



75 min

Math Learning Goals

- Establish classroom expectations.
- Establish a positive learning environment.
- Review volume of cylinders by investigation.
Note: This will not be review for 2005–2006.

Materials

- acetate (2 sheets)
- marbles
- clear tape
- BLM 1.1
- BLM 1.2 (Teacher)

Assessment Opportunities

Minds On ...

Whole Class → Ice Breaker

Each student is given a card with information related to a geometric shape – name, illustration, or algebraic expression. Once students have formed a group of four by matching cards, they introduce themselves and share a personal interest or experience. Use the matched cards to begin a class Word Wall.

Action!

Whole Class → Discussion

Roll two identical pieces of acetate into two different cylinders. See BLM 1.2 for teacher reference. Pose the question, Which cylinder will hold the most marbles? Students think about their answer and identify their choice by moving to opposite sides of the classroom.

One side represents the short, fat cylinder and the other represents the tall, skinny cylinder. Students who think that they will hold the same go to the middle of the room. Students discuss and justify their choice with other group members.

Groups of 3 → Investigation

Each group determines a strategy for estimating the number of marbles in the cylinder of their choice using blank paper and one marble per group member. Students record their method and estimate.

Reasoning and Proving/Observation/Anecdotal: Observe groups as they work, listening to the strategies they use and the thought processes they go through as they estimate and ask questions to arrive at a reasonable estimate.

Be sure to use the same-sized paper as acetate for experimenting.

Consolidate Debrief

Whole Class → Sharing

Discuss with students how they made their choice on which cylinder holds more and ask them to describe their estimation strategy.

Home Activity or Further Classroom Consolidation

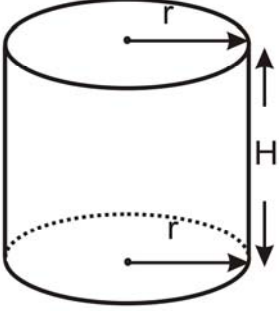
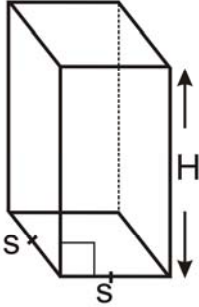
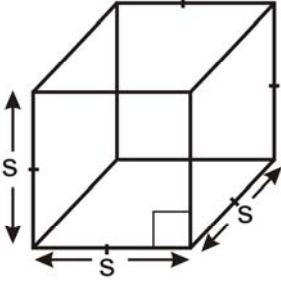
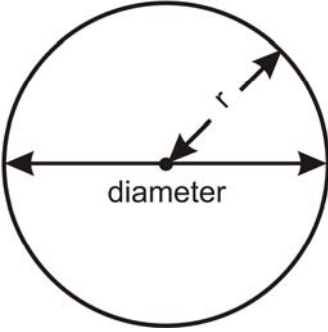
Use the following information to determine which cylinder has the greatest capacity:

- Length of paper: 27.9 cm; width of paper: 21.6 cm
 - Dimensions of short, fat cylinder – radius: 4.4 cm and height: 21.6 cm
 - Dimensions of tall, skinny cylinder – radius: 3.4 cm and height: 27.9 cm

See BLM 1.2 (Teacher)

*Application
Concept Practice*

1.1: Geo Match!

| | | | |
|----------------------------------|---|--|---|
| <p>Cylinder</p> |  | $V = (\text{area base})(H)$ $= (\pi r^2)(H)$ | $SA = \text{top} + \text{bottom} + \text{side}$ $= 2\pi r^2 + 2\pi r(H)$ |
| <p>Square-based Prism</p> |  | $V = (\text{area base})(H)$ $= (s)(s)(H)$ $= s^2(H)$ | $SA = \text{top} + \text{bottom} + \text{sides}$ $= 2(s)(s) + 4(s)(H)$ $= 2s^2 + 4(s)(H)$ |
| <p>Cube</p> |  | $V = (s)(s)(s)$ $= (s)^3$ | $SA = 6(s)(s)$ $= 6s^2$ |
| <p>Circle</p> |  | $C = \pi d$ <p>or</p> $C = 2\pi r$ | $A = \pi r^2$ |

1.1: Geo Match! (continued)

| | | | |
|-----------------------------|--|------------------|-------------------------|
| <p>Parallelogram</p> | <p>A parallelogram is shown with a horizontal base labeled 'Base (b)'. A vertical dashed line from the top side to the base is labeled 'Height (h)'. The slanted side is labeled 'c'. Tick marks on opposite sides indicate they are parallel.</p> | $P = 2b + 2c$ | $A = (b)(h)$ |
| <p>Rectangle</p> | <p>A rectangle is shown with a vertical side labeled 'Width (w)' and a horizontal side labeled 'Length (l)'. A right-angle symbol is shown in the bottom-left corner. Tick marks on opposite sides indicate they are equal in length.</p> | $P = 2w + 2l$ | $A = (l)(w)$ |
| <p>Trapezoid</p> | <p>A trapezoid is shown with a top horizontal base labeled 'a' and a bottom horizontal base labeled 'b'. A vertical dashed line between the bases is labeled 'Height (h)'. The slanted sides are labeled 's'. Tick marks on the top and bottom bases indicate they are parallel.</p> | $P = a + b + 2s$ | $A = \frac{(a+b)h}{2}$ |
| <p>Square</p> | <p>A square is shown with a horizontal side labeled 's'. A right-angle symbol is shown in the bottom-left corner. Tick marks on all four sides indicate they are equal in length.</p> | $P = 4s$ | $A = (s)(s)$ $= s^2$ |

1.2: Which Cylinder Has the Greater Volume? (Teacher)

Paper can be folded in two different ways to form cylinders. In this activity, students examine how this affects the volume of the cylinders.

