CCGPS Frameworks Student Edition

Mathematics

6th Grade
Unit 5: Area and Volume

Dr. John D. Barge, State School Superintendent
"Making Education Work for All Georgians"

The contents of this guide were developed under a grant from the U. S. Department of Education. However, those contents do not necessarily represent the policy of the U. S. Department of Education, and you should not assume endorsement by the Federal Government.

Unit 5
Area and Volume

TABLE OF CONTENTS

OVERVIEW

In this unit students will:

- Find areas of right, equilateral, isosceles, and scalene triangles, and special quadrilaterals
- Find areas of composite figures and polygons by composing into rectangles and decomposing into triangles and other shapes
- Solve real-world and mathematical problems involving area
- Decipher and draw views of rectangular and triangular prisms from a variety of perspectives
- Recognize and construct nets for rectangular and triangular prism
- Find the surface area of rectangular and triangular prisms by using manipulatives and by constructing nets
- Solve real-world that require determining the surface area of rectangular and triangular prisms
- Measure and compute volume with fractional edge length (like ¾ in edge or 1¼) using cubic units of measure.
- Find the volumes of right rectangular prisms by substituting given values for their dimensions into the correct formulas
- Make the connection that finding the volume given the *length (l) x width (w)* is the same as the *base (B)*
- Solve real-world problems that require determining the volume of right rectangular prism

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed on an ongoing basis. Ideas related to the eight practice standards should be addressed constantly as well. To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the tasks listed under "Evidence of Learning" be reviewed early in the planning process. A variety of resources should be utilized to supplement this unit. This unit provides much needed content information, but excellent learning activities as well. The tasks in this unit illustrate the types of learning activities that should be utilized from a variety of sources.

STANDARDS ADDRESSED IN THIS UNIT

KEY STANDARDS

<u>Solve real-world and mathematical problems involving area, surface area, and volume.</u>

MCC6.G.1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

MCC6.G.2. Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume

is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

MCC6.G.4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

RELATED STANDARDS

Apply and extend previous understandings of arithmetic to algebraic expressions.

MCC6.EE.2c. Evaluate expressions at specific values for their variables. Include expressions that arise from formulas in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

MCC6.NS.1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi? Compute fluently with multi-digit numbers and find common factors and multiples.

MMC6.NS.2. Fluently divide multi-digit numbers using the standard algorithm.

MMC6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

MMC6.NS.4. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36+8 as 4(9+2).

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them. Given a rectangular prisms, rectangular pyramids, triangular prisms, and triangular prisms students will find surface area using the net. Students will solve problems by finding the volume of rectangular prisms with fractional edges. Students will decompose and compose polygons to find the area.

2. Reason abstractly and quantitatively – Students will use their understanding of the value of fractions in solving with area. Students will be able to see and justify the reasoning for decomposing and composing of an irregular polygon/nets using area of triangles and quadrilaterals to solve for surface area. Students will use the relationships between two-dimensional and three-dimensional shapes to understand surface area.

3. Construct viable arguments and critique the reasoning of others. Students will justify how they found surface area of rectangular and triangular prisms, area of irregular polygons, and volume of rectangular prisms with fractal edges by packing it with unit cubes. Students will justify why finding the volume of a rectangular prisms by multiplying the length by the width by the height is the same as multiply the area of the base by the height. Students will review solutions and justify (verbally and written) why the solutions are reasonable.

4. Model with mathematics. Use hands on/virtual manipulatives (prisms, pyramids and folding nets) using every day two-dimensional and three-dimensional shapes. Students will draw irregular polygons and decompose into triangles and special quadrilaterals.

5. Use appropriate tools strategically. Students will use a ruler, graph paper two-dimensional and three-dimensional shapes to solve for area, volume and surface area. In addition, students will determine appropriate area formulas to use for given situations.

6. Attend to precision. Students will use appropriate measurement units (square units and cubic units) and correct terminology to justify reasonable solutions.

7. Look for and make use of structure. Students will understand the relationship between the structure of a three-dimensional shape and its volume formula. Students also decompose two-dimensional figures to find areas.

8. Look for and express regularity in repeated reasoning. Students will explain why formula or process is used to solve given problems. Students use properties of figures and properties of operations to connect formulas to surface area and volume.

ENDURING UNDERSTANDINGS

- The area of irregular and regular polygons can be found by decomposing the polygon into rectangles and triangles.
- Manipulatives and the construction of nets may be used in computing the surface area of rectangular and triangular prisms, and volume of right rectangular prism.
- Formulas may be used to compute the areas of polygons and volumes of right rectangular prisms.
- Appropriate units of measure should be used when computing the area (square units) of polygons, and surface area (square units) and volume of prisms (cubic units).
- Views of rectangular and triangular prisms may be interpreted and sketched to provide a 2-dimensional representation (nets) of a three dimensional figure.
- Dimensions of solid figures may have fractional lengths.
- The volume of a solid figure is the number of same sized cubes filling the space so that there are no gaps and overlaps.

CONCEPTS & SKILLS TO MAINTAIN

- number sense
- computation with whole numbers and decimals, including application of order of operations
- multiplication and division of fractions
- formulas for finding area, surface area and volume
- area measures in square units and volume measures in cubic units
- properties of polygons, 2-D, and 3-D shapes

SELECTED TERMS AND SYMBOLS

The following terms and symbols are often misunderstood. These concepts are not an inclusive list and should not be taught in isolation. However, due to evidence of frequent difficulty and misunderstanding associated with these concepts, instructors should pay particular attention to them and how their students are able to explain and apply them.

