Unit D: Geometry Project

Half Course II

HALF COURSE II

Unit D: Geometry Project

Hours: 17

General Learning Outcome:

Complete a project which includes 2-D diagrams and a 3-D model of some physical structure.

The intent of this unit is to move beyond rote calculations by providing students an opportunity to learn about linear scale factors, surface area, and volume in a hands-on environment.

Specific Outcomes

D-1 Measure the length of figures and objects using both SI metric units (mm, cm, m) and imperial units (inches, feet, yards).

D-2 Determine the relationships among linear scale factors, areas, surface areas, and volumes of similar figures and objects.

D-3 Enlarge or reduce a dimensioned object according to a specified scale.

D-4 Solve problems involving linear dimensions, area, and volume.

D-5 Interpret drawings and use the information to solve problems.

GEOMETRY PROJECT

Instructional Material

- *Essentials of Mathematics 10*
- imperial and metric rulers
- imperial and metric measuring tapes
- calculator
- geometric solids
- volume relation kit
- Internet access
- home building magazines
- quilting magazines
- architecture books
- flyers from home building suppliers
- building materials
  - — cardboard
  - — ¼-inch plywood

Connections with Problem Analysis and Analysis of Games and Numbers

Designing a Quilt

Purchasing Lumber

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
Geometry Project	The goal of this unit is to have students research, plan, and construct a scale model of their favourite historical building, castle, monument, or other architectural structure. The specific outcomes are designed to provide students with the skills in order to complete the project. Due to the complexity of the project, it is recommended that students work in groups. While completing the specific outcomes, the students will have the opportunity to reinforce their skills using area, perimeter, surface area, and volume. The students will also practise creating scale drawings and interpreting scale drawings. This unit can be a hands-on type of unit by having students work with objects they can find around them. The more that students work with actual objects, the more mathematics will seem real to them, rather than isolated, abstract skills. Students are expected to be able to work in both imperial and SI measurements. If students are unfamiliar with imperial units of measurement, it may be necessary to review this system with the class. For the project, three students is the suggested group size. Have each group determine who will be the “chair” and who will be the “recorder” or “scribe.” The following list of architects and styles will provide students with a starting point for research and design. **Architects** Gropius, Walter Le Corbusier, Charles Édouard Mallet-Stevens, Roberts Saarinen, Eero Soane, John Mies van der Rohe, Ludwig Wright, Frank Lloyd **Styles** Bauhaus Group Cubism Modern Architecture Pointillism Brainstorm with students for different structures that they can construct for the project.

SUGGESTIONS FOR ASSESSMENT

Project

Research, plan, and construct a scale model of your favourite historical building, castle, monument, or other architectural structure.

Provide a written report that explains

a) the function of the structure
b) the highlights of its construction and design (who designed it? who built it? what 2-D and 3-D figures appear in its design and decoration? how did geometry play a role in the construction of the building?)
c) the significance of the structure today
d) why you chose your particular architectural structure
e) the mathematics you used in order to complete the floor plan, the side elevation

Provide a scale drawing of the floor plan and of one side elevation of the structure. Include a citation of sources.

Each group is required to present their project to the class. The presentation should include:

a) a brief description of the function, highlights, and significance of the structure
b) a description of one significant problem you encountered while creating the model and floor plan, and how you solved that problem
c) a description of the mathematics involved in creating your structure

Have students (or groups) keep a learning log or journal of their activities. This will be a collection of minutes taken by the recorder of work assigned and of what was accomplished (what decisions were made each day). You may want to check with your ELA department regarding report writing.

Project Examples

a) CN Tower
b) Golden Gate Bridge
c) Confederation Bridge
d) Brooklyn Bridge
e) Taj Mahal
f) Legislative Building
g) Big Ben
h) Washington Monument
i) Shasta Dam
j) grain elevator
k) bachelor apartment
l) church
m) Sears Tower
n) Parthenon

The Internet is a valuable resource when conducting the initial research. A variety of materials can be used to construct the model, such as cardboard, quarter-inch plywood, et cetera.

SUGGESTED LEARNING RESOURCES

Print

Senior 2 Consumer Mathematics (25S) Part II: A Course for Distance Learning. Winnipeg, MB: Manitoba Education and Training, 2000.
— Module 8

Baron, Celia, Rick Wunderlich, and Leanne Zorn. *Essentials of Mathematics 10*. Vancouver, BC: British Columbia Ministry of Education, 2002.
Chapter 5
ISBN 0-7726-4675-9

Blocksma, Mary. *Reading the Numbers: A Survival Guide to the Measurements, Numbers, and Sizes Encountered in Everyday Life*. New York, NY: Penguin Books, 1989.

Burrell, Brian. *Merriam Webster's Pocket Guide to Business and Everyday Math*. Springfield, MA: Merriam Webster, 1996.

Cole, Alison. *Eyewitness Art: Perspective*. Toronto, ON: Stoddart, 1992.

