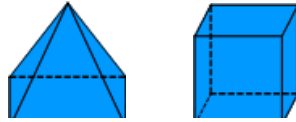


# 11-3

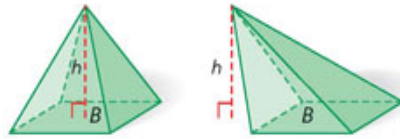
## Volume of Pyramids and Cones

Given a Pyramid and a Prism, both with the same base and height, how many times will the volume of the pyramid fill the prism?



### Volume of a Pyramid

The volume of a pyramid with base area  $B$  and height  $h$  is



### Volume of Cones

The volume of a cone with base area  $B$ , radius  $r$ , and height  $h$  is  $V = \frac{1}{3}Bh$ , or

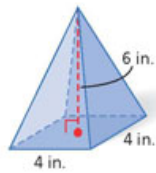


### 1 Finding Volumes of Pyramids

Find the volume of each pyramid.

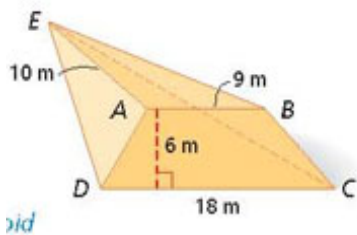
**A** a rectangular pyramid with length 7 ft, width 9 ft, and height 12 ft

**B** the square pyramid



Find the volume of the pyramid.

**C** the trapezoidal pyramid with base  $ABCD$ , where  $\overline{AB} \parallel \overline{CD}$  and  $\overline{AE} \perp$  plane  $ABC$



aid

## 2 **Architecture Application**

The Rainforest Pyramid in Galveston, Texas, is a square pyramid with a base area of about 1 acre and a height of 10 stories. Estimate the volume in cubic yards and in cubic feet. (*Hint:* 1 acre = 4840 yd<sup>2</sup>, 1 story  $\approx$  10 ft)

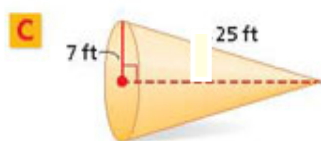


## 3 **Finding Volumes of Cones**

Find the volume of each cone. Give your answers both in terms of  $\pi$  and rounded to the nearest tenth.

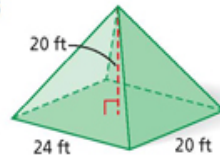
**A** a cone with radius 5 cm and height 12 cm

**B** a cone with a base circumference of  $21\pi$  cm and a height 3 cm less than twice the radius



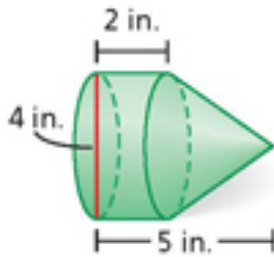
**4 Exploring Effects of Changing Dimensions**

The length, width, and height of the rectangular pyramid are multiplied by  $\frac{1}{4}$ . Describe the effect on the volume.



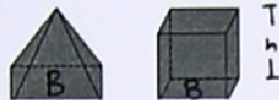
**5 Finding Volumes of Composite Three-Dimensional Figures**

Find the volume of the composite figure. Round to the nearest tenth.



**11-3 Volume of Pyramids and Cones**

Given a Pyramid and a Prism, both with the same base and height, how many times will the volume of the pyramid fill the prism?

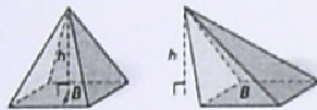


**3**

**Volume of a Pyramid**

The volume of a pyramid with base area  $B$  and height  $h$  is

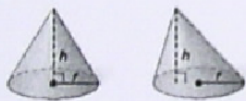
$V = \frac{Bh}{3}$



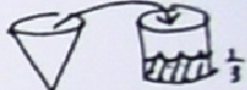
**Volume of Cones**

The volume of a cone with base area  $B$ , radius  $r$ , and height  $h$  is  $V = \frac{1}{3}Bh$ ,

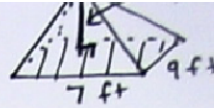
or  $V = \frac{Bh}{3}$  or  $\frac{\pi r^2 h}{3}$



**Fun Fact!**

- ★ Given a cone and cylinder with same height and same base, if you fill the cone with water and pour into the cylinder it will only fill  $\frac{1}{3}$  of the cylinder
- ★ 
- ★ (Volume is cubic (3) units)
- ★ ★ ★

☹ remember  
 $B = \text{area of base}$



**1 Finding Volumes of Pyramids**

Find the volume of each pyramid.