The definitions below are for teacher reference only and are not to be memorized by the students. Students should explore these concepts using models and real life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

The websites below are interactive and include a math glossary suitable for middle school students. **Note – Different sources use different definitions. Please preview any website for alignment to the definitions given in the frameworks.**

http://www.amathsdictionaryforkids.com/
This web site has activities to help students more fully understand and retain new vocabulary

http://intermath.coe.uga.edu/dictnary/homepg.asp
Definitions and activities for these and other terms can be found on the Intermath website. Intermath is geared towards middle and high school students.

http://www.corestandards.org/Math/Content/mathematics-glossary/glossary

- **2-Dimensional:** A shape that only has two dimensions (such as width and height) and no thickness.
- **3-Dimensional:** An object that has height, width and depth (thickness), like any object in the real world.
- **Area:** The number of square units it takes to completely fill a space or surface.
- **Bases of a Prism:** The two faces formed by congruent polygons that lie in parallel planes, all of the other faces being parallelograms.
- **Composing:** Composing is putting two or more geometric figures.
- **Cubic Units:** Volume of the solids is measured in Cubic Units.
- **Dimension:** a measure of spatial length; a linear measurement
- **Decomposing:** subdividing a polygon
- **Edge:** The intersection of a pair of faces in a three-dimensional figure.
- **Equilateral Triangle:** A triangle which has all three of its sides equal in length.
- **Face:** One of the polygons that makes up a polyhedron.
- **Fractional edge length:** The length of each edge of the cube is a fraction.
- **Isosceles Triangle:** A triangle which has two of its sides equal in length.

- **Kite:** A quadrilateral with two distinct pairs of equal adjacent sides. A kite-shaped figure.
- **Lateral Faces:** In a prism, a face that is not a base of the figure.
- **Net:** A two-dimensional figure that, when folded, forms the surfaces of a three-dimensional object.
- **Parallelogram:** A quadrilateral with both pairs of opposite sides parallel.
- **Polygon:** A number of coplanar line segments, each connected end to end to form a closed shape. A *regular polygon* has all sides equal and all interior angles equal. An *irregular polygon* sides are not all the same length nor does the interior angles have the same measure.
- **Polyhedron:** A 3-dimensional figure that has polygons as faces.
- **Prism:** A polyhedron with two parallel and congruent faces, called bases, and all other faces that are parallelograms.
- **Quadrilaterals:** Four coplanar line segments linked end to end to create a closed figure. A 4-sided polygon.
- **Rectangle:** A 4-sided polygon where all interior angles are 90°.
- **Rectangular prism:** A solid (3-dimensional) object which has six faces that are rectangles.
- **Rhombus:** A quadrilateral with all four sides equal in length.
- **Right Triangle:** A triangle where one of its interior angles is a right angle (90 degrees).
- **Right rectangular prism:** In a right prism, the lateral faces are each perpendicular to the bases.
- **Scalene Triangle:** A triangle where all three sides are different in length.
- **Square:** A quadrilateral that has four right angles and four equal sides.
- **Surface area:** The total area of the 2-dimensional surfaces that make up a 3-dimensional object.
- **Trapezoid:** A quadrilateral which has at least one pair of parallel sides.

- **Triangles:** A closed figure consisting of three line segments linked end-to-end. A 3-sided polygon

- **Triangular prism:** A prism whose bases are triangles. A solid (3-dimensional object what has five faces: three rectangles and two bases.

- **Vertices:** The common endpoint of two or more rays or line segments

- **Volume:** The amount of space occupied by an object.

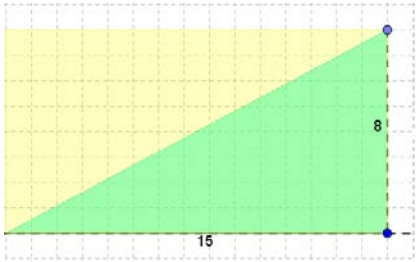
- **Volume of a Prism**: The area of a base times the height. The number of cubic units to fill a prism.

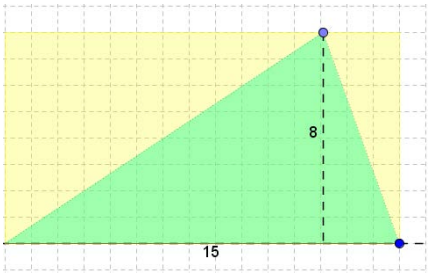
MISCONCEPTIONS

- Students may believe the orientation of the figure changes the type of figure. They struggle with recognizing common figures in different orientation. For example students may think that "square" rotated 45 degrees is no longer a square and instead is called a "diamond." This impacts students' ability to decompose composite figures and to appropriately apply formulas for area. Providing multiple orientations of objects within classroom examples and work is essential for students to overcome this misconception.

- Students may have trouble identifying the height of triangles and parallelograms. They confuse the height with always being a side length. Height is the altitude and must perpendicular to the base (form a right angle).

