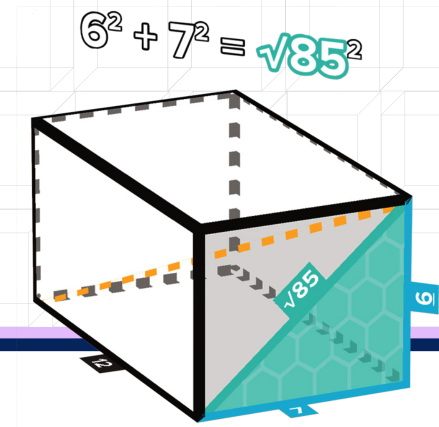
AR



Pythagorean Theorem in 3D

Overview

In this activity, students will explore the Pythagorean Theorem in three dimensions. They will observe how the Pythagorean Theorem can be used twice to find specific segments within three-dimensional objects.

Objectives

Upon completion of the activity, students will be able to apply the Pythagorean Theorem in 3D and use the Pythagorean Theorem twice to find specific line segments in 3D objects.

Launch

Scanning The device needs a variety of perspective information to understand the space.

- Slowly move the camera throughout the space.
- View surfaces at an angle.
- Aim the camera at multiple points throughout the space.

Exploration

- Move the phone closer in to increase the size of the objects in AR.
- Move the phone around the objects to view them from different angles.
- Touch the screen to select and drag objects.

Environment Ideal spaces for AR should feature the following:

- a flat open space
- a surface with non-patterned visual texture and contrast
- a matte or minimally reflective surface
- a static environment, where nothing in the space is in motion
- a well-lit space, where detail is visible in the darkest and brightest parts of the space

Duration of Activity

15-20 minutes

Materials

- Smartphone or tablet with the McGraw Hill AR Application installed,
- flat, non-patterned surface

Standards

8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

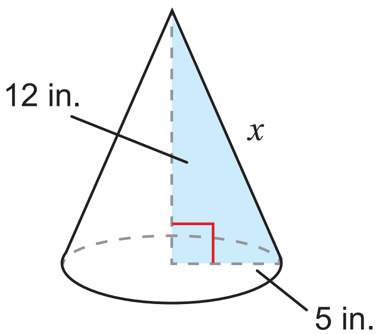
During the Activity

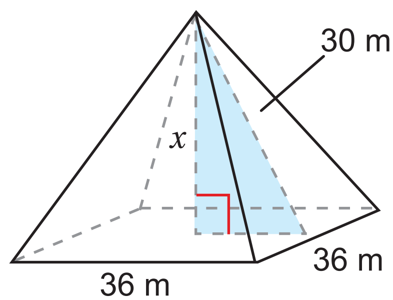
Teacher Tips

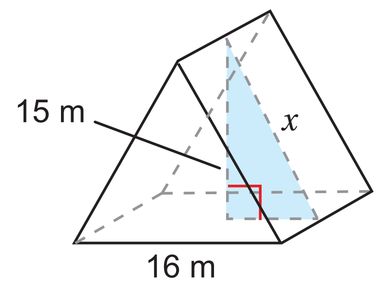
- Make sure students understand how to use the Pythagorean Theorem in two-dimensions prior to doing this activity.
- Point out that there are multiple ways to use the sides of a rectangular prism to find the diagonal length from one corner of the prism to the opposite corner.
- Discuss the similarities between the use of the Pythagorean Theorem in the coordinate plane and in three-dimensional space.

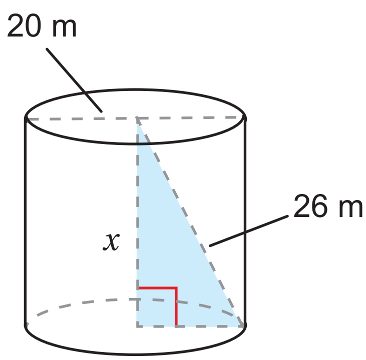
Evaluate

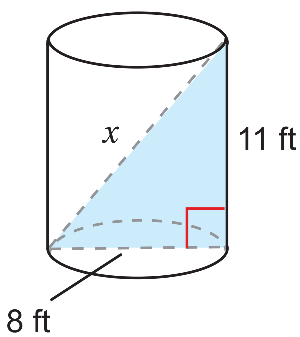
- Students will be presented with five randomly selected exercises from the following exercise set. *Solve for x.*

