Volume of a Cylinder

7.3

***MathLinks 8*, pages 262–267**

Suggested Timing
80–100 minutes

Materials
- ruler
- a variety of empty cylindrical cans (one per pair of students)
- centimetre grid paper
- measuring cup (one per pair of students)
- sand or rice
- calculator
- construction paper (optional)
- transparent tape (optional)
- dime (optional)
- models of right prisms, cubes, and right cylinders

Blackline Masters
Master 8 Centimetre Grid Paper
BLM 7–3 Chapter 7 Warm-Up
BLM 7–9 Section 7.3 Extra Practice
BLM 7–10 Section 7.3 Math Link

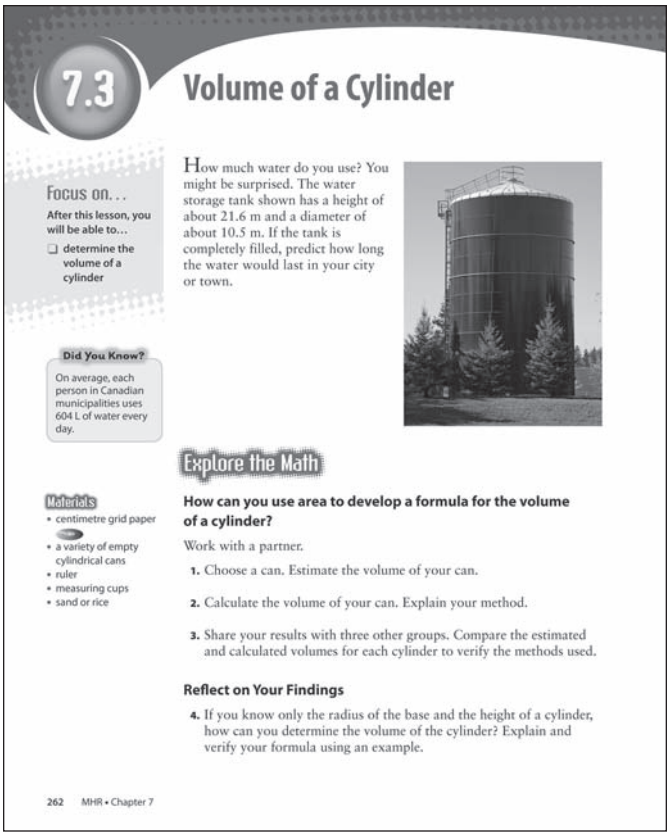
Mathematical Processes
- ☑ Communication (C)
- ☑ Connections (CN)
- ☑ Mental Mathematics and Estimation (ME)
- ☑ Problem Solving (PS)
- ☑ Reasoning (R)
- ☑ Technology (T)
- ☑ Visualization (V)

Specific Outcomes
SS4 Develop and apply formulas for determining the volume of right prisms and right cylinders.

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	1, 3, 4a), b), 5a), d), 6a), b), 7a), b), 8, Math Link
Typical	1, 3, 4a), b), 5a), d), 6a), b), 7a), b), 8, 10, 12–14, Math Link
Extension/Enrichment	1, 3, 11, 12, 15–18, Math Link

Planning Notes

Have students complete the warm-up questions on **BLM 7–3 Chapter 7 Warm-Up** to reinforce material learned in previous sections.



7.3 Volume of a Cylinder

Focus on...
After this lesson, you will be able to...
- determine the volume of a cylinder

How much water do you use? You might be surprised. The water storage tank shown has a height of about 21.6 m and a diameter of about 10.5 m. If the tank is completely filled, predict how long the water would last in your city or town.

Did You Know?
On average, each person in Canadian municipalities uses 604 L of water every day.

Explore the Math

Materials
- centimetre grid paper
- a variety of empty cylindrical cans
- ruler
- measuring cups
- sand or rice

How can you use area to develop a formula for the volume of a cylinder?

Work with a partner.

1. Choose a can. Estimate the volume of your can.
2. Calculate the volume of your can. Explain your method.
3. Share your results with three other groups. Compare the estimated and calculated volumes for each cylinder to verify the methods used.

Reflect on Your Findings

4. If you know only the radius of the base and the height of a cylinder, how can you determine the volume of the cylinder? Explain and verify your formula using an example.