- The height of a triangle can be one of the sides of the right angle in a right triangle. The height is an interior segment in an acute triangle, and it is an exterior segment (the base needs to be extended) in an obtuse triangle. See the screen shots below from the GeoGebra web site for examples of each of these types of triangles.





The image below is the official middle grades formula sheet used for standardized testing. Teachers may access this page on the Georgia Department of Education webpage under assessment.
http://www.doe.k12.ga.us/Curriculum-Instruction-and-Assessment/Assessment/Documents/CRCT%20Mathematics%20Formula%20Sheet%20Revised2013.pdf

MATHEMATICS

Formulas

Below are formulas you may find useful as you work the problems. However, some of the formulas may not be used. You may refer to this page as you take the test.

Circumference

$C = \pi d$ or $C = 2\pi r$ $\pi = 3.14$

Area

Rectangle $A = bh$ or $A = lw$

Triangle $A = \frac{1}{2}bh$

Circle $A = \pi r^2$

Pythagorean Theorem

$a^2 + b^2 = c^2$

Mean

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

Mean Absolute Deviation

$$\frac{\text{Total Distance (of all values from the mean value)}}{\text{Number of values}}$$

Interquartile Range: the difference between the first quartile and third quartile of a set of data

Volume

Rectangular Prism Volume = (area of base) × (height) or $V = lwh$

Cylinder Volume = (area of base) × (height)

Sphere $V = \frac{4}{3}\pi r^3$

Cone $V = \frac{1}{3}Bh$

Formative Assessment Lessons (FALs)

Formative Assessment Lessons are intended to support teachers in formative assessment. They reveal and develop students' understanding of key mathematical ideas and applications. These lessons enable teachers and students to monitor in more detail their progress towards the targets of the standards. They assess students' understanding of important concepts and problem solving performance, and help teachers and their students to work effectively together to move each student's mathematical reasoning forward.
More information on types of Formative Assessment Lessons may be found in the Comprehensive Course Guide.

Name _____ Date _____

Who Put the Tang in Tangram?

Find the area of the following figures.

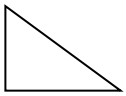
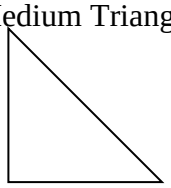
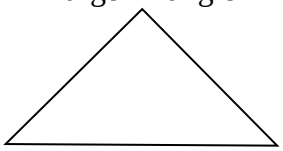
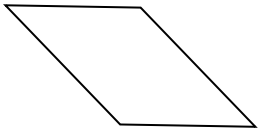
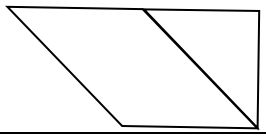
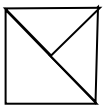
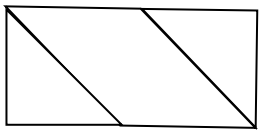
Figure	Show your work	Area of Figure (in square units)
Small Triangle 		
Medium Triangle 		
Large Triangle 		
Parallelogram 		
Trapezoid 		
Two small and one medium triangles 		
Rectangle 		

Figure **Sketch it below**	**Show your work**	**Area of Figure** **(in square units)**
Triangle congruent to a large triangle (Do not use the square)		
Trapezoid (Different from the one page 1)		
Parellelogram (Different from the one on page 1)		
Pentagon		
Square using all 7 pieces		

LEARNING TASK: RECTANGLE WRAP-AROUND

Name _____ Date _____

1. On your geoboard, make a square with an area of nine square units. Record it on the given geoboard.
   a. Determine its length and its width._____
   b. Write a formula for the area of the square.

      _____
   c. Divide the square in half by drawing a diagonal in the square.
   d. What two congruent shapes have you made?

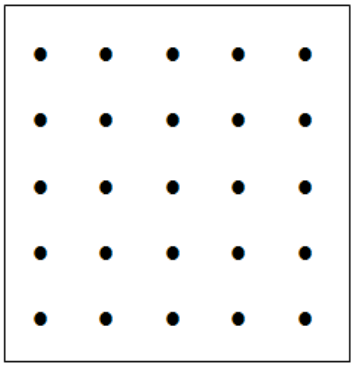
      _____
   e. What is the area of one triangle? _____

      Explain how you found the area of one triangle. Show all work on the geoboard.

      _____

      _____

      _____



2. Make a different rectangle on your geoboard. Record it on the given geoboard.
   a. Determine its length and its width._____
   b. Write a formula for the area of the rectangle.

      _____
   c. Divide the rectangle in half by drawing a diagonal in the square.
   d. What two congruent shapes have you made?

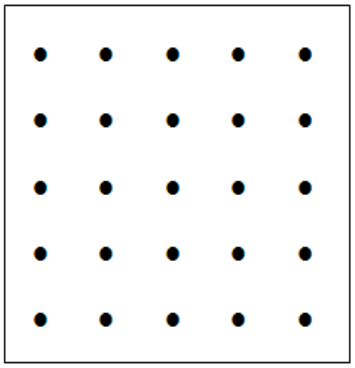
      _____
   e. What is the area of one triangle? _____

      Explain how you found the area of one triangle. Show all work on the geoboard.

