This activity is to be done in groups of three to four students. Each student will get a "Sugar Cube Squeeze Record Sheet," to record his or her information and a ruler. Each group will receive a box of a different dimension. There will be a total of three boxes with three different dimensions. The dimensions of the boxes should be multiples of each other. Example: 2x4, 4x8, 8x16. (For larger classes, the teacher could include another set of three boxes of the same dimensions.) Students will work together in groups of four to complete the activity with their assigned box. The boxes will rotate around to each group after the students have collected the data for their box.

Embedded Assessment – Students will be assessed on the "Sugar Cube Squeeze Report" sheet and on the discussion question based on the measurements they collected.

Reteaching – Students who did not completely understand the "Sugar Cube Squeeze Volume" assignment will complete more practice problems. These problems will be simplified to reiterate the idea of volume being the area of the base times the height.

Extension – Students who master the volume of the rectangular prism project could complete a similar project using a cylinder and jellybeans.

Summative Assessment:

Students will conclude their unit by completing a chart and questions about comparing surface area and volume of 3-dimensional solids.

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Name: _____

Date: _____

Quadrilateral Exploration

Dimensions	Area (cm^2)	Perimeter (cm)

What conclusions can you draw about the relationship between perimeter and area?

Name: Answer Key
Date: _____

Quadrilateral Exploration

Dimensions	Area (cm^2)	Perimeter (cm)
1 x 24	24	50
2 x 12	24	28
3 x 8	24	22
4 x 6	24	20
6 x 4	24	20
8 x 3	24	22
12 x 2	24	28
24 x 1	24	50

What conclusions can you draw about the relationship between perimeter and area?

As the dimensions of a quadrilateral change and the area stays the same, the perimeter can change. As the dimensions get closer to each other, the perimeter grows smaller. Dimensions that are the reverse of each other have the same area and perimeter. (Example: A 1 x 24 quadrilateral and a 24 x 1 quadrilateral have the same area and perimeter.)

Name: _____

Date: _____

Quilt Confusion???

Help! Grandma Rhombus needs to make a quilt for her new grandson, Tangram. She has pre-made 36 quilt squares, each measuring 1-foot by 1-foot. The problem is she only has 300 inches of lace trim for the border. Grandma Rhombus needs your help to determine the possible dimensions of her quilt, using all 36 quilt squares, while still having enough lace trim to cover the entire edge. Use what you know about area and perimeter to help you.

Make sure you show all your work and list all the possible dimensions. You may want to create a chart to organize your data. Then, write a letter to Grandma Tangram explaining which dimensions she can use for her quilt and why. Good luck and remember to label your work!

Calculations:

_____

Dear Grandma Rhombus,

Sincerely,

_____

_____

Dear Grandma Rhombus,

Answers will vary. All reasonably supported answers accepted.

Sincerely,

_____

Name: _____ **Date:** _____

A Sandbox Predicament

Heraldo is building a rectangular sandbox for his younger sister, but wants to spend the least amount of money. He has decided to build a sandbox with an area of 48 square feet. What is the smallest dimension he could build his sandbox, to save money on wood? What would be the largest dimension he could build his sandbox? Remember to show all work and label!

Name: Answer Key Date: _____

A Sandbox Predicament

Heraldo is building a rectangular sandbox for his younger sister, but wants to spend the least amount of money. He has decided to build a sandbox with an area of 48 feet. What is the smallest dimension he could build his sandbox, to save money on wood? What would be the largest dimension he could build his sandbox? Remember to show all work and label!

Dimensions (ft.)	Perimeter (ft.)
1 x 48	98
2 x 24	52
3 x 16	38
4 x 12	32
6 x 8	28

"I am"

The teacher will read these aloud to the students. Students respond with italicized answers.

1. I am a shape with four congruent sides and four right angles.
   You are Square.

2. I am a shape with four congruent sides and two pairs of congruent angles.
   You are Parallelogram.

3. I am a shape with 3 sides.
   You are Triangle.

4. I am a shape with 3 sides, all of different lengths.
   You are a Scalene Triangle.

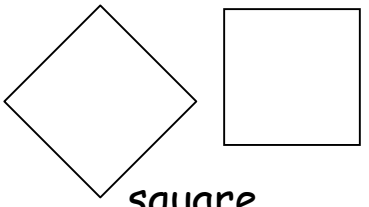
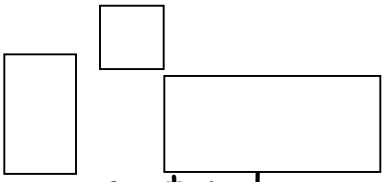
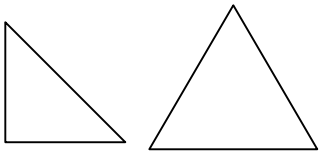
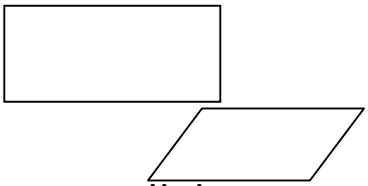
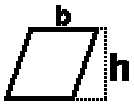
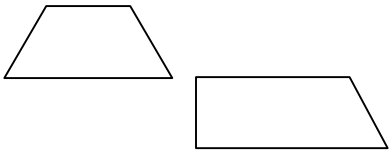
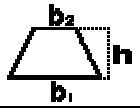
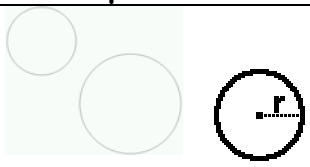
5. I am a shape with two pairs of congruent sides and four right angles.
   You are a Rectangle.

6. I am a three-sided shape with 3 congruent angles.
   You are an Equilateral Triangle.

Have fun! Create your own.

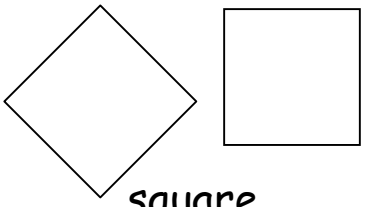
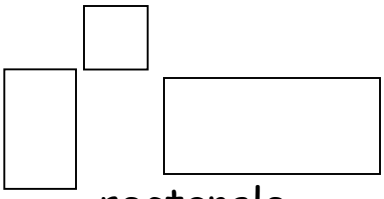
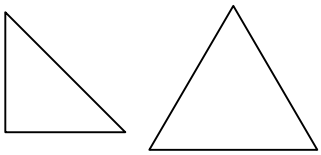
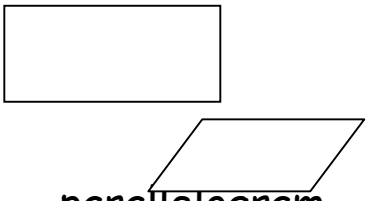
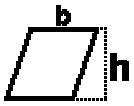
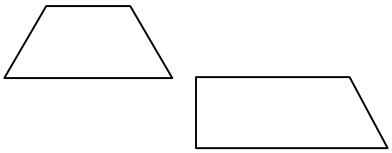
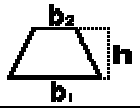
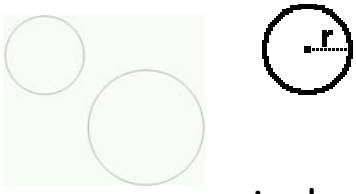
Name: _____