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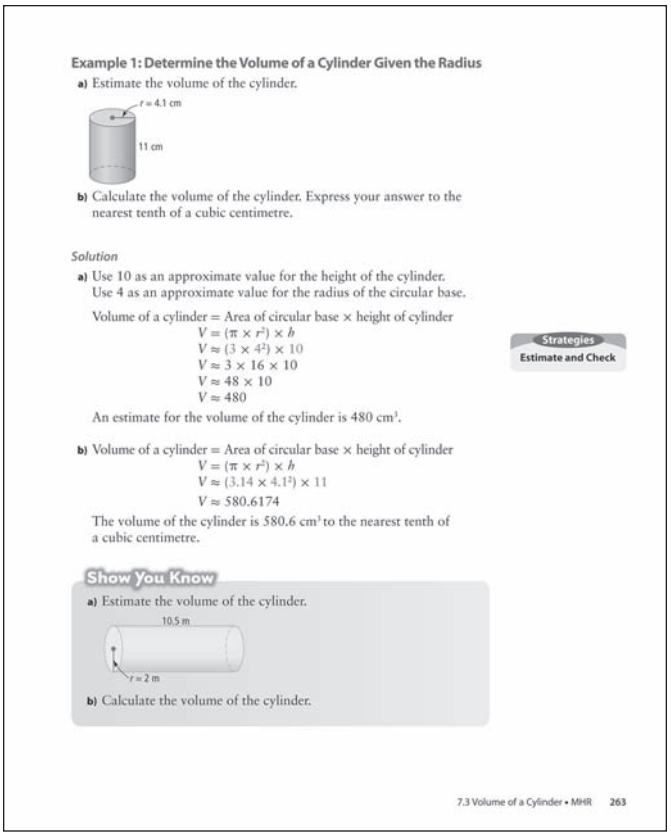
As a class, read the opening text as an introduction to the Explore the Math. Have students brainstorm how to calculate the volume of the water storage tank after identifying its shape (cylinder). After completing Example 2, you might have students do the calculation.

Explore the Math

In advance, collect empty cans in several different shapes and sizes. Make sure the cans have no sharp edges.

In this exploration, students use a cylindrical can to explore the relationship between the area of the base, the height, and the volume of a cylinder in order to develop a formula for volume. Remind students that they did a similar exploration in section 7.1 using a prism.

Most students will have measured volume in science class using a measuring cup or graduated cylinder. This exploration demonstrates that volumes estimated



Example 1: Determine the Volume of a Cylinder Given the Radius

a) Estimate the volume of the cylinder.

$r = 4.1$ cm

11 cm

b) Calculate the volume of the cylinder. Express your answer to the nearest tenth of a cubic centimetre.

Solution

a) Use 10 as an approximate value for the height of the cylinder. Use 4 as an approximate value for the radius of the circular base.

Volume of a cylinder = Area of circular base × height of cylinder

$V = (\pi \times r^2) \times h$

$V \approx (3 \times 4^2) \times 10$

$V \approx 3 \times 16 \times 10$

$V \approx 48 \times 10$

$V \approx 480$

An estimate for the volume of the cylinder is 480 cm³.

Strategies: Estimate and Check

b) Volume of a cylinder = Area of circular base × height of cylinder

$V = (\pi \times r^2) \times h$

$V \approx (3.14 \times 4.1^2) \times 11$

$V \approx 580.6174$

The volume of the cylinder is 580.6 cm³ to the nearest tenth of a cubic centimetre.

Show You Know

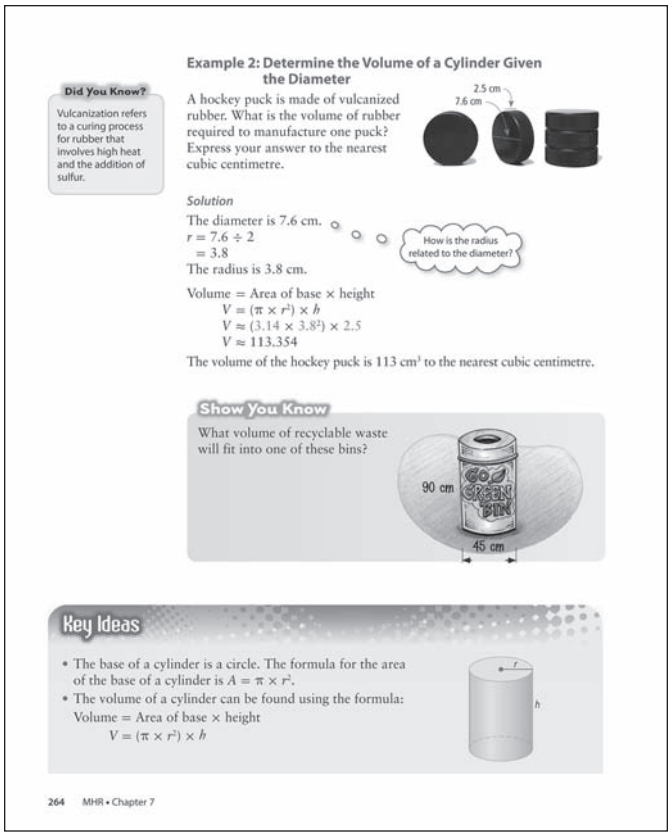
a) Estimate the volume of the cylinder.

10.5 m

$r = 2$ m

b) Calculate the volume of the cylinder.

7.3 Volume of a Cylinder • MHR 263



Example 2: Determine the Volume of a Cylinder Given the Diameter

Did You Know?

Vulcanization refers to a curing process for rubber that involves high heat and the addition of sulfur.

A hockey puck is made of vulcanized rubber. What is the volume of rubber required to manufacture one puck? Express your answer to the nearest cubic centimetre.

2.5 cm

7.6 cm

Solution

The diameter is 7.6 cm.

$r = 7.6 \div 2$

$= 3.8$

How is the radius related to the diameter?

