

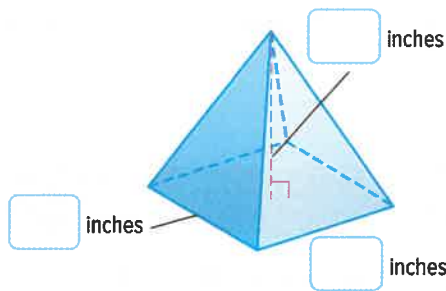
Volume of Pyramids



Real-World Link

Sand Sculpture Dion is helping his mother build a sand sculpture at the beach in the shape of a pyramid. The square pyramid has a base with a length and width of 12 inches each and a height of 14 inches.

- Label the dimensions of the sand sculpture on the square pyramid below.



- What is the area of the base of the pyramid?

- What is the volume of a square prism with the same dimensions as the pyramid?



Essential Question

HOW do measurements help you describe real-world objects?



Vocabulary

lateral face



Common Core State Standards

Content Standards

7.G.6

MP Mathematical Practices

1, 3, 4, 6



Which **MP** Mathematical Practices did you use?

Shade the circle(s) that applies.

- | | |
|--|---|
| <input type="checkbox"/> 1 Persevere with Problems | <input type="checkbox"/> 5 Use Math Tools |
| <input type="checkbox"/> 2 Reason Abstractly | <input type="checkbox"/> 6 Attend to Precision |
| <input type="checkbox"/> 3 Construct an Argument | <input type="checkbox"/> 7 Make Use of Structure |
| <input type="checkbox"/> 4 Model with Mathematics | <input type="checkbox"/> 8 Use Repeated Reasoning |

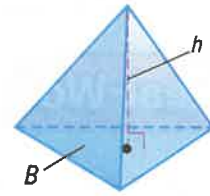
Key Concept

Volume of a Pyramid

Work Zone

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

Model



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

In a polyhedron, any face that is not a base is called a **lateral face**. The lateral faces of a pyramid meet at a common vertex. The height of a pyramid is the distance from the vertex perpendicular to the base.

Examples



1. Find the volume of the pyramid. Round to the nearest tenth.

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

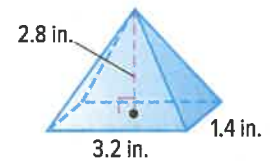
Volume of a pyramid

$$V = \frac{1}{3}(3.2 \cdot 1.4)2.8$$

$B = 3.2 \cdot 1.4$, $h = 2.8$

$$V \approx 4.2$$

Simplify.



The volume is about 4.2 cubic inches.

2. Find the volume of the pyramid. Round to the nearest tenth.

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

Volume of a pyramid

$$V = \frac{1}{3}\left(\frac{1}{2} \cdot 8.1 \cdot 6.4\right)11$$

$B = \frac{1}{2} \cdot 8.1 \cdot 6.4$, $h = 11$

$$V = 95.04$$

Simplify.



The volume is about 95.0 cubic meters.

Got it? Do this problem to find out.

- a. Find the volume of a pyramid that has a height of 9 centimeters and a rectangular base with a length of 7 centimeters and a width of 3 centimeters.

Show your work.

a. _____

Find the Height of a Pyramid

You can also use the formula for the volume of a pyramid to find a missing height.

Examples



- 3.** The rectangular pyramid shown has a volume of 90 cubic inches. Find the height of the pyramid.

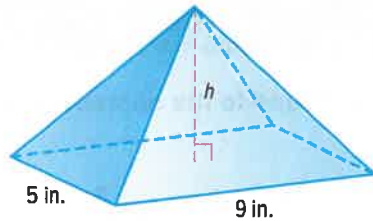
$$V = \frac{1}{3}Bh \quad \text{Volume of a pyramid}$$

$$90 = \frac{1}{3}(9 \cdot 5)h \quad V = 90, B = 9 \cdot 5$$

$$90 = 15h \quad \text{Multiply.}$$

$$\frac{90}{15} = \frac{15h}{15} \quad \text{Divide by 15.}$$

$$6 = h \quad \text{Simplify.}$$



The height of the pyramid is 6 inches.