Prediction

Students predict how the volumes will compare and estimate the difference in volume. Do you think that the volumes will be equal or will one be bigger? If so, estimate how much bigger the volume of one cylinder will be compared to the other.

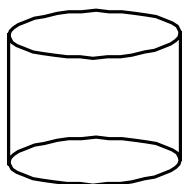
(Example: The volumes of both cylinders will be the same because we are using the same piece of paper.)

Materials

2 pieces of paper of equal size ($8\frac{1}{2} \times 11$), ruler, tape

Solutions

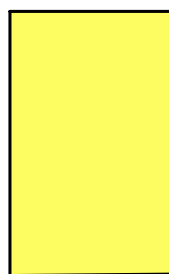
Case 1



Length: 27.9 cm
Width: 21.6 cm

Radius: 4.4 cm
Height: 21.6 cm
Volume: 1338 cm^3

Case 2



New Length: 21.6 cm
New Width: 27.9 cm

Radius: 3.4 cm
Height: 27.9 cm
Volume: 1036 cm^3

Note: The paper is turned to create a new length and width.

Conclusion

Students make a conclusion based on their observations and measurements.

(Example: The volumes of the cylinders are different! The volume of one [1] is nearly 1.3 times as much as the other [2]).



75 min

Math Learning Goals

- Solve problems involving the volume of prisms and cylinders.

Materials

- acetate (2 sheets)
- envelope
- marbles
- BLM 2.1
- BLM 1.2 (Teacher)
- linking cubes

Assessment Opportunities

Minds On ...

Whole Class → Activating Prior Knowledge

Make two or three copies of BLM 2.1, each in a different colour. Cut out each card, shuffle them, and place them in an envelope for distribution. Each student receives one card. Students find the matching diagram and corresponding formula of the same colour. These pairs form the grouping for the Action activity.

Whole Class → Discussion

Ask the question assigned in the previous lesson: Which cylinder has the greater capacity? Determine if any students changed their minds after doing the calculations. See BLM 1.2 for answers.

Review how to calculate the volume of a cylinder.

Complete the discussion by filling up the two acetate cylinders with marbles. Count the marbles in each one. As well, distribute one marble to each student.

Ensure that matching sets are distributed.

Action!

Pairs → Investigation

Provide each pair with 24 linking cubes. Students construct rectangular prisms using all 24 linking cubes and record information about the length, width, height, and volume of their prism. Encourage students to find as many different rectangular prisms as they can.

Students should recognize that the volume is the same as the number of cubes. At this point, it is not necessary to use the formula. Use students' models and discuss whether $2 \times 3 \times 4$ and $4 \times 3 \times 2$ are the same.

Ask how they will know when they have constructed all possibilities.

Learning Skills (Organization)/Observation/Rating Scale: Observe students as their work on identifying different rectangular prisms.

Consolidate Debrief

Whole Class → Note Making

Write a definition for a prism (include all types of prisms). Students provide examples, e.g., a loaf of bread, an elevator shaft, or a potato chip can. Highlight that prisms have congruent layers, leading to the concept that volume is area of the base times the height. Using the shapes from the matching activity, students describe what the prism based on their shape would look like. Create the volume formula for their shape and then create a volume problem.

Formalize the volume of all prisms as $V = (\text{area of base}) \times (\text{height})$. To review simple area formulas, do sample questions with students involving a variety of bases.

A prism is a 3-D figure with at least one pair of parallel and congruent sides.

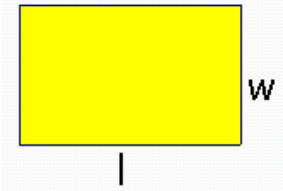
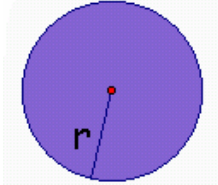
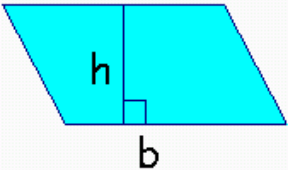
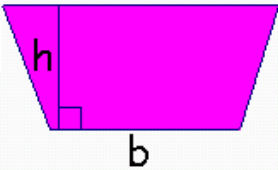
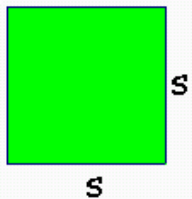
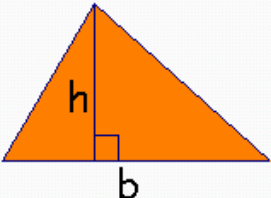
Concept Practice

Home Activity or Further Classroom Consolidation

Complete the problems involving volume of prisms. Use the formula $V = (\text{area of base}) \times (\text{height})$.

Provide appropriate practice problems.

2.1: Matching the Math

| | |
|--|---------------------------|
| <p>Rectangle</p>  | $A = l \times w$ |
| <p>Circle</p>  | $A = \pi r^2$ |
| <p>Parallelogram</p>  | $A = bh$ |
| <p>Trapezoid</p>  | $A = \frac{1}{2}(a + b)h$ |
| <p>Square</p>  | $A = s^2$ |
| <p>Triangle</p>  | $A = \frac{1}{2}bh$ |