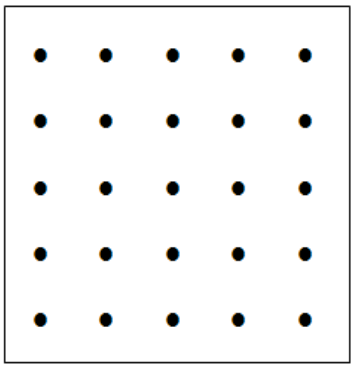
      _____

      _____

      _____



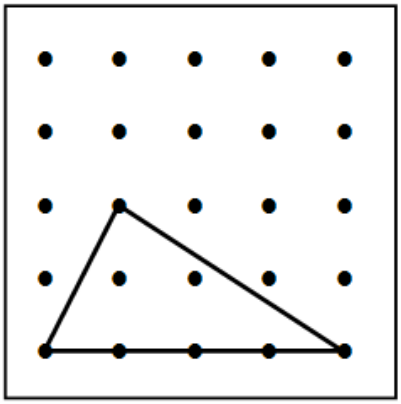
3. Make another different rectangle on your geoboard. How would you find the area of a triangle created in your rectangle by a diagonal? Explain how you found the area of the triangle. Record your work on the geoboard.

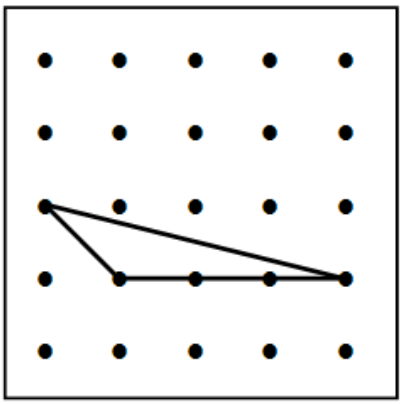


4. What do patterns do you notice about finding the area of a triangle?

5. What is a formula we could use to find the area of a triangle?

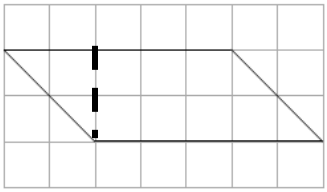
6. Use the formula to find the area of the triangles below. Use another method to find the area of each triangle. Verify that the area is the same using both methods. Show all work.





Name _____ Date _____

7. Use a straight edge to draw a parallelogram in one of the grids at the bottom of the page.
8. Carefully cut out your parallelogram.
9. Follow a line on the graph paper to cut off a triangle from one end of your parallelogram. See the diagram below.



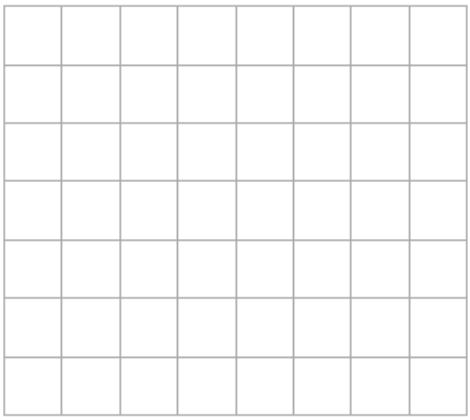
10. Slide the triangle to the opposite side of your parallelogram.
    What shape is formed? _____
11. What are the dimensions of the shape? _____What is the area? _____
12. Do you think this will always work? Explain your thinking.