Fendel, Dan, et al. *Shadows: Interactive Mathematics Program, Year 1. Teacher's Guide*. Emeryville, CA: Key Curriculum Press, 1997.

Kicklighter, Clois E. *Workbook for Architecture: Residential Drawing and Design*. Tinley Park, IL: Goodheart-Wilcox, 1990.

Kogelman, Stanley, and Barbara R. Heller. *The Only Math Book You'll Ever Need*. New York, NY: Harper Perennial, 1994.

PRESCRIBED LEARNING OUTCOMES

SUGGESTIONS FOR INSTRUCTION

Examine pictures of different buildings and discuss the different geometry used in their construction. The following are five common architectural forms: post and lintel, arch, vault, and dome and truss. (See Appendix, page II-D-29.)

Take a sheet of looseleaf and fold it lengthwise into quarters. Tape the sheet together to make a rectangular prism. Stand it upright on a table and see how many books it can support. Next take a sheet of looseleaf and roll it into a cylinder. Tape the sheet together, stand it upright on a table, and see how many books it can support. Discuss which geometric shape supports the greater load.

Demonstrate that the triangle is the only 2-dimensional shape that has rigidity. This can be shown by constructing squares, triangles, pentagons, et cetera, from straws and attempting to distort the shapes by bending them.

General Outcome

Complete a project which incudes 2-D diagrams and a 3-D model of some physical structure

Specific Outcome(s)

D-1 measure the length of figures and objects using both SI metric units (mm, cm, m) and imperial units (inches, feet, yards)

D-1.1 Introduce the students to the development of the Système Internationale.

D-1-2 Using a clear ruler on the overhead projector, explain the different divisions found on an imperial ruler (half, fourth, eighth, sixteenth of an inch).

D-1-3 Draw a series of lines on the overhead and using a clear ruler have the students indicate the length of the lines to the nearest half, fourth, eighth, or sixteenth of an inch.

D-1-4 Use a ruler or tape measure to measure the following objects to the nearest quarter of an inch.

a) sheet of paper

b) top of the desk

D-1-5 Use a ruler or tape measure to measure the following objects to the nearest millimetre.

a) length of a pencil

b) length of a calculator

D-1.6 Provide students with a worksheet of lines drawn to various lengths and have them indicate the length of the lines to the nearest fourth, eighth, or sixteenth of an inch.

D-1-7 Provide students with a worksheet of lines drawn to various lengths and have them indicate the length of the line to the nearest millimetre or tenth of a centimetre.

✔ **Communications**	✔ **Patterns**
✔ **Connections**	✔ **Problem Solving**
✔ **Number Sense**	✔ **Reasoning**
Organization and Structure	Technology
	✔ **Visualization**

SUGGESTIONS FOR ASSESSMENT

Mental Math

1. Convert the following fractions to decimals:

a) $\frac{1}{2}$	f) $\frac{1}{10}$
b) $\frac{1}{4}$	g) $\frac{25}{100}$
c) $\frac{3}{4}$	h) $\frac{3}{50}$
d) $\frac{1}{8}$	i) $\frac{50}{100}$
e) $\frac{3}{8}$	j) $\frac{9}{10}$

2. Convert the following decimals to fractions:

a) 0.7	e) 0.125
b) 0.18	f) 0.50
c) 0.04	g) 0.45
d) 0.25	h) 0.75

Journal Entries

1. Which system of measurement do you find easier to use? Explain.
2. Why would it be beneficial for all countries to use the metric system? Provide examples.
3. Explain how to convert a decimal to a fraction. Provide an example.
4. Explain how to convert a fraction to a decimal. Provide an example.

SUGGESTED LEARNING RESOURCES

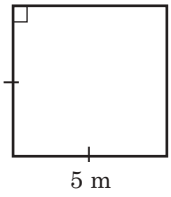
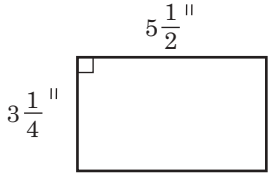
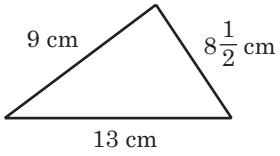
Print

Powell, William F. *Perspective.* Laguna Hills, CA: Walter Foster, 1989.

Ridge, H. Laurence, et al. *Mathscope 3.* Scarborough, ON: Prentice Hall, 1986.

