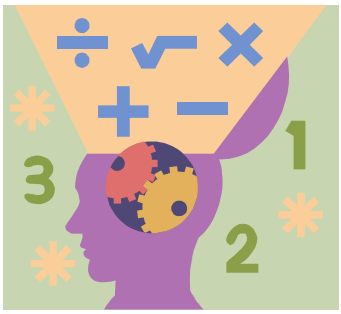
Algebra/Geometry Institute Summer 2010



Faculty Name: Diana Sanders

School: John F. Kennedy Memorial High School
Mound Bayou, MS

Grade Level: 7th Grade

Investigating Surface Area

1. Teaching objective(s)

- Students will solve real-world and mathematical problems involving the surface area of three-dimensional figures. (Institute's Objective)
- ***MS 3b. Construct two-dimensional representations of three-dimensional objects. (DOK 2)***
- ***MS 4c. Develop and justify geometric formulas for volume and surface area of cylinders, pyramids, and prisms. (DOK 3)***

2. Instructional Activities

- **Introduction:**
- Teacher will give each student a cylinder to observe.
- Students will discuss their observations made of the cylinder.
- Students will cut the tape on the cylinder, open it up, and lay it flat on the table/desk.
- Teacher will ask students to observe the cylinder again and describe what they see (2 circles and 1 rectangle).
- Teacher will point out that the rectangular part of the cylinder is called the lateral face and the circles are called the circular bases.
- Teacher will provide guided practice on calculating the surface area of cylinders and rectangular prisms using teacher created worksheets.
- Students will use the formulas for a circle and rectangle to find the areas.
- Teacher will have students to add all the areas of the cylinder to find the sum (surface area).
- The class will discuss steps taken to find the surface area of a cylinder.
- Teacher will provide feedback.
- Students will complete the hands-on activity involving finding the surface area of a cylinder.
    - **Activity:**
        1. Students will work in groups and use manipulatives (cylinders) to calculate the surface area.
        2. Students will use prepared data and models of cylinders to calculate the surface area.
        3. Students will write collected data on index cards (optional).

- Teacher will observe students while working and provide immediate feedback.
- After students have completed the activity, students will explain how to find the surface area of a cylinder.

- Teacher will give each student a rectangular prism to observe.
- Students will discuss observations made of the rectangular prism.
- Students will cut the tape on the rectangular prism, open it up, and lay it flat on the table/desk.
- Teacher ask students to observe the cylinder again and describe what they see [6 rectangles (a square is a type of rectangle)].
- Students will use the formula for a rectangle to find all the areas of the faces of the rectangular prism.
- Teacher will have students to add the areas of all the faces of the rectangular prism to find the sum (surface area).
- The class will discuss steps taken to find the surface area of a rectangular prism.
- Students will complete hands-on activity involving finding the surface area of a rectangular prism.
    - **Activity:**
        1. Students will work in groups and use manipulatives (building unit cubes) to calculate the surface area.
        2. Students will use prepared data and models of rectangular prism to calculate the surface area.
        3. Students will write collected data on index cards (optional).
- Teacher will observe students and provide immediate feedback.
- After students have completed the activity, have students to explain how to find the surface area of a rectangular prism.

- The class will discuss the characteristics of cylinders and rectangular prisms and how to find the surface area.
    - **Cylinders** are made up of three different surfaces – two congruent circular bases and a rectangular surface that wraps around the bases (lateral face).
    - **Rectangular Prisms** are prisms in the shape of rectangles that have six faces; all of which are rectangles.
    - **To calculate** the surface area for cylinders use the formula *Surface Area* = $2\pi r\,(r + h)$, where r = radius and h = height. To calculate the surface area for rectangular prisms use the formula *Surface Area* = $2(lw + lh + wh)$, where l = length, w = width and h = height.

3. Materials and Resources

Teacher created worksheets
Pencil
Rectangular Prisms (nets)
Building Unit Cubes
Cylinders (nets)
Index Cards (optional)
Overhead Projector
Transparencies
Transparencies markers
Rulers
Calculators
Scissors

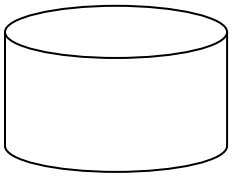
Resources

Enright, Brian; Fox, Joan; and Gyles, Robert; Breakaway Math: From Practice to Performance, Options Publishing CO, Merrimack, NH, Level H, pp. 72-76.