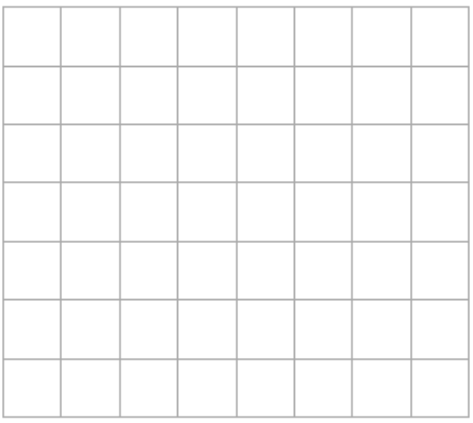
    _____

    _____

    _____

13. Use the grid paper below to draw a different parallelogram. Find the area of the area of the parallelogram.

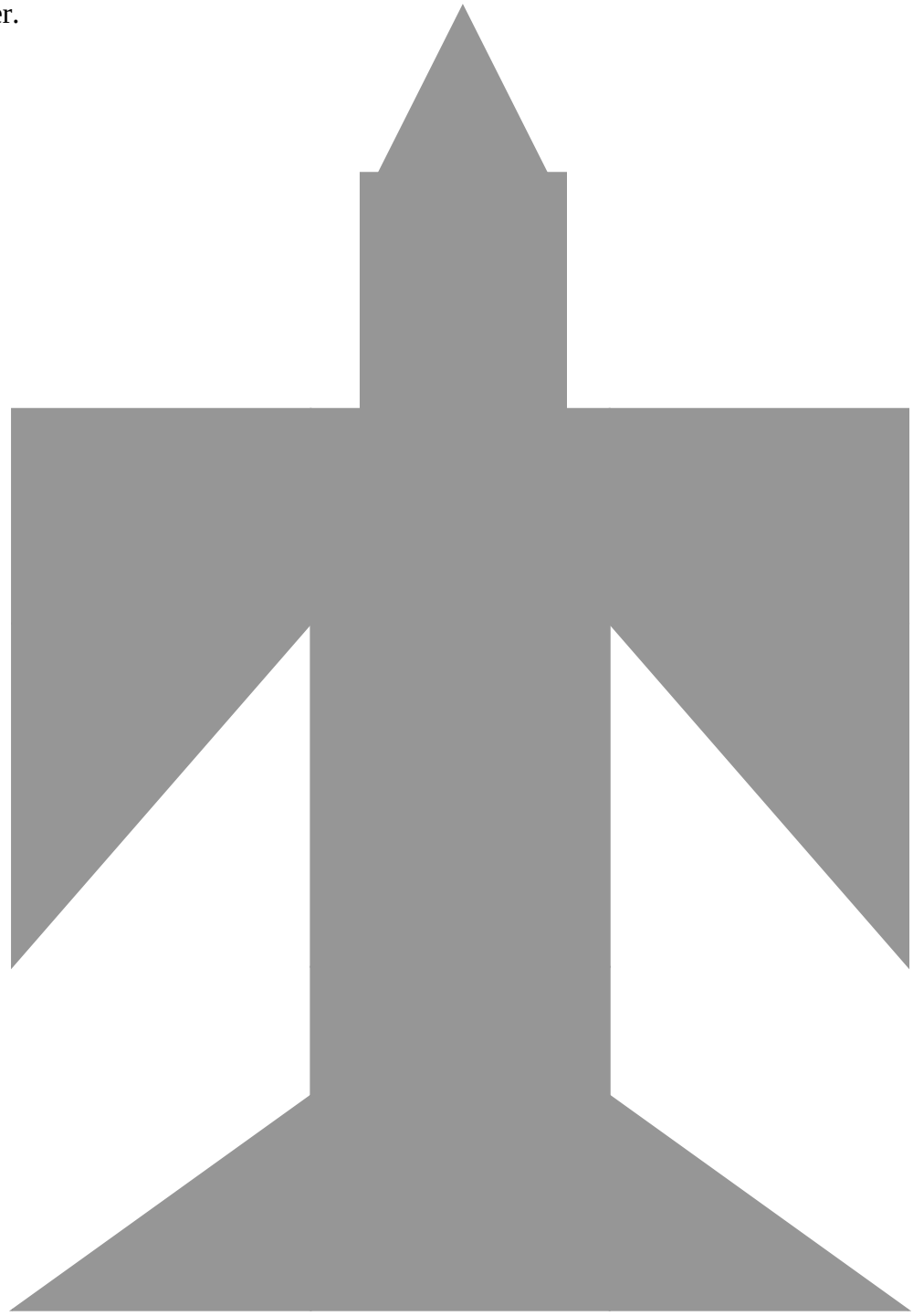




Name _____ Date _____

What's My Area?

Find the area of this figure in square millimeters. Measure each segment to the nearest millimeter.



Name _____ Date _____

King Arthur's New Table

If King Arthur's meeting room is 20 m x 12 m, what would be a perfect shape and size for the table in his meeting room?

The table must seat all twelve knights and leave least 3 m of space between the table and the wall for the knights to walk and each knight will need approximately 1.5 meters of space at the table. Use the grid paper to sketch each table and the charts below to record the information for each table your group considers creating for the knights.

Table Shape: Rectangle

Formula: _____

Table Number	Base	Height	Area
1			
2			
3			
4			
5			

Table Shape: Square

Formula: _____

Table Number	Base	Height	Area
1			
2			
3			
4			
5			

Table Shape: Parallelogram

Formula: _____

Table Number	Base	Height	Area
1			
2			
3			
4			
5			

Table Shape: Triangle

Formula: _____

Table Number	Base	Height	Area
1			
2			
3			
4			
5			

Name _____ Date _____

King Arthur's New Table

20 x 12 Grid Paper

Name _____ Date _____

King Arthur's New Table

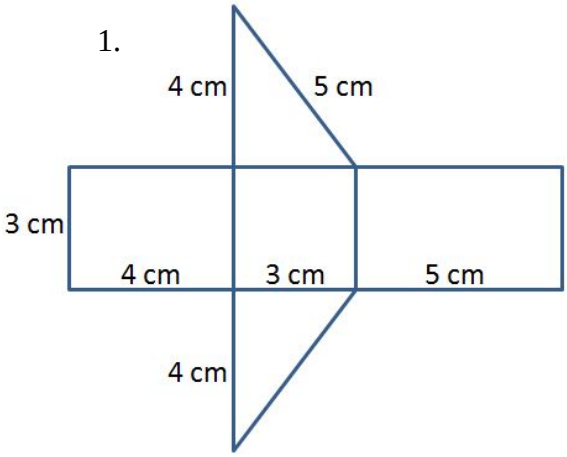
20 x 12 Grid Paper

Name_____

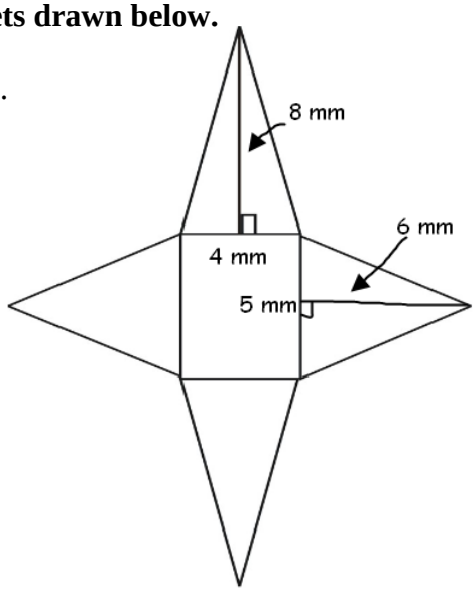
TASK: FINDING SURFACE AREA

Write the name of each figure and find the surface area of the nets drawn below.