The radius is 3.8 cm.

Volume = Area of base × height

$V = (\pi \times r^2) \times h$

$V \approx (3.14 \times 3.8^2) \times 2.5$

$V \approx 113.354$

The volume of the hockey puck is 113 cm³ to the nearest cubic centimetre.

Show You Know

What volume of recyclable waste will fit into one of these bins?

90 cm

45 cm

Key Ideas

- The base of a cylinder is a circle. The formula for the area of the base of a cylinder is $A = \pi \times r^2$.
- The volume of a cylinder can be found using the formula:
  Volume = Area of base × height
  $V = (\pi \times r^2) \times h$

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by measurement are virtually the same as volumes calculated using the dimensions of the cylinder. In step 6, ensure that students understand that this is true no matter the size or shape of a cylinder.

Have students work in pairs to do the activity. Have different types of measuring devices available, but not visible to students. Before starting the Explore, brainstorm with students what they might need to measure the volume of a cylinder (note that this could be done the previous day). Ask:

- What different methods have you already used to measure the volume of a cylinder? (If students do not make a connection to science or cooking, hold up a container of milk and ask how they could measure out a volume of milk.)
- What equipment do you need to measure volume in this way?
- Where can you get it?
- What is the conversion rate for mL to cm³? (1 mL = 1 cm³)

Have students collect one can and the other materials they decided they needed to complete this Explore. Make **Master 8 Centimetre Grid Paper** available for students who may find it useful to trace and count the number of cm³ in the base of their can.

As students work, circulate and observe what they are doing. If necessary, encourage them to extend their thinking from section 7.1 by asking questions such as the following:

- You have now measured the volume of this cylinder. What is the volume?
- If 1 mL is the same as 1 cm³, what is another way of reporting the volume of this cylinder?
- How could you use what you learned in section 7.1 to help you calculate the volume of this cylinder?
- How can you use your knowledge of the area of a circle to help you solve this problem?
- What measurements do you need? How can you get them?
- How can you use these measurements?
- How can you calculate the area of the base of this cylinder?
- How can you use that area to calculate the volume of this cylinder?
- Does your calculation agree with the measured volume? Explain why or why not.

Have groups compare the results from the different cylinders they have used. For each cylinder, have them check whether the calculated volume is the same as the measured volume. Discuss why this might be so.

Challenge students to generalize what they are observing by developing one or more formulas for calculating the volume of a cylinder. Discuss these formulas in groups and then as a class. Ask:

- How does this formula work?
- Is using the formula the only way to solve this problem? Explain.
- What can you do if you forget the formula? What other strategy(ies) can you use to solve this type of problem?

Example 1

This example illustrates using a formula to estimate and calculate the volume of a cylinder given the radius. Work through the solution as a class. If students understand the shared property that makes calculating the volume of prisms and cylinders similar, then they will understand that a cylinder is a specific case of a general property. Prompt students to explain the benefit of estimating before calculating.

Ask students how else the problem in the Example could be solved. Discuss these strategies, including how else the formula could be stated.

Have students estimate the answer to the Show You Know. In pairs, have them solve the Show You Know using a strategy different from the one in Example 1, and then check their answer using a formula of their choice.

Example 2

Have students read the problem in Example 2 and ask them how the information provided differs from the information in Example 1. (They are given the diameter instead of the radius of the cylinder.) Ask them to discuss with a partner how this will affect their calculations and then develop a strategy for solving this problem. Discuss the strategies developed.

Encourage students to make a habit of checking whether they are given a measurement for radius or diameter when working with cylinders. Highlight the importance of reading questions carefully. Discuss how estimating an answer might help them identify an error made in calculation.

Meeting Student Needs

- Some students may struggle with radius squared (r^2) when calculating the volume of a cylinder. Consider having them multiply the radius by the radius ($r \times r$) initially, until they gain understanding. At some point, have students revisit evaluating exponents by hand and with a calculator, and have them discontinue multiplying the radius by the radius.
- Provide students with a similar problem to solve using a familiar context. Or, students might calculate the volume of a cylinder from home.

ELL

- Ensure that English language learners understand the following terms: *water storage tanks*, *municipalities*, *radius*, *diameter*, *hockey puck*, *vulcanized rubber*, and *manufacture*. Have students add any new terms to their dictionary.

Gifted and Enrichment

- Challenge students to research the size of the water storage tank in the school community. Have them use the information from the Did You Know? on page 262 to estimate how long the water in the storage tank would last if it was not replenished.

Common Errors

- Some students may round numbers too early in their calculations.

R_x Encourage students to use as many decimal points of accuracy as their calculator provides, and wait until the final answer before rounding. Unless otherwise specified, you may wish to have them round to one decimal place.

Answers

Explore the Math

1.-3. Answers will vary depending on the dimensions of the cans.

4. Answers may vary. Example: Use the formula for the area of a circular base and multiply by the height of a cylinder to determine its volume. Students should verify the formula using an example they develop.

