LESSON MAKER PRO

Solid Space

Find volume and surface area, even when part of a solid is removed.

HIGH SCHOOL · GDA.GM.A.17

GDA.GM.A.17 "Model and solve problems using surface area and volume of solids, including composite solids and solids with portions removed. a. Give an informal argument for the formulas for the surface area and volume of a sphere, cylinder, pyramid..."

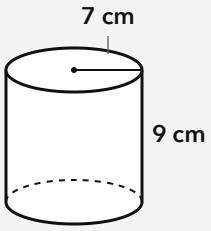
NAME _____ DATE _____

CHOOSE WHAT TO COUNT

For a cylinder, $V = \pi r^2 h$ and total surface area is $2\pi r^2 + 2\pi rh$. Its curved side alone has area $2\pi rh$. For a cone, $V = \pi r^2 h/3$; for a sphere, surface area is $4\pi r^2$. For a hollow solid, subtract the removed volume. When finding surface area, count only exposed surfaces.

WORKED EXAMPLE

What is the volume of the cylinder shown?

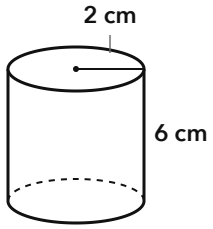


1. Use $V = \pi r^2 h$.
2. Substitute: $V = \pi(7)^2(9)$.
3. Multiply: $V = 441\pi$.

Answer: 441π cm^3

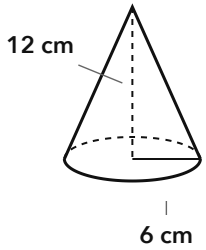
PRACTICE 6 problems

1 Find the total surface area of the cylinder shown.



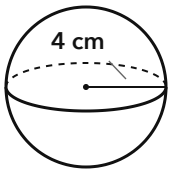
ANSWER _____

2 Find the volume of the cone shown.



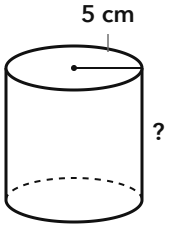
ANSWER _____

3 Find the surface area of the sphere shown.



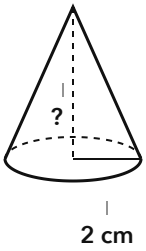
ANSWER _____

4 The cylinder shown has a volume of 150π cm^3. Find its height.



ANSWER _____

5 The cone shown has a volume of 20π cm^3. Find its height.



ANSWER _____

6 A cylindrical core is removed all the way through a larger cylinder. The outer radius is 6 cm, the core radius is 2 cm, and both cylinders are 5 cm long. Find the remaining volume.

ANSWER _____

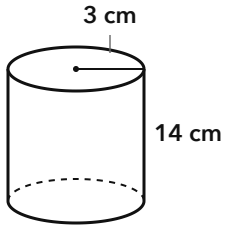
APPLY IT Show your work

1 A 3D-printed desk cup is made by hollowing a cylinder. Its outside radius is 5 cm and its height is 10 cm. A cylindrical hole of radius 4 cm goes 8 cm down from the top. What volume of plastic remains?

WORK SPACE

ANSWER _____

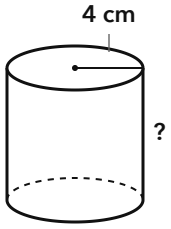
2 A sticker wraps around the curved side of the water bottle shown, with no overlap. It does not cover the top or bottom. What area of sticker is needed?



ANSWER _____

CHALLENGE One step up

The cylinder shown has a volume of 96π cm^3. Find its height and total surface area.



WORK SPACE AND ANSWER

Solid Space

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the total surface area of the cylinder shown.	**32π cm^2**
2	Find the volume of the cone shown.	**144π cm^3**
3	Find the surface area of the sphere shown.	**64π cm^2**
4	The cylinder shown has a volume of 150π cm^3. Find its height.	**6 cm**
5	The cone shown has a volume of 20π cm^3. Find its height.	**15 cm**
6	A cylindrical core is removed all the way through a larger cylinder. The outer radius is 6 cm, the core radius is 2 cm, and both cylinders are 5 cm long. Find the remaining volume.	**160π cm^3**

PART 2 · APPLY IT

1. **122π cm^3** Subtract the hole's volume from the outside cylinder's volume: $\pi(5)^2(10) - \pi(4)^2(8) = 122\pi$ cm^3.
2. **84π cm^2** Use only the cylinder's curved surface area: $2\pi rh = 2\pi(3)(14) = 84\pi$ cm^2.

CHALLENGE

Height: 6 cm; total surface area: 80π cm^2

Accept equivalent exact expressions with π. In the desk cup problem, the hole is only 8 cm deep, so 2 cm of material remains beneath it.