1.



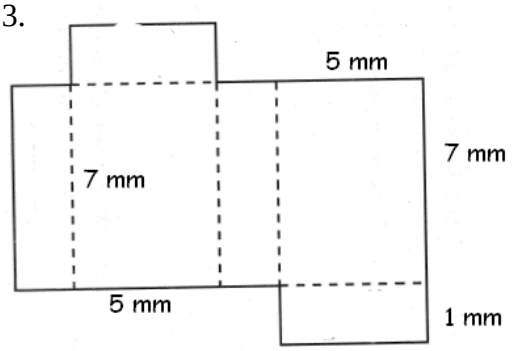
2.



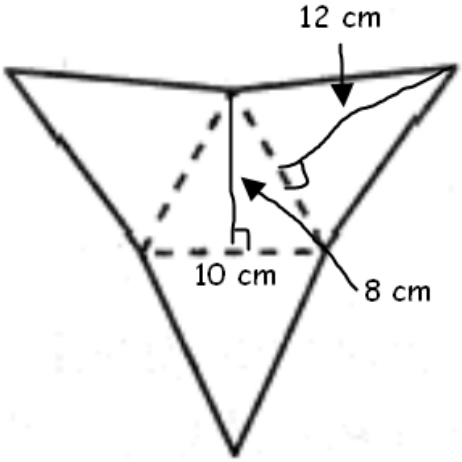
Name_____ Surface Area _____

Name_____ Surface Area _____

3.



4.



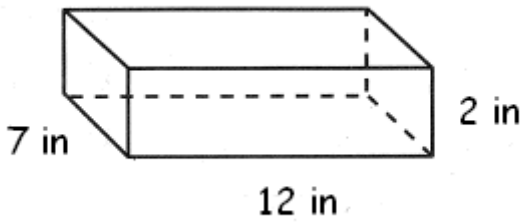
Name_____ Surface Area _____

Name_____ Surface Area _____

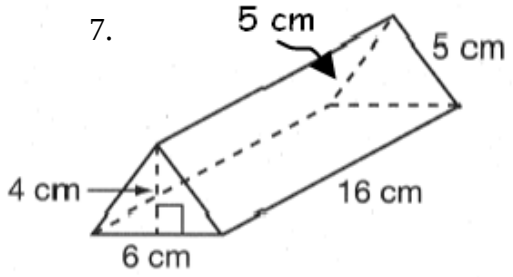
5. Choose ONE of the nets above and write a constructed response that explains the steps used to calculate the surface area of the figure.

For 6-10, name each figure, draw the NET, and find the surface area.
Name each figure and the surface area of each figure.

6.

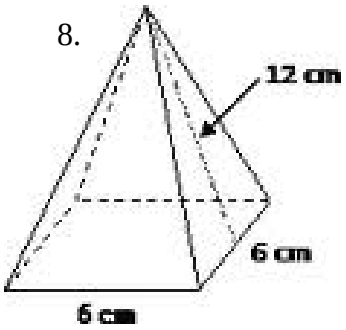


7.

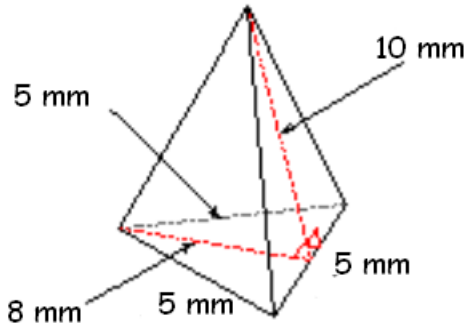


Name_____ Surface Area _____ Name_____ Surface Area _____

8.



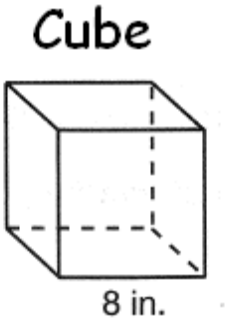
9.



Name_____ Surface Area _____

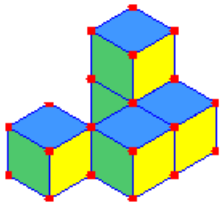
Name_____ Surface Area _____

10.



Name_____ Surface Area _____

Name_____ Date _____



How Many Ways?

1. Count out 24 cubes.
2. Build all the rectangular prisms that can be made with the 24 cubes. For each rectangular prism, record the dimensions and volume in the table below.
3. What do you notice about the rectangular prisms you created?
4. How can you find the volume without building and counting the cubes?

Shape #	**Area of the BASE of the Solid A = *bh***		**Number of Layers of the Base (Height of Solid)**	**Volume**
	base	**height**		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Now that we have found the volume in terms of number of cubes, let's find the volume of your shapes in terms of cubic inches.