Show You Know: Example 1

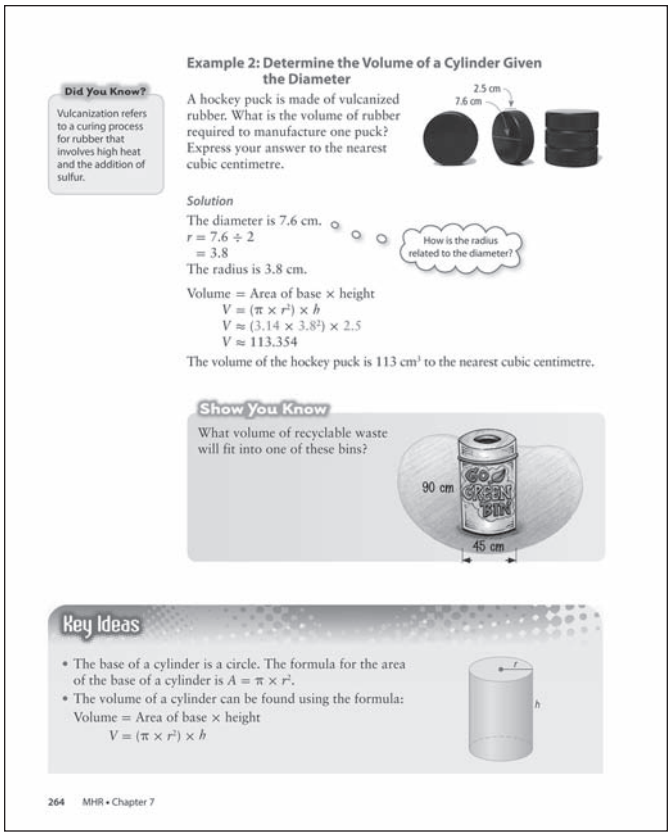
a) Answers may vary. Example: Estimate of volume of cylinder: 120 m^3

b) Volume of cylinder: 131.88 m^3

Show You Know: Example 2

Volume of recyclable waste: 143 066.25 cm^3

Assessment	Supporting Learning
Assessment *as* Learning	
Reflect on Your Findings Listen as students discuss what they discovered during the Explore the Math. Try to have students generalize the formula for the volume of a cylinder.	• Encourage students to refer to section 7.2 to help them make the connection between the area and volume of a prism and the area and volume of a cylinder. • Make the connections between sections 7.2 and 7.3 explicit for students who might limit themselves to memorizing the formula without understanding it. • Check that students understand how to find the area of a circle and use 3.14 as a value for pi.
Assessment *for* Learning	
Example 1 Have students do the Show You Know related to Example 1.	• Encourage students to verbalize their thinking. • You may wish to have students work with a partner. • Some students may benefit from reactivating their skills with exponents and squaring numbers. • Some students may benefit from drawing the base of the cylinder and calculating the area of the base first, before multiplying by the height. • Encourage students to avoid using a calculator until the final step of the solution. This should minimize the number of potential errors, and also makes it easier to note where an error is made. • Remind students to use estimation to check for the reasonableness of answers.
Example 2 Have students do the Show You Know related to Example 2.	• Encourage students to verbalize their thinking. • You may wish to have students work with a partner. • As the first step to solve a problem, have students develop a habit of writing: The radius is ____. Doing this will reduce the chance of using the value of the diameter instead of the radius in applying the formula. • Some students may benefit from drawing the base of the cylinder and calculating the area of the base first, before multiplying by the height. Labelling the radius and diameter may help them avoid using the diameter to calculate the area of a circle.



Example 2: Determine the Volume of a Cylinder Given the Diameter

Did You Know?

Vulcanization refers to a curing process for rubber that involves high heat and the addition of sulfur.

A hockey puck is made of vulcanized rubber. What is the volume of rubber required to manufacture one puck? Express your answer to the nearest cubic centimetre.

2.5 cm
7.6 cm

Solution

The diameter is 7.6 cm.
$r = 7.6 \div 2$
$= 3.8$
The radius is 3.8 cm.

How is the radius related to the diameter?

Volume = Area of base × height
$V = (\pi \times r^2) \times h$
$V \approx (3.14 \times 3.8^2) \times 2.5$
$V \approx 113.354$

The volume of the hockey puck is 113 cm^3 to the nearest cubic centimetre.

Show You Know

What volume of recyclable waste will fit into one of these bins?

90 cm
45 cm

Key Ideas

- The base of a cylinder is a circle. The formula for the area of the base of a cylinder is $A = \pi \times r^2$.
- The volume of a cylinder can be found using the formula:
  Volume = Area of base × height
  $V = (\pi \times r^2) \times h$

