Volume, Surface Area for Cylinders

Summary

Students will measure and use formulas to find volume and surface area cylinders.

Main Core Tie

Mathematics Grade 8
Strand: GEOMETRY (8.G) Standard 8.G.9

Materials

    Centimeter paper for each student
    scissors
    tape
    Cylindrical object for each pair
    centimeter or inch paper
    Three cylindrical objects for each team
  - Copy of the pages for Volume and Surface Area Pocket Foldable
  - Prism and cylinder examples transparency
    (optional)

Background for Teachers

Enduring Understanding (Big Ideas):
volume and surface area
Essential Questions:
    What is the shape for the base and for the lateral area of a cylinder?
    How can formulas for surface area for cylinders help me find the surface area?
    What information is needed for finding volume a cylinder?
Skill Focus:
Find volume and surface area
Vocabulary Focus:
Base area, diameter, radius, Pi, cylinder, lateral area, bases, volume, surface area
Ways to Gain/Maintain Attention (Primacy):
Manipulatives, sketches, predicting, journaling, calculators, music, game, cooperative groups

Instructional Procedures

Starter:
Find the volume and surface area for each
Lesson Segment 1: What is the shape for the base and for the lateral area of a cylinder?
Making cylinders: Have students fold a piece of centimeter paper in half on a line and cut the halves apart. Have them roll one half sheet the short way and stick seam together with two small pieces of tape that can be easily undone. Have them fold the other half sheet in half, and cut it in two. Place the centimeter paper cylinder the paper, trace around the cylinder to make the two bases for the cylinder, and then cut the bases out. Tape the bases to the cylinder in one place.
Q. What is the base shape? What is the lateral area shape?
Do Three-Step Interview:
    If we were wrapping or covering up with squares the entire cylinder, what parts would need to be covered?
    What are the shapes for each of the covered parts?

Wrapping Cylinders. Give each pair a cylindrical object, centimeter paper and scissors. Students work with a partner to cut out a rectangle to fit around the lateral area and two circles to cover the bases. Ask students to measure the diameter to determine the radius.

Q. What is the base shape? What is the lateral area shape?

Do Three-Step Interview:

   If we were wrapping or covering up with squares the entire cylinder, what parts would need to be covered?

   What are the shapes for each of the covered parts?

Help them see that the circumference is the length of the rectangular lateral surface.

Lesson Segment 2: How can formulas for surface area for cylinders help me find the surface area?

Have students look at their Class Reference Sheet to remember the formula for finding area of a circle and area of a rectangle.

Q. What do the variables in these formulas represent? (r = radius, l = length, w = height).

Have students find the area for the circular bases of the centimeter cylinder by counting the radius and using the formula from the Class Reference sheet. Have them find the area for the rectangular lateral area by counting length and width and by using the formula for rectangle on the Class Reference sheet.

Q. Think-Team-Share: Knowing the area of both bases and of the lateral area, how would we now find the area of all these surfaces together?

Q. Think-Team-Share: How is the formula for circumference of a circle related to the length of the rectangle?

Q. Think-Team-Share: If the length of the rectangle is the circumference of the base, what dimension of the rectangle is the height of the cylinder?

Have students look at the formula for finding surface area of a cylinder. Have them read the formula aloud saying the word for what each symbol represents. Discuss what each part of the formula means.

Have students use the formula to find the surface area of their wrapped cylinder.

Lesson Segment 3: What information is needed in finding volume of a cylinder? How can I use a formula to find volume?

Sing the Perimeter, Area and Volume song with students again reminding them that area is measured in square units, but volume is measured in cubic units. Tell them they will be using cubic centimeters to estimate the volume of their cylinder. Give each team a package of centimeter cubes. Ask them to take off a base from their centimeter cylinder and arrange cubes to cover the base. Next they should set the cylinder by the base and try stacking up the centimeter cubes to the height of the cylinder, so they can determine how many layers of the base area would have to be stacked up to count the volume. Have them work as a team to estimate the approximate number of centimeter cubes needed to "fill it up".

Point out that Finding *volume* for a cylinder is difficult because stacking cubes in a round shape is not very accurate. However, if they can find the area of the base using a formula, they would then be able to multiply by the number of layers (or the height) to find a closer approximation to the volume. Have students look at the formula on the Class Reference Sheet. Discuss the meaning of each symbol in the formula. Have the class read the formula aloud saying the word for what each symbol represents. Ask students to use the formula to find the volume of their wrapped cylinder.

Game-Red Rover: Give each team three cylindrical objects. Have them use a ruler to measure for radius (half diameter) and height information. They use the data with the formulas for finding surface area and height. Give them 10-15 minutes making sure they write the problems on a paper. Tell each team they will be calling someone from another team over to bring one cylinder and their paper. The Rover will teach that team how to find volume and surface area for their cylinder. If they explain well and are accurate, they will be awarded two points for the Rover's team. If not, the team that called

them over will get one or both points. Teacher says, "Red Rover, Red Rover, send (and points to each team to say who they want to be sent over) _____ right over. When the Rover has had a chance to teach the team, teacher checks with each team to ask how many points they think the Rover should have and to defend this by telling whether the Rover explained correctly and explained well, so the team could work the problem. Continue Red Rover for four rounds giving students a chance to practice, and then reward the teams who have accumulated the most points.

Summarizing: Volume and Surface Area Pocket foldable

Have student fold the Title page of the foldable to make pockets. The cards are cut out to make index cards to slip into the pockets for reference. Help student fill out the sections on each index card to review the definitions and formulas they have learned.

Practice:

Practice of all surface area and volume formulas for this unit can be done using any game format and the examples for a transparency (attached) or any text practice.

Assessment Plan

Performance tasks, questions, observation

Bibliography

This lesson plan created by Linda Bolin.

Authors

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