Geometry Definition Sheet

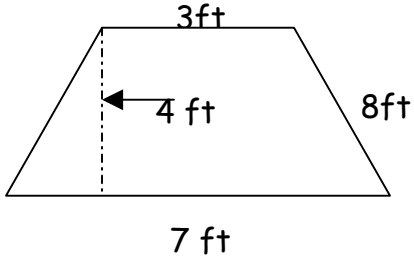
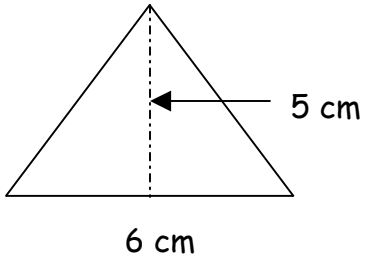
Shape	Definition	Area Formula
 square		
 rectangle		
 triangle		
 parallelogram		
 trapezoid		
 circle		

Name: Answer Key

Geometry Definition Sheet

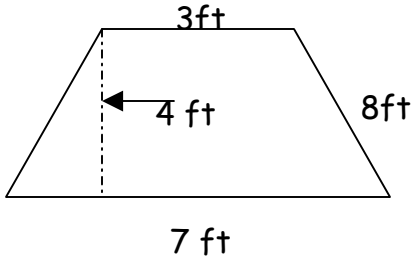
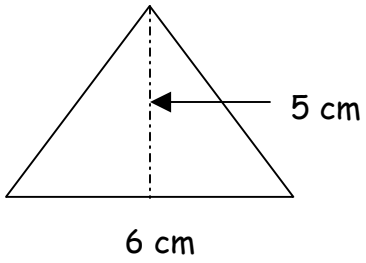
Shape	Definition	Area Formula
 square	A quadrilateral with four equal sides and four 90 degree angles	$A = s^2$
 rectangle	A quadrilateral with four 90-degree angles	$A = bh$
 triangle	A polygon having three sides and three angles. The sum of the three angles of a triangle is equal to 180 degrees.	$A = \frac{1}{2}\ bh$
 parallelogram	A quadrilateral with opposite sides parallel	$A = bh$ 
 trapezoid	A quadrilateral that has exactly two sides parallel	$A = h/2(b_1 + b_2)$ 
 circle	The locus of all points equidistant from a central point	$A = \pi r^2$

Pass the Problem – Teacher Copy

Find the area and circumference of a circle with a diameter of 16 in. Use 3.14 for pi. Round to the nearest tenth. *Area = 201.0 square inches* *Circumference = 50.2 inches*	Find the area of the trapezoid.  *Area = 20 square feet*
A rectangle has an area of 45 square inches. What is the largest perimeter possible, why? *The largest perimeter is 46 inches, when the dimensions are 1 inch by 45 inches.*	Find the area of the triangle.  *Area = 15 square cm*

A parallelogram has an area of 56 km^2. The height has a length of 8 km. What is the length of the base? *Base = 7 km*	A triangle has an area of 72 square inches and a base of 12 inches. What is the length of the height? *Height = 12 inches*

Pass the Problem

Find the area and circumference of a circle with a diameter of 16 in. Use 3.14 for pi. Round to the nearest tenth.	Find the area of the trapezoid. 
A rectangle has an area of 45 square inches. What is the largest perimeter possible?	Find the area of the triangle. 

A parallelogram has an area of 56 km^2. The height has a length of 8 km. What is the length of the base?	A triangle has an area of 72 square inches and a base of 12 inches. What is the length of the height?

Names/Letters: _____ _____ Pass the Problem

_____ _____ _____

1.	2.
3.	4.
5.	6.

I have the 1st card! What is the formula for finding the area of a rectangle?	A Triangle What is the formula for the area of a circle?	$A = h/2(b_1 + b_2)$ What is the name of a quadrilateral with opposite sides parallel?	180 degrees What is the formula for the area of a square?
$A = bh$ What is the name of the polygon that has three sides and three angles?	$A = \pi r^2$ What is the formula for the area of a trapezoid?	A parallelogram What is the sum of all angles of a triangle?	$A = s^2$ What is the definition of perimeter?

The distance around the outside edge of a closed figure. What is the definition of area?	A rectangle What is the name of a quadrilateral with four equal sides and four 90-degree angles?	A circle What is the name of a quadrilateral with four equal sides, where opposite sides are parallel?	An octagon What is the name of a nine-sided polygon?
The measurement of the region inside a closed plane figure. What is the name of a quadrilateral with four 90° angles?	A square What is the name of the locus of all points equidistant from a central point?	A rhombus What is the name of a polygon with eight sides?	A nonagon What is the name of a polygon with five sides?

A pentagon What is the name of a polygon with six sides?			
A hexagon What is the name of a four-sided polygon?			

A quadrilateral What is the point where the two rays that form the angle intersect?	A Heptagon Who is your favorite Math Teacher?	A dodecagon What is the study of points and lines and curves and surfaces?	Mathematics! I have the last card! Congratulations!
A vertex What is the name of a polygon with seven sides?	_____ What is the name of a twelve-sided polygon?	Geometry! What is everyone's favorite subject in school?	**Sequencing Activity**