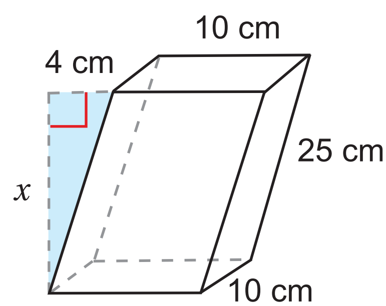


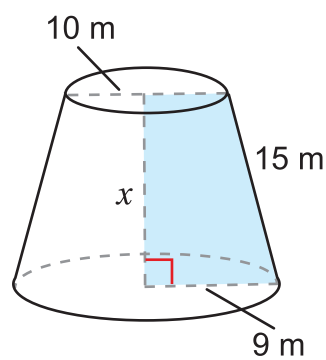


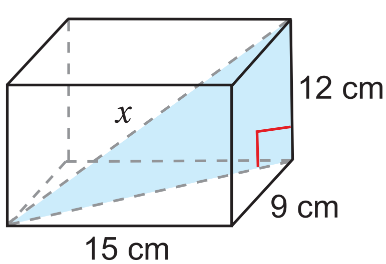


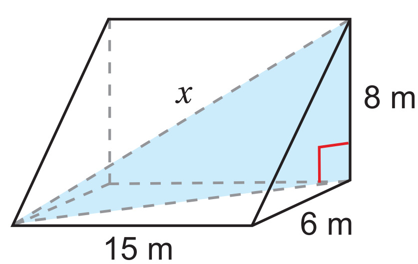


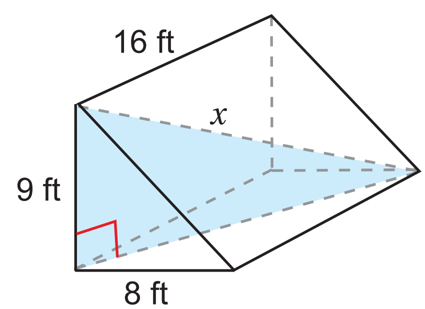












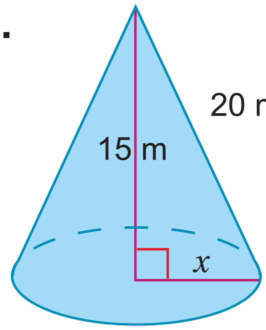
After the Activity

Additional Exercises

These are additional exercises that can be assigned after the activity.

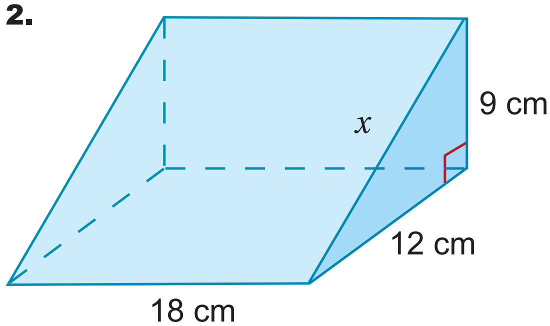
Solve for *x*. Round to the nearest tenth, if necessary.

1.



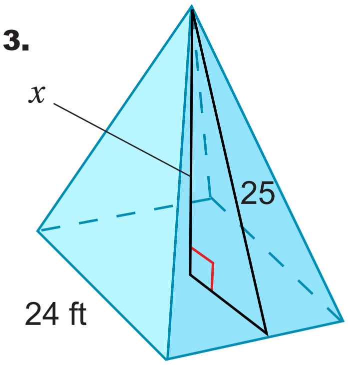
13.2 m

2.