**A** a rectangular pyramid with length 7 ft, width 9 ft, and height 12 ft

$$A. V = \frac{Bh}{3} = \frac{7(9)(12)}{3} = \boxed{252 \text{ ft}^3}$$

**B** the square pyramid

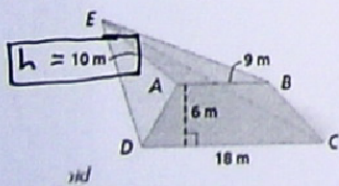


$$B. V = \frac{Bh}{3} = \frac{4(4)(6)}{3} = \boxed{32 \text{ m}^3}$$

Find the volume of the pyramid.

**C** the trapezoidal pyramid with base  $ABCD$ , where  $\overline{AB} \parallel \overline{CD}$  and  $\overline{AE} \perp \text{plane } ABC$

$$C. V = \frac{Bh}{3} = \frac{81(10)}{3} = \boxed{270 \text{ m}^3}$$



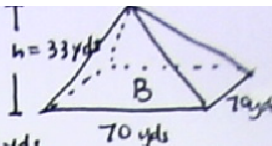
$$B = \frac{h(b_1 + b_2)}{2} = \frac{6(9 + 18)}{2} = 81 \text{ m}^2$$

**2 Architecture Application**

The Rainforest Pyramid in Galveston, Texas, is a square pyramid with a base area of about 1 acre and a height of 10 stories. Estimate the volume in cubic yards and in cubic feet. (Hint: 1 acre = 4840 yd<sup>2</sup>, 1 story ≈ 10 ft)



height = 10 stories  
 1 story ≈ 10 ft  
 = 10(10)  
 = 100 ft ≈ 33 yds



$B = 1 \text{ acre}$   
 $s^2 = 4840 \text{ yd}^2$   
 $s = \sqrt{4840} \approx 70 \text{ yds}$

$$V = \frac{Bh}{3} = \frac{70(70)(33)}{3}$$

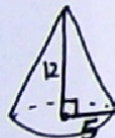
$$\approx \boxed{53,900 \text{ yd}^3}$$

$$\approx \frac{53,900 \text{ yd}^3 \cdot 3^3 \text{ ft}^3}{1 \text{ yd}^3}$$

$$53,900(27) \approx \boxed{1,455,300 \text{ ft}^3}$$

**3 Finding Volumes of Cones**

Find the volume of each cone. Give your answers both in terms of  $\pi$  and rounded to the nearest tenth.



**A** a cone with radius 5 cm and height 12 cm

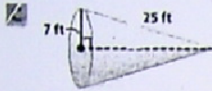
$$V = \frac{Bh}{3} = \frac{\pi r^2 h}{3} = \frac{\pi(5)^2(12)}{3}$$

$$= 100\pi \text{ cm}^3$$

$$\approx 314.2 \text{ cm}^3$$

**B** a cone with a base circumference of  $21\pi$  cm and a height 3 cm less than twice the radius

than twice the radius



$$C = \pi d$$

$$21\pi = \pi d$$

$$d = 21$$

$$r = 10.5 \text{ cm}$$

$$h = 2r - 3$$

$$= 2(10.5) - 3$$

$$= 21 - 3$$

$$h = 18 \text{ cm}$$

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

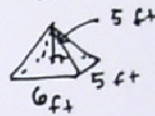
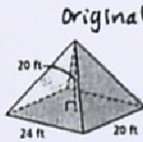
$$= \frac{\pi (10.5)^2 (18)}{3}$$

$$= 661.5\pi \text{ cm}^3$$

$$\approx 2078.2 \text{ cm}^3$$

4 Exploring Effects of Changing Dimensions

The length, width, and height of the rectangular pyramid are multiplied by  $\frac{1}{4}$ . Describe the effect on the volume.



$$V = \frac{Bh}{3} = \frac{24(20)(20)}{3}$$

$$= 3200 \text{ ft}^3$$

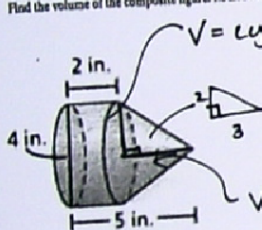
$$V = \frac{Bh}{3} = \frac{6(5)(5)}{3}$$

$$= 50 \text{ ft}^3$$

$$\frac{50}{3200} = \frac{1}{64} \text{ or } \left(\frac{1}{4}\right)^3$$

5 Finding Volumes of Composite Three-Dimensional Figures

Find the volume of the composite figure. Round to the nearest tenth.



$$V = \text{cylinder} = Bh$$

$$= \pi r^2 h$$

$$= \pi (2)^2 (4)$$

$$= 8\pi$$

$$V = \text{cone} = \frac{\pi r^2 h}{3} = \frac{\pi (2)^2 (3)}{3} = 4\pi$$

$$\text{Total } 8\pi + 4\pi$$

$$= 12\pi \text{ in}^3$$

$$\approx 37.7 \text{ in}^3$$

If each dimension changes by  $\frac{1}{4}$  then the volume will be changed by  $\left(\frac{1}{4}\right)^3$