Reteach

Spheres

Volume and Surface Area of a Sphere

<table>
<thead>
<tr>
<th>Volume</th>
<th>The volume of a sphere with radius $r$ is $V = \frac{4}{3} \pi r^3$.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Area</td>
<td>The surface area of a sphere with radius $r$ is $S = 4\pi r^2$.</td>
</tr>
</tbody>
</table>

Find each measurement. Give your answer in terms of $\pi$.

1. the volume of the sphere

![5 mm sphere](image1)

2. the volume of the sphere

![16 cm sphere](image2)

3. the volume of the hemisphere

![2 ft hemisphere](image3)

4. the radius of a sphere with volume $7776\pi \text{ in}^3$

5. the surface area of the sphere

![7 in sphere](image4)

6. the surface area of the sphere

![20 in sphere](image5)
Reteach

Spheres continued

The radius of the sphere is multiplied by $\frac{1}{4}$.

Describe the effect on the surface area.

original surface area: new surface area, radius multiplied by $\frac{1}{4}$:

$S = 4\pi r^2$

$= 4\pi(16)^2 \quad r = 16$

$= 1024\pi \text{ m}^2 \quad \text{Simplify}$

$S = 4\pi(4)^2 \quad r = 4$

$= 64\pi \text{ m}^2 \quad \text{Simplify}$

Notice that $1024 \cdot \frac{1}{16} = 64$. If the dimensions are multiplied by $\frac{1}{4}$,

the surface area is multiplied by $\left(\frac{1}{4}\right)^2$, or $\frac{1}{16}$.

Describe the effect of each change on the given measurement of the figure.

7. surface area

The radius is multiplied by 4.

8. volume

The dimensions are multiplied by $\frac{1}{2}$.

Find the surface area and volume of each composite figure.

Round to the nearest tenth.

9. Hint: To find the surface area, add the lateral area of the cylinder, the area of one base, and the surface area of the hemisphere.

10. Hint: To find the volume, subtract the volume of the hemisphere from the volume of the cylinder.
12. Consider the octahedron as two square pyramids with different altitudes, \( h_1 \) and \( h_2 \). \( V = \frac{1}{3} B(h_1 + h_2) \) Note that altitude is always a positive number.

13. \( V \approx 433.3 \) units³

**Problem Solving**

1. \( V \approx 940.0 \) m³  
2. \( V = 50.75\pi \) cm³  
3. \( V \approx 210.8 \) cm³  
4. \( V = 98\pi \) in³  
5. A  
6. G  
7. A

**Reading Strategies**

1. \( V \approx 3141.6 \) cm³  
2. \( V = 28 \) ft³  
3. \( V \approx 277.3 \) in³  
4. \( V \approx 3534.3 \) ft³

**11-4 SPHERES**

**Practice A**

1. \( V = \frac{4}{3} \pi r^3 \)  
2. \( S = 4\pi r^2 \)
3. \( V = 288\pi \) cm³  
4. \( V = 486\pi \) in³  
5. \( r = 30 \) mm  
6. the sphere  
7. \( S = 256\pi \) ft²  
8. \( S = 64\pi \) yd²  
9. \( V = 36\pi \) m³; \( S = 36\pi \) m²  
10. \( V = 972\pi \) m³; \( S = 324\pi \) m²  
11. The volume is multiplied by 27. The surface area is multiplied by 9.  
12. \( V = 81\pi \) m³; \( S = 69\pi \) m²

**Practice B**

1. \( V = 3888\pi \) mm³  
2. \( V = \frac{8788\pi}{3} \) ft³ = \( 2929\frac{1}{3} \) ft³  
3. \( d = 10 \) m  
4. \( V = \frac{250\pi}{3} \) cm³; \( V = \frac{32\pi}{9} \) cm³  
5. \( S = 484\pi \) in²  
6. \( S = 48\pi \) yd²; \( S = 16\pi \) yd²  
7. \( V = \frac{1372\pi}{3} \) km³ = \( 457\frac{1}{3} \) π km³  
8. The surface area is divided by 16.

9. The volume is multiplied by \( \frac{8}{125} \).

10. \( S \approx 271.6 \) in²; \( V \approx 234.8 \) in³  
11. \( S \approx 446.0 \) cm²; \( V \approx 829.4 \) cm³

**Practice C**

1. Possible answer:

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\[ r \]
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2. Possible answer: \( S = 4\pi r^2 + r^2 + r^2\sqrt{4\pi^2 + 1} \)

3. \( S = 3\pi r^2 + \pi r \)  
4. \( h \approx 11.1 \) in.  
5. \( h \approx 6.9 \) in.  
6. \( h = 6 \) in.  
7. \( S = 4\pi(x^2 + y^2 + z^2); V = \frac{4}{3} \pi(x^2 + y^2 + z^2)^3 \)

8. \( V = \frac{375\pi}{32} \) in³  
9. \( V = \frac{125\pi}{32} \) in³

10. \( 66\frac{2}{3} \)

**Reteach**

1. \( V = \frac{500\pi}{3} \) mm³  
2. \( V = \frac{2048\pi}{3} \) cm³  
3. \( V = \frac{16\pi}{3} \) ft³  
4. \( r = 18 \) in.

5. \( S = 196\pi \) in²  
6. \( S = 400\pi \) m²  
7. The surface area is multiplied by 16.

8. The volume is multiplied by \( \frac{1}{8} \).

9. \( S \approx 1442.0 \) cm²; \( V \approx 4580.4 \) cm³  
10. \( S \approx 216.8 \) in²; \( V \approx 141.4 \) in³

**Challenge**

1. \( 16\pi \) in²; \( 24\pi \) in²; \( 16\pi \) in³; \( 16\pi \) in²; \( \frac{32}{3} \pi \) in³

2. \( 100\pi \) cm²; \( 150\pi \) cm²; \( 250\pi \) cm³; \( 100\pi \) cm²; \( \frac{500}{3} \pi \) cm³

3. \( 400\pi \) ft²; \( 600\pi \) ft²; \( 2000\pi \) ft³; \( 400\pi \) ft²; \( \frac{4000}{3} \pi \) ft³