- 4.** A triangular pyramid has a volume of 44 cubic meters. It has an 8-meter base and a 3-meter height. Find the height of the pyramid.

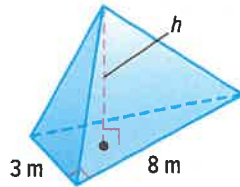
$$V = \frac{1}{3}Bh \quad \text{Volume of a pyramid}$$

$$44 = \frac{1}{3}\left(\frac{1}{2} \cdot 8 \cdot 3\right)h \quad V = 44, B = \frac{1}{2} \cdot 8 \cdot 3$$

$$44 = 4h \quad \text{Multiply.}$$

$$\frac{44}{4} = \frac{4h}{4} \quad \text{Divide by 4.}$$

$$11 = h \quad \text{Simplify.}$$



The height of the pyramid is 11 meters.

Got it? Do these problems to find out.

- b. A triangular pyramid has a volume of 840 cubic inches. The triangular base has a base length of 20 inches and a height of 21 inches. Find the height of the pyramid.
- c. A rectangular pyramid has a volume of 525 cubic feet. It has a base of 25 feet by 18 feet. Find the height of the pyramid.

Multiplying Fractions

To find $\frac{1}{3} \cdot \frac{1}{2} \cdot 8 \cdot 3$, multiply $\frac{1}{3} \cdot \frac{1}{2}$ and $8 \cdot 3$ to get $\frac{1}{6}$ and 24, then find $\frac{1}{6}$ of 24.

Show your work.

b. _____

c. _____



Example

Tutor



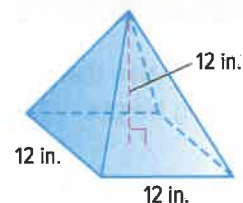
5. Kamilah is making a model of the Food Guide Pyramid for a class project. Find the volume of the square pyramid.

$$V = \frac{1}{3}Bh \quad \text{Volume of a pyramid}$$

$$V = \frac{1}{3}(12 \cdot 12)12 \quad B = 12 \cdot 12, h = 12$$

$$V = 576 \quad \text{Multiply.}$$

The volume is 576 cubic inches.



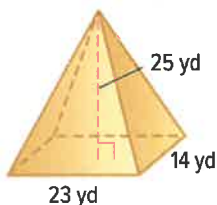
Guided Practice

Check

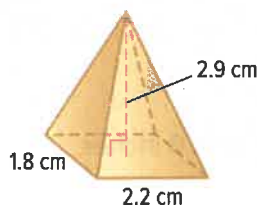


Find the volume of each pyramid. Round to the nearest tenth if necessary. (Examples 1 and 2)

1.



2.




Find the height of each pyramid. (Examples 3 and 4)

3. square pyramid: volume $1,024 \text{ cm}^3$;
base edge 16 cm _____

4. triangular pyramid: volume 48 in^3 ; base
edge 9 in.; base height 4 in. _____



5. The Transamerica Pyramid is a skyscraper in San Francisco. The rectangular base has a length of 175 feet and a width of 120 feet. The height is 853 feet. Find the volume of the building. (Example 5) _____

6.  **Building on the Essential Question** When you are finding the volume of a pyramid, why is it important to know the shape of the base of the pyramid?
- _____
- _____

Rate Yourself!

How well do you understand volume of pyramids? Circle the image that applies.



Clear



Somewhat Clear



Not So Clear

For more help, go online to access a Personal Tutor.

Tutor



FOLDABLES Time to update your Foldable!

Independent Practice

Go online for Step-by-Step Solutions



Find the volume of each pyramid. Round to the nearest tenth if necessary. (Examples 1 and 2)

1 _____

2. _____

3. _____

4. _____

Find the height of each pyramid. (Examples 3 and 4)

5. rectangular pyramid: volume 448 in^3 ; base edge 12 in.; base length 8 in.

