5E Lesson Plan - Volume of Cylinders [12.3]

Authors: Whitney Parsons & Emilee Conard
Title of Lesson: Volume of Cylinders
Date of Lesson: 26 October 2012
Length of Lesson: 50 Minutes
Name/Level of Course: 6th grade, IB Pre-algebra

Why Is This Lesson Appropriate for Middle School Students?:
This lesson is middle school appropriate because it allows the student to have a hands on activity, appealing to their sensory needs, and also allows them the opportunity to work with their peers and share ideas.

Technology Lesson? No

Source of the Lesson:
- Online Blog: "Runde's Room", 2012. Retrieved from http://www.rundesroom.com/search?q=volume
- Mcgraw-Hill, Pre-Algebra, Section 12.3

Concepts:
Volume is the quantitative measurement of the capacity of a three-dimensional object. Understanding the concept of volume is important for everyday life because volume is everywhere around us. It is what fills the soda bottles, fills up the bathtub or swimming pool, and the amount of pumpkin in a can to make pumpkin pie. It can be defined by formulas for simple shapes, such as prisms, spheres, and cylinders. The calculations involve cubic units of measurement, for example cubic centimeters.

Objectives: Students will be able to:
1.) describe the formula for the volume of cylinder.
2.) apply the formula for the volume of cylinder.
3.) solve for missing components of the formula given a volume.

State Standards:

Benchmark Number:	MA.6.G.4.3
Benchmark Description:	Determine a missing dimension of a plane figure or prism given its area or volume and some of the dimensions, or determine the area or volume given the dimensions.
Subject Area:	NGSSS: Mathematics
Grade Level:	6
Body of Knowledge:	Geometry
Supporting Idea:	Geometry and Measurement - Geometry and Measurement

Benchmark Number:	MA.6.A.3.4

Benchmark Description:	Solve problems given a formula.
Subject Area:	NGSSS: Mathematics
Grade Level:	6
Body of Knowledge:	Algebra
Big Idea:	BIG IDEA 3 - Write, interpret, and use mathematical expressions and equations.

FACT Used: Commit and Toss (#7)
pg. 68-71 from "Mathematics Formative Assessment" by Keeley and Tobey

Safety: No safety concerns for this lesson.

Materials List and Advanced Preparations:
2" cylinder & 4" cylinder
Sand w/ measuring cup
Different sized pill bottles
Quarters
"Discovering Volume of Cylinders" Worksheet (for each student)
"Toss & Share" Half-sheet (for each student)
Post-Assessment (for each student)

Pre-Assessment Time: 5 Minutes		
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Give the students pre-test prior to teaching the lesson.		
Based on the results of pretest, modify the lesson as needed.		

ENGAGEMENT Time: 6 Minutes		
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Hold up a cylindrical object.	Who knows what we call this three-dimensional shape? Does anyone have any ideas on how we can	Cylinder Fill it with stuff. Use a formula.

	measure the volume of this cylinder? Can we use the centimeter cubes like we did a few weeks ago for rectangular prisms?	 No, because it is not square/rectangular.
Hold up a measuring cup with sand to a particular point such as 4 cups for all the students to see. Fill the 2” cylindrical object with the sand so it fills the cylinder to the top.		
	How is measuring the volume of the cylinder different than the 4 cups of sand I poured in to the cylinder?	We can’t calculate volume as 4 cups. 4 cups isn’t in cubic units.
Hold up a 4” cylinder.	How much more will the 4” cylinder hold?	Misconception: Twice as much
Now pour the sand from the 2” cylinder to a 4”	Why isn’t it half full?	

Transition Statement:*Everyone had great ideas on how we can measure these items, let’s do an activity now to explore how to measure the volume of cylinders.*

EXPLORATION **Time: 20 Minutes**		
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
The teacher will group students in groups of three. The teacher will distribute to each student the “Toss and Share” half-sheet. **(FACT)** Say: Take a couple of minutes to answer the question on the		

worksheet, but do not put your name on it. When you are done, crumble your paper into a ball. Say: Toss the paper ball into the center of the room. Everyone, one table at a time, can go get one paper ball and sit back down at their table. Flatten your paper ball. Say: Can I have a volunteer to read me the answers on the paper they chose? The teacher will choose 4-5 students to read the answer and explanation on their papers. Demonstrate to the students that we have to measure the volume of cylinders using the area of a circle which is the base of the cylinder. Use circles and stack on on top of each other to make a cylinder. (like the circles are “layers” of the cylinder) The thickness of the circles represents units.		
The teacher will pass out the “Discovering Volume of Cylinders” worksheet to each student. The students will work in their groups to complete the worksheet, as the teacher walks around asking probing questions.	What measurements do you need to calculate the volume of a cylinder? What would happen if you were not given the radius, but you were given the diameter?	Radius, height, pi Divide the diameter by two to give you the radius.

	How could you find the volume of a cylinder if you were give the area of the base and the height, but no radius?	Just multiply the area of the base by the height of the cylinder.