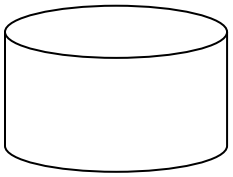
Enright, Brian; Fox, Joan; and Gyles, Robert; Breakaway Math: From Practice to Performance, Options Publishing CO, Merrimack, NH, Level G, pp. 78-82.

4. Assessment

- Teacher will observe students, listen to oral responses, and have students complete "Working with Surface Area Activity (Cylinder) and Using Unit Cubes to find the Surface Area (Rectangular Prism)" activities.



Surface Area
Cylinder



I. **Let' Do It! (Make a list if necessary)**

A. Finding the area of the circular base

B. Finding the area of the rectangular surface (lateral face).

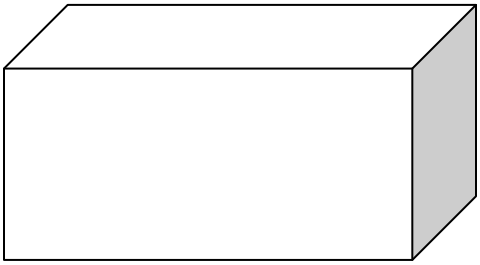
IV. Now Let's Find the Surface Area of the Cylinder!!!

_____ + _____ + _____ = _____

area of base 1 **area of base 2** **area of lateral face** **surface area**

GREAT JOB!!!!!

Surface Area
Rectangular Prism



I. **Let's Do It!!!**

A. Finding the area of the top and bottom faces. Total 1=_____

B. Find the area of the front and back faces. Total 2 = _____

C. Find the area of the left and right faces. Total 3 = _____

II. Now Let's Find the Surface Area of the Rectangular Prism!!!

_____	+	_____	+	_____	=	_____
Total 1		**Total 2**		**Total 3**		**Surface Area**

GREAT JOB!!!!!

Using Unit Cubes to Find the Surface Area

Directions: Using the unit cubes, build a 4" by 3" three story rectangular prism. (Each cube = 1 inch)

It's your turn to answer questions!

1. What are the dimensions of each rectangular face? List each.

2. What is the surface area of the rectangular prism constructed? _____

3. What method did you use to find the surface area of the rectangular prism? Use pictures/words to represent your answer.

Working with Surface Area Activity
Cylinder

I. The dimensions of a given cylinder are:

h = _____

d = _____

II. Use the data in #I to sketch and label the 2-dimensional and 3-dimensional diagram of this cylinder.

III. Find the surface area of the cylinder:

Work Area **Circular Base**	**Work Area** **Lateral Face**

IV. What is the surface area of the cylinder? _____

V. How do you find the surface area of a cylinder?

Surface Area
Rectangular Prism

How well did you do?

A. Finding the area of the top and bottom faces. Total 1=_____

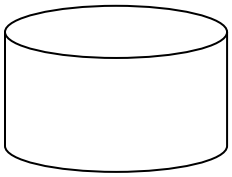
Top: _____ x_____ = _____ length width area	Bottom:_____ x _____ = _____ length width area

B. Find the area of the front and back faces. Total 2 = _____

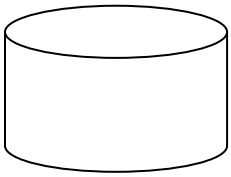
Front: _____ x_____ = _____ length width area	Back:_____ x _____ = _____ length width area

C. Find the area of the left and right faces. Total 3 = _____

Left: _____ x_____ = _____ length width area	Right:_____ x _____ = _____ length width area



Surface Area
Cylinder
Answer Key



I. **Let' Do It! (Make a list if necessary)**

Height = 8.5 cm
Diameter = 5.1 cm

A. Finding the area of the circular base
   1. Let $\pi = 3.14$
   2. Find the radius (1/2 the diameter) = 2.55
   3. Square the radius $(2.55)^2 = 6.5025$
   4. Multiply steps 1 and 3 (this is the area)

$A=\pi r^2$
$A=(3.14)(2.55)^2$
$A=(3.14)(6.5025)$
$A=20.4178\ cm^2$

B. Finding the area of the rectangular surface (lateral face).
   1. Find the height
   2. Find the circumference
   3. Multiply height x circumference

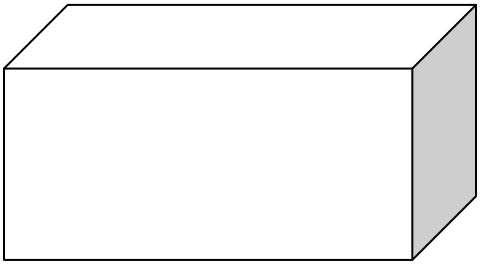
$A=2\pi rh$
$A=(2)(3.14)(2.55)(8.5)$
$A=136.119$

IV. Now Let's Find the Surface Area of the Cylinder!!!

$20.41785\ cm^2$	+	$20.41785\ cm^2$	+	$136.119\ cm^2$	=	$176.9547\ cm^2$
area of base 1		**area of base 2**		**area of lateral face**		**surface area**

GREAT JOB!!!!!