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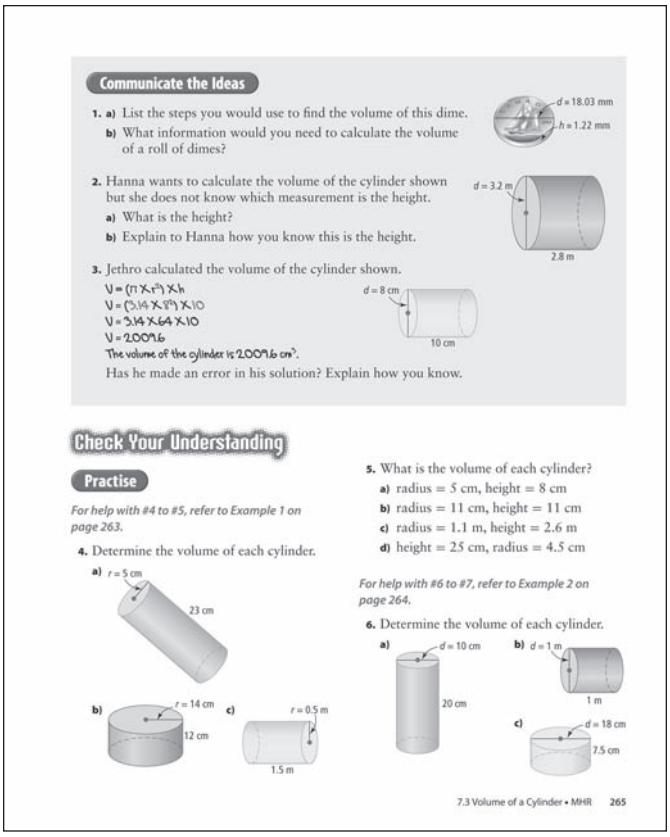


Communicate the Ideas

1. a) List the steps you would use to find the volume of this dime.
   b) What information would you need to calculate the volume of a roll of dimes?

d = 18.03 mm
h = 1.22 mm

2. Hanna wants to calculate the volume of the cylinder shown but she does not know which measurement is the height.
   a) What is the height?
   b) Explain to Hanna how you know this is the height.

d = 3.2 m
2.8 m

3. Jethro calculated the volume of the cylinder shown.

$V = (\pi \times r^2) \times h$
$V = (3.14 \times 8^2) \times 10$
$V = 3.14 \times 64 \times 10$
$V = 2009.6$
The volume of the cylinder is 2009.6 cm^3.

Has he made an error in his solution? Explain how you know.

d = 8 cm
10 cm

Check Your Understanding

Practise

For help with #4 to #5, refer to Example 1 on page 263.

4. Determine the volume of each cylinder.

a) r = 5 cm
23 cm

b) r = 14 cm
12 cm

c) r = 0.5 m
1.5 m

5. What is the volume of each cylinder?
   a) radius = 5 cm, height = 8 cm
   b) radius = 11 cm, height = 11 cm
   c) radius = 1.1 m, height = 2.6 m
   d) height = 25 cm, radius = 4.5 cm

For help with #6 to #7, refer to Example 2 on page 264.

6. Determine the volume of each cylinder.

a) d = 10 cm
20 cm

b) d = 1 m
1 m

c) d = 18 cm
7.5 cm

7.3 Volume of a Cylinder • MHR 265

Key Ideas

The Key Ideas summarize the formula for the volume of a right cylinder. Consider having students create a model of a cylinder using either a net or construction paper and tape. Make **Master 8 Centimetre Grid Paper** available for this purpose. Have students label the model with the radius and area of the base at one end, and the height. Students can use the model as a visual reminder of what they learned. Alternatively, have students use an index card to draw and label a diagram of the model and record the formula for volume. Have them store the card in their chapter Foldable.

Communicate the Ideas

Use #1 to gain insight into students' understanding of applying the formula for volume of a cylinder. Some students may be confused about how to respond to a question that does not necessarily refer to measurements. It might be worth noting that many situations in life require measurement before calculating. Have students do #1 individually, and then compare their steps with a partner. For #2, encourage students to make a connection with their work on prisms when identifying the height. If students work in pairs, they should be able to correct any misconceptions about the height of a cylinder. For #3, students are required to identify the error in using the diameter instead of the radius in the formula. Have students do #3 individually.

Meeting Student Needs

- Encourage students to estimate the volume of each cylinder in #1 to #3 by using the volume of a rectangular prism with a square base that completely contains each cylinder. This will give them an upper limit of the volume, and should help catch errors such as using the diameter instead of the radius.

ELL

- Give English language learners the opportunity to answer the questions in their own language, and then try to explain their thinking in English. Alternatively, allow students to answer the questions using numbers and diagrams.

Common Errors

- Some students may make errors such as using diameter instead of radius, forgetting to square the radius, or confusing squaring with doubling.

R_x Remind students that estimating before calculating is a helpful way to note errors.

Answers

Communicate the Ideas

1. a) Answers may vary. Example: Divide the diameter by 2 to obtain the length of the radius. Square the radius. Multiply by 3.14. Then, multiply the result by the height. The volume of the dime is 311.3 mm^3.