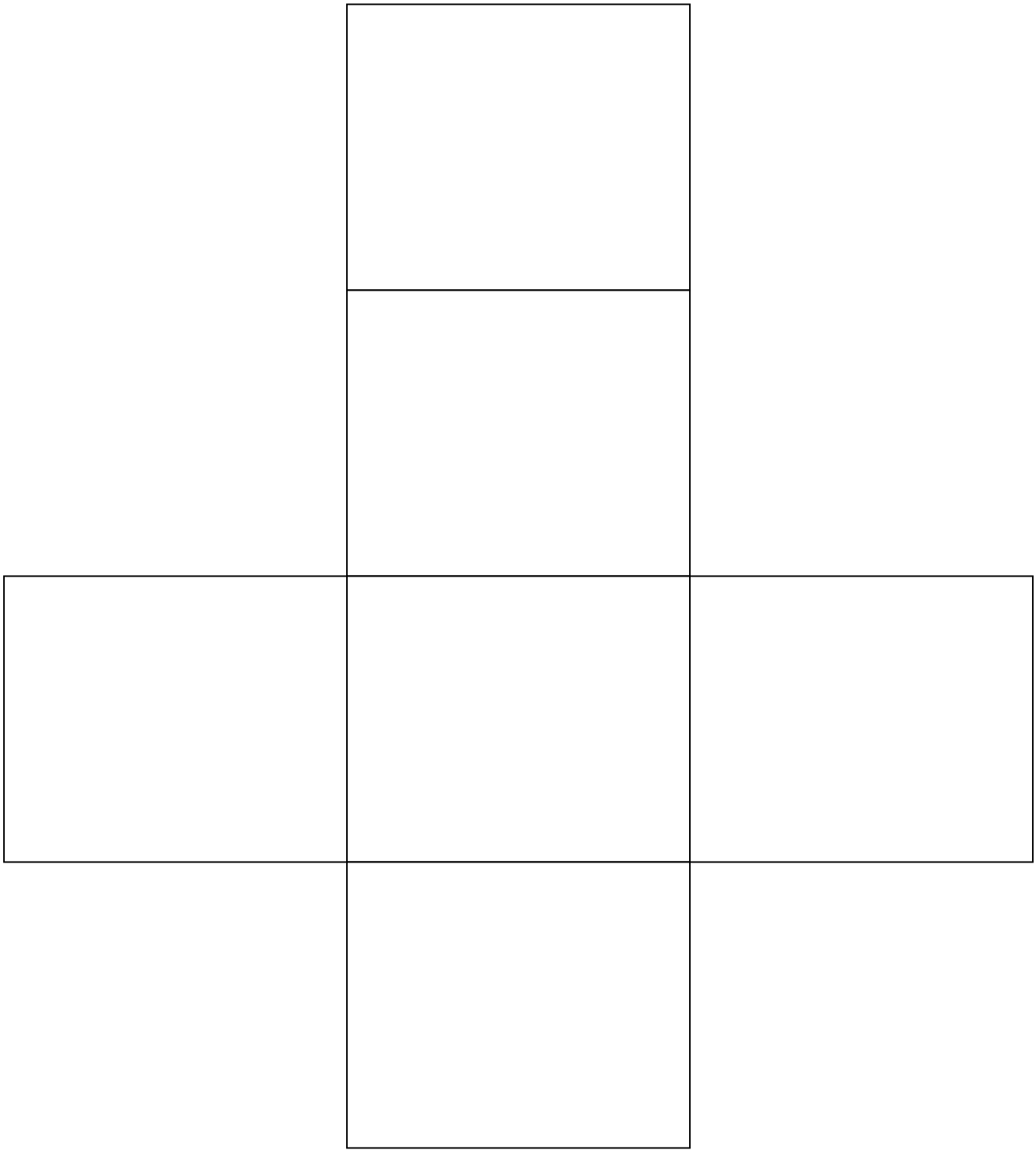
I have the 1st card! What is the formula for finding the area of a rectangle? 1	A Triangle What is the formula for the area of a circle? 3	$A = h/2(b_1 + b_2)$ What is the name of a quadrilateral with opposite sides parallel? 5	180 degrees What is the formula for the area of a square? 7
$A = bh$ What is the name of the polygon that has three sides and three angles? 2	$A = \pi r^2$ What is the formula for the area of a trapezoid? 4	A parallelogram What is the sum of all angles of a triangle? 6	$A = s^2$ What is the definition of perimeter? 8

The distance around the outside edge of a closed figure. What is the definition of area? 9	A rectangle What is the name of a quadrilateral with four equal sides and four 90-degree angles? 11	A circle What is the name of a quadrilateral with four equal sides, where opposite sides are parallel? 13	An octagon What is the name of a nine-sided polygon? 15
The measurement of the region inside a closed plane figure. What is the name of a quadrilateral with four 90° angles? 10	A square What is the name of the locus of all points equidistant from a central point? 12	A rhombus What is the name of a polygon with eight sides? 14	A nonagon What is the name of a polygon with five sides? 16

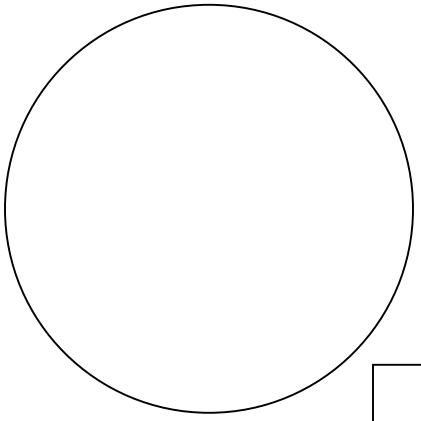
A pentagon What is the name of a polygon with six sides? 17			
A hexagon What is the name of a four-sided polygon? 18			

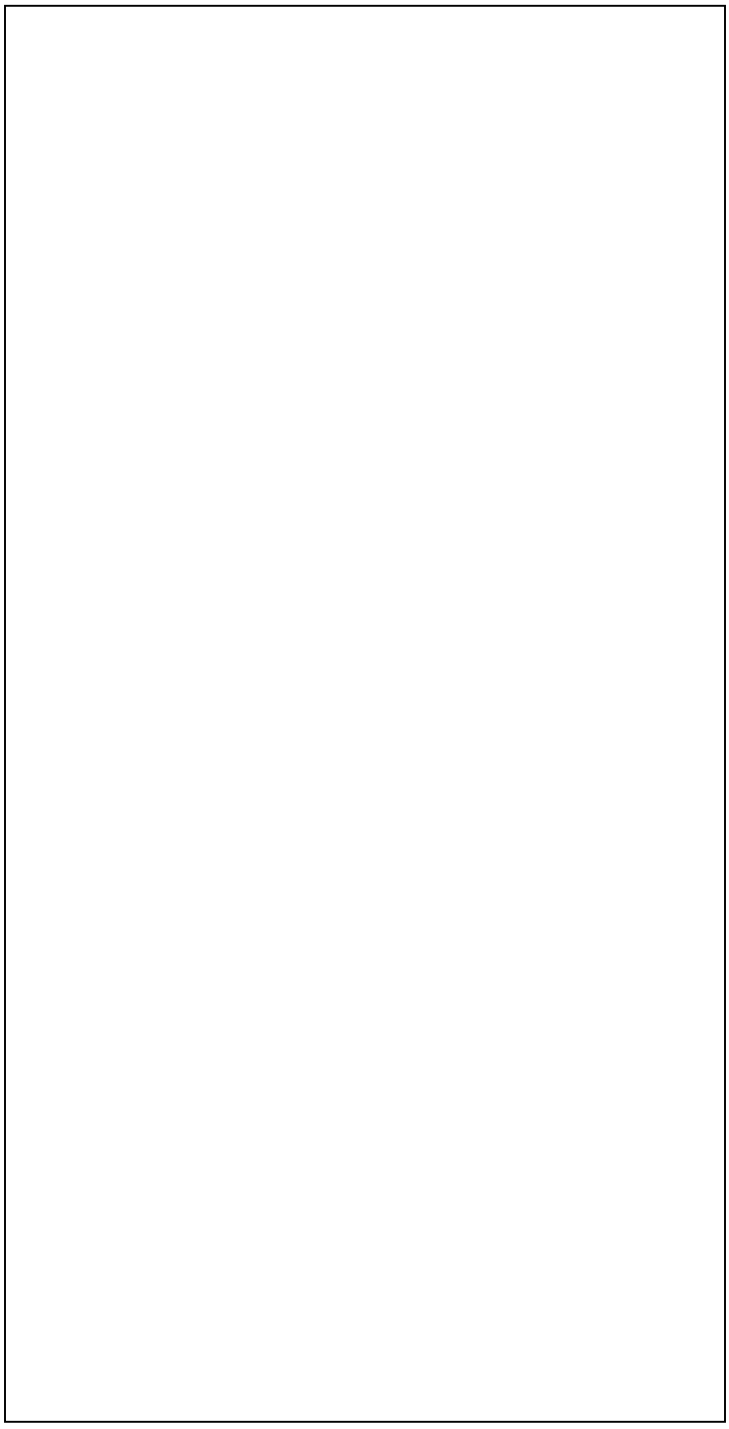
A quadrilateral What is the point where the two rays that form the angle intersect? 19	A heptagon Who is your favorite Math Teacher? 21	A dodecagon What is the study of points and lines and curves and surfaces? 23	Mathematics! I have the last card! Congratulations! 25
A vertex What is the name of a polygon with seven sides? 20	_____ What is the name of a twelve-sided polygon? 22	Geometry! What is everyone's favorite subject in school? 24	**Sequencing Activity**

