This is the LAST UNIT in Geometry. Yay!

Please follow along with the examples and do your best!

We miss you VERY much! Please keep yourselves and your families safe :) You are important to us and we can't wait to see you next year.

❤️❤️❤️
Similar Solids

If two figures are similar, then the ratios have the following relationship:

Lengths – $x : y$

Area/Surface Area – $x^2 : y^2$

Volume – $x^3 : y^3$
Example

The radii of two similar spheres is 2:7. What is the ratio of their area? What is the area of their area and volume?

Step 1: Fill in chart with 2:7, since you are given ratio of length

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>2 : 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$2^2 : 7^2$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>$2^3 : 7^3$</td>
</tr>
</tbody>
</table>

Step 2: Square the numbers for area!

Step 3: Cube the numbers for volume!

Step 4: Simplify and answer!

Answer: Ratio of Surface Area/Area $\frac{4}{49}$

Ratio of Volume $\frac{8}{343}$
You try!

1. The ratio of the radii of two similar spheres is $3:5$. What is the ratio of their volumes?

   Step 1: Fill in chart with 3:5, since you are given ratio of length

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>$3 : 5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$3^2 = 9$ : $5^2 = 25$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>$3^3 = 27$ : $5^3 = 125$</td>
</tr>
</tbody>
</table>

   Step 2: Square the numbers for area!

   Step 3: Cube the numbers for volume!

   Step 4: Simplify and answer!

   **Answer:** Ratio of Surface Area/Area $9 : 25$

   **Answer:** Ratio of Volume $27 : 125$
You try!

2. The ratio of the heights of two similar cones is 4:9. What is the ratio of their surface areas AND volumes?

Ratio of Lengths: $\frac{4}{5}$

Ratio of Surface Area/Area: $\frac{4^2}{5^2}$

Ratio of Volume: $\frac{4^3}{5^3}$

Answer: Ratio of Surface Area/Area: $\frac{16}{25}$

Ratio of Volume: $\frac{64}{125}$
3. Two cylinders are similar. The height of cylinder A is 10 inches. The height of cylinder B is 12 inches. What is the ratio of the surface area and volume of cylinder A to cylinder B?

**The only difference is that you have to simplify the ratio first.**

Step 1: Simplify the ratio!

\[
\frac{10}{12} = \frac{5}{6}
\]
3. Step 2: Square and cube the numbers

Two cylinders are similar. The height of cylinder A is 10 inches. The height of cylinder B is 12 inches. What is the ratio of the surface area and volume of cylinder A to cylinder B?

Ratio of Lengths \( \frac{5}{6} \) \( a : b \)

Ratio of Surface Area/Area \( \frac{5^2}{6^2} = \frac{25}{36} \) \( a^2 : b^2 \)

Ratio of Volume \( \frac{5^3}{6^3} = \frac{125}{216} \) \( a^3 : b^3 \)

Answer: Ratio of Surface Area/Area \( 25 : 36 \)

Ratio of Volume \( 125 : 216 \)
**This problem is a little different!!**

**Example - when given another ratio**

The ratio of the *surface areas* of two rectangular boxes is **16 : 9**. What is the ratio of their corresponding sides?

Step 1: Fill in chart for area, since you are given ratio of area

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>4 : 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>( \sqrt{16} : \sqrt{9} )</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>( 4^3 : 3^3 = 64 : 27 )</td>
</tr>
</tbody>
</table>
Example - when given another ratio

The ratio of the **surface areas** of two rectangular boxes is $16 : 9$. What is the ratio of their corresponding sides?

**Step 2: Take the SQUARE ROOT to get the ratio of lengths**

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>$\frac{4}{\sqrt{16}} : \sqrt{9}^{\frac{3}{3}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$\frac{16}{9}$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>((64)) $\frac{4^3}{3^3} &lt; (27)$</td>
</tr>
</tbody>
</table>

**Step 3: Simplify.**

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>$\frac{4}{3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$\frac{4^3}{3^3} \frac{16}{9}$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>$\frac{4^3}{3^3} \frac{64}{27}$</td>
</tr>
</tbody>
</table>
Example - when given another ratio

The ratio of the surface areas of two rectangular boxes is $16 : 9$. What is the ratio of their corresponding sides?

