

Activity 11

What Goes Around Comes Around—But Can You Measure It?



Teacher Notes

Topics Covered

- ◆ Applying the process of mathematical modeling to real-world problem situations
- ◆ Expressing mathematical generalizations discovered through investigations
- ◆ Deducing relationships between figures in geometric contexts

Introduction

The perimeter of a region is the distance around the region. The area of a region is the sum of the areas of all its non-overlapping parts. A calculator is a useful tool for finding areas and perimeters of these regions. Can you find the area in square feet for each room in your house? How would you find the total square feet in your house?

Concepts

- ◆ Perimeter and area of non-overlapping region
- ◆ Surface area and volume of spheres

Calculator Skills

- ◆ Storing and recalling data: $\boxed{\text{STO}}$, $\boxed{2\text{nd}}$ $\boxed{\text{RCL}}$
- ◆ Setting decimal places: $\boxed{2\text{nd}}$ $\boxed{\text{FIX}}$
- ◆ Using the $\boxed{\pi}$ key

Materials

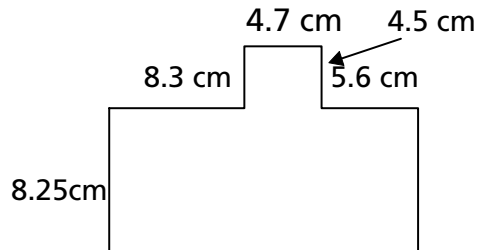
- ◆ TI-30X IIS
- ◆ Student Activity pages (p.106-108)
- ◆ Transparency

Objective

- ◆ In this activity, students will find perimeter and area for several geometric shapes. They also will find the surface area and volume of spheres.

Investigation

1. Display the transparency, and discuss how to find the perimeter and area of the region below. Assume that all angles are right angles. Divide the region into rectangles. Label the sides that have "missing" dimensions.



2. Review the formulas for finding perimeter ($2 * \text{length} + 2 * \text{width}$) and area ($\text{length} * \text{width}$) of a rectangle.
3. Use the overhead calculator to find the length of the bottom base of the figure.

Press:	The calculator shows:
<code>CLEAR</code> 8.3 <code>+</code> 4.7 <code>+</code> 5.6 <code>ENTER</code>	8.3 + 4.7 + 5.6 18.6 DEG
<code>STO</code> <code>ENTER</code>	Ans→2 18.6 DEG

Use the calculator to find the perimeter and the area.

Press:	The calculator shows:
<code>2nd</code> <code>RCL</code> <code>ENTER</code> <code>x</code> 2 <code>+</code> 4.5 <code>x</code> 2 <code>+</code> 8.25 <code>x</code> 2 <code>ENTER</code>	18.6 * 2 + 4.5*→ 62.7 DEG
<code>(</code> <code>2nd</code> <code>RCL</code> <code>ENTER</code> <code>x</code> 8.25 <code>)</code> <code>+</code> <code>(</code> 4.7 <code>x</code> 4.5 <code>)</code> <code>ENTER</code>	18.6 * 8.25) → 174.6 DEG

The perimeter is 62.7cm, and the area is 174.6cm.

4. Have the students work individually or in groups to complete Student Activity Part 1. If they work in groups, have them explain how they solved the problems.
5. Review the formulas for finding the surface area ($4 * \pi * \text{radius}^2$) of a sphere.
6. Have the students work individually or in groups to complete Student Activity Part 2. Discuss their results.

Wrap-up

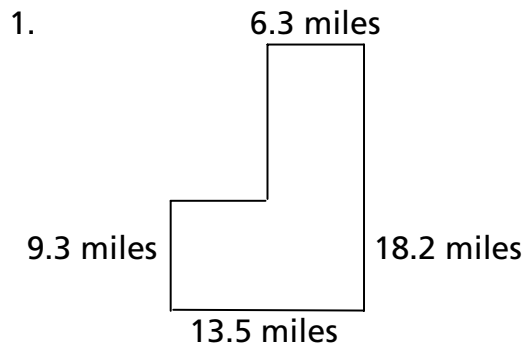
You should give students opportunities to sketch and label many different figures. Have them measure the figures, and write the dimensions on the sketch. Then have students find the perimeter and area for each figure. Realtors will provide you with small floor plans of homes listed in your area. Students may use these to practice finding area and perimeter.