Home Building Design Magazines

Quilting Magazines

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
D-1 measure the length of figures and objects using both SI metric units (mm, cm, m) and imperial units (inches, feet, yards) – *continued*	D-1-8 Have students measure the following items: a) the width of the classroom door to the nearest eighth of an inch b) the width of a shelf in your classroom to the nearest sixteenth of an inch c) the length of your pen or pencil to the nearest sixteenth of a inch d) your height to the nearest half-inch D-1-9 Have students measure the following items: a) the height of the classroom door to the nearest tenth of a centimetre b) the height of your desk to the nearest millimetre c) the width of the hallway to the nearest tenth of a metre
D-2 determine the relationships among linear scale factors, areas, surface areas, and volumes of similar figures and objects	Provide students with the formulas found in the Appendix (pages II-D-27 and II-D-28). D-2-1 Find the perimeter of each of the following: a)  *Solution* $p = 4a$ $p = 4(5)$ $p = 20$ m b)  *Solution* $p = 2l + 2w$ $p = 2\left(5\frac{1}{2}\right) + 2\left(3\frac{1}{4}\right)$ $p = 11 + 6\frac{1}{2}$ $p = 17\frac{1}{2}$ " c)  *Solution* $p = 9 + 8\frac{1}{2} + 13$ $p = 30\frac{1}{2}$ cm *(continued)*

Communications	✔ **Patterns**
✔ **Connections**	✔ **Problem Solving**
✔ **Number Sense**	✔ **Reasoning**
Organization and Structure	Technology
	✔ **Visualization**

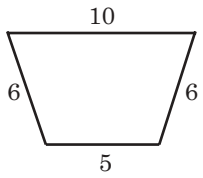
SUGGESTIONS FOR ASSESSMENT	SUGGESTED LEARNING RESOURCES

PRESCRIBED LEARNING OUTCOMES

D-2 determine the relationships among linear scale factors, areas, surface areas, and volumes of similar figures and objects – *continued*

SUGGESTIONS FOR INSTRUCTION

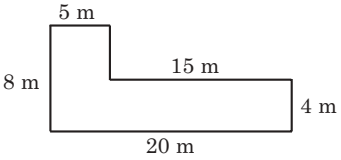
d)



Solution

$p = 10 + 6 + 5 + 6$
$p = 27$

e)

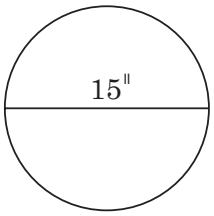


Solution

$p = 5 + 4 + 15 + 4 + 20 + 8$
$p = 56$ m

D-2-2 Find the circumference of the following:

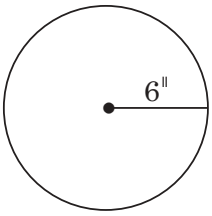
a)



Solution

$C = \pi d$
$C = 15\pi$
$C = 47.1"$

b)

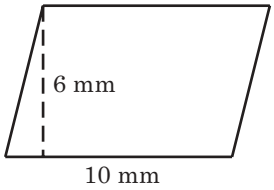


Solution

$C = 2\pi r$
$C = 2\pi(6)$
$C = 12\pi$
$C = 37.7"$

D-2-3 Find the area of the following figures:

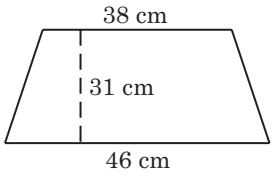
a)



Solution

$A = bh$
$A = 6 \times 10$
$A = 60 \text{ mm}^2$

b)



Solution

$$A = \frac{1}{2}(a+b)h$$
$$A = \frac{1}{2}(38+46)(31)$$
$$A = \frac{1}{2}(84)(31)$$
$$A = 1302 \text{ cm}^2$$

(continued)

Communications	✔ **Patterns**
✔ **Connections**	✔ **Problem Solving**
✔ **Number Sense**	✔ **Reasoning**
Organization and Structure	Technology
	✔ **Visualization**

SUGGESTIONS FOR ASSESSMENT

Journal Entries

1. Explain the difference between area and surface area. Provide a diagram in your explanation.
2. Cereal is packed in boxes with a volume of 100 cm^3. What dimensions should the cereal company choose for the boxes? Explain the reasons for your choice.
3. You want to place a fence around a 36 m^2 rectangular garden. In order to save money, you want to build the fence with the smallest possible perimeter. Give the shape and the dimensions of the fence.

SUGGESTED LEARNING RESOURCES

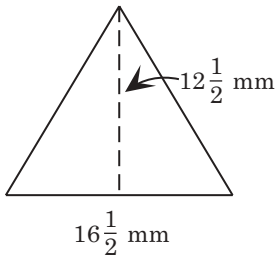
PRESCRIBED LEARNING OUTCOMES

D-2 determine the relationships among linear scale factors, areas, surface areas, and volumes of similar figures and objects – *continued*

D-4 solve problems involving linear dimensions, areas, and volume

SUGGESTIONS FOR INSTRUCTION

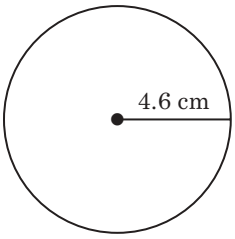
c)



Solution

$$A = \frac{1}{2}bh$$
$$A = \frac{1}{2}\left(16\frac{1}{2}\right)\left(12\frac{1}{2}\right)$$
$$A = 103\frac{1}{8}\text{ mm}^2$$