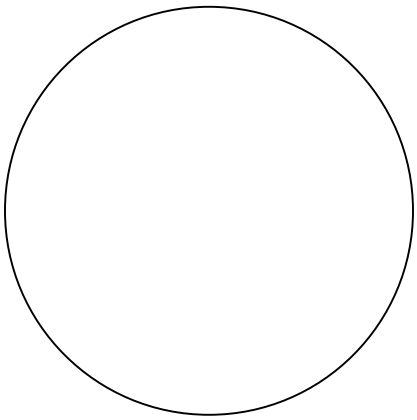
Cube



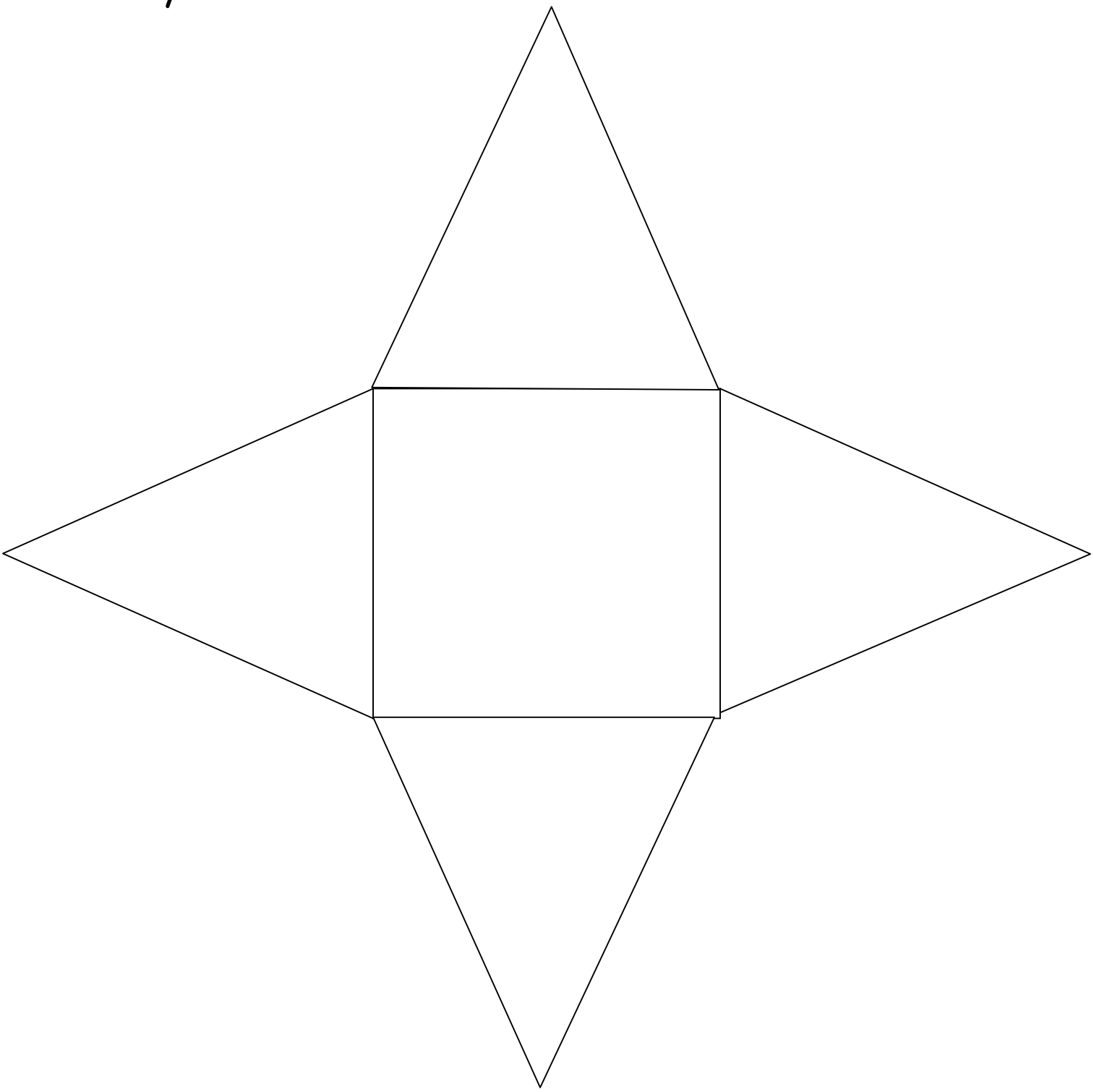
Cylinder



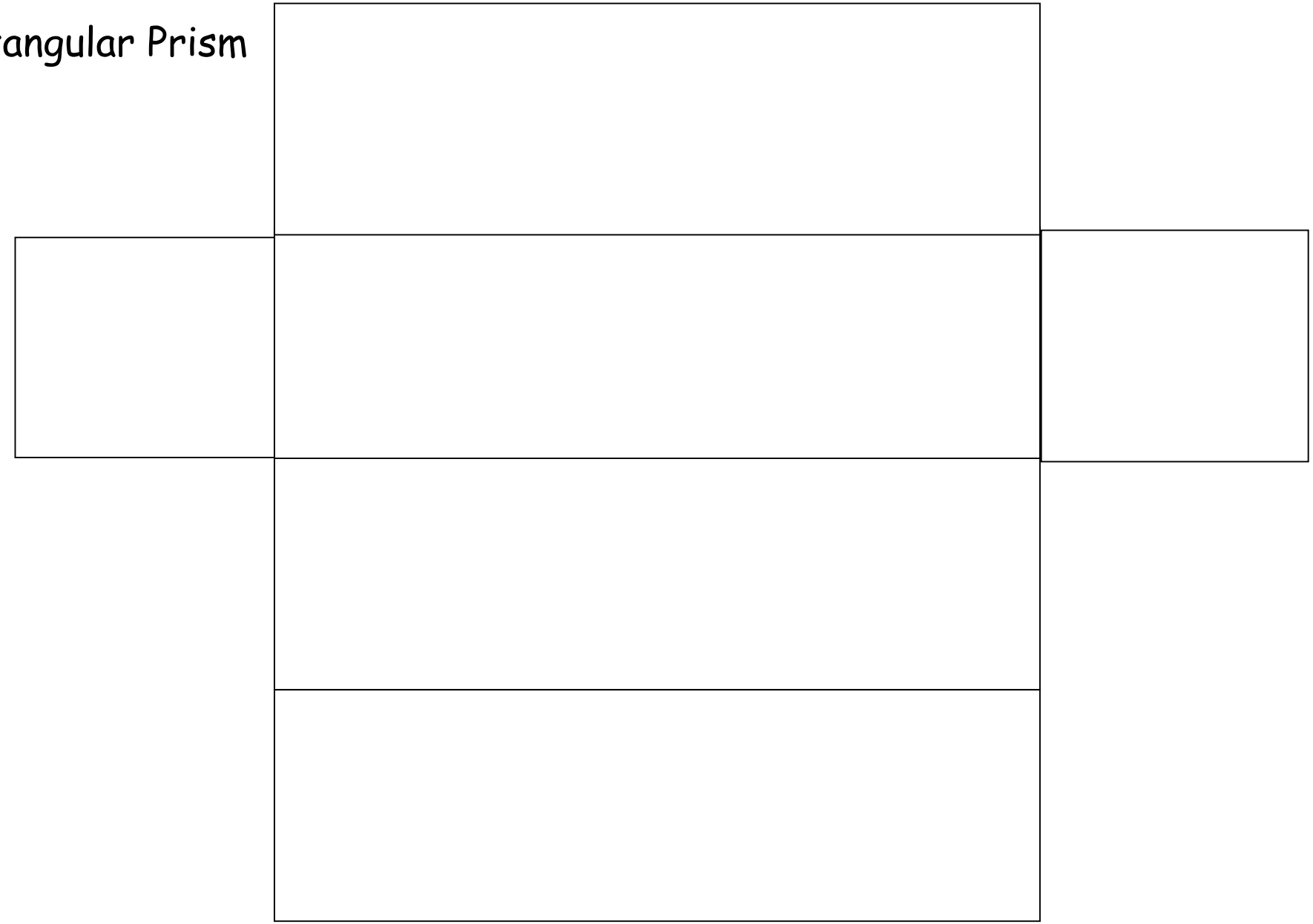




Pyramid



Rectangular Prism



Name: _____

Wrap it Up!

Directions: Your school is having a toy drive for children in the community. Your job is to wrap the presents in time for the holidays. The only problem is that the school has just enough wrapping paper for all the toys with little to spare. You must calculate the surface area of each toy so that you use the correct amount of wrapping paper.

Group #1

Kaleidoscope

Formula: _____

Radius: _____

Length: _____

Width: _____

Total Surface Area: _____

How much wrapping paper do you need? _____

Wrap it up!

Discussion Questions:

Did you have enough, more than enough, or too little wrapping paper in which to wrap your gift?

_____

If you had too much paper or too little paper, what do you think went wrong?

_____
_____
_____
_____
_____

What other factors need to be considered when wrapping a gift?

_____
_____
_____
_____
_____
_____

Name: _____

Wrap it Up!

Directions: Your school is having a toy drive for children in the community. Your job is to wrap the presents in time for the holidays. The only problem is that the school has just enough wrapping paper for all the toys with little to spare. You must calculate the surface area of each toy so that you use the correct amount of wrapping paper.

Group #2

Puzzle Box

Formula: _____

Radius: _____

Length: _____

Width: _____

Total Surface Area: _____

How much wrapping paper do you need? _____

Wrap it up!

Discussion Questions:

Did you have enough, more than enough, or too little wrapping paper in which to wrap your gift?

_____

If you had too much paper or too little paper, what do you think went wrong?

_____
_____
_____
_____
_____
_____

What other factors need to be considered when wrapping a gift?

