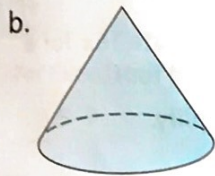
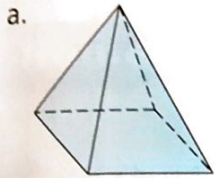


Volumes of Pyramids and Cones

Check Skills You'll Need

- Vocabulary Review**
How are the shapes of *pyramids* and *cones* different?
- What shape is the base of each of the figures below?



GO for Help
Lesson 9-1

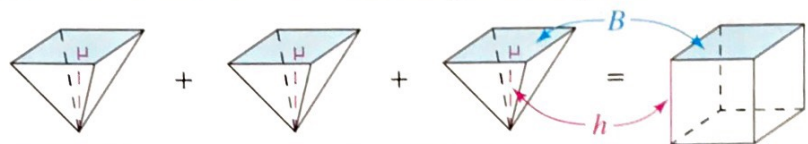
What You'll Learn

To find the volumes of pyramids and cones

Why Learn This?

You consider volume when you fill an ice cream cone or use a funnel.

The contents you need to fill a prism with base area B will fill exactly three pyramids with the same base area and height as the prism.



KEY CONCEPTS Volume of a Pyramid

The volume V of a pyramid is one third the product of the base area B and the height h .

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

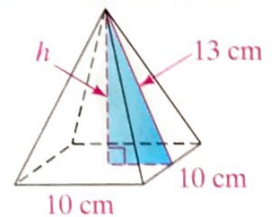


EXAMPLE Finding Volume of a Square Pyramid

- Find the volume of the pyramid below to the nearest cubic centimeter.

Step 1 Find the area of the base.

$$\begin{aligned} B &= s^2 && \leftarrow \text{area of a square} \\ &= 10^2 && \leftarrow \text{Substitute.} \\ &= 100 && \leftarrow \text{Simplify.} \end{aligned}$$



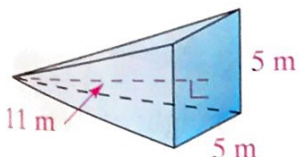
Step 2 Find the pyramid's height.

$$\begin{aligned} h^2 + 5^2 &= 13^2 && \leftarrow \text{Pythagorean Theorem} \\ h &= 12 && \leftarrow \text{Simplify.} \end{aligned}$$

Step 3 Find the volume.

$$\begin{aligned} V &= \left(\frac{1}{3}\right)Bh && \leftarrow \text{volume of a pyramid} \\ &= \left(\frac{1}{3}\right)(100)12 && \leftarrow \text{Substitute.} \\ &= 400 && \leftarrow \text{Multiply.} \end{aligned}$$

The volume of the pyramid is 400 cm^3 .

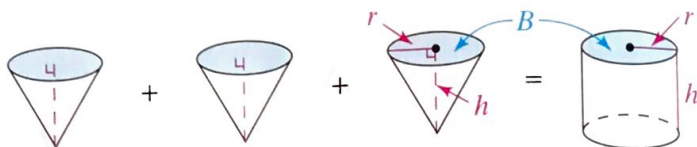


Quick Check

- Find the volume of the pyramid at the left to the nearest cubic meter.

CONTENT STANDARD
8.G.9

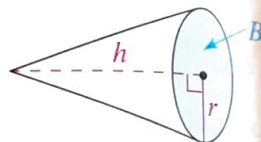
The contents of three cones fill a cylinder with the same dimensions.



KEY CONCEPTS Volume of a Cone

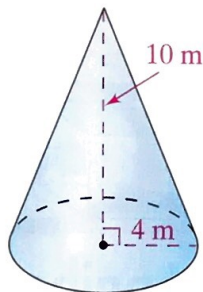
The volume V of a cone is one third the product of base area B and height h .

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



You can use the formula to find the volume or missing dimensions.

EXAMPLES Using the Volume Formula



- 2 Find the volume of the cone at the left to the nearest cubic meter.