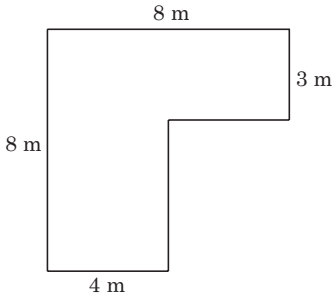
d)



Solution

$A = \pi r^2$
$A = \pi(4.6)^2$
$A = 21.16\pi$
$A = 66.5\text{ cm}^2$

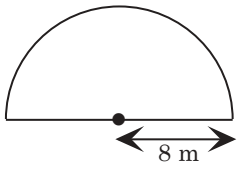
e)



Solution

$A = (8)(3)$
$A = 24$
$A = (5)(4)$
$A = 20$
$A = 24 + 20$
$A = 44\text{ m}^2$

f)



Solution

$$A = \frac{1}{2}\pi r^2$$
$$A = \frac{1}{2}(\pi)(8)^2$$
$$A = \frac{1}{2}(\pi)(64)$$
$$A = 32\pi$$
$$A = 100.5\text{ m}^2$$

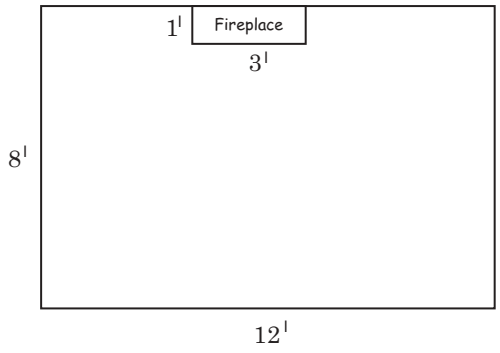
✔ **Communications**	✔ **Patterns**
✔ **Connections**	✔ **Problem Solving**
✔ **Number Sense**	✔ **Reasoning**
Organization and Structure	Technology
	✔ **Visualization**

(continued)

SUGGESTIONS FOR ASSESSMENT

Problems

1. One side of a parallelogram measures 50 mm, while the second side measures 45 mm. Find the perimeter of the parallelogram.
2. A cylindrical tank has a diameter of 5 metres and a height of 3.5 metres. Find the surface area of the tank.
3. The diameter of a pizza is 26.2 cm. Find the area of the pizza.
4. Find the volume of a sphere with a diameter of 10 metres.
5. Find the volume of a cone that is 5 inches tall and has a diameter of 3.5 inches.
6. If a circular fish pond is 9.5 metres across, what is the area of the top surface and what is the distance around the pond?
7. The following diagram is an illustration of a great room.



   a) If the entire great room except for the fireplace is to be covered with carpet, what area is to be carpeted?
   b) If the carpet costs $6.99 per square foot, how much would it cost, including tax, to purchase the carpet?

8. The perimeter of a square rug is 48 cm. What is the area?
9. Determine the quantity of wheat that can be stored in a cylindrical bin with a cone-shaped top. The diameter of the base of the bin is 7 m and its height is 5 m. The cone top has a height of 2 m.

SUGGESTED LEARNING RESOURCES

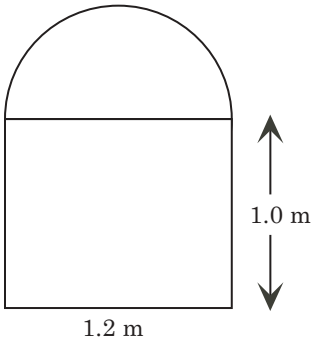
PRESCRIBED LEARNING OUTCOMES

D-2 determine the relationships among linear scale factors, areas, surface areas, and volumes of similar figures and objects – *continued*

D-4 solve problems involving linear dimensions, areas, and volume – *continued*

SUGGESTIONS FOR INSTRUCTION

g) Calculate the area of the window to the nearest tenth of a square metre.



Solution

$A = lw$

$A = (1)(1.2)$

$A = 1.2 \text{ m}^2$

$A = \frac{1}{2}\pi r^2$

$A = \frac{1}{2}\pi(0.6)^2$

$A = \frac{1}{2}(0.36)\pi$

$A = 0.18\pi$

$A = 0.6 \text{ m}^2$

$A = 1.2 \text{ m}^2 + 0.6 \text{ m}^2$

$A = 1.8 \text{ m}^2$

h) Have the students determine the area of the following:

— a desk

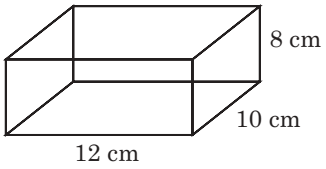
— a binder

— the classroom

— a door

D-2-4 Determine the volume of the following shapes:

a)



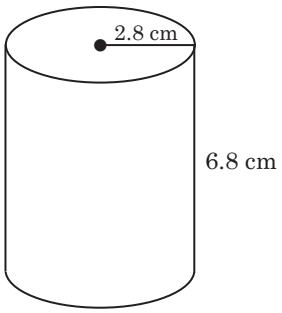
Solution

$V = lwh$

$V = (8)(10)(12)$

$V = 960 \text{ cm}^3$

b)



