

Name: Key  
Date: \_\_\_\_\_

Lesson 2-2: Surface Area of Cylinders and Spheres

#4: How do I find the surface area of cylinders? #5: How do I find the *lateral* surface area of a cylinder?  
#6: How do I find the surface area of a sphere?



Warm Up

Name the figures below:

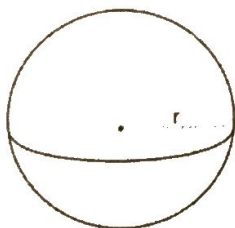


Figure 1

Sphere

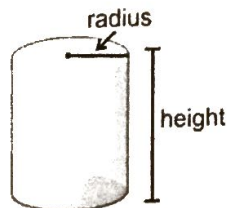


Figure 2

cylinder.

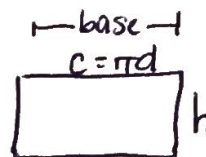
Surface Area of a Cylinder

What familiar polygons make up the net of a cylinder? → So, what **area** formulas do we need?

2 circles (top and bottom) →  $A = \pi r^2$

1 rectangle (middle part) →  $A = b \times h$

So, how will we find the **total surface area** of a cylinder?



$$\begin{aligned} \text{Total SA of Cylinder} &= A(\text{circle}) + A(\text{circle}) + A(\text{rectangle}) \\ &= 2\pi r^2 + \pi d h \end{aligned}$$

2 circles

"Lateral/curved S.A."

Surface Area of a Sphere

What familiar shape makes up a Sphere? → So, then what **area** formula will we need?

Circle →  $A = \pi r^2$



$$\text{Total Surface Area of a Sphere} = 4\pi r^2$$

Let's try it!

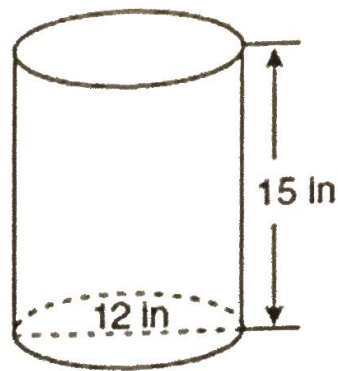


Watch Me!

**Example 1:** Find the total surface area of the following three-dimensional figure. Leave your answer in terms of  $\pi$ .

$$\begin{aligned} SA &= 2\pi r^2 + \pi dh \\ &= 2\pi(6)^2 + \pi(12)(15) \\ &= 2\pi(36) + \pi(180) \\ &= 72\pi + 180\pi \\ &= \boxed{252\pi \text{ in}^2} \end{aligned}$$

$$h = 15, d = 12 \rightarrow r = 6$$



**Example 2:** Find the surface area of the curved surface of a cylinder with a radius of 5 feet and a height of 9 feet. Use appropriate units in your answers. Round to the nearest tenth.

How is this different from #1?

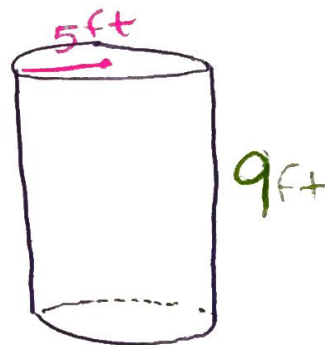
- "Curved surface area"
- Only use part of the formula

$$SA = \cancel{2\pi r^2} + \boxed{\pi dh}$$

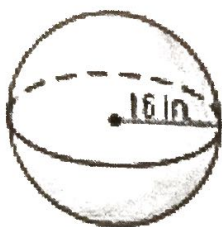
Curved      Curved

$$\begin{aligned} &= \pi dh \\ &= \pi(10)(9) \\ &= 90\pi \\ &= 282.7433388 \\ &= \boxed{282.7 \text{ ft}^2} \end{aligned}$$

$$r = 5 \rightarrow d = 10$$



**Example 3:** Find the surface area of the sphere. Round your answer to the nearest whole number.



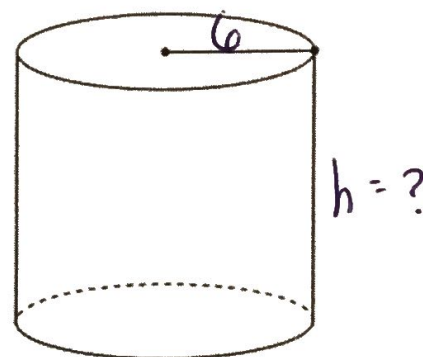
$$\begin{aligned} SA &= 4\pi r^2 \\ &= 4\pi (16)^2 \\ &= 4\pi (256) \\ &= 3216.990877 \end{aligned} \rightarrow \boxed{3217 \text{ in}^2}$$

