Section 10.4: Volume And Surface Area

§1 Volume

The volume refers to the amount of space occupied by a solid 3-D object. We can think of it as how many cubic units will it take to fill up the interior of the object. We will find the volume of rectangular solids, cubes, pyramids, right circular cylinders, cones and spheres.

Rectangular solid has length, width and height.

A cube also has length, width and height, but they are all the same.

A rectangular pyramid has a rectangle as its base. The sides of the pyramid are in the shape of triangles, where all the triangles meet at a single point.

Note that there are 5 faces to a rectangular pyramid. The base is a rectangle and there are four triangles.
A right circular cylinder has circles as the bases. The sides form a right angle with the bases.

![Cylinder Diagram](image)

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

Remember, the height must be perpendicular to the base!

A cone has a circular base, but the sides extend up and meet at a single point. It turns out that if you compare the volume of a cylinder and a cone with the same base and height, then you can fit three cones into the cylinder!

![Cone Diagram](image)

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

A sphere is simply a round ball. Remember, it’s a 3-D shape.

![Sphere Diagram](image)

\[ V = \frac{4}{3} \pi r^3 \]

Basically, as long as you know the formulas, you should be able to calculate the volume. The measurements will always be given. Make sure you have a good calculator handy, and round to the nearest tenth!
PRACTICE

1) Find the volume of a swimming pool that measures 12 feet by 10 feet by 20 feet. If cleaning chemicals for the pool costs $0.02 per cubic feet, how much will the chemicals cost?

2) Find the volume of a right circular cylinder and a cone that have a radius of 4 yards and height of 6 yards.

§2 Surface Area

The surface area simply refers to the sum of the areas all the faces of the figure. Remember, a cube has 6 faces where all the sides have the same length. A rectangular solid also has 6 faces, but depending on the length and height and width, only the opposite faces have the same area. A circular cylinder has three faces – 2 are circles and one is for the cylindrical part.

<table>
<thead>
<tr>
<th>Cube</th>
<th>Rectangular Solid</th>
<th>Circular Cylinder</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SA = 6s^2$</td>
<td>$SA = 2lw + 2lh + 2hw$</td>
<td>$SA = 2\pi r^2 + 2\pi rh$</td>
</tr>
</tbody>
</table>

PRACTICE

3) Find the surface area of a rectangular solid whose length is 4 yards, width is 6 yards, and height is 8 yards. What happens to the surface area if the length and width and height are all doubled in length?

4) Find the surface area of a cylinder whose radius is 4 feet and whose height is 10 feet.