6. triangular pyramid: volume 270 cm^3 ; base edge 15 cm; height of base 4 cm

7 A glass pyramid has a height of 4 inches. Its rectangular base has a length of 3 inches and a width of 2.5 inches. Find the volume of glass used to create the pyramid. (Example 5)

8. The Pyramid Arena in Memphis, Tennessee, is a square pyramid that is 321 feet tall. The base has 600-foot sides. Find the volume of the pyramid. (Example 5)

9. **MP Reason Inductively** A rectangular pyramid has a length of 14 centimeters, a width of 9 centimeters, and a height of 10 centimeters. Explain the effect on the volume if each dimension were doubled.

10. Find the height of a square pyramid that has a volume of $25\frac{3}{5}$ meters and a base with 4 meter sides.



H.O.T. Problems Higher Order Thinking

11. **MP Be Precise** A rectangular pyramid has a volume of 160 cubic feet. Find two possible sets of measurements for the base area and height of the pyramid.

12. **MP Persevere with Problems** A square pyramid and a cube have the same bases and volumes. How are their heights related? Explain.

13. **MP Reason Inductively** The two figures shown have congruent bases. How does the volume of the two square pyramids in Figure B compare to the volume of the square pyramid in Figure A?



Figure A

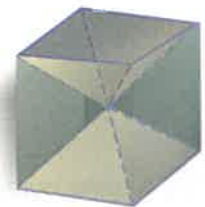


Figure B

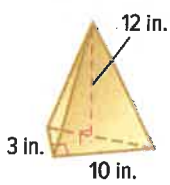
14. **MP Reason Inductively** Determine whether the following statement is *true* or *false*. Explain your reasoning.

The volumes of a rectangular-based pyramid and a triangular-based pyramid with congruent heights and equal base areas are equal.

Extra Practice

Find the volume of each pyramid. Round to the nearest tenth if necessary.

15.



$$60 \text{ in}^3$$

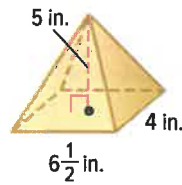
Homework
Help

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

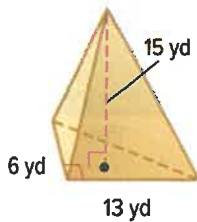
$$V = \frac{1}{3} \left(\frac{1}{2} \cdot 10 \cdot 3 \right) 12$$

$$V = 60$$

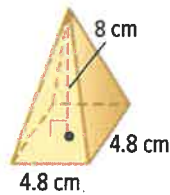
16.



17.



18.



Find the height of each pyramid.

19. square pyramid: volume 297 ft^3 ; area of the base 81 ft^2

20. hexagonal pyramid: volume $1,320 \text{ ft}^3$; area of the base 120 ft^2

21. square pyramid: volume 550 in^3 ; area of the base 75 in^2

22. rectangular pyramid: volume $3,800 \text{ m}^3$; area of the base 300 m^2

23. An ancient stone pyramid has a height of 13.6 meters. The edges of the square base are 16.5 meters. Find the volume of the stone pyramid.



Power Up! Common Core Test Practice

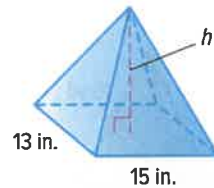
24. The table shows the base dimensions and heights of 4 rectangular pyramids. Sort the pyramids from least to greatest volume.

Pyramid	l (yd)	w (yd)	h (yd)
A	4	9	5
B	6	6	7
C	5	5	9
D	3	6	12

	Pyramid	Volume (yd ³)
Least		
Greatest		

Which pyramid has the greatest volume?

25. The rectangular pyramid shown has a volume of 1,560 cubic inches. What is the height of the pyramid? Explain how you found your answer.



Common Core Spiral Review

Convert each length to feet. Then find the area of each figure in square feet.

5.MD.1

26. _____

27. _____

28. _____

29. _____