_____
_____
_____
_____
_____
_____

Name: _____

Wrap it Up!

Directions: Your school is having a toy drive for children in the community. Your job is to wrap the presents in time for the holidays. The only problem is that the school has just enough wrapping paper for all the toys with little to spare. You must calculate the surface area of each toy so that you use the correct amount of wrapping paper.

Group #3

Shape Sorter

Formula: _____

Radius: _____

Length: _____

Width: _____

Total Surface Area: _____

How much wrapping paper do you need? _____

Wrap it up!

Discussion Questions:

Did you have enough, more than enough, or too little wrapping paper in which to wrap your gift?

_____

If you had too much paper or too little paper, what do you think went wrong?

_____
_____
_____
_____
_____
_____

What other factors need to be considered when wrapping a gift?

_____
_____
_____
_____
_____
_____

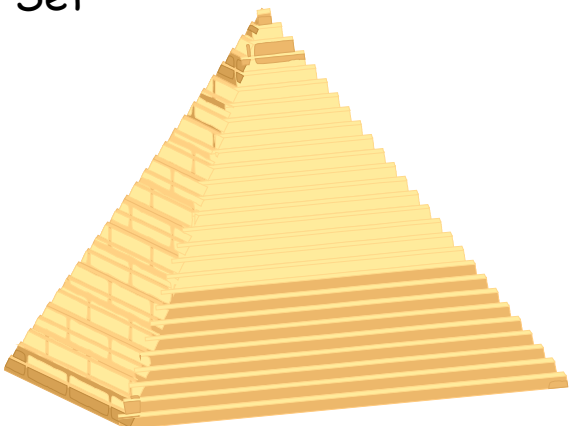
Name: _____

Wrap it Up!

Directions: Your school is having a toy drive for children in the community. Your job is to wrap the presents in time for the holidays. The only problem is that the school has just enough wrapping paper for all the toys with little to spare. You must calculate the surface area of each toy so that you use the correct amount of wrapping paper.

Group #4

Wooden Pyramid Building Set



Formula: _____

Radius: _____

Length: _____

Width: _____

Total Surface Area: _____

How much wrapping paper do you need? _____

Wrap it up!

Discussion Questions:

Did you have enough, more than enough, or too little wrapping paper in which to wrap your gift?

_____

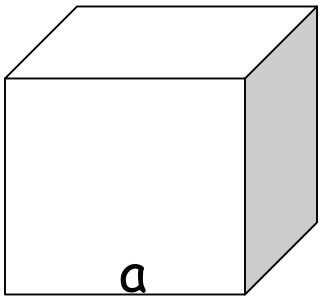
If you had too much paper or too little paper, what do you think went wrong?

_____
_____
_____
_____
_____
_____

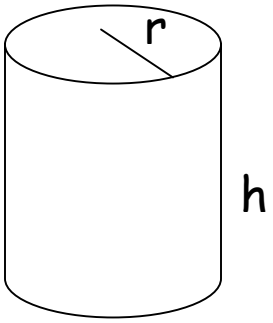
What other factors need to be considered when wrapping a gift?