Solution

$V = \pi r^2 h$

$V = \pi(2.8)^2(6.8)$

$V = 53.3\pi$

$V = 167.4 \text{ cm}^3$

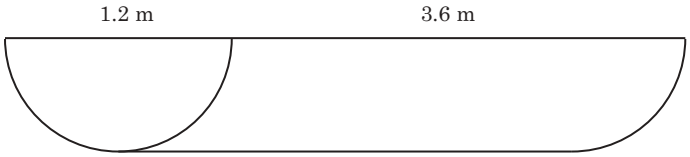
(continued)

✔ **Communications** ✔ **Patterns**
✔ **Connections** ✔ **Problem Solving**
✔ **Number Sense** ✔ **Reasoning**
Organization and Structure — Technology
✔ **Visualization**

SUGGESTIONS FOR ASSESSMENT

Problems

1. Form two cylinders from a rectangular piece of paper, one by joining the long sides, one by joining the short sides. Which of these cylinders will have greater volume, or will they hold the same amount?
2. Find a number of cans with the same radius but different heights. Calculate the surface area of each can. Graph the results and determine the relationship between the surface area and height.
3. A trough has the following shape. What volume of water can this tank hold to the nearest cubic metre?



SUGGESTED LEARNING RESOURCES

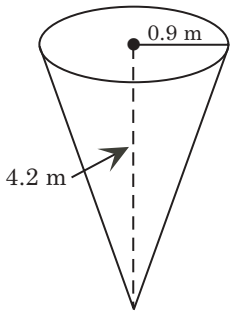
PRESCRIBED LEARNING OUTCOMES

D-2 determine the relationships among linear scale factors, areas, surface areas, and volumes of similar figures and objects – *continued*

D-4 solve problems involving linear dimensions, areas, and volume – *continued*

SUGGESTIONS FOR INSTRUCTION

c)



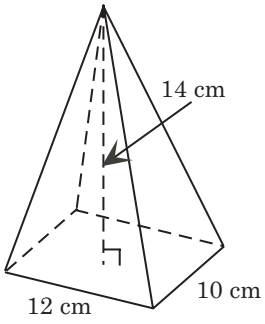
Solution

$$V = \frac{1}{3}\pi r^2 h$$

$$V = \frac{1}{3}(\pi)(0.9)^2(4.2)$$

$$V = 3.6 \text{ m}^2$$

d)



Solution

$$V = \frac{1}{3}lwh$$

$$V = \frac{1}{3}(12)(10)(14)$$

$$V = \frac{1}{3}(1680)$$

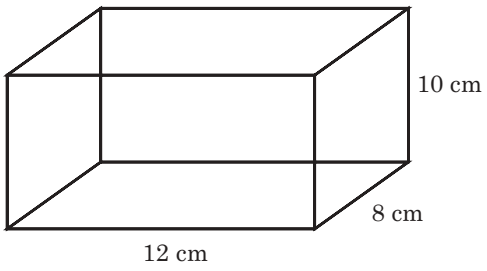
$$V = 560 \text{ cm}^3$$

D-2.5 Use a volume relationship kit to discover the relationship between the volume of a cone and cylinder having the same diameter and height.

D-2-6 Use a volume relationship kit to discover the relationship between the volume of a prism and pyramid having the same base and height.

D-2-7 Determine the surface area of the following:

a)



Solution

$SA = 2lw + 2lh + 2wh$
$SA = 2(12)(8) + 2(12)(10) + 2(8)(10)$
$SA = 192 + 240 + 160$
$SA = 592 \text{ cm}^2$

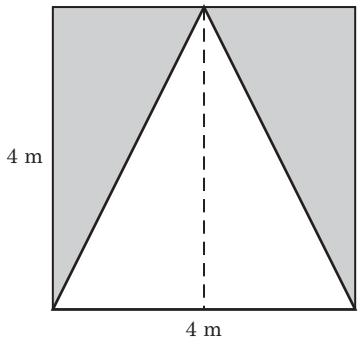
(continued)

✔ **Communications** ✔ **Patterns**
✔ **Connections** ✔ **Problem Solving**
✔ **Number Sense** ✔ **Reasoning**
Organization and Structure — Technology
✔ **Visualization**

SUGGESTIONS FOR ASSESSMENT

Problems

1. Calculate the area of the shaded region.



2. A storage box measures 1.3 by 1.2 by 1.0 yards. How much plywood would it take to build the storage box? A sheet of plywood measures 4' x 8' and costs $22.00. What is the cost to build the box?

3. What happens to the volume of a rectangular prism if:
   a) the base is not changed but the height is doubled? tripled?
   b) the height and base width are not changed, but its base length is doubled? tripled?

4. Set up a spreadsheet that will calculate the area of one side of a cube with a side length "s," the volume of the cube, and the surface area of the cube. Explain any patterns you notice in the chart.

