How to Use a Formula

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n = 3.14 \text{ or } \frac{22}{7} )</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Square</strong></td>
<td>Area = ( s^2 )</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Perimeter = 4s</td>
<td>-</td>
</tr>
<tr>
<td><strong>Circle</strong></td>
<td>Area = ( \pi r^2 )</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Circumference = ( 2\pi r )</td>
<td>-</td>
</tr>
<tr>
<td><strong>Triangle</strong></td>
<td>Area = ( \frac{1}{2}bh )</td>
<td>-</td>
</tr>
<tr>
<td><strong>Rectangle</strong></td>
<td>Area = ( lw )</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Perimeter = ( 2l + 2w )</td>
<td>-</td>
</tr>
<tr>
<td><strong>Trapezoid</strong></td>
<td>Area = ( \frac{1}{2}h(b_1 + b_2) )</td>
<td>-</td>
</tr>
</tbody>
</table>

Jenny is putting a string trim around a circular design she is creating. The plate has a diameter of 8 inches. What is the length of string she needs?

\[
C = \pi d
C = (3.14)(8)
C = 25.12 \text{ in}
\]

Henry has a large rectangular rug that is 12 ft by 15 ft. How much of the floor is covered with the rug?

\[
A = lw
A = 12(15)
A = 180 \text{ ft}^2
\]

The measure of the side of each grid square is one unit. What is the perimeter of the shaded figure?

John plans to put a fence around his entire property. If the property measures 115 feet by 130 feet, how many feet of fencing does John need?

\[
P = 2l + 2w
P = 2(115) + 2(130)
P = 230 + 260
P = 490 \text{ ft}
\]

A plate with a diameter of 7 inches sits on a 7-inch square placemat. What is the area of the plate?

Paul is going to carpet his bedroom and drew the diagram below. What is the minimum number of square feet of carpet he will need?
Surface Area vs. Volume

Surface Area- The total **area** of the **sides** (including the bases) and curved surfaces of a solid figure

Always measured in **units**^2^.

Volume- The number of cubic units it takes to **fill** a figure.

Always measured **units**^3^.

For each situation below, would you use Surface Area or Volume to solve?

<table>
<thead>
<tr>
<th>Situation</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>To make a prop for the school play, you are covering this item with glitter.</td>
<td>Surface Area (SA)</td>
</tr>
<tr>
<td>You are making a paper hat and need to know how much paper to use.</td>
<td></td>
</tr>
<tr>
<td>You are covering the wall with wallpaper in a room.</td>
<td>Surface Area (SA)</td>
</tr>
<tr>
<td>You are cleaning out your locker and filling a garbage can.</td>
<td>Volume (Vol)</td>
</tr>
<tr>
<td>A volcano contains lava.</td>
<td>Volume (Vol)</td>
</tr>
<tr>
<td>You are using fabric to make a tent.</td>
<td></td>
</tr>
<tr>
<td>You are painting a block.</td>
<td>Surface Area (SA)</td>
</tr>
<tr>
<td>You are stuffing a pillow</td>
<td>Volume (Vol)</td>
</tr>
<tr>
<td>You are filling a mold with cement to make a brick.</td>
<td>Volume (Vol)</td>
</tr>
<tr>
<td>You are trying to find out how much soup is inside a can.</td>
<td></td>
</tr>
</tbody>
</table>

Surface Area Key Words: **Cover** **Outside**

Volume Key Words: **Fill** **Inside**

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Cylinders

A cylinder is a 3D shape with two identical **circular** ends that are **congruent** and one **rectangular** side.

<table>
<thead>
<tr>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SA = 2\pi r^2 + 2\pi rh$</td>
<td>$V = \pi r^2 h$</td>
</tr>
</tbody>
</table>
1. Underline/highlight the key words.
2. Identify the shape.
3. Write the formulas.
4. Define the variables
5. Substitute and solve to find your final answer

**Practice 1:**

<table>
<thead>
<tr>
<th>How much paper do you need to make a cylinder with a radius of 4 cm and a height of 8.5 cm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r = 4 \text{ cm} )</td>
</tr>
<tr>
<td>( h = 8.5 \text{ cm} )</td>
</tr>
</tbody>
</table>

\[
SA = 2\pi r^2 + 2\pi rh
\]
\[
SA = 2(3.14)(4)^2 + 2(3.14)(4)(8.5)
\]
\[
SA = 100.48 + 313.52
\]
\[
SA = 314 \text{ cm}^2
\]

**Practice 2:**

<table>
<thead>
<tr>
<th>The current of an alkaline battery corresponds to its volume. Find the volume of an AAA battery with a diameter of 10.5 mm and a height of 44.5 mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( d = 10.5 \text{ mm} )</td>
</tr>
<tr>
<td>( r = 5.25 \text{ mm} )</td>
</tr>
<tr>
<td>( h = 44.5 \text{ mm} )</td>
</tr>
</tbody>
</table>

\[
V = \pi r^2h
\]
\[
V = (3.14)(5.25)^2(44.5)
\]
\[
V = 3851.308125 \text{ mm}^3
\]
Extra Practice

1. Determine the volume of the cylinder shown below.

Formula:

\[ V = \pi r^2 h \]
\[ V = (3.14)(4)^2(5) \]
\[ V = 251.2 \text{ units}^3 \]

2. An oil tank is 32 feet tall with a diameter of 84 feet. If the outside wall of the tank is to be painted, what is the minimum amount of paint needed?