_____
_____
_____
_____
_____
_____

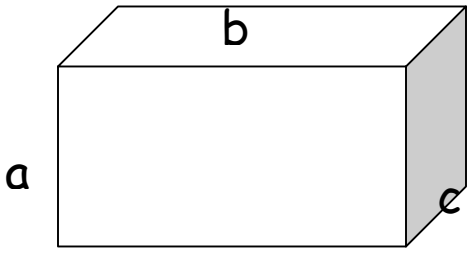
Surface Area Formulas



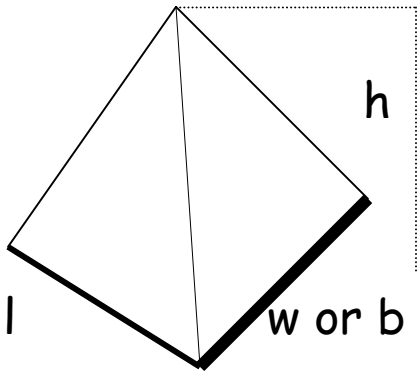
Cube : $6a^2$



Cylinder: $2\pi r^2 + 2\pi rh$



Rectangular Prism: $2ab + 2bc + 2ac$



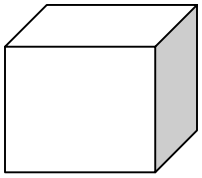
Pyramid: $4(\frac{1}{2}bh) + lw$

Name: _____

Surface Area Practice

Directions: Use surface area formulas in order to solve.

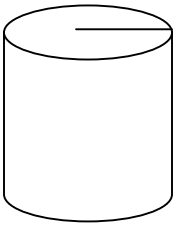
1.



5.2 in

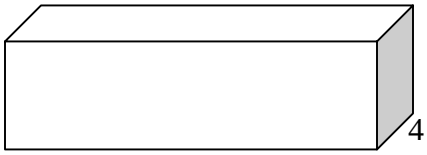
SA=_____

2.



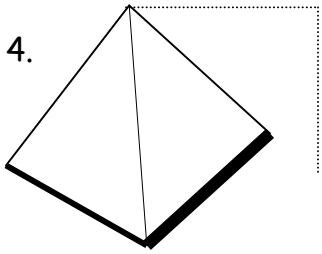
SA= _____

3.



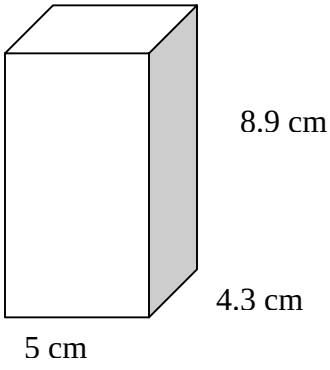
SA=_____

4.



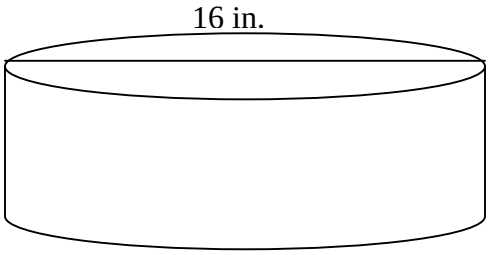
SA=_____

5.



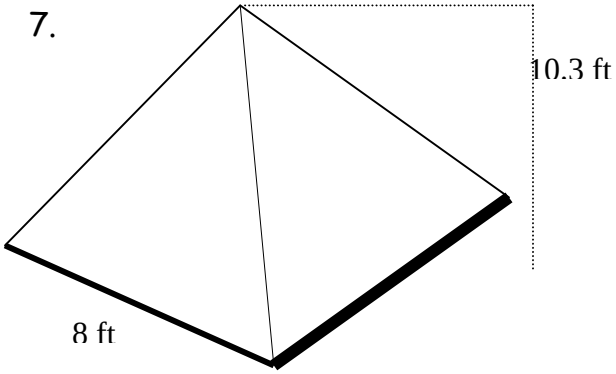
SA=_____

6.



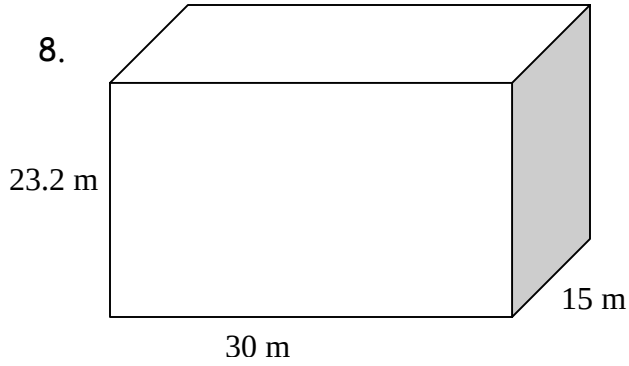
SA=_____

7.



SA=_____

8.



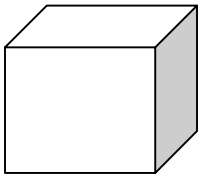
SA=_____

Name: _____

Surface Area Practice
Answer Key

Directions: Use surface area formulas in order to solve.

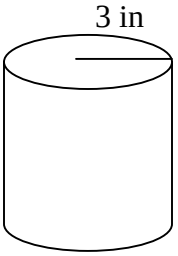
1.



5.2 in

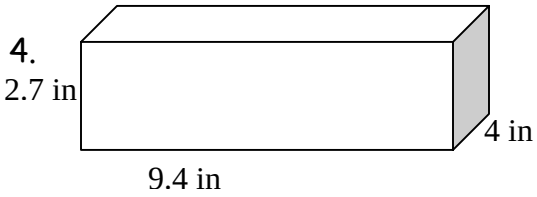
SA= 162.24 in^2

2.



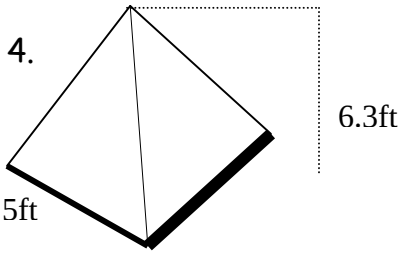
SA= 197.92 in^2

4.



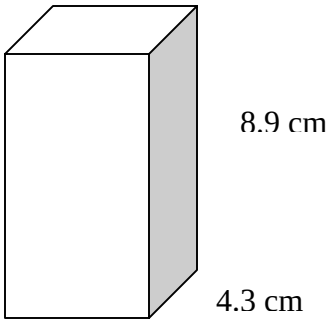
SA= 147.56 in^2

4.



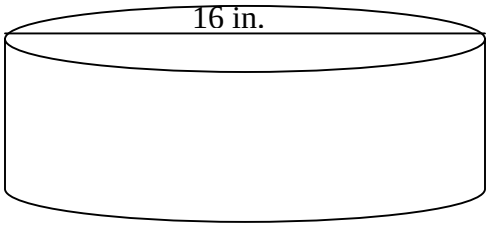
SA= 88 ft^2

5.



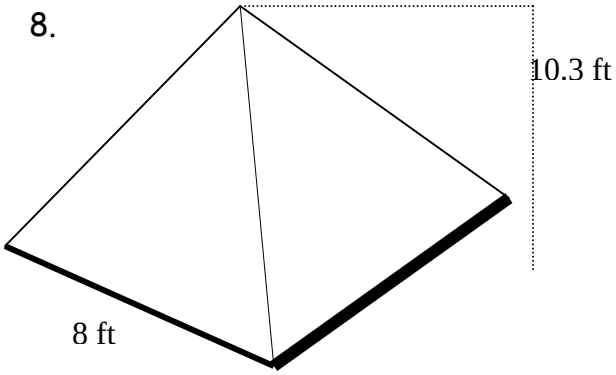
S.A. = 208.54 cm^2

6.