**Step 4: Fill in the rest of the chart**

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>$\frac{4}{3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$16 : 9$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>$64 : 27$</td>
</tr>
</tbody>
</table>

**Step 5: Answer the question. The question asks for the ratio of sides, so that is the first row of the chart - lengths.**

**Answer:** Ratio of Lengths $\frac{4}{3}$
You try!

4. The ratio of the areas of two similar cones is 4:25. What is the ratio of their volumes?

Ratio of Lengths

\[ \frac{2}{\sqrt{4}} : \frac{5}{\sqrt{25}} \]

Ratio of Surface Area/Area

\[ \frac{\sqrt{4}}{\sqrt{125}} \]

Ratio of Volume

\[ \frac{2^3}{5^3} \]

Answer:

Ratio of Volume

\[ \frac{8}{125} \]
**This problem is a little different!!**

**Example - when given another ratio**

The ratio of the volumes of two similar cylinders is 8:64. What is the ratio of their areas?

Step 1: Fill in chart for volume, since you are given ratio of volume

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>2 : 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a^2 = 4$</td>
<td>$4^2 = 16$</td>
</tr>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$\sqrt[3]{8} : \sqrt[3]{64}$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td></td>
</tr>
</tbody>
</table>
Example - when given another ratio

The ratio of the volumes of two similar cylinders is $8:64$. What is the ratio of their areas?

**Step 2:** Take the CUBE ROOT to get the ratio of lengths

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>$\frac{\sqrt[3]{8}}{\sqrt[3]{64}} : \frac{\sqrt[3]{64}}{\sqrt[3]{64}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$\frac{2^2}{4^2} : \frac{4^2}{4^2}$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>$8 : 64$</td>
</tr>
</tbody>
</table>

**Step 3:** Simplify.

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>$\frac{2}{4}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
<td>$\frac{4}{16}$</td>
</tr>
<tr>
<td>Ratio of Volume</td>
<td>$8 : 64$</td>
</tr>
</tbody>
</table>
Example - when given another ratio

The ratio of the **volumes** of two similar cones is **8:64**. What is the ratio of their **areas**?

**Step 4: Fill in the rest of the chart**

<table>
<thead>
<tr>
<th>Ratio of Lengths</th>
<th>2 : 4</th>
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</thead>
<tbody>
<tr>
<td>Ratio of Surface Area/Area</td>
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</tr>
<tr>
<td>Ratio of Volume</td>
<td>8 : 64</td>
</tr>
</tbody>
</table>

**Step 5: Answer the question. The question asks for the ratio of areas, so that is the second row of the chart**

**Answer:** Ratio of Surface Area/Area \( \frac{4}{16} \)
4. Two cylinders are similar. The radius of cylinder A is 3 inches. The radius of cylinder B is 9 inches. What is the ratio of the surface area and volume of cylinder A to cylinder B?

\[ \frac{r}{a} = \frac{1}{3} \]

S.A \( 1 : 3^2 \) (9)

V \( 1 : 3^3 \) (27)

5. The ratio of the volumes of two similar prisms is 8:125. What is the ratio of their lengths?

L \( 2 : 5 \)

S.A \( \sqrt[3]{8} \) \( \sqrt[3]{125} \)
6. The ratio of the surface areas of two prisms is 36:49. Complete the table by finding the ratio of their lengths and the ratio of their volumes.

<table>
<thead>
<tr>
<th></th>
<th>Prism 1</th>
<th>Prism 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Surface Area</td>
<td>$\sqrt{36}$</td>
<td>$\sqrt{49}$</td>
</tr>
<tr>
<td>Volume</td>
<td>$6^3 = 216$</td>
<td>$7^3 = 343$</td>
</tr>
</tbody>
</table>

7. The radius of Sphere A is 2 inches and the radius of Sphere B is 4 inches. How many times larger is the volume of Sphere B compared to the volume of Sphere A?

A. 2
B. 3
C. 4
D. 8
Directions: Click and drag each selected number to the correct box.

The ratio of the surface areas of two spheres is 9 : 64. What is the ratio of their radii?

\[ \frac{3}{8} \]

The ratio of the heights of two similar pyramids is 4 : 5. What is the ratio of their volumes?

\[ \frac{\sqrt[3]{256}}{\sqrt[3]{125}} = \frac{4}{5} \]

Page 17
12. Given: Objects A and B are three-dimensional and similar. The height of Object A is 12 inches and the height of Object B is 18 inches. \[ \frac{12}{18} = \frac{2}{3} \]