5. Each cube is ¾" x ¾" x ¾". What is the volume of each cube in cubic inches?

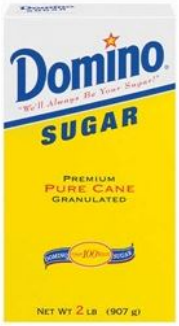
6. Fill out the chart using the measurement of each edge of your rectangular prisms.

7. What do you notice about the volumes of the rectangular prisms you created?

Shape #	**Area of the BASE of the Solid A = *bh***		**Height of Solid (in.)**	**Volume (cubic in.)**
	Base (in.)	**height (in.)**		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Name_____

TASK: VOLUME AND CUBES



Part 1

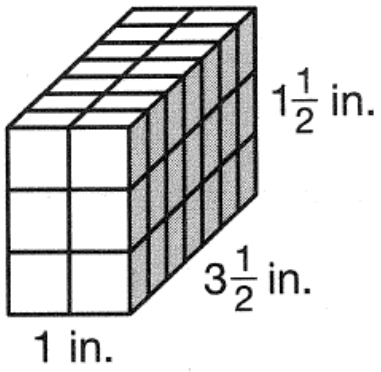
Domino produces boxes that are 2 in. by 1½ in. by 4 in. The sugar cubes used to fill the box are 1 inch on each side.

1. How many sugar cubes would it take to fill the Domino box?

2. If Domino decided to decrease the size of the sugar cubes and make them ½ in. on all sides, how many ½ in. sugar cubes would it take to fill the Domino box?

3. The Domino Company packs 36 boxes in cases to ship to stores. You have been assigned the task of determining the dimensions of a case that will hold 36 boxes. Give the dimensions and explain how you arrived at your answer.

Part 2



Use the rectangular prism above to answer questions 1-5.

1. How many cubes are there in the rectangular prism?

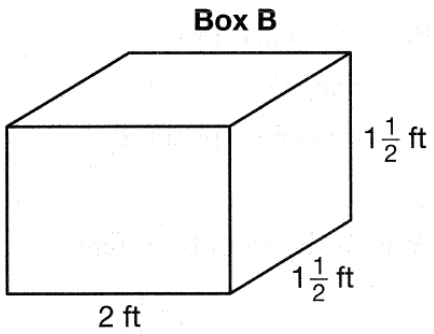
2. What are the dimensions of the cubes used to build the rectangular prism?

3. What is volume of each cube?

4. What is the volume of the rectangular prism?

5. How is the volume of the rectangular prism related to the number of cubes and volume of cubes that fit into the rectangular prism?

Part 3



1. What is the volume of the rectangular prism above?

2. Using cubes with side lengths of ½ foot, how many cubes would fit inside the rectangular prism?

3. What is the volume of each cube in question 2?

4. Multiply the number of cubes by the volume of each cube. EXPLAIN how this answer compares to the volume you calculated in number 1?

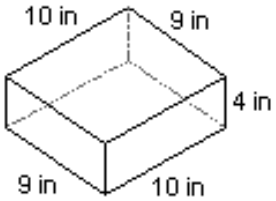
5. Using cubes with side lengths of ¼ foot, how many cubes would fit inside this rectangular prism?

6. What is the volume of each cube?

7. Multiply the number of cubes by the volume of each cube, EXPLAIN how this answer compares to the volume you calculated in number 6?

8. Why does number of cubes change but the volume stays the same?

Part 3



1. How many 1 in. cubes are needed to fill the bottom of the rectangular prism?

2. How many rows will be needed to fill the entire rectangular prism?

3. How many ½ in. cubes are needed to fill the bottom of the rectangular prism?

4. How many rows will be needed to fill the entire rectangular prism?

5. How many ¼ in. cubes are needed to fill the bottom of the rectangular prism?

6. How many rows will be needed to fill the entire rectangular prism?

7. How many 2 in. cubes are needed to fill the bottom of the rectangular prism?

8. How many rows will be needed to fill the entire rectangular prism?

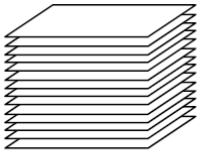
9. What relationship do you see between the size of the cube and the number of cubes needed to fill the rectangular prism?

Name_____ Date _____

TASK: PACKAGING OUR GOODS

Part 1

Quality Track printing company is filling an order of graduation programs for all high schools in the district. On average, there are 200 programs printed packaged in stacks that are 50 cm high. The programs measure 10 cm by 17 cm by 2 cm.



Note: The figure is not drawn to scale.

1. What is the volume of a single program?

2. What is the volume of a stack of program stand 50 cm tall?

3. How many programs are packaged in stacks that are 50 cm high?

4. The company will seal wrap and package the programs. If 200 programs are packaged per box, how many stacks of programs will be package in one box?

5. Draw a picture of the number of stacks of programs. Label the dimensions of each stack.

6. What is the volume of the box needed to package these programs for shipping to schools?

7. Compute the dimensions of the box that Quality Track printing should use to package these orders with no leftover space. Your specifications for the box:

    a. The length of the box must not exceed 44 cm
    b. The width of the box must not exceed 34 cm

Packages	Dimensions	Volume

8. Explain your rationale for choosing these dimensions for your box.

Part 2

Quality Track printing wants to increase one of the dimensions for the box by 1 ½ cm to form space that would prevent the programs from being damaged.