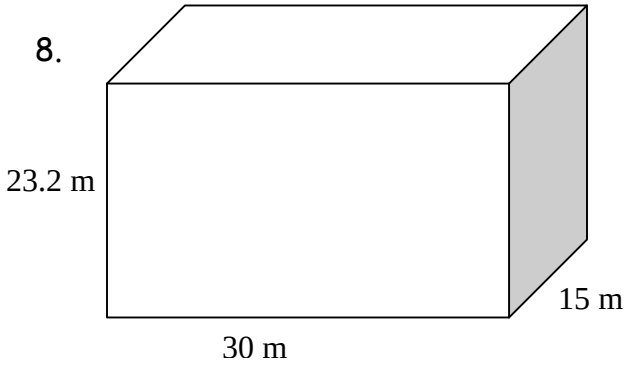
SA= 839.43 in^2

8.



SA= 228.8 ft^2

8.



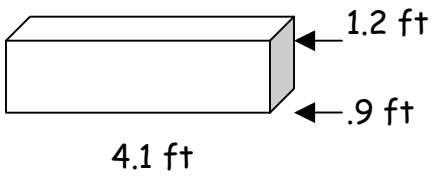
SA= 2988 m^2

Name_____ Guided Notes

Volume: The amount contained inside

Rectangular Prisms:

Jill just built a new flower box to put outside her window. She is going to the store to buy dirt to put in the box so she can plant flowers. How much dirt should she buy?



1. Since Jill wants to know the amount contained inside the box, she needs to find the _____ of the box.

2. The flower box is made of _____ piled on top of one another. So to find the volume of the box, find the _____ of all of the rectangles and multiply by 1.2 ft.

Lets try it:

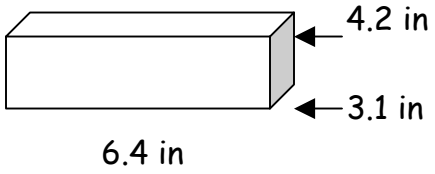
Area of base =

Volume = area of base x height

(don't forget about units)

Your turn: Find the volume

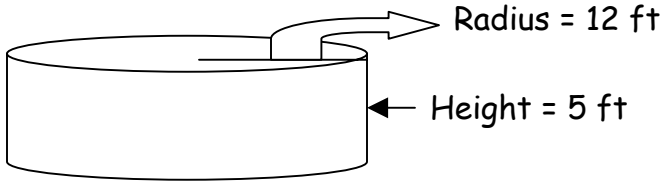
3.



4. The dimensions of a shoebox are 5 in, 7 in and 10 in. What is the volume of the shoebox?

<u>Cylinders</u>:

Jill also just put a pool in her backyard. She wants to know how much water to fill the pool with. The pool has the following dimensions:



5. Since Jill wants to know the amount of water contained in the pool, she needs to find the _____ of the pool.

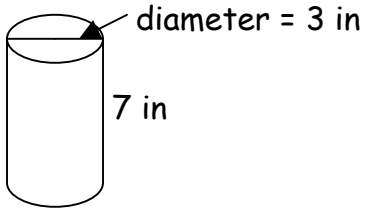
6. The pool is made of _____ piled on top of one another. So to find the volume of the pool, find the _____ of all of the circles and multiply by 5 ft.

Lets try it:

Area of base:

Volume of cylinder = area of base x height =

Your turn: Find the volume.

7. 

8. A cylindrical can of soup has the following dimensions: height = 6.2 in, radius = 3.0 in. Find the amount of soup contained in the can.

<u>Write a Formula:</u>

9. Write a formula for the volume of a rectangular prism.

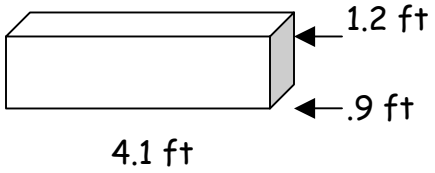
10. Write a formula for the volume of a cylinder.

Name_____ Guided Notes – Teacher Copy

Volume: The amount contained inside

Rectangular Prisms:

Jill just built a new flower box to put outside her window. She is going to the store to buy dirt to put in the box so she can plant flowers. How much dirt should she buy?



1. Since Jill wants to know the amount contained inside the box, she needs to find the *volume* of the box.

2. The flower box is made of *rectangles* piled on top of one another. So to find the volume of the box, multiply the area of the base by the number of rectangles or the *height* of the box.

Lets try it:

Area of base = *Since the base is a rectangle,*

area = 4.1 ft x .9 ft = 3.69 ft^2

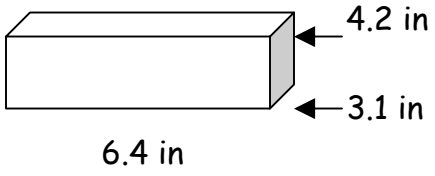
Volume = area of base x height

= *3.69 ft^2 x 1.2 ft = 4.428 ft^3*

Notice the units, ft x ft x ft = ft^3

Your turn: Find the volume

3.



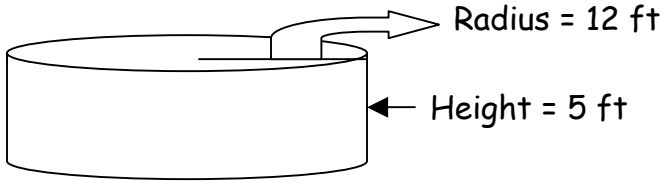
Volume = area of base x height
= area of a rectangle x height
= 6.4 in x 3.1 in x height
= 19.84 in^2 x 4.2 in
= 83.328 in^3

4. The dimensions of a shoebox are 5 in, 7 in and 10 in. What is the volume of the shoebox?

Volume = area of base x height
= area of a rectangle x height
= 350 in^3

Cylinders:

Jill also just put a pool in her backyard. She wants to know how much water to fill the pool with. The pool has the following dimensions:



5. Since Jill wants to know the amount of water contained in the pool, she needs to find the *volume* of the pool.

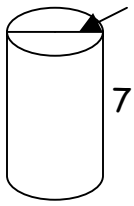
6. The pool is made of *circles* piled on top of one another. So to find the volume of the pool, multiply the area of the base by the number of circles or the *height* of the pool.
Lets try it:

Area of base = *area of a circle* = $\pi r^2 = 3.14(12^2)$
$= 452.16 ft^2$

Volume of cylinder = area of base x height
= *area of a circle x height*
$= \pi r^2$ *x height*
$= 452.16 ft^2 \times 5 ft$
$= 2260.8 ft^3$

Your turn: Find the volume.

7.



volume $= \pi r^2$ *x height*
$= \pi(1.5^2)\ 7$
$= 49.455 in^3$

8. A cylindrical can of soup has the following dimensions: height = 6.2 in, radius = 3.0 in. Find the amount of soup contained in the can.

volume $= \pi r^2$ *x height*
$= \pi(3^2)(6.2)$
$= 175.212 in^3$

Write a Formula:
9. Write a formula for the volume of a rectangular prism.

