## Challenge Problems

Lesson $7 \quad$ Volume: Pyramids and Cones

## Set 1

(1) Explain how you can find the radius of a cone with a volume of 942 cubic inches and a height of nine inches.

Explain what happens to a cone's volume when its radius is doubled but its height remains the same.
(3) Explain what happens to a cone's volume when its height is doubled but its radius remains the same.

## Set 2

Create a square pyramid with the same height and volume as the rectangular pyramid shown here. Explain how you created it.


Luria is designing storage areas for her out-of-season clothing. Which design has greater volume, A or B? How much greater?

$\qquad$
Module 13 Perimeter, Area, and Volume
Lesson 7 Volume: Pyramids and Cones

## Possible Answers

Set 1

1. In the volume formula, substitute $\mathbf{3 . 1 4}$ for $\pi, 942$ cubic inches for the volume, and nine inches for the height.

$$
\begin{aligned}
V & =\frac{1}{3} \pi r^{2} h \\
942 \mathrm{in}^{3}{ }^{3} & =\frac{1}{3} \times 3.14 \times r^{2} \times 9 \mathrm{in} . \\
942 \mathrm{in} .^{3} & =9.42 \mathrm{in} . \times r^{2} \\
\frac{942 \mathrm{in}^{3}}{9.42 \mathrm{in} .} & =r^{2} \\
100 \mathrm{in} .^{2} & =r^{2} \\
10 \mathrm{in} . & \approx r
\end{aligned}
$$

The radius is approximately 10 inches.
2. The volume is quadrupled.

$$
\begin{aligned}
& \begin{array}{ll}
\underline{r} \\
V=\frac{1}{3} \pi r^{2} h & \underline{2 r} \\
V & =\frac{1}{3} \pi(2 r)^{2} h
\end{array} \\
& =\frac{1}{3} \pi \times 4 r^{2} h \\
& =4 \times\left(\frac{1}{3} \pi r^{2} h\right)
\end{aligned}
$$

3. The volume is doubled.

$$
\begin{aligned}
& \frac{\underline{h}}{V}=\frac{1}{3} \pi r^{2} h \quad \begin{aligned}
\underline{V} & =\frac{1}{3} \pi r^{2}(2 h) \\
& =2 \times\left(\frac{1}{3} \pi r^{2} h\right)
\end{aligned}
\end{aligned}
$$

Set 2
1.

$$
\begin{aligned}
V & =\frac{1}{3} B h \\
& =\frac{1}{3} \times(16 \mathrm{ft} \times 4 \mathrm{ft}) \times 20 \mathrm{ft} \\
& =\frac{1}{3} \times\left(64 \mathrm{ft}^{2}\right) \times 20 \mathrm{ft} \\
& =\frac{1}{3} \times(8 \mathrm{ft} \times 8 \mathrm{ft}) \times 20 \mathrm{ft} \\
& =\frac{1}{3} \times(8 \mathrm{ft})^{2} \times 20 \mathrm{ft}
\end{aligned}
$$



The area of the base is $\mathbf{6 4}$ square feet. To find the side length of the square base take the square root of 64 . The side length of the square base is eight feet.
2.

$$
\begin{aligned}
& \text { A: } \\
& V=\frac{1}{3} B h \\
& =\frac{1}{3}(15 \mathrm{ft})^{2} \times 20 \mathrm{ft} \quad=\frac{1}{3}(20 \mathrm{ft} \times 10 \mathrm{ft}) \times 18 \mathrm{ft} \\
& =1,500 \mathrm{ft}^{3} \\
& \text { B: } \\
& V=\frac{1}{3} B h \\
& =\mathbf{1 , 2 0 0} \mathrm{ft}^{3} \\
& 1,500 \mathrm{ft}^{\mathbf{3}}-\mathbf{1 , 2 0 0} \mathrm{ft}^{3}=300 \mathrm{ft}^{\mathbf{3}} \\
& \text { Pyramid A has } 300 \mathrm{ft}^{3} \text { more volume. }
\end{aligned}
$$

