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Unit 5, Lesson 16: Finding Cone Dimensions

Let’s figure out the dimensions of cones.

16.1: Number Talk: Thirds

For each equation, decide what value, if any, would make it true.

$27 = \frac{1}{3}h$

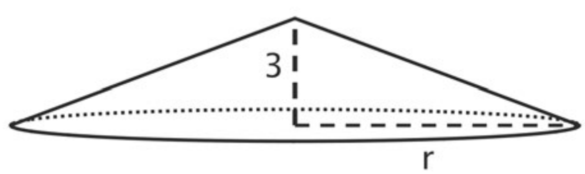
$27 = \frac{1}{3}r^2$

$12\pi = \frac{1}{3}\pi a$

$12\pi = \frac{1}{3}\pi b^2$

16.2: An Unknown Radius

The volume V of a cone with radius r is given by the formula $V = \frac{1}{3}\pi r^2 h$.



The volume of this cone with height 3 units and radius r is $V = 64\pi$ cubic units. This statement is true:

$$64\pi = \frac{1}{3}\pi r^2 \cdot 3$$

What does the radius of this cone have to be? Explain how you know.

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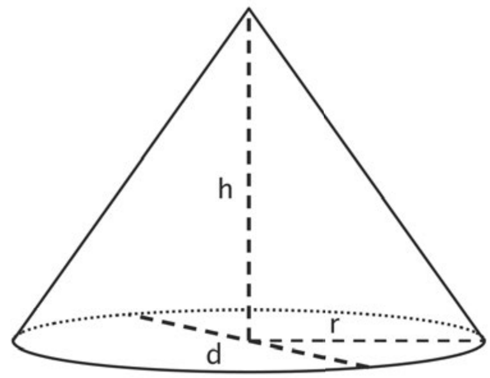
16.3: Cones with Unknown Dimensions



Each row of the table has some information about a particular cone. Complete the table with the missing dimensions.

diameter (units)	radius (units)	area of the base (square units)	height (units)	volume of cone (cubic units)
	4		3	
	$\frac{1}{3}$		6	
		36π	$\frac{1}{4}$	
20				200π
			12	64π
			3	3.14

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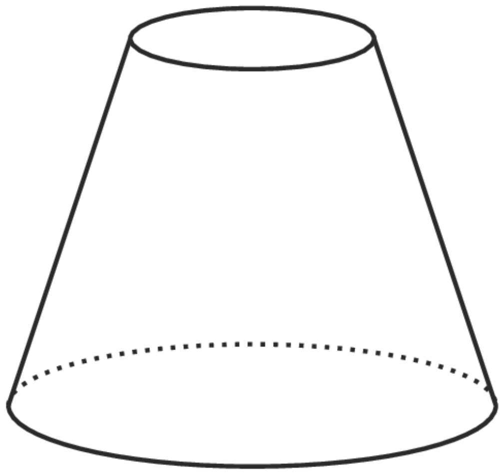
Are you ready for more?

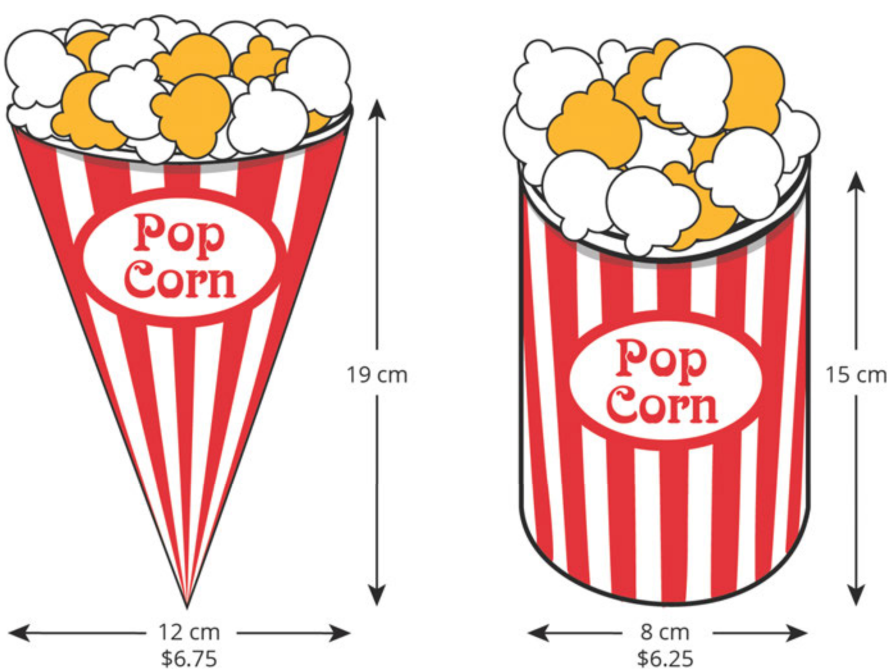
A *frustum* is the result of taking a cone and slicing off a smaller cone using a cut parallel to the base.