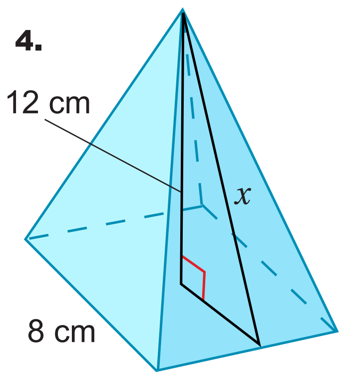
15 cm

3.



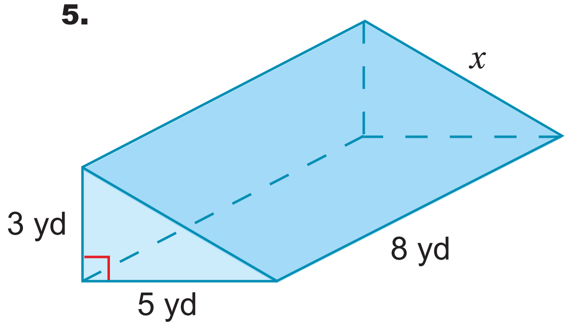
21.9 ft

4.



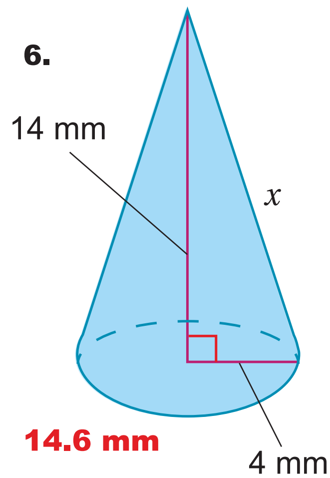
12.6 cm

5.



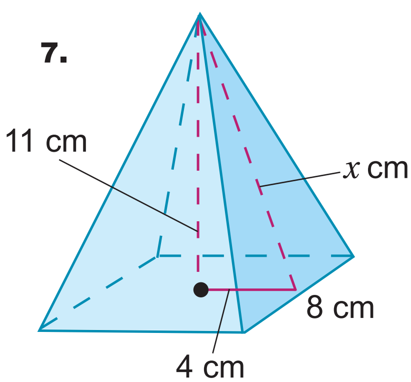
5.8 yd

6.



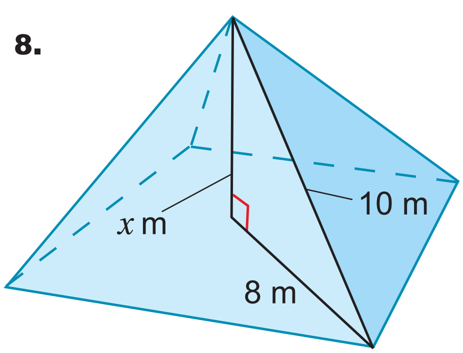
14.6 mm

7.



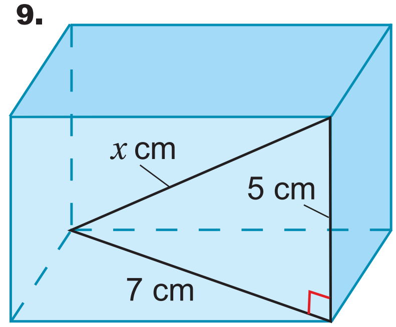
11.7 cm

8.



6 m

9.



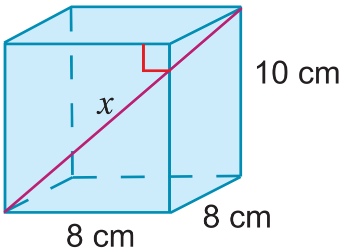
8.6 m

Extension

These are additional exercises that can be assigned after the activity.

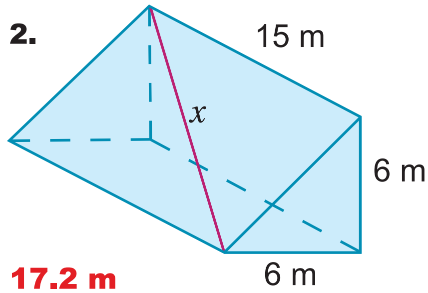
Solve for x. Round to the nearest tenth, if necessary.