**Example 4:** The total surface area of a cylinder is  $108\pi \text{ in}^2$ . The radius of the cylinder is 6 in. What is the height of the cylinder?

$$\rightarrow SA = 108\pi$$

$$\downarrow r = 6 \rightarrow d = 12$$

$$h = ?$$



★ Why is this considered a "working backwards" question?

Looking for "height", not surface area.

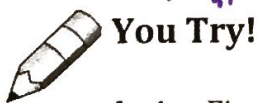
$$SA = 2\pi r^2 + \pi dh$$

$$108\pi = 2\pi (6)^2 + \pi (12)h$$

$$\begin{array}{r} 108\pi = 72\pi + 12\pi h \\ -72\pi \quad -72\pi \\ \hline \end{array}$$

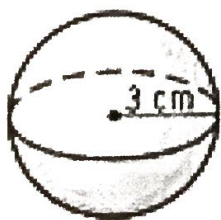
$$\frac{36\pi}{12\pi} = \frac{12\pi h}{(12\pi)}$$

$$\rightarrow h = \frac{36}{12} = \boxed{3 \text{ in}}$$



**You Try!**

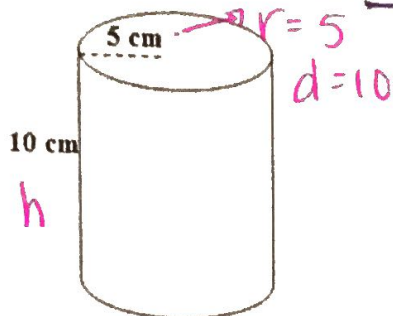
**Example 4:** Find the surface area of the sphere. Round your answer to the nearest whole number.



$$\begin{aligned} SA &= 4\pi (3)^2 \\ &= 4\pi (9) \\ &= 113.0973355 \\ &= \boxed{113 \text{ cm}^2} \end{aligned}$$



**Example 5:** Calculate the total surface area the cylinder below. Keep in terms of Pi.



$$\begin{aligned}
 SA &= 2\pi r^2 + \pi dh \\
 &= 2\pi(5)^2 + \pi(10)(10) \\
 &= 50\pi + 100\pi \\
 &= \boxed{150\pi \text{ cm}^2}
 \end{aligned}$$

**Example 6:** Campbell Soup is creating a new soup label. If a can has a height of 6 in and a diameter of 4 in, how much material does Campbell need for each soup **label**?

\*Hint: Does the label cover the whole can? **No!**

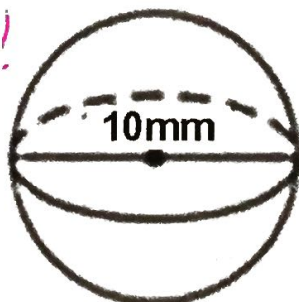
What area(s) do we need to find? **Curved area!**

Round your answer to the nearest tenth of a square inch.

$$\begin{aligned}
 SA &= 2\pi r^2 + \pi dh \quad \text{(Lateral) Curved S.A.} \\
 \text{L.S.A.} &= \pi dh \\
 &= \pi(4)(6) \\
 &= 24\pi \\
 &= 75.39822369 \\
 &= \boxed{75.4 \text{ in}^2}
 \end{aligned}$$

**Example 7:** Bob is asked to find the surface area (to the nearest tenth) of a sphere with a diameter of 10 millimeters. **Explain** and **correct** his errors (there are two errors!).