Length "s"	Area of One Side	Volume	Surface Area
1			
2			
3			
4			
5			
6			
7			
8			

5. A juice box measures 10 cm x 6 cm x 3 cm. What is its volume?

SUGGESTED LEARNING RESOURCES

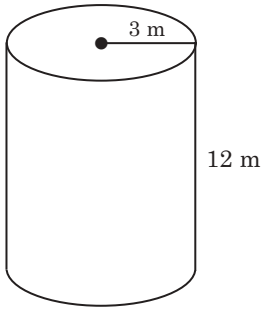
PRESCRIBED LEARNING OUTCOMES

D-2 determine the relationships among linear scale factors, areas, surface areas, and volumes of similar figures and objects – *continued*

D-4 solve problems involving linear dimensions, areas, and volume – *continued*

SUGGESTIONS FOR INSTRUCTION

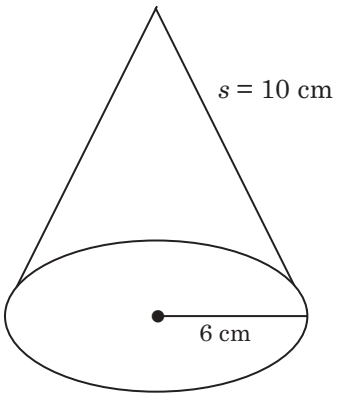
b)



Solution

$SA = 2\pi rh + 2\pi r^2$
$SA = 2\pi(36) + 2\pi(9)$
$SA = 226.2 + 56.5$
$SA = 282.7\ m^2$

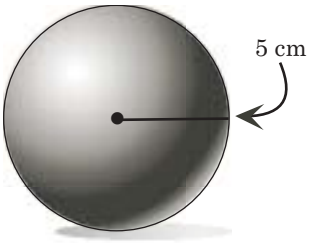
c)



Solution

$SA = \pi r^2 + \pi rs$
$SA = \pi(36) + \pi(60)$
$SA = 113.1 + 188.5$
$SA = 301.6\ cm^2$

d)



Solution

$SA = 4\pi r^2$
$SA = 4(\pi)(5)^2$
$SA = 100\pi$
$SA = 226.2 + 56.5$
$SA = 314.2\ cm^2$

D-2.8 Have the students draw four squares with side lengths of 1 cm, 2 cm, 3 cm, and 4 cm. Have the students determine the area for each square. Have students examine the relationship between the areas of each figure and the side length.

Example

A rectangle has an area of 8.6 m^2. Find the area of a rectangle with a length and width that are six times as large as the original rectangle.

Solution

$8.6 \times 6^2 = 309.6\ m^2$

(continued)

✔ **Communications**	✔ **Patterns**
✔ **Connections**	✔ **Problem Solving**
✔ **Number Sense**	✔ **Reasoning**
Organization and Structure	Technology
	✔ **Visualization**

SUGGESTIONS FOR ASSESSMENT

1. Have students keep a dictionary of math terms related to the unit.

surface area	cylinder
volume	sphere
radius	cube
prism	inches
pyramid	feet
yards	perimeter
area	circumference
scale	ratio
scale drawing	

2. Suggested rubric for assessing problems:
   - 3 — All parts of the question are answered correctly and completely.
   - 2 — Answer deals correctly with most aspects of the question, but something is missing.
   - 1 — Addresses item but only partially correct.
   - 0 — Does not address task. Nothing is correct.

SUGGESTED LEARNING RESOURCES

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
	D-2-9 Have students determine the volume of four cubes with side lengths of 1 cm, 2 cm, 3 cm, and 4 cm. Have students examine the relationship between the side lengths and the volumes. ***Example*** A grain silo has a volume of 350 m^3. What is the volume of a silo with dimensions twice as large? *Solution* $350 \times 2^3 = 2800\ m^3$
D-3 enlarge or reduce a dimensioned object according to a specified scale D-5 interpret drawings and use the information to solve problems	D-3.1 The following diagram represents a coffee table. If the scale is 1:30, determine the actual dimensions of the table.  D-3-2 A recreation centre has dimensions of 35 m in length and 27 m in width. Represent the recreation centre with a scale drawing where 1 cm represents 5 m. D-3-3 Complete the following chart: **Drawing Length (cm)** / **Actual Length (cm)** / **Scale** 5.6 / 560 / — 0.6 / 600 / — 3.3 / 1650 / — — / 200 / 1:20 — / 5000 / 1:1000 D-3-4 Using the scale $\frac{1}{4}$ inch = 1 foot, find the actual length in feet represented by the following lengths on the drawing: a) 3" b) $2\frac{1}{4}$" c) $4\frac{3}{4}$"

✔ **Communications** ✔ **Patterns**
✔ **Connections** ✔ **Problem Solving**
✔ **Number Sense** ✔ **Reasoning**
Organization and Structure ✔ **Technology** ✔ **Visualization**

