# Module 16c: Volumes of Pyramids & Cones

**Math Practice(s):**

-Model with mathematics.

-Look for & make use of structure.

**Learning Target(s):**

- Apply the formulas for volume to solve problems in real-world context.

**Homework:**

HW#10: 16c #1-5

Nov 20-12:32 PM

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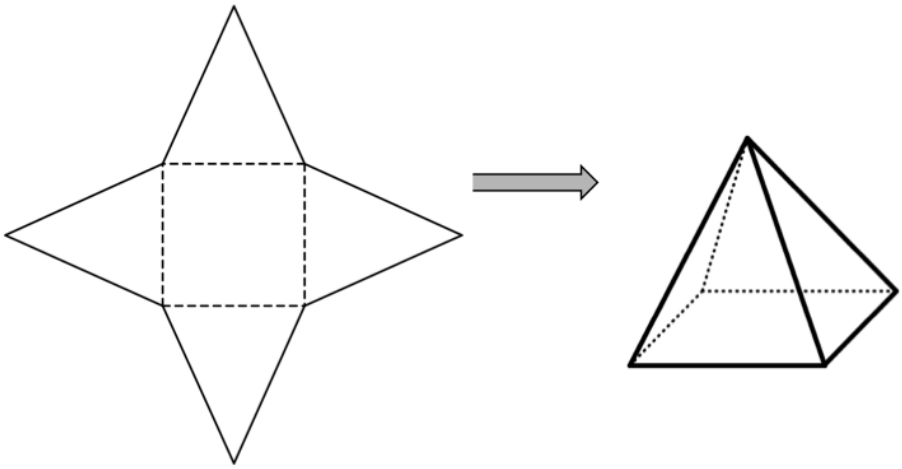
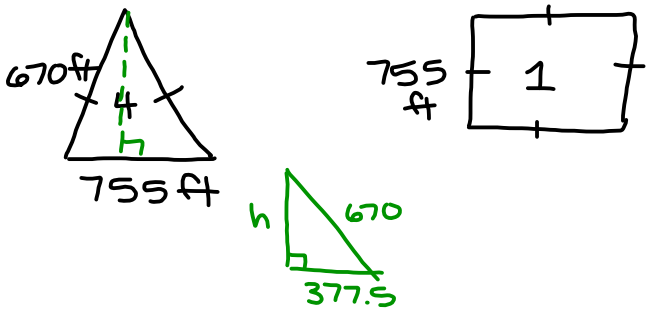
**Warm-up:**

1. If we cut out the figure on the left (a two-dimensional object, comprised of a square with an isosceles triangle on each side), then fold the triangles upward along the dashed lines, you would end up with the figure on the right: a pyramid with a square base (known as a square pyramid).



The Great Pyramid of Giza in Egypt, is a pyramid with a square base where each side of the base has a length of 755 ft., and the two legs of each triangle have a length of 670 ft. Determine the surface area of the Great Pyramid of Giza.




$377.5^2 + h^2 = 670^2$

$\vdots$

$h = \sqrt{306,393.75}$

$A = \frac{1}{2}bh$

$= \frac{1}{2}(755)(\sqrt{306,393.75})$

$= 208,956.9916$

$\times \quad 4$

$835,827.9664 \quad + \quad 570,025$

$A = 755(755)$

$1,405,852.966$

$1,405,853 \text{ ft}^2$

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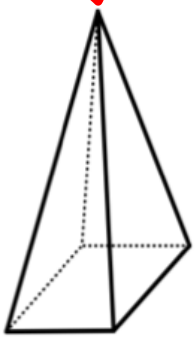
## Pyramids (#VOC)

A 3 -dimensional figure with a polygon base and △ faces that meet at the apex.



## Volume of a Pyramid (#THM)

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

B = area of the base

**Example 1:** Find the volume of a square pyramid with the given dimensions. Express your answer in exact form and as a decimal rounded to the nearest hundredths place.

**a)** base length of 3 in. and a pyramid height of 7 in.

$V = \frac{1}{3}(9)(7)$

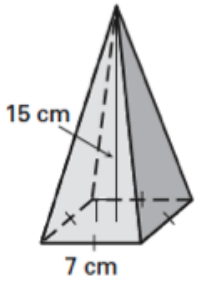
$V = \frac{1}{3}(63)$

$V = 21 \text{ in}^3$

$B = 3 \cdot 3$

$= 9$

**b)**




$B = 7^2$

$= 49$

$V = \frac{1}{3}(49)(15)$

$= \frac{1}{3}(735)$

$V = 245 \text{ cm}^3$

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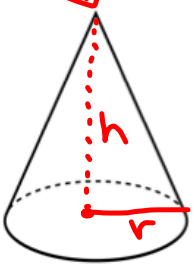
## Cones (#VOC)

A 3 -dimensional figure with a circular base and a single vertex.