1. What are the largest dimensions for this box?

2. What is the volume for this box?

3. Draw and label the net for this box; this does not have to be drawn to scale.

Part 3

The company has decided to place a decorative label on the lateral faces of the box.

1. What is the minimum number of square centimeters needed to cover the faces of the box with this decorative paper?

2. What steps did you take to find the surface area to cover the faces of the box with decorative paper?

3. If the programs and box were triangular shaped, what steps would you take to find the surface area of the prism?

FORMATIVE ASSESSMENT LESSON: DESIGNING CANDY CARTONS

Source: Formative Assessment Lesson Materials from Mathematics Assessment Project
http://map.mathshell.org/materials/download.php?fileid=1364

TASK COMMENTS:

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:
http://www.map.mathshell.org/materials/background.php?subpage=formative

The task, *Designing: Candy Cartons*, is a Formative Assessment Lesson (FAL) that can be found at the
website: http://map.mathshell.org/materials/lessons.php?taskid=488&subpage=problem

The FAL document provides a clear lesson design, from the opening of the lesson to the closing of the lesson.

The PDF version of the task can be found at the link below:
http://map.mathshell.org/materials/download.php?fileid=1364

STANDARDS ADDRESSED IN THIS TASK:

Solve real-world and mathematical problems involving area, surface area, and volume.
MCC6.G.1 Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
MCC6.G.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
MCC6.G.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Standards for Mathematical Practice

This lesson uses all of the practices with emphasis on: 1, 3, 4

SHORT CYCLE TASK: CANDLE BOX

Source: Balanced Assessment Materials from Mathematics Assessment Project
http://www.map.mathshell.org/materials/download.php?fileid=1145

TASK COMMENTS:

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website: http://www.map.mathshell.org/materials/background.php?subpage=summative

The task, *Candle Box*, is a Mathematics Assessment Project Assessment Task that can be found at the website: http://www.map.mathshell.org/materials/tasks.php?taskid=385&subpage=expert

The PDF version of the task can be found at the link below:
http://www.map.mathshell.org/materials/download.php?fileid=1145

The scoring rubric can be found at the following link:
http://www.map.mathshell.org/materials/download.php?fileid=1146

STANDARDS ADDRESSED IN THIS TASK:

Solve real-world and mathematical problems involving area, surface area, and volume.

MCC6.G.1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

MCC6.G.2. Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

MCC6.G.4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Standards for Mathematical Practice
This task uses all of the practices with emphasis on: 1, 2, 3 ,4, 5, 6, 7 & 8

SHORT CYCLE TASK: SMOOTHIE BOX

Source: Balanced Assessment Materials from Mathematics Assessment Project
http://www.map.mathshell.org/materials/download.php?fileid=1166

TASK COMMENTS:

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:
http://www.map.mathshell.org/materials/background.php?subpage=summative

The task, *Smoothie Box*, is a Mathematics Assessment Project Assessment Task that can be found at the
website: http://www.map.mathshell.org/materials/tasks.php?taskid=392&subpage=expert

The PDF version of the task can be found at the link below:
http://www.map.mathshell.org/materials/download.php?fileid=1166

The scoring rubric can be found at the following link:
http://www.map.mathshell.org/materials/download.php?fileid=1167

STANDARDS ADDRESSED IN THIS TASK:

Solve real-world and mathematical problems involving area, surface area, and volume.

MCC6.G.1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

MCC6.G.2. Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

MCC6.G.4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Standards for Mathematical Practice

This task uses all of the practices with emphasis on: 1, 2, 3, 4, 5, 6 ,7 & 8

TASK: BOXING BRACELETS

You are the owner of a prestigious jewelry store that sells popular bracelets. They are packaged in boxes that measure 8.3 centimeters by 11 centimeters by 2.5 centimeters.

Part I.

1. Sketch a drawing of the box and label its dimensions.

2. Estimate the volume of the bracelet box.

3. Find the volume of the bracelet box. Be sure to show all of your work.

Part II.

Suppose the company that makes your boxes is out of the ones that you usually purchase. They have offered to send you another size box for the same cost. The three different boxes that you may choose from have two of the dimensions the same as your regular box, but increase one of the dimensions by exactly 1 centimeter.

1. List the dimensions of three boxes they are offering to send.

Box 1	Box 2	Box 3

2. Make a prediction of which box you would order if you wanted the largest possible increase in volume.

   A. Explain with details how you could be certain of which dimension you should increase.

   B. Test your prediction.

   C. Was your prediction correct? Why or why not?

3. Make a **sketch** of the new box and label its dimensions and find the **volume** of the new box. Show all of your work.

   Volume _____

4. What is the difference of the volume of the original box and the volume of the new box?

Part III.
Some of your customers frequently like to have their bracelets gift wrapped. To determine the price for wrapping the new boxes, you wish to compare the surface area of the original box to the surface area of the box with the largest volume. (Note – we are thinking about the net so we are ignoring the fact that when you actually wrap a gift some paper is overlapped.)

1. Sketch a drawing of the nets of the two boxes (new and old) and label the dimensions.

2. Find the actual surface area for each box. Show your work.

3. If you charge $2.00 to gift wrap the original box, how much should you charge to gift wrap the new box? Justify your answer.