$$\begin{aligned}
 SA &= 4\pi r^2 \\
 &= 4\pi(10)^2 \quad \text{Radius is } 10 \div 2 = 5!! \\
 &= 400\pi \\
 &= 1256.6 \text{ mm}^3 \\
 &\quad \text{Wrong units!}
 \end{aligned}$$



**Hint!** Try answering the question first how you normally would, and then look to see if you spot any differences!

$$\begin{aligned}
 SA &= 4\pi(5)^2 \\
 &= 157.0796327 \\
 &= \boxed{157.1 \text{ mm}^2}
 \end{aligned}$$

Name

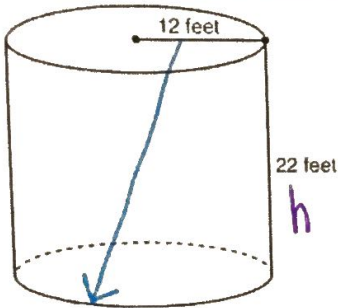
Date

Key

### Lesson 2-2: Homework

Homework Scale	
Score	Description (must complete all components to earn score)
3	<ul style="list-style-type: none"> <li>Homework Complete</li> <li>Use different color to check work</li> <li>Mark correct answers with check mark ✓</li> <li>For incorrect answers, circle specific mistakes</li> <li>Incorrect answers should have thorough corrections</li> </ul>
2.5	<ul style="list-style-type: none"> <li>Corrections made but not in a different color</li> </ul>
2	<ul style="list-style-type: none"> <li>Homework complete</li> <li>Marked answers right/wrong, but no corrections made</li> </ul>
1.5	<ul style="list-style-type: none"> <li>Completed but not checked</li> </ul>
1	<ul style="list-style-type: none"> <li>Homework incomplete</li> </ul>
0	<ul style="list-style-type: none"> <li>Homework missing/no effort or attempt</li> </ul>

- 1) The cylindrical tank shown in the diagram is to be painted. How many square feet of paint must be used to complete the job? Round your answer to the nearest square foot. → *Surface area!*



$r = 12$   
 $d = 24$

$$\begin{aligned}
 SA &= 2\pi r^2 + \pi dh \\
 &= 2\pi (12)^2 + \pi (24)(22) \\
 &= 288\pi + 528\pi \\
 &= 2563.539605 \\
 &= \boxed{2,564 \text{ ft}^2}
 \end{aligned}$$

- 2) The total surface area of a sphere  $100\pi \text{ cm}^2$ . What is the radius of the sphere?

$SA = 4\pi r^2 \rightarrow SA = 100\pi$

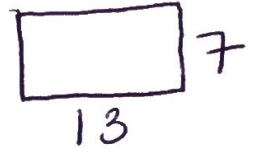
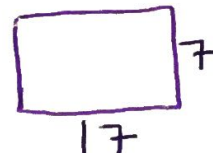
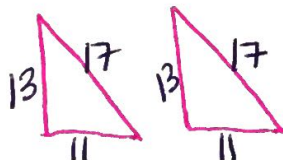
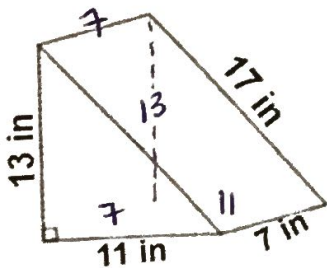
$$\frac{100\pi}{4\pi} = \frac{4\pi(r)^2}{4\pi} \rightarrow r^2 = \frac{100}{4}$$

→  $r^2 = \sqrt{25}$   
 $r = 5 \text{ cm}$

- 3) Consider the figure below:

a) What is the name of the figure? triangular prism

b) Draw and label the net.



- c) Calculate the surface area:

$$\begin{aligned}
 SA &= \left(\frac{1}{2}bh\right) + \left(\frac{1}{2}bh\right) + (b \times h) + (b \times h) + (b \times h) \\
 &= \left(\frac{1}{2} \cdot 11 \cdot 13\right) + \left(\frac{1}{2} \cdot 11 \cdot 13\right) + (7 \times 11) + (17 \times 7) + (13 \times 7) \\
 &= (71.5) + (71.5) + (77) + (119) + (91) = \boxed{430 \text{ in}^2}
 \end{aligned}$$