(continued)

SUGGESTIONS FOR ASSESSMENT

Mental Math

1. Complete the following chart:

Drawing Length (cm)	Actual Length (cm)	Scale
2.3	230	
2.3	460	
0.5	500	
10.0		1:10
4.5		1:200

2. a) (25)(4)
   b) (400)(6)
   c) (4)(800)
   d) $\frac{4}{8}+\frac{1}{8}$
   e) $\frac{5}{6}-\frac{1}{6}$
   f) $\frac{3}{10}+\frac{2}{10}$
   g) $3500 \div 7$
   h) $2000 \div 50$

Journal Entries

1. List five occupations where the workers use scale drawings.
2. Explain how you would make a scale drawing of a piece of furniture from your home.

Problems

1. A scale drawing of a family room has dimensions of 4.5 cm by 3.25 cm. In the scale drawing, 1 cm represents 3 m. What are the dimensions of the actual family room?
2. An apartment building is 150 m tall. If the height of the building in the scale drawing is 25 cm, what scale is used in the drawing?
3. Represent a circular window with a diameter of 50 cm. Use a scale of 1:10.
4. Represent a rectangular room measuring 12 feet by 24 feet with a scale drawing. Use a scale of 1 inch representing 2 feet.

SUGGESTED LEARNING RESOURCES

PRESCRIBED LEARNING OUTCOMES

D-3 enlarge or reduce a dimensioned object according to a specified scale
– continued

D-5 interpret drawings and use the information to solve problems
– continued

SUGGESTIONS FOR INSTRUCTION

D-3-4 Using the scale $\frac{1}{8}$ inch = 1 foot, how long a segment should be drawn to represent an object whose actual length is:

a) 32 feet

b) 5 yards

c) 12 feet

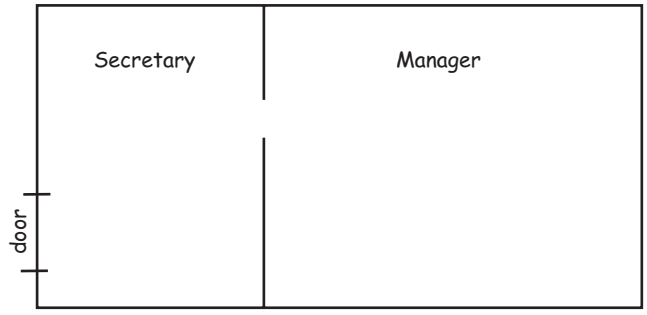
d) 4 feet

D-3-6 Make a scale drawing of a rectangular-shaped room with dimensions of 4 m by 6 m.

D-3-7 Measure the length and width of the classroom. Choose a convenient scale and make a scale drawing of the floor plan.

D-3-8 Draw a geometric figure on the overhead. Using a scale of 1:5, create a scale drawing of the figure.

D-3-9 The following is a drawing of an office, drawn to a scale of 1 cm = 1 m.



How much carpet would be needed for the secretary's office? Manager's office?

D-3-10 Puzzle books are available with cartoon drawings to enlarge or reduce.

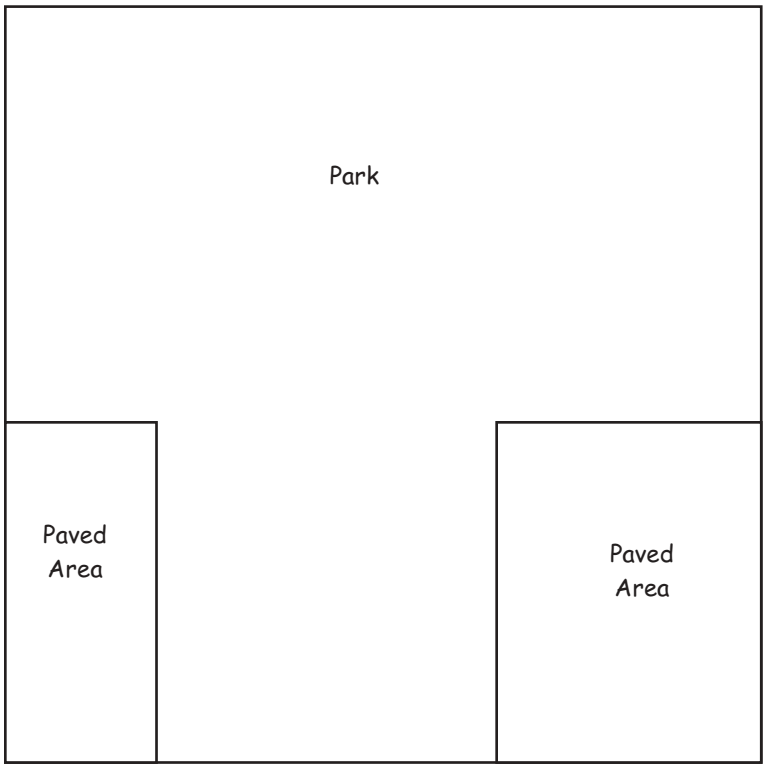
✔ **Communications**	✔ **Patterns**
✔ **Connections**	✔ **Problem Solving**
✔ **Number Sense**	✔ **Reasoning**
Organization and Structure	✔ **Technology**
	✔ **Visualization**