Transition Statement: *There were a lot of good questions being asked in the activity, so let's hear some of them and talk about what we have figured out.*

EXPLANATION **Time: 8 Minutes**		
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
The teacher will go over the "Discovering Volume of Cylinders" worksheet and ask students to volunteer their answers and how they got it by coming up to the board. The worksheet will be displayed on the Promethean board.	How do you find the volume if you were given the diameter? How do you find the volume of the cylinder if you were given the area of the base? How do you find the radius and height of the cylinder if all you are given is the volume of the cylinder and the area of the base?	I divided the diameter by two to give me the radius, and used the radius in the formula. Multiply the area of the base by the height of the cylinder. Divide the volume of the cylinder by the area of the base, which gives you the height. Then take the square root of the number in front of pi from the area of the base, which is the radius.

Transition Statement: *Now that we have discovered how to measure the volume of cylinders, let's work on our interactive notebook and come up with definitions for each of the terms.*

ELABORATION **Time: 8 Minutes**		
What the Teacher Will Do	**Probing/Eliciting**	**Student Responses**

	Questions	and Misconceptions
The teacher will have the interactive notebook page on the Promethean board and the students will volunteer definitions of each item on the notebook, and as a class the students and teacher will define each item in proper terms.	How can we define diameter?	The length across the middle of a circle from one edge to the other.
	radius?	Half the diameter. From the center of a circle to the edge.
	pi?	Constant used with circles. 3.14
	cylinder?	can- shaped 3-D figure. 2 circle bases
	What is the formula for finding the volume of a cylinder?	V=area of base * height $V = \prod r^2 h$

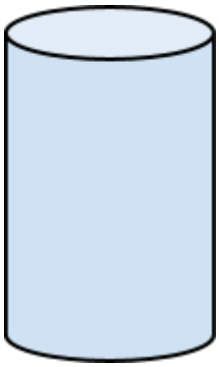
Transition Statement: *Now we are going to take a quiz. It is the same quiz you have taken before, we just want to see how much you have learned.*

EVALUATION **Time: 8 Minutes**		
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Collect all the worksheets from students. Instruct them to go back to their own seats.		
Distribute post-assessment to each student and instruct them to work independently. Allow 5-8 minutes to complete it.		

Pre-Assessment (Post-Assessment)
19 October 2012 ????
Ms. Chomat

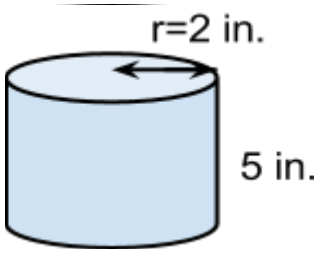
Name: _____

1.) What is one way to find the volume of a cylinder?



2.) Find the volume of the cylinder.

Show all work here:
{original document will have a box here}



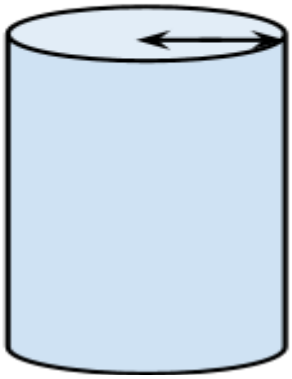
A) 10π in^3

B) 50π in^3
C) 10 in^3
D) 20π in^3

3.) If a cylinder with a volume of 90π cm^3 and the area of the base was $9\pi cm^2$, what is the height of the cylinder?

Show all work.

using the area given, r = _____ cm

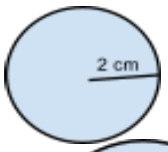


h = _____ cm

Toss & Share (Half-sheet)

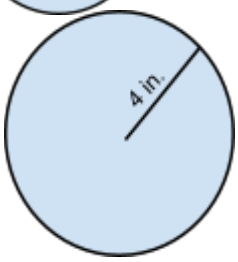
Formula for the area of circles: $A = \pi r^2$

1.



A =

2.



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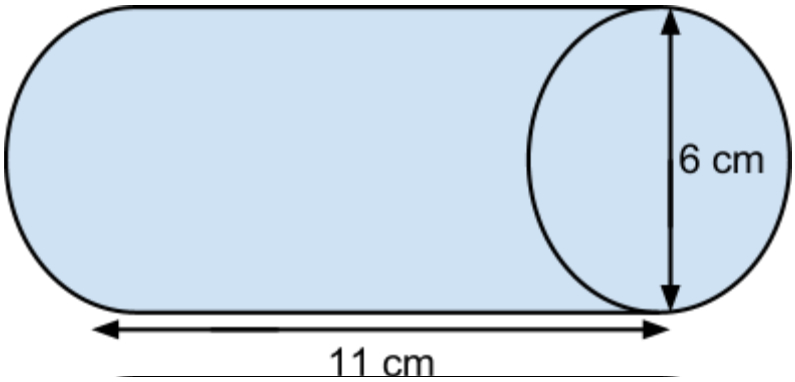
3. True OR False: We can use the area of a circle to find the volume of a cylinder. Explain.