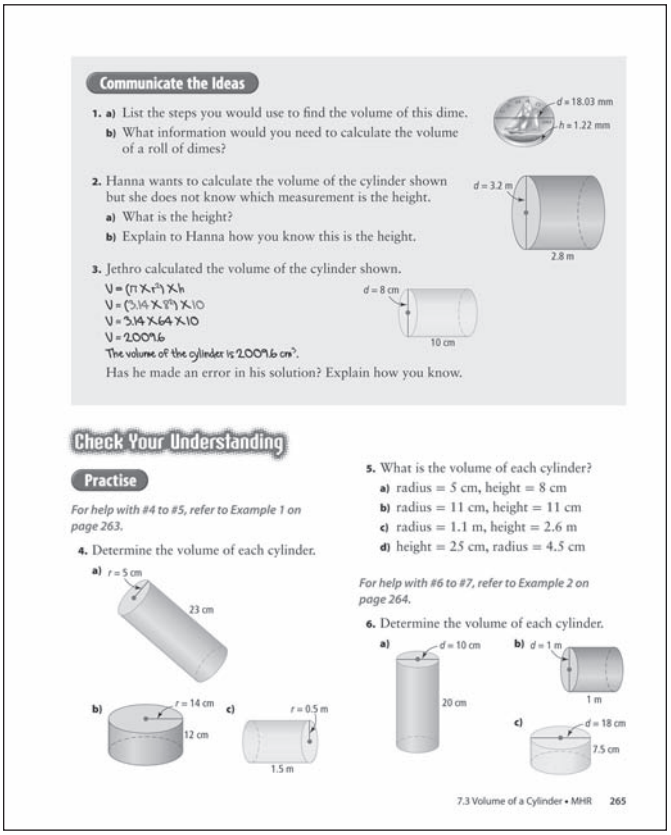
b) Answers may vary. Example: You need to know how many dimes are in a roll of dimes.

2. a) Height: 2.8 m

b) Answers may vary. Example: The height is the perpendicular distance between the circular bases.

3. Answers may vary. Example: Jethro has made an error in his solution. He did not use the radius to find the volume; he used the diameter. The correct volume is 502.4 cm^3.

Assessment	Supporting Learning
Assessment *as* Learning	
Communicate the Ideas Have all students complete #1 and #3.	• For #1, some students may benefit from handling a dime and then preparing their own labelled diagram. • Coach students who struggle with recording the steps for #1 to verbalize the steps and then record the steps. • Students who do not identify the error in #3 may benefit from setting up a table with two columns. Have them use column 1 to record the solution using the radius of the cylinder, and column 2 to record the solution using the diameter of the cylinder. This will help students locate the error. • To avoid the error in #3, prompt students to write the following statement as the first step in determining the volume of a cylinder: The radius is ____. Alternatively, they can sketch and label each cylinder.



Communicate the Ideas

1. a) List the steps you would use to find the volume of this dime.
b) What information would you need to calculate the volume of a roll of dimes?

2. Hanna wants to calculate the volume of the cylinder shown but she does not know which measurement is the height.
a) What is the height?
b) Explain to Hanna how you know this is the height.

3. Jethro calculated the volume of the cylinder shown.

$V = (\pi \times r^2) \times h$
$V = (3.14 \times 3^2) \times 10$
$V = 3.14 \times 64 \times 10$
$V = 2009.6$
The volume of the cylinder is 2009.6 cm^3.

Has he made an error in his solution? Explain how you know.

Check Your Understanding

Practise

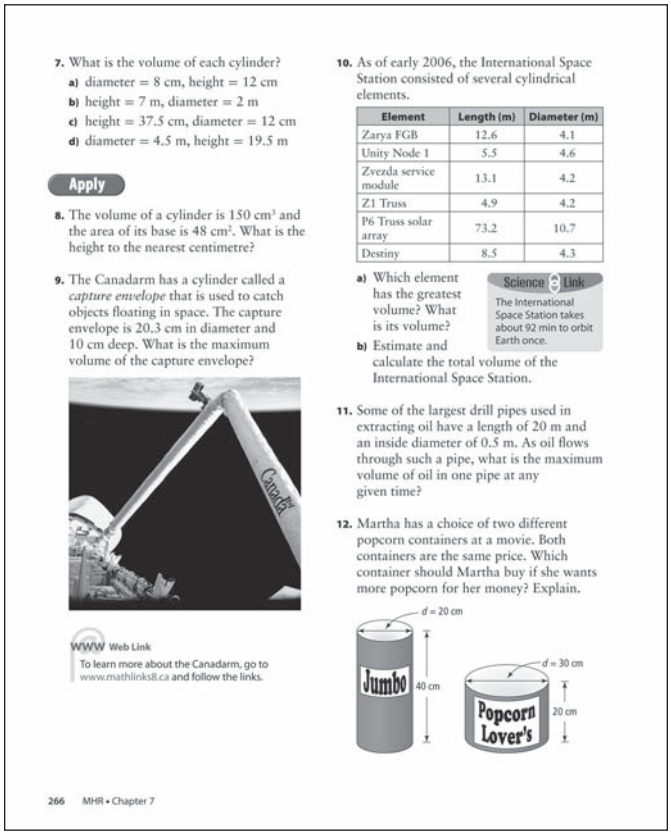
For help with #4 to #5, refer to Example 1 on page 263.

4. Determine the volume of each cylinder.

5. What is the volume of each cylinder?
a) radius = 5 cm, height = 8 cm
b) radius = 11 cm, height = 11 cm
c) radius = 1.1 m, height = 2.6 m
d) height = 25 cm, radius = 4.5 cm

For help with #6 to #7, refer to Example 2 on page 264.