1. What is the ratio of surface area of Object A to Object B in simplest form? \[ a^2 \cdot 3^2 \]
   A. 2:3  
   B. 4:9  
   C. 8:27  
   D. 12:18

2. What is the ratio of their volume in simplest form? \[ a^3 : b^3 \]
   A. 2:3  
   B. 4:9  
   C. 8:27  
   D. 12:18
Changing Dimensions

*Get your FORMULA SHEET ready!*

Example 1:

If the height of a cone is tripled, but the radius stays the same, what happens to the volume of the cone?

a. the volume stays the same
b. the volume is 3 times bigger
c. the volume is 9 times bigger
d. the volume is 27 times bigger

Step 1: Find the formula that is in the problem.

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

L.A. = \pi rl

S.A. = \pi r^2 + \pi rl
Changing Dimensions

*Get your FORMULA SHEET ready!

Example 1:

If the height of a cone is tripled, but the radius stays the same, what happens to the volume of the cone?

a. the volume stays the same  
b. the volume is 3 times bigger  
c. the volume is 9 times bigger  
d. the volume is 27 times bigger

Step 2: Locate the variable that is being changed.

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

L.A. = \pi rl  
S.A. = \pi r^2 + \pi rl
Changing Dimensions

*Get your FORMULA SHEET ready!

Example 1:

If the **height** of a cone is **tripled**, but the radius stays the same, what happens to the **volume** of the cone?

a. the volume stays the same
b. the volume is 3 times bigger
c. the volume is 9 times bigger
d. the volume is 27 times bigger

Step 3: If the variable does NOT have an exponent, then the resulting change is exactly the same number that is in the original problem.

3 \cdot h =

height, \( h \), has no exponent, so the volume is tripled, just like in the original problem.

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

L.A. = \pi rl
S.A. = \pi r^2 + \pi rl
Changing Dimensions

*Get your FORMULA SHEET ready!*

Example 2:

If the **radius** of a **cone** is tripled, but the height stays the same, what happens to the **volume** of the cone?

a. the volume stays the same
b. the volume is 3 times bigger
c. the volume is 9 times bigger
d. the volume is 27 times bigger

---

Step 1&2: Find the formula and variable that is mentioned and being changed in the problem.

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

L.A. = \( \pi rl \)

S.A. = \( \pi r^2 + \pi rl \)
-changing dimensions

*Get your FORMULA SHEET ready!*

Example 2:

If the **radius** of a cone **is tripled**, but the radius stays the same, what happens to the **volume** of the cone?

- a. the volume stays the same
- b. the volume is 3 times bigger
- c. the volume is 9 times bigger
- d. the volume is 27 times bigger

---

**Step 3:** If the variable **DOES** have an exponent, then the resulting change needs to use that exponent!

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

- L.A. = \( \pi rl \)
- S.A. = \( \pi r^2 + \pi rl \)

---

the radius, \( r \), has an exponent of 2, so the answer needs to have that exponent (\( 3^2 \) which equals 9)
You try!

#1 Carl has two cylinders that are the same height, but the radius of the second cylinder is 8 times the radius of the first cylinder. The volume of the second cylinder is ---?

\[ V = \pi r^2 h \]

a. 8 times the volume of the first cylinder
b. 16 times the volume of the first cylinder
c. 64 times the volume of the first cylinder
d. 512 times the volume of the first cylinder

\[ = 8^2 = 64 \]

#2 If the height of a pyramid is decreased by \( \frac{1}{2} \), which statement is true?

a. The volume would decrease by \( \frac{1}{2} \)
b. The volume would decrease by \( \frac{1}{4} \)
c. The volume would decrease by \( \frac{1}{8} \)
d. The volume would decrease by 2
#3
Directions: Write your answer in the box.

The height and radius of a cone are each multiplied by 3. What effect does this have on the volume of the cone?

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

The volume of the cone is multiplied by -- 3

\[ \frac{1}{3} \pi \quad 3^2 \cdot 3 \]

#4
If the radius of a cylinder is decreased by \( \frac{1}{2} \), which statement is true?

a. The volume would decrease by \( \frac{1}{2} \)

b. The volume would decrease by \( \frac{1}{4} \)

c. The volume would decrease by \( \frac{1}{8} \)

d. The volume would decrease by 2

\[ \Gamma = \pi \Gamma^2 h \]  
\[ \Gamma^2 = 4 \quad 4 \div \frac{1}{2} = 2 \]