SUGGESTIONS FOR ASSESSMENT

Problems

1. Provide the students with a worksheet of geometric figures. Have them create scale drawings of the figures using a specified scale, e.g., 1:4.
2. Have the students create a scale drawing of two objects in the classroom according to a specified scale.
3. The park below is drawn to a scale of 1 cm = 20 m. A groundskeeper must apply grass seed to the unpaved areas, taking care not to get any on the paved areas. The directions on the grass seed recommend 3.75 kg/100 m^2.

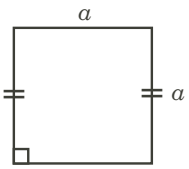
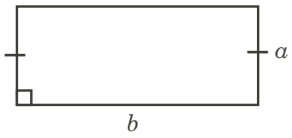
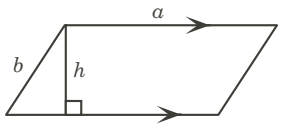
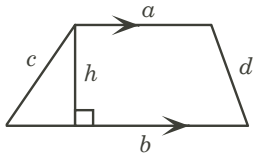
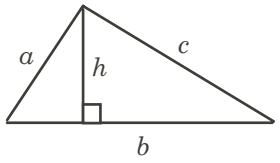
   Calculate how much grass seed the groundskeeper will need to apply.



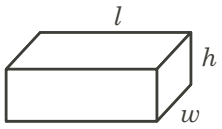
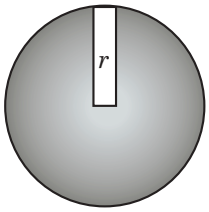
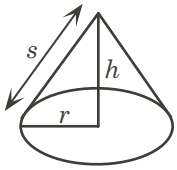
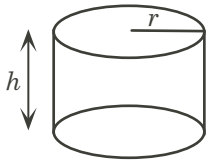
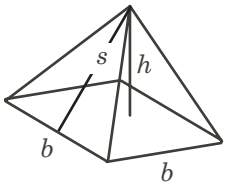
SUGGESTED LEARNING RESOURCES

Appendix

Blackline Master

Figure	Diagram	Area (in square units)	Perimeter (in units of length)
square		$A = a^2$	$p = 4a$
rectangle		$A = ab$	$p = 2(a + b)$ *or* $p = 2a + 2b$
parallelogram		$A = ah$	$p = 2a + 2b$
trapezoid		$A=\frac{1}{2}(a+b)h$	$p = a + b + c + d$
triangle		$A=\frac{1}{2}bh$	$p = a + b + c$
circle		$A = \pi r^2$	$C = 2\pi r$

Blackline Master

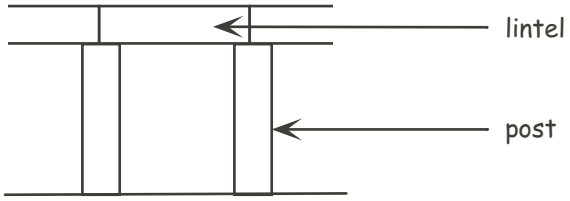
Figure	Diagram	Surface Area (in square units)	Volume (in cubic units)
rectangular solid		$SA = 2wh + 2lw + 2lh$	$V = lwh$
sphere		$SA = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$
cone		$SA = \pi rs$ (slanted side only)	$V = \frac{1}{3}\pi r^2 h$
cylinder		$SA = 2\pi rh + 2\pi r^2$	$V = \pi r^2 h$
pyramid		$SA = 2sb$ (all four sides — not the bottom)	$V = \frac{1}{3}b^2 h$

The Geometry of Architecture

Geometry is an important part of architectural design and construction. Following are descriptions of five architectural forms.

Post and Lintel

The post and lintel is a way of supporting a load (the lintel) by using columns (the posts), while allowing openness of space.



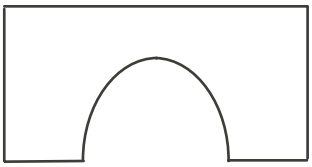
Take a sheet of looseleaf and fold it lengthwise into quarters. Tape the sheet together to make a rectangular prism. Stand it upright on a table and see how many books it can support.

Next take a sheet of looseleaf and roll it into a cylinder. Tape the sheet together, stand it upright on a table, and see how many books it can support.

Which geometric shape supports the greater load? _____

Arch

The arch is a curved construction which creates an opening. The arch is a modified _____ shape.



Vault

The vault is a series of arches strung together to create a ceiling or roof.

Dome

The dome is a vault which is in the shape of a portion of a _____ .

Truss

The truss is used to support bridges and roofs. It is based on the geometric rigidity of the _____ .