Surface Area
Rectangular Prism
Answer Key



I. **Let's Do It!!!**

A. Finding the area of the top and bottom faces. Total 1= **67.5 cm^2**

Top: 7.5 cm x 4.5 cm = 33.75 cm^2
Bottom: 7.5 cm x 4.5 cm = 33.75 cm^2

B. Find the area of the front and back faces. Total 2 = **67.5 cm^2**

Front: 7.5 cm x 4.5 cm = 33.75 cm^2
Back: 7.5 cm x 4.5 cm = 33.75 cm^2

C. Find the area of the left and right faces. Total 3 = **40.5 cm^2**

Left: 4.5 cm x 4.5 cm = 20.25 cm^2
Right: 4.5 cm x 4.5 cm = 20.25 cm^2

II. Now Let's Find the Surface Area of the Rectangular Prism!!!

67.5 cm^2	+	**67.5 cm^2**	+	**40.5 cm^2**	=	**175.5 cm^2**
Total 1		**Total 2**		**Total 3**		**Surface Area**

GREAT JOB!!!!!

Surface Area
Rectangular Prism
Answer Key

How well did you do?

A. Finding the area of the top and bottom faces. Total 1= **67.5 cm^2**

Top: 7.5 cm (length) x 4.5 cm (width) = 33.75 cm^2 (area)	Bottom: 7.5 cm (length) x 4.5 cm (width) = 33.75 cm^2 (area)

B. Find the area of the front and back faces. Total 2 = **67.5 cm^2**

Front: 7.5 cm (length) x 4.5 cm (width) = 33.75 cm^2 (area)	Back: 7.5 cm (length) x 4.5 cm (width) = 33.75 cm^2 (area)

C. Find the area of the left and right faces. Total 3 = **40.5 cm^2**

Left: 4.5 cm (length) x 4.5 cm (width) = 20.25 cm^2 (area)	Right: 4.5 cm (length) x 4.5 cm (width) = 20.25 cm^2 (area)

Working with Surface Area Activity

Cylinder

Answer Key

J. The dimensions of a given cylinder are:

h = <u>11. 2 cm</u>

d = <u>4.5 cm</u>

II. Use the data in #I to sketch and label the 2-dimensional and 3-dimensional diagram of this cylinder. **Answers will vary**

III. Find the surface area of the cylinder:

Work Area Circular Base	Work Area Lateral Face
$A=\pi r^2$ **$A=(3.14)(2.25)^2$** **$A=(3.14)(5.0625)$** **$A=15.89625\ cm^2$**	**$A=2\pi rh$** **$A=(2)(3.14)(2.25)(11.2)$** **$A=158.256$**

IV. What is the surface area of the cylinder? **<u>$174.155225\ cm^2$</u>**

V. How do you find the surface area of a cylinder? (**answers will vary**)

1. Find the area of the circular base.
2. Find the area of lateral face.
3. Add all the areas to find the sum.

Using Unit Cubes to Find the Surface Area

Answer Key

Directions: Using the unit cubes, build a 4" by 3" three story rectangular prism. (Each cube = 1 inch)

It's your turn to answer questions!

1. What are the dimensions of each rectangular face? List each.
   Top: **4 in x 3 in = 12 in^2**
   Bottom: **4 in x 3 in = 12 in^2**

   Front: **4 in x 3 in = 12 in^2**
   Back: **4 in x 3 in = 12 in^2**

   Left: **3 in x 3 in = 9 in^2**
   Right: **3 in x 3 in = 9 in^2**

2. What is the surface area of the rectangular prism constructed? **66 in^2**

   24 in^2 + 24 in^2 + 18 in^2 = **66 in^2**

3. What method did you use to find the surface area of the rectangular prism? Use pictures/words to represent your answer. (anwers will vary)

   1. **Find the areas of the top and bottom faces. Add the areas and get a total.**
   2. **Find the areas of the front and back faces. Add the areas and get a total.**
   3. **Find the areas of the left and right faces. Add the areas and get a total.**
   4. **To find the surface area, add all the totals.**