Step 1 Find base area, B .

$$\begin{aligned} B &= \pi r^2 && \leftarrow \text{area of a circle} \\ &= \pi(4^2) && \leftarrow \text{Substitute.} \\ &= 16\pi && \leftarrow \text{Simplify.} \end{aligned}$$

Step 2 Find the volume.

$$\begin{aligned} V &= \frac{1}{3}Bh && \leftarrow \text{volume of a cone} \\ &= \frac{1}{3}(16\pi)10 && \leftarrow \text{Substitute } 16\pi \text{ for } B \\ &&& \leftarrow \text{and } 10 \text{ for } h. \\ &\approx 168 && \leftarrow \text{Simplify.} \end{aligned}$$

The volume of the cone is about 168 m^3 .

- 3 **Food** An ice cream shop owner designs a new ice cream cone. He wants the volume to be about 240 cm^3 . The cone is 14 cm tall. What is its radius?

$$240 = \frac{1}{3}(\pi r^2)(14) \quad \leftarrow \text{Substitute } 240 \text{ for } V, \pi r^2 \text{ for } B, \text{ and } 14 \text{ for } h \text{ in the formula for the volume of a cone.}$$

$$240 = \frac{14\pi}{3}r^2 \quad \leftarrow \text{Simplify.}$$

$$\frac{3}{14\pi} \cdot 240 = \frac{3}{14\pi} \cdot \frac{14\pi}{3}r^2 \quad \leftarrow \text{Multiply each side by the reciprocal of } \frac{14\pi}{3}.$$

$$\frac{3(240)}{14\pi} = r^2 \quad \leftarrow \text{Simplify.}$$

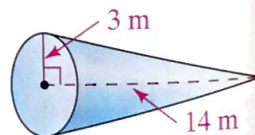
$$\sqrt{\frac{3(240)}{14\pi}} = \sqrt{r^2} \quad \leftarrow \text{Find the positive square root of each side.}$$

$$4.046013188 \approx r \quad \leftarrow \text{Use a calculator.}$$

The radius of the cone is about 4 cm.

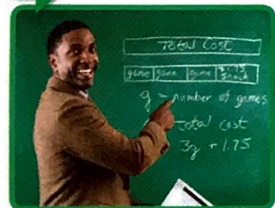
Quick Check

2. Find the volume of the cone at the right. Round to the nearest cubic meter.



3. Find the radius of a cone with a volume of 360 cm^3 and a height of 9 cm.

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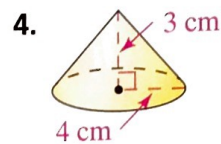
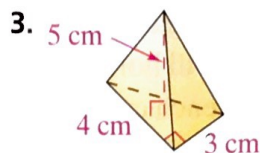
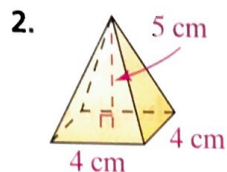
Video Tutor Help

PearsonSuccessNet.com

Check Your Understanding

1. **Mental Math** A square pyramid has a base area of 9 m^2 . Its height is 5 m. The volume of the pyramid is (15 m^3 , 45 m^3).

Match each pyramid or cone with the equation you can use to find the area of its base.



A. $B = \pi(4^2)$

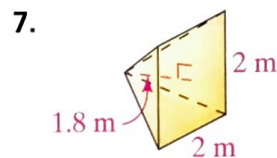
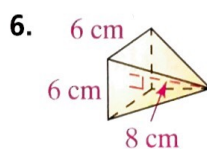
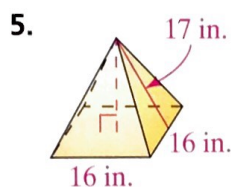
B. $B = \frac{1}{2}(4)(3)$

C. $B = 4^2$

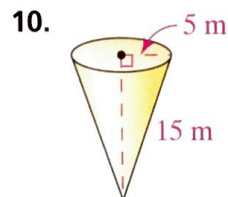
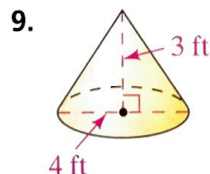
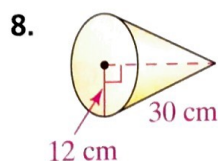
Homework Exercises

For more exercises, see Extra Skills and Word Problems.