Discovering Volume of Cylinders

26 October 2012

Name: _____

(#1) Use the cylinder below to answer the questions.



What is the height of the cylinder? _____

What is the diameter of the base of the cylinder? _____

What is the radius of the base of the cylinder? _____

Find the area of the base of the cylinder.

(Insert box here to show work)

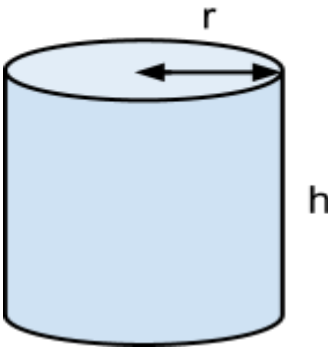
How can you use the area of the base to find the volume?

Putting it all together, what is the formula of volume of a cylinder?

$$V =$$

What is the volume of the cylinder pictured above?

(#2) If a cylinder with a volume of 200π ft^3 and the area of the base was $25\pi ft^2$, what is the height of the cylinder?
Reminder: Show all work.



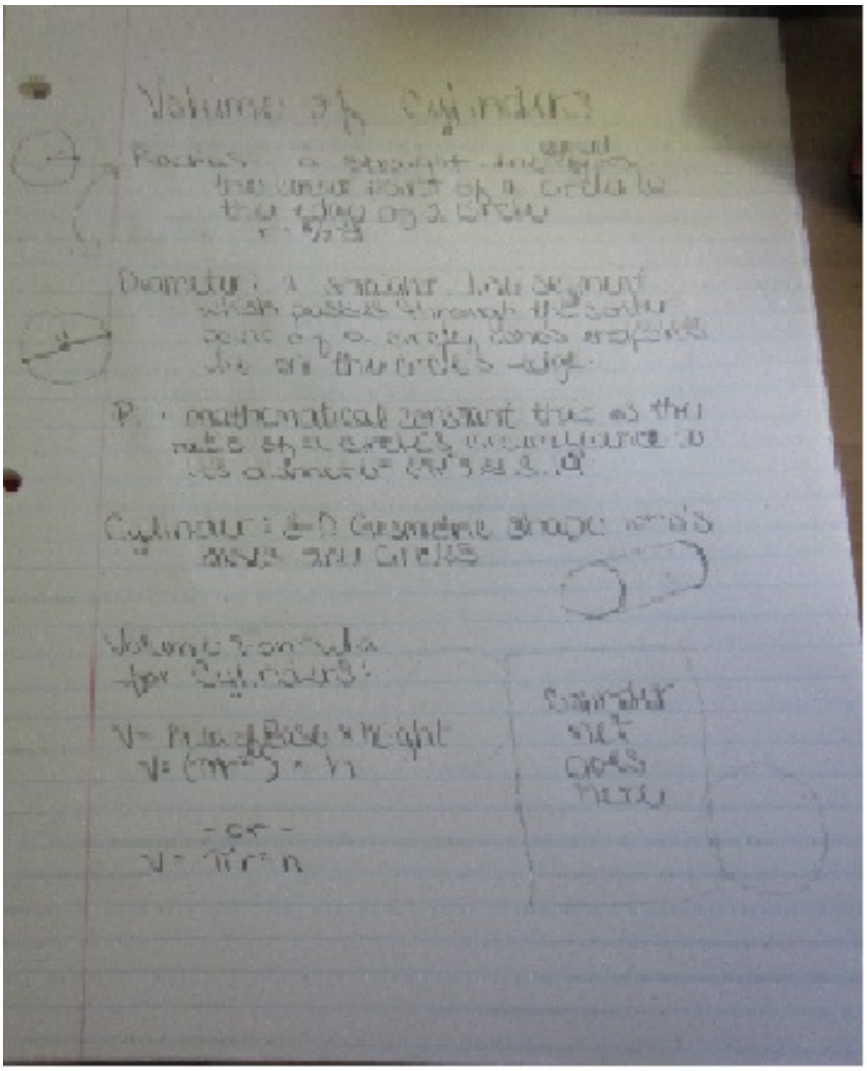
Step1- Using the area of the base that was given, what is the radius? _____ft
Explain:

Step2- Using the formula for volume of a cylinder, write an equation with the known variables (*radius & volume*) and the unknown variable (*height*).

Step3- What is the height of the given cylinder?

h = _____ft

Interactive Notebook Page


Volume of a Cylinder
Radius: a straight line segment that joins the center point of a circle to the edge of a circle
Diameter: a straight line segment which passes through the center point of a circle, connecting two points on the circle's edge.
π: a mathematical constant that is the ratio of a circle's circumference to its diameter (3.14)
Cylinder: a 3-D geometric shape with 2 bases and circles
Volume formula for Cylinders:
V = Area of Base x Height
V = (πr²) x h
- or -
V = πr²h
Consider what goes here