V= area of base x height
= length x width x height

10. Write a formula for the volume of a cylinder.
V = area of base x height
$= \pi r^2$ *x height*

Name_____

Sugar Cube Squeeze

Since you have become such an expert in measuring volume, Sweet Stuff, a Sugar Cube Company, has hired you to pack sugar cubes in their boxes. There are three different sized boxes to pack the sugar cubes in. Unfortunately, the company has not told you the dimensions of all of the boxes or the number of cubes to pack in each box. You know a little information about each box. You need to fit in as many sugar cubes as possible into each box. Make all measurements in centimeters.

Directions: This activity is to be done in groups of three to four students. Each student will get a "Sugar Cube Squeeze Record Sheet," to record his or her information. Each student will also get a ruler. Students will work together in their groups to complete the record sheet.

Part A:

1. **Estimate:** Observe the three boxes and the sugar cubes. By observation, without measuring or counting estimate how many cubes will fit in each box.
2. **Calculated Estimate:** Use your knowledge of volume to determine how many cubes **should** fit in each box. To complete this task you will need to find the volume of each sugar cube and the volume of the box. Once you know both volumes you can determine how many cubes should fit in each box.
3. **Actual Amount:** To find the actual amount of sugar cubes in each container count how many sugar cubes fit in each container. Make sure they are piled together tightly. Count the amount of sugar cubes for each container or use the fact that each container is 1.5 times bigger than the next smallest one.

Part B: Answer the discussion question.

Why is the actual amount of sugar cubes in each container different from the calculated volume/estimate of sugar cubes in each container?

Name_____ Sugar Cube Squeeze – Teacher Copy

Since you have become such an expert in measuring volume, Sweet Stuff, a Sugar Cube Company, has hired you to pack sugar cubes in their boxes. There are three different sized boxes to pack the sugar cubes in. Unfortunately, the company has not told you the dimensions of all of the boxes or the number of cubes to pack in each box. You know a little information about each box. You need to fit in as many sugar cubes as possible into each box. Make all measurements in centimeters.

Directions: This activity is to be done in groups of three to four students. Each student will get a "Sugar Cube Squeeze Record Sheet," to record his or her information. Each student will also get a ruler. Students will work together in their groups to complete the record sheet.

Part A:

4. **Estimate:** Observe the three boxes and the sugar cubes. By observation, without measuring or counting, estimate how many cubes will fit in each box.
5. **Calculated Volume/Estimate:** Use your knowledge of volume to determine how many cubes **should** fit in each box. To complete this task you will need to find the volume of each sugar cube and the volume of the box. Once you know both volumes you can determine how many cubes should fit in each box.

$$\textit{Amount of Cubes} = \frac{\textit{volume of box}}{\textit{volume of a cube}}$$

6. **Actual Amount:** To find the actual amount of sugar cubes in each container count how many sugar cubes fit in each container. Make sure they are piled together tightly. Count the amount of sugar cubes for each container or use proportions to find the amount in all containers if you know how many fit in the smallest container.

Part B: Answer the discussion question.

Why is the actual amount of sugar cubes in each container different from the calculated volume/estimate of sugar cubes in each container?

The actual amount of sugar cubes is different because there are gaps between the cubes. When we did the calculated estimate we assumed all the cubes fit together perfectly. In the real world the calculated volume may not be the same as the actual volume.

Name_____

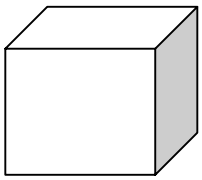
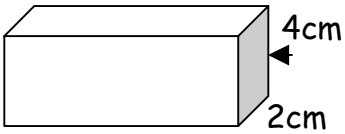
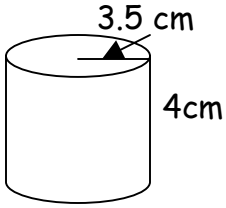
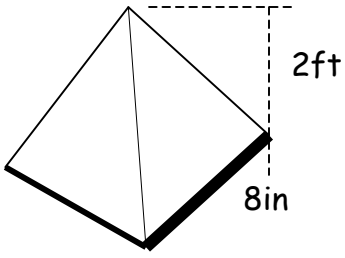
Sugar Cube Squeeze Record Sheet

	Estimate	Calculated Volume/Estimate	Actual Amount
Small Box			
Medium Box			
Large Box			

Name: _____

Unit Assessment:
Surface Area and Volume

Directions: Complete the chart by writing the formula for surface area and volume, and solving the problem. Don't forget about units!!

Geometric Solid	Surface Area	Volume
Cube  4.5in		
Rectangular Prism  7 cm		
Cylinder 		
Square Pyramid 		**Bonus**

Answer the following questions.

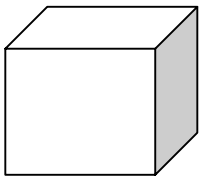
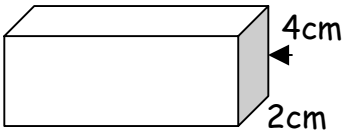
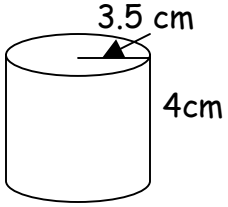
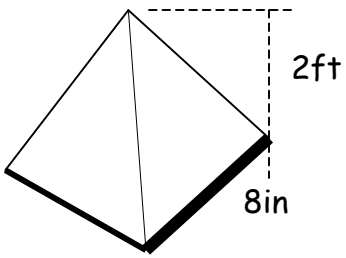
1. What is the difference between surface area and volume?

2. Explain two real life applications of surface area not previously discussed.

3. Explain two real life applications of volume not previously discussed.

Unit Assessment:
Surface Area and Volume – Teacher Copy

Directions: Complete the chart by writing the formula for surface area and volume, and solving the problem. Don't forget about units!!

Geometric Solid	Surface Area	Volume
Cube  4.5in	*S.A. = $6s^2$* *S.A. = 121.5 in^2*	*V = s^3* *V =91.125in^3*
Rectangular Prism  7 cm	*S.A. = 2lw + 2lh + 2wh* *S.A. = 100cm^2*	*V=lwh* *56cm^3*
Cylinder 	*S.A. = $2\pi r^2 + 2\pi rh$* *S.A. = 164.85 cm^2*	*V = $\pi r^2 h$* *V = 153.86 cm^3*
Square Pyramid 	*S.A. = $4(1/2)(bh) + lw$* *S.A. = 160 in^2* ***Change ft to inches***	***Bonus*** *V = $s^2h/3$* *V = 512 in^3*

Answer the following questions.

1. What is the difference between surface area and volume?

Surface area is the amount of area around an object. Surface area is measured in square units.

Volume is the amount contained inside an object. Volume is measured in cubic units.

2. Explain two real life applications of surface area not previously discussed.

A label manufacturer would need to know the surface area of a can to put a label on it. If the manufacturer did not know the surface area the label may not fit or may be to big and not minimize cost.

A builder would need to know the surface area of a house to put siding on the house.

3. Explain two real life applications of volume not previously discussed.

A coffee manufacturer would need to know the volume of a coffee can.

A pool keeper would need to know the volume of a swimming pool.