6. Determine the volume of each cylinder.



7. What is the volume of each cylinder?
a) diameter = 8 cm, height = 12 cm
b) height = 7 m, diameter = 2 m
c) height = 37.5 cm, diameter = 12 cm
d) diameter = 4.5 m, height = 19.5 m

Apply

8. The volume of a cylinder is 150 cm^3 and the area of its base is 48 cm^2. What is the height to the nearest centimetre?

9. The Canadarm has a cylinder called a *capture envelope* that is used to catch objects floating in space. The capture envelope is 20.3 cm in diameter and 10 cm deep. What is the maximum volume of the capture envelope?

WWW Web Link
To learn more about the Canadarm, go to www.mathlinks8.ca and follow the links.

10. As of early 2006, the International Space Station consisted of several cylindrical elements.

Element	Length (m)	Diameter (m)
Zarya FGB	12.6	4.1
Unity Node 1	5.5	4.6
Zvezda service module	13.1	4.2
Z1 Truss	4.9	4.2
P6 Truss solar array	73.2	10.7
Destiny	8.5	4.3

a) Which element has the greatest volume? What is its volume?
b) Estimate and calculate the total volume of the International Space Station.

Science Link
The International Space Station takes about 92 min to orbit Earth once.

11. Some of the largest drill pipes used in extracting oil have a length of 20 m and an inside diameter of 0.5 m. As oil flows through such a pipe, what is the maximum volume of oil in one pipe at any given time?

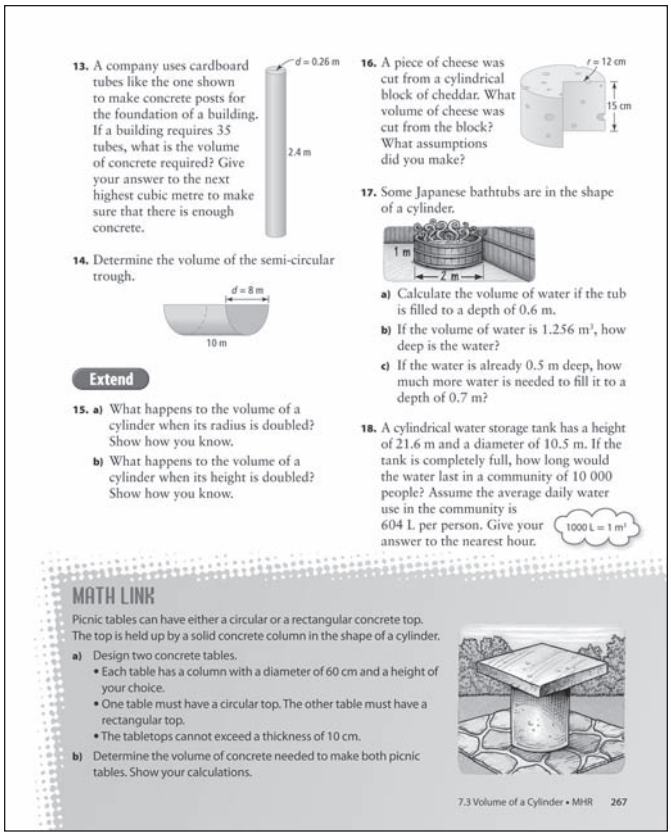
12. Martha has a choice of two different popcorn containers at a movie. Both containers are the same price. Which container should Martha buy if she wants more popcorn for her money? Explain.

Check Your Understanding

Practise

These questions provide students with ample practice in determining the volume of a cylinder, given the radius or diameter, and the height. Encourage students to locate their own errors when their answers do not match those of their peers or the student resource. The limited number of potential numerical errors provides an excellent opportunity for students to develop their error analysis skills.

Consider having students estimate and then calculate the volumes for #4 to #7. Encourage students to draw and label diagrams for #5 and #7.



13. A company uses cardboard tubes like the one shown to make concrete posts for the foundation of a building. If a building requires 35 tubes, what is the volume of concrete required? Give your answer to the next highest cubic metre to make sure that there is enough concrete.

14. Determine the volume of the semi-circular trough.

16. A piece of cheese was cut from a cylindrical block of cheddar. What volume of cheese was cut from the block? What assumptions did you make?

17. Some Japanese bathtubs are in the shape of a cylinder.

a) Calculate the volume of water if the tub is filled to a depth of 0.6 m.
b) If the volume of water is 1.256 m³, how deep is the water?
c) If the water is already 0.5 m deep, how much more water is needed to fill it to a depth of 0.7 m?

Extend

15. a) What happens to the volume of a cylinder when its radius is doubled? Show how you know.
b) What happens to the volume of a cylinder when its height is doubled? Show how you know.

18. A cylindrical water storage tank has a height of 21.6 m and a diameter of 10.5 m. If the tank is completely full, how long would the water last in a community of 10 000 people? Assume the average daily water use in the community is 604 L per person. Give your answer to the nearest hour.