1.



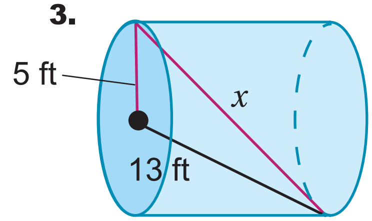
15.1 cm

2.



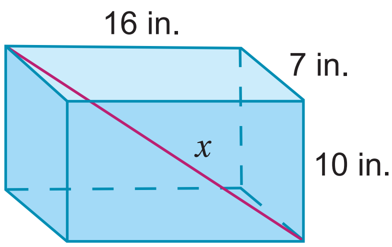
17.2 m

3.



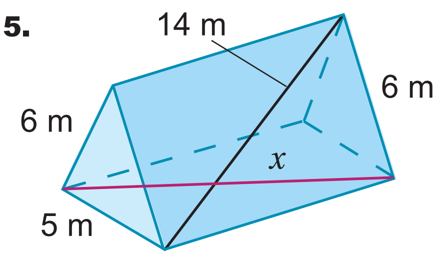
15.6 ft

4.



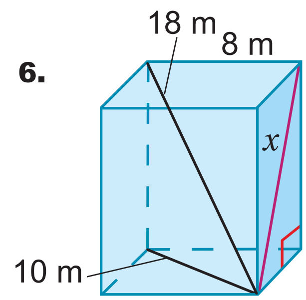
20.1 in.

5.



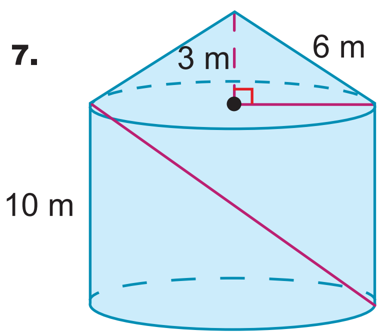
13.6 m

6.



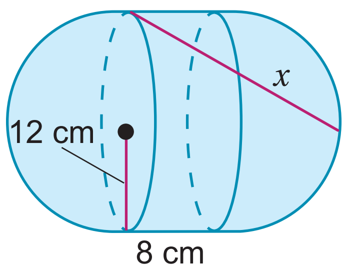
16.1 m

7.



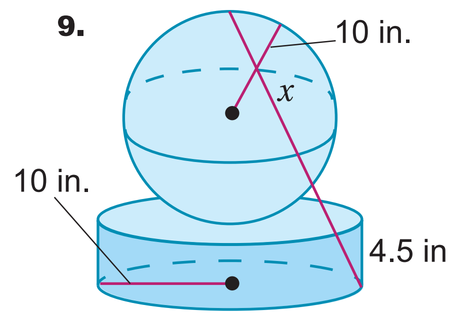
14.4 m

8.



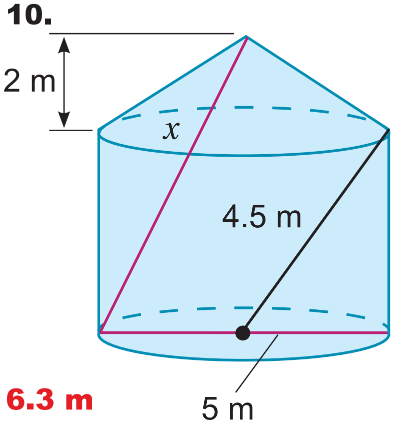
31.2 cm

9.



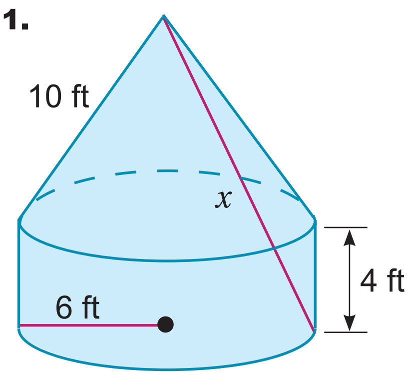
26.5 in.

10.