## Volume of a Cone (#THM)

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

$B = \pi r^2$

B = area of the base

**Example 2:** Find the volume of the cone with the given dimensions. Express your answer in exact form and as a decimal rounded to the nearest hundredths place.

**a)** radius of 4 cm and height of 6 cm

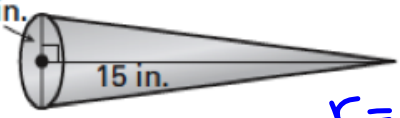
$V = \frac{1}{3}Bh$ $B = \pi(4)^2$ $= 16\pi$

$= \frac{1}{3}(16\pi)(6)$

$V = 32\pi \text{ cm}^3$

$V \approx 100.53 \text{ cm}^3$

**b)** 4 in.




$V = \frac{1}{3}(4\pi)(15)$

$V = 20\pi \text{ in}^3$

$V \approx 62.83 \text{ in}^3$

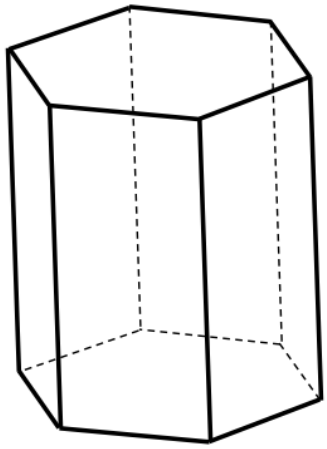
$r = 2$ in

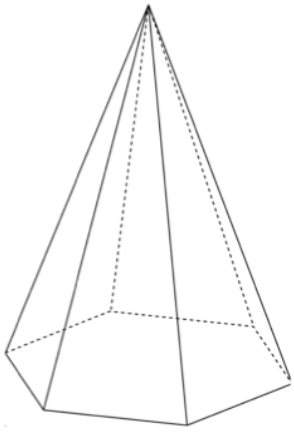
$B = \pi(2)^2$

$= 4\pi$

**Example 3:** A hexagonal prism and a hexagonal pyramid are shown below.

- The base of both figures are congruent hexagons with an area of 75 square feet.
- The height of both figures is the same length.





**A.** If the height of both figures is 12 feet, determine the volume of both figures.

$V_{prism} = Bh$

$= 75(12)$

$V = 900\ ft^3$

$V_{pyramid} = \frac{1}{3}(900)$

$V = 300\ ft^3$

**B.** Determine the height of the hexagonal prism if its volume is 225 cubic feet. Set-up and solve an equation to show how you determined your answer.

$V = Bh$

$\frac{225}{75} = \frac{75h}{75}$

$h = 3\ ft$

**C.** Determine the height of the hexagonal pyramid if its volume is 250 cubic feet. Set-up and solve an equation to show how you determined your answer.

$250 = \frac{1}{3}(75)h$

$\frac{250}{25} = \frac{25h}{25}$

$h = 10\ ft$

Apr 19-10:00 AM

**Practice:**

Grandma's birthday is in a few weeks and we would like to buy her a new fish tank for her pet fish, Ramsey and Karyl. Ramsey and Karyl like a lot of water to swim in, and therefore Grandma needs a sufficiently large fish tank. There are two tanks available, and we want to purchase the one that holds the most water. The first tank is a cylinder with diameter 12 cm and height 30 cm. The second tank is a cone with base diameter 18 cm and height 35 cm.

**1.** Which tank should we purchase?

Cylinder

$V = Bh$ $B = \pi(6)^2$

$= (36\pi)(30)$ $= 36\pi$

$= 1080\pi \text{ cm}^3$

Cone

$V = \frac{1}{3}Bh$ $B = \pi(9)^2$

$= \frac{1}{3}(81\pi)(35)$ $= 81\pi$

$= 945\pi \text{ cm}^3$

We should purchase the cylindrical tank.

**2.** How much more water does the larger tank hold than the smaller tank?

$1080\pi - 945\pi$

$135\pi$

The larger tank holds about 424 cm³ more water.

**3.** Suppose the diameter of each tank decreases by 2 cm. Which tank would then hold the most water?

Cylinder

$d = 10\text{cm}, r = 5\text{cm}$

$h = 30\text{cm}$

$B = \pi(5)^2$ $= 25\pi$

$V = (25\pi)(30)$

$= 750\pi \text{ cm}^3$

$\approx 2356.2 \text{ cm}^3$

Cone

$d = 16\text{cm}, r = 8\text{cm}$

$h = 35\text{cm}$

$B = \pi(8)^2$ $= 64\pi$

$V = \frac{1}{3}(64\pi)(35)$

$= \frac{2240}{3}\pi \text{ cm}^3$

$\approx 2345.7 \text{ cm}^3$

The cylindrical tank would still hold more water.