MATH LINK

Picnic tables can have either a circular or a rectangular concrete top. The top is held up by a solid concrete column in the shape of a cylinder.

a) Design two concrete tables.
- Each table has a column with a diameter of 60 cm and a height of your choice.
- One table must have a circular top. The other table must have a rectangular top.
- The tabletops cannot exceed a thickness of 10 cm.

b) Determine the volume of concrete needed to make both picnic tables. Show your calculations.

Apply

These questions provide a range of contexts for students to apply their skills in solving problems involving volume of cylinders. Encourage students to use their estimation and error analysis skills. Consider giving students some choice in the questions they do.

Extend

For #15, students are required to consider abstractly how volume changes as the radius or height changes. The remaining questions involve using volume calculations to solve more complex problems.

Math Link

The Math Link provides an opportunity for students to apply their knowledge of the volume of a cylinder and a rectangular prism. Invite artistic students to draw several examples of tables that fit the criteria. This will help clarify the expectations for the activity, as well as provide a cue to students who have difficulty choosing their own measurements.

Meeting Student Needs

- Providing a template for solving the volume of a cylinder with a place for students to write the radius and height should help them avoid using the diameter instead of the radius in the formula. Walk through the first few problems by providing the formula and the first step, with a place for students to record the values. Move toward having students provide the steps.
- For #10, encourage students to draw and label a diagram as a first step to solving the problem.
- Some students may struggle with the text-dense questions in the Apply and Extend sections. Help students extract the information they need to answer each question.
- Consider allowing students to work in pairs. They might work on one question together and then work individually on the next one. Ensure that students complete a number of questions individually.
- Provide **BLM 7–9 Section 7.3 Extra Practice** to students who would benefit from more practice.

ELL

- Allow newer English language learners to focus their work on the Practise questions and #9 in Apply as the balance of the questions in the Apply and Extend sections are text dense. The Practise questions allow English language learners to demonstrate what they know. As they develop language skills, have students try some word problems.
- English language learners may not be familiar with the following terms: *Canadarm*, *capture envelope*, *International Space Station*, *cylindrical elements*, *extracting oil*, *cardboard tubes*, *concrete posts*, and *semi-circular trough*. Use the visuals in the student resource, visuals from other sources, and descriptions from other students to help describe each of these terms.

Answers

Math Link

a) Designs will vary. Ensure that students choose reasonable dimensions for a table with a circular top and one with a rectangular top.

b) The volume of concrete will vary depending on dimensions chosen. Check that students have calculated the volume of the top and the volume of the base to determine the total volume of concrete for each table design.

Assessment	Supporting Learning
Assessment *for* Learning	
Practise Have students do #4a) and b), #5a) and d), #6a) and b), #7a) and b). Students who have no problems with these questions can go on to the Apply questions.	• Note that #4 and #5 are similar questions that deal with determining the volume of a cylinder given the radius. • Provide additional coaching with Example 1 to students who need help with #4a) and b). Coach students through #4a) and b), and then have them try part c) on their own. • For #5a) and d), some students may benefit from drawing and labelling a sketch before determining the volume. Suggest that they use a diagram in #4 as a model. Have students who have difficulty with #5a) and d) verbalize the process, coach them through corrections, and then have them try parts b) and c) on their own. • Note that #6 and #7 are similar questions that deal with determining the volume of a cylinder given the diameter. • Provide additional coaching with Example 2 to students who need help with #6a) and b). Coach students through #6a) and b), and then have them try part c) on their own. • For #7a) and b), some students may benefit from drawing and labelling a sketch before determining the volume. Suggest that they use a diagram in #6 as a model. Have students who have difficulty with #7a) and b) verbalize the process, coach them through corrections, and then have them try parts c) and d) on their own.
Math Link The Math Link on page 267 is intended to help students work toward the chapter problem wrap-up titled Wrap It Up! on page 279.	• This is a multi-step problem. Encourage students to break the problem into individual steps. – Draw and label a table with a circular top and a cylindrical column. – Draw and label a table with a rectangular top and a cylindrical column. – Find the total of the volume of the table with the circular top and the volume of the cylindrical column. – Find the total of the volume of the table with the rectangular top and the volume of the cylindrical column. • Encourage students to draw and label diagrams for each table. • Encourage students to write out the formula for each calculation. • Make sure that students understand the meaning of *exceed* in the context of the problem. • To help them get started, some students may benefit from using **BLM 7–10 Section 7.3 Math Link**, which provides scaffolding for this activity.
Assessment *as* Learning	
Math Learning Log Have students answer the following question: • A right cylinder is not a right prism, yet it shares the same general property of volume: volume = area of base × height. What physical property do cylinders and prisms share that makes this so?	• Make a variety of right prisms, cubes, and cylinders available for students to help them make the connection that cylinders and triangular prisms each have two faces that can be considered a base, while rectangular prisms and cubes have six faces that can be considered a base. • Having students verbally describe a formula for finding the volume of a 3-D object and then linking their explanation to the different shapes of cylinders and prisms may help them in answering the question. • Ensure that students understand that all 3-D objects (including prisms and cylinders) have volume. • Ask students to describe what makes each shape different and how that is reflected in the calculation of its volume.