Find the volume of each pyramid to the nearest whole cubic unit.



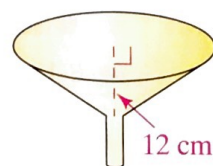
Find the volume of each cone to the nearest whole cubic unit.



11. A party hat has the shape of a cone. The volume of the hat is about 419 cm^3 . If the hat has a height of 16 cm, what is its radius?

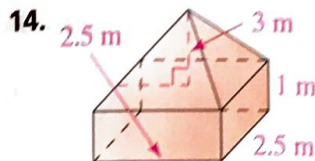
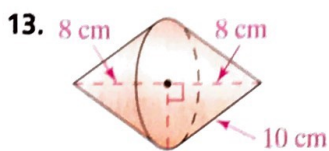
GPS

12. **Guided Problem Solving** The funnel shown at the right can hold 500 cm^3 of fluid. Its height (without the stem) is 12 cm. Find the diameter of the cone part of the funnel.



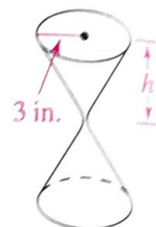
- **Estimation** You can use the strategy *Systematic Guess and Check* to estimate the radius. Select radius values for the formula $V = \frac{1}{3}\pi r^2 h$ until you calculate a volume of about 500 cm^3 . Then estimate the diameter.
- Use the formula for the volume of a cone to solve the problem. Use your estimation to check that your answer is reasonable.

Find the volume of the following solids to the nearest whole cubic unit.



15. **Reasoning** Does the volume of a cone stay the same if you add 1 unit to the radius and subtract 1 unit from the height? Explain.

16. A glassblower decides to make an hourglass that will hold about 47 in.^3 in each cone. If the radius of each cone is 3 in., what is the height of each cone h ?



17. **Algebra** The volume of a square pyramid is 15 ft^3 . Its base area is 27 ft^2 . What is its height?

18. **Error Analysis** Lian says that if you double the dimensions of a square pyramid, you double its volume. What is her error?

19. **Writing in Math** Explain how you might use the area formulas for rectangles, triangles, and circles to help you remember volume formulas for pyramids, cones, prisms, and cylinders.

20. **Challenge** Find the volume of a cone with a slant height of 7.5 in. and a lateral area of about 106 in.^2 .



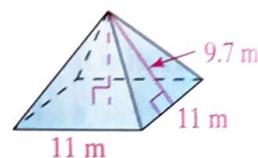
Test Prep and Mixed Review

Practice

Multiple Choice

21. Which is closest to the volume of the pyramid at the right?

- (A) 323 m^3 (C) 88 m^3
 (B) 121 m^3 (D) 16 m^3



22. Casey works 3 days each week. She worked 24 hours this week. This is 12 hours less than twice the number of hours she worked last week. Which equation can you use to find the number of hours Casey worked last week?

- (F) $n = \frac{24 + 12}{2}$ (H) $n = \frac{24 - 12}{2}$
 (G) $n = 2(24) - 12$ (J) $n = 2(24) + 12$

23. The microwaves used in a microwave oven have a wavelength of about $1.2 \times 10^{-1} \text{ m}$. A meter is about $3.9 \times 10^1 \text{ in.}$ What is this wavelength in inches?

- (A) 0.47 in. (C) $4.7 \times 10^{-2} \text{ in.}$
 (B) 4.7 in. (D) $4.7 \times 10^2 \text{ in.}$

24. Write a rule to describe the translation of the black triangle to the blue triangle.

GO for Help

For Exercise	See Lesson
24	8-1