Find a formula for the volume of a frustum, including deciding which quantities you are going to include in your formula.

16.4: Popcorn Deals

A movie theater offers two containers:



Which container is the better value? Use 3.14 as an approximation for π.

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Lesson 16 Summary

As we saw with cylinders, the volume V of a cone depends on the radius r of the base and the height h:

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

If we know the radius and height, we can find the volume. If we know the volume and one of the dimensions (either radius or height), we can find the other dimension.

For example, imagine a cone with a volume of 64π cm^3, a height of 3 cm, and an unknown radius r. From the volume formula, we know that

$$64\pi = \frac{1}{3}\pi r^2 \cdot 3$$

Looking at the structure of the equation, we can see that $r^2 = 64$, so the radius must be 8 cm.

Now imagine a different cone with a volume of 18π cm^3, a radius of 3 cm, and an unknown height h. Using the formula for the volume of the cone, we know that

$$18\pi = \frac{1}{3}\pi 3^2 h$$

so the height must be 6 cm. Can you see why?

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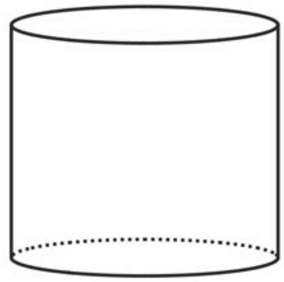
Unit 5, Lesson 16: Finding Cone Dimensions

1. The volume of this cylinder is 175π cubic units.



   What is the volume of a cone that has the same base area and the same height?

   (from Unit 5, Lesson 15)

2. A cone has volume 12π cubic inches. Its height is 4 inches. What is its radius?

3. A cone has volume 3π.

   a. If the cone's radius is 1, what is its height?

   b. If the cone's radius is 2, what is its height?

   c. If the cone's radius is 5, what is its height?

   d. If the cone's radius is $\frac{1}{2}$, what is its height?

   e. If the cone's radius in r, then what is the height?

4. Three people are playing near the water. Person A stands on the dock. Person B starts at the top of a pole and ziplines into the water. Person C climbs out of the water and up the zipline pole. Match the people to the graphs where the horizontal axis represents time in seconds and the vertical axis represents height above the water level in feet.

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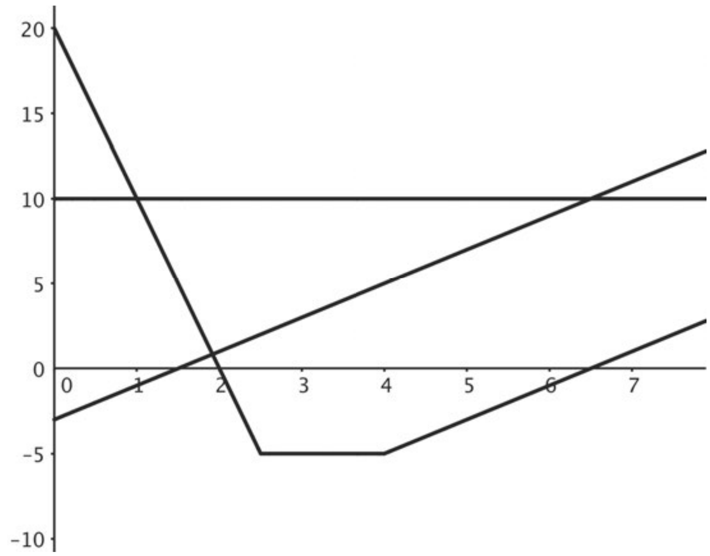

(from Unit 5, Lesson 6)

5. A room is 15 feet tall. An architect wants to include a window that is 6 feet tall. The distance between the floor and the bottom of the window is b feet. The distance between the ceiling and the top of the window is a feet. This relationship can be described by the equation

$$a = 15 - (b + 6)$$

   a. Which variable is independent based on the equation given?

   b. If the architect wants b to be 3, what does this mean? What value of a would work with the given value for b?

   c. The customer wants the window to have 5 feet of space above it. Is the customer describing a or b? What is the value of the other variable?

(from Unit 5, Lesson 3)