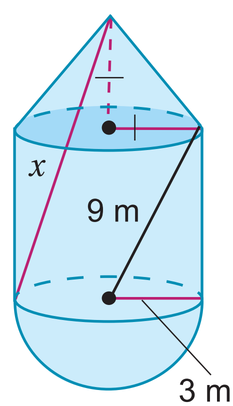
6.3 m

11.



13.4 ft

12.

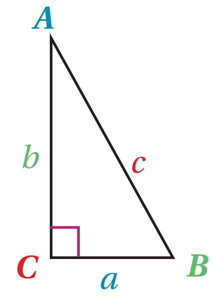


11.9 m

Enrichment

Enrichment content beyond what is learned in the activity

If you know one side length and one of the acute angles of a right triangle, you can use trigonometric ratios to find the other side lengths.

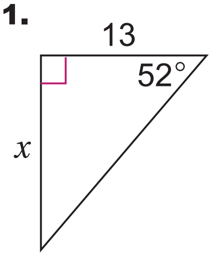


$\sin A = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{a}{c}$ $\cos A = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{b}{c}$ $\tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{a}{b}$

$\sin B = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{b}{c}$ $\cos B = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{a}{c}$ $\tan B = \frac{\text{opposite}}{\text{adjacent}} = \frac{b}{a}$

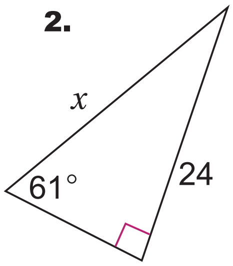
Use a calculator and the trigonometric ratios to find x. Round to the nearest hundredth.

1.



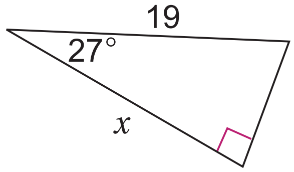
16.64

2.



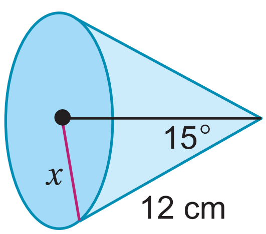
27.44

3.



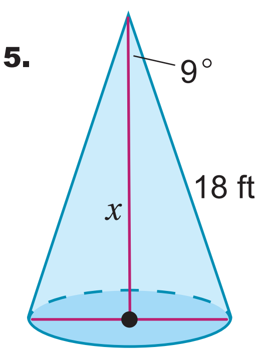
16.93

4.



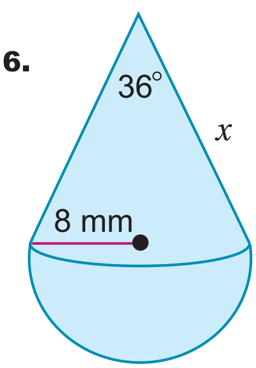
3.1 cm

5.



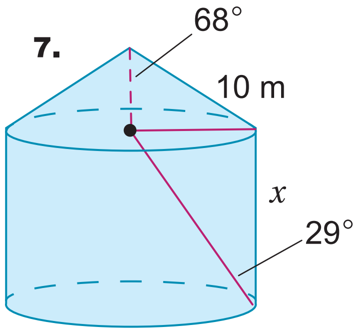
17.8 ft

6.



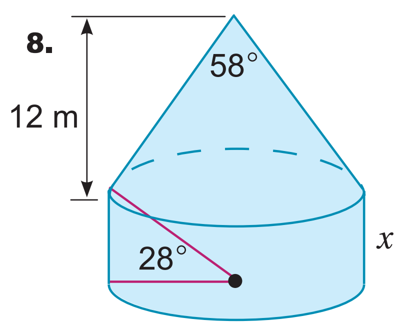
25.9 mm

7.



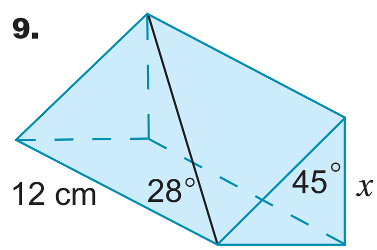
16.7 m

8.



3.5 m

9.



4.5 cm