Extensions

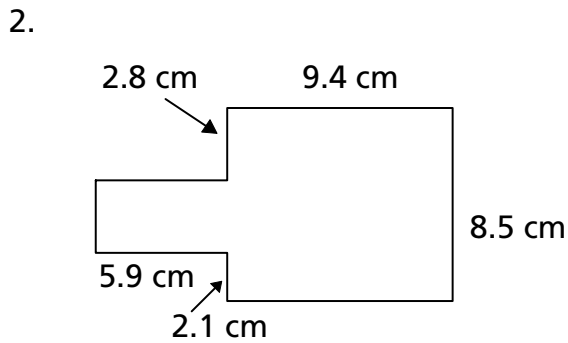
Have students take the sketch of the floor plan of their house or apartment and go home and measure each room. Have them calculate the perimeter and area of each room in their house and the total square feet in their home.

Solutions Part 1

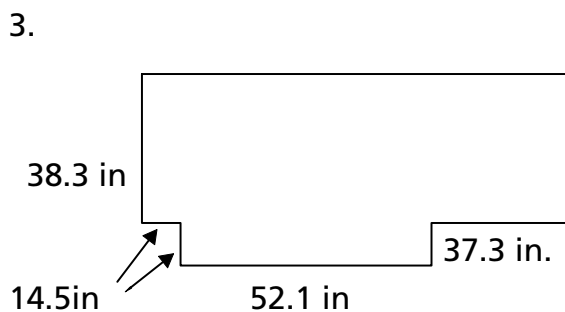
Find the perimeter and area of each figure. Assume that all angles shown are right angles.



Perimeter = 63.4 miles
 Area = 181.62 sq. miles

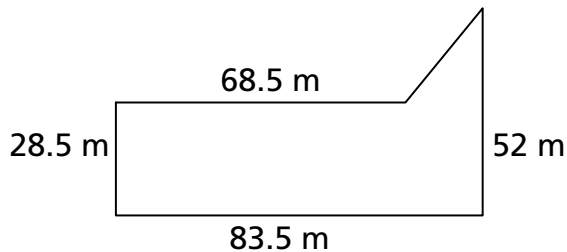


Perimeter = 47.6 cm
 Area = 102.32 sq. cm



Perimeter = 313.4 inches
 Area = 4734.82 sq. inches

4.



Perimeter = 260.4 m
 Area = 2556 sq. m

Hint: the formula for the area of a triangle is $\frac{\text{base} \times \text{height}}{2}$.

Solutions Part 2

Complete the table below showing the surface area and volume for four objects in our solar system. The radius of the earth is used as the base unit for the table. Express each entry in the table in terms of π and as a decimal.

Surface Area of a Sphere = $4\pi r^2$

Volume Area of a Sphere = $\frac{4}{3}\pi r^3$

Solar Object	Radius	Surface Area	Volume
Earth	1 unit	$4\pi \text{ units}^2$ $= 12.57 \text{ units}^2$	$\frac{4}{3}\pi (1^3) \text{ units}^3 =$ 4.188 units^3
Moon	0.27 unit	$= 4\pi (.27^2)$ $= 0.916 \text{ units}^2$	$\frac{4}{3}\pi (.27^3) \text{ units}^3 =$ 4.188 units^3
Mars	0.53 unit	$= 4\pi (.53^2)$ $= 3.53 \text{ units}^2$	$\frac{4}{3}\pi (.53^3) \text{ units}^3 =$ 4.188 units^3
Jupiter	10.8 units	$= 4\pi (10.8^2) \text{ units}^2$ $= 1465.74 \text{ units}^2$	$\frac{4}{3}\pi (10.8^3) \text{ units}^3$ $= 4.188 \text{ units}^3$
Sun	109.2 units	$= 4\pi (109.2^2) \text{ units}^2$ $= 149849.45 \text{ units}^2$	$\frac{4}{3}\pi (109.2^3) \text{ units}^3$ $= 4.188 \text{ units}^3$

2. The radius of Mars is approximately twice the radius of the Moon and half the radius of the Earth. Use your calculator to find these ratios 2 decimal places, and round to the nearest whole number:

$$\frac{\text{Surface Area of Mars}}{\text{Surface Area of Moon}} = 3.85 = 4$$

$$\frac{\text{Volume of Mars}}{\text{Volume of Moon}} = 7.57 = 8$$

$$\frac{\text{Surface Area of Earth}}{\text{Surface Area of Mars}} = 3.56 = 4$$

$$\frac{\text{Volume of Earth}}{\text{Volume of Mars}} = 6.72 = 7$$

Describe any relationships that you discovered.

Answers may vary. The ratio of the volume of Mars to the Moon is about twice that of the surface area ratio. The same also holds true for the ratios of Earth to Mars.

3. The radius of the sun is approximately 10 times the radius of Jupiter. Therefore, the surface area of the sun must be approximately 100 times that of Jupiter, while the volume of the Sun must be approximately 1,000 times that of Jupiter.

Explain your reasoning.