Formula:

\[ SA = 2\pi r^2 + 2\pi rh \]
\[ SA = 2(3.14)(42)^2 + 2(3.14)(42)(32) \]
\[ SA = 11,077.92 + 8440.32 \]
\[ SA = 19,518.24 \text{ ft}^2 \]

3. Determine the volume of the cylinder shown below.

Formula:

\[ V = \pi r^2 h \]
\[ V = (3.14)(1)^2(5) \]
\[ V = 15.7 \text{ in}^3 \]
4. What is the surface area of the cylinder shown below?

Formula:

\[ SA = 2\pi r^2 + 2\pi rh \]

\[ r = 1.5 \text{ in} \]
\[ h = 3 \text{ in} \]

\[ SA = 2\pi(1.5)^2 + 2\pi(1.5)(3) \]
\[ SA = 14.13 + 28.26 \]
\[ SA = 42.39 \text{ in}^2 \]

5. In complete sentences, explain the difference between the radius and the diameter of a cylinder.

The radius connects from the center of the circle to any point on the circle. The diameter connects a point on the circle to another through the center point.

6. Sarah is going to cook her family spaghetti. Her brothers are really hungry so she needs to make as much spaghetti as possible. Her first pot is 3 ½ inches tall and has a diameter of 7 inches. Her second pot is 4 ¼ inches tall, but the diameter is only 6 inches. Which pot should she use? How do you know? SHOW ALL OF YOUR WORK.

\[ V = \pi r^2 h \]
\[ V = 3.14 \times (3.5)^2 \times 6.5 \]
\[ V = 134.6 \text{ in}^3 \]

\[ V = \pi r^2 h \]
\[ V = (3.14) (3)^2 (4.5) \]
\[ V = 127.17 \text{ in}^3 \]

7. (Challenge) Josiah is making a homemade pencil holder out of an old coffee can and some wall paper. If the coffee can has a radius of 6 cm and a height of 13 cm, how much wall paper will Josiah need to cover it? (Hint: The top won’t be covered)

\[ SA = \pi r^2 + 2\pi rh \]
\[ SA = (3.14)(6)^2 + 2(3.14)(6)(13) \]
\[ SA = 113.04 + 489.84 \]
\[ SA = 602.88 \text{ cm}^2 \]
8. A cylinder-shaped barrel has a diameter of 3 feet and a height of 4.5 feet. If the barrel is empty, which is closest to the minimum amount of water needed to completely fill the barrel?

- A) 32 cubic feet
- B) 71 cubic feet
- C) 49 cubic feet
- D) 98 cubic feet

9. A cylindrical-shaped water tank has a diameter of 4 feet and is 12 feet tall. Which is closest to the volume of this tank?

- A) 48 cubic feet
- B) 452 cubic feet
- C) 151 cubic feet
- D) 603 cubic feet

10. A cylinder-shaped paperweight has a height of 7 cm, and a radius of 4 cm. Which is closest to the total surface area of the paperweight?

- A) 8.834 sq. cm.
- B) 276 sq. cm.
- C) 226 sq. cm.
- D) 75 sq. cm.

11. What is the number of cubic inches the cylindrical canister of this fire extinguisher will hold when filled?

\[ V = 169.56 \text{ in}^3 \]

12. How much liquid is needed to fill this object?

\[ V = 2063.20608 \text{ mm}^3 \]

13. Each student in Mr. Bardwell’s art class is painting a coffee can with a height of 7 in. and a radius of 5 in. Which of the following is closest to the surface area of each can to be painted?

- A) 183 square inches
- B) 376 square inches
- C) 188 square inches
- D) 549 square inches
14. Tory is filling her swimming pool with water. If she fills her pool to full capacity, what is the volume of water in the pool?

\[
\text{Volume} = \pi r^2 h = \pi (6 \text{ ft})^2 (10 \text{ ft}) = 360\pi \text{ ft}^3
\]

A) 188.50 ft\(^3\)
B) 1,130.97 ft\(^3\)
C) 314.16 ft\(^3\)
D) 1,884.96 ft\(^3\)

15. Find the approximate surface area of a cylinder with a height of 3 inches and a base with a 4-inch radius, as shown in the figure below.

\[
\text{Surface Area} = 2\pi r h + 2\pi r^2 = 2\pi (2\text{ in}) (3\text{ in}) + 2\pi (2\text{ in})^2 = 12\pi \text{ in}^2 + 8\pi \text{ in}^2 = 20\pi \text{ in}^2
\]

A) 37.68 in\(^2\)
B) 75.36 in\(^2\)
C) 100.48 in\(^2\)
D) 175.84 in\(^2\)

16. The makers of Oat Flakes cereal want to design a new box. The current box has a height of 11 inches, a width of 3 inches, and length of 6 inches. Which of the following new box designs is the closest to the volume of the old box?

\[
V = 198\text{ in}^3
\]

A) A height of 8 inches, a width of 4 inches, and a length of 6 inches
\[
V = 192\text{ in}^3
\]
B) A height of 13 inches, a width of 3 inches, and a length of 5 inches
\[
V = 195\text{ in}^3
\]
C) A height of 11 inches, a width of 4 inches, and a length of 5 inches
\[
V = 220\text{ in}^3
\]
D) A height of 9 inches, a width of 4 inches, and a length of 7 inches
\[
V = 252\text{ in}^3
\]