Answers may vary, but ratios should be shown and calculated.

$$\frac{\text{Surface Area of Sun}}{\text{Surface Area of Jupiter}} = 102.23 = 102$$

$$\frac{\text{Surface Area of Sun}}{\text{Surface Area of Jupiter}} = 1033.70 = 1034$$

4. If the average radius of the Earth is 3956.5 miles. What is the approximate surface area of the Earth in square miles?

Approximately 200 million sq. miles. That is, $196,712,612 = (1.97 \times 10^8)$ sq. miles.

5. What is the approximate volume of the Earth in cubic miles?

Approximately 62 billion cu. miles. That is, $61,934,624,687 = (6.19 \times 10^{10})$ cu. miles.

Student Activity 11

Name _____

Date _____

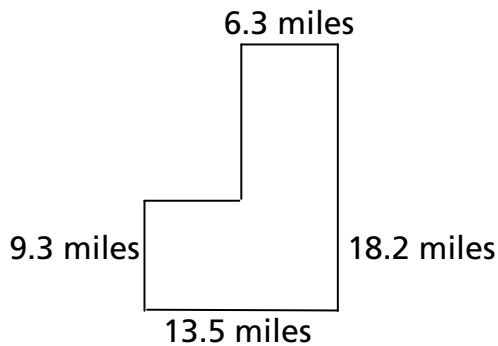
Area, Perimeter, Surface Area and Volume: What Goes Around, Comes Around—But Can You Measure It?

Objective: In this activity, you will find perimeter and area for several geometric shapes and the surface area and volume of spheres.

Part 1: Finding Perimeter and Area

Find the perimeter and area of each figure. Assume that all angles shown are right angles.

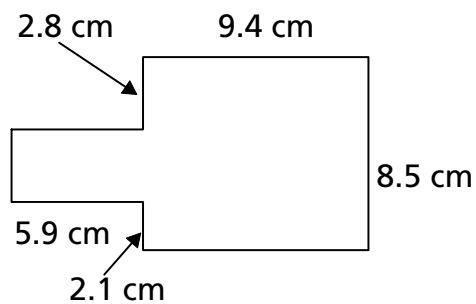
1.



Perimeter =

Area =

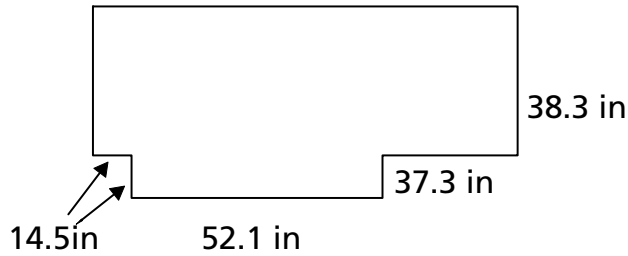
2.



Perimeter =

Area =

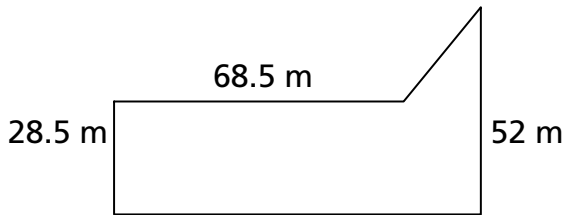
3.



Perimeter =

Area =

4.



Perimeter =

Area =

Hint: the formula for the area of a triangle is $\frac{\text{base} \times \text{height}}{2}$.

Part 2: Finding Surface Area and Volume

1. Complete the table below showing the surface area and volume for four objects in our solar system. The radius of the earth is used as the base unit for the table. Express each entry in the table in terms of π and as a decimal.

Solar Object	Radius	Surface Area	Volume
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Moon	0.27 unit		
Mars	0.53 unit		
Jupiter	10.8 units		
Sun	109.2 units		

2. The radius of Mars is approximately twice the radius of the Moon and half the radius of the Earth. Use your calculator to find these ratios to 2 decimal places, and round to the nearest whole number:

$$\frac{\text{Surface Area of Mars}}{\text{Surface Area of Moon}} =$$

$$\frac{\text{Volume of Mars}}{\text{Volume of Moon}} =$$

$$\frac{\text{Surface Area of Earth}}{\text{Surface Area of Mars}} =$$

$$\frac{\text{Volume of Earth}}{\text{Volume of Mars}} =$$

Describe any relationships that you discovered.

3. The radius of the sun is approximately ten times the radius of Jupiter. Therefore, the surface area of the sun must be approximately _____ times that of Jupiter, while the volume of the sun must be approximately _____ times that of Jupiter.

Explain your reasoning.

4. If the average radius of the Earth is 3956.5 miles. What is the approximate surface area of the Earth in square miles?
5. What is the approximate volume of the Earth in cubic miles?

TRANSPARENCY

Finding Perimeter and Area

