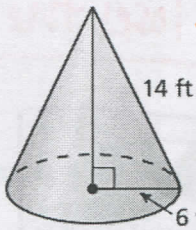
Name Key Date

## 11.7 & 11.8 Surface Area & Volume of Cones & Spheres

Cones: $LA = \frac{1}{2}Pl$ (Pyramid) $\pi rl$ (cone); $SA = LA + B = \pi rl + \pi r^2$; $V = \frac{1}{3}Bh = \frac{1}{3}(\pi r^2)h$

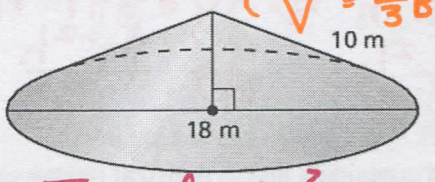
**In Exercises 1 and 2, find the surface area of the right cone.**

1.




$T = \pi rl + \pi r^2$
$= \pi(6)(14) + \pi(6)^2$
$= 84\pi + 36\pi$
$= 120\pi \text{ ft}^2$
$\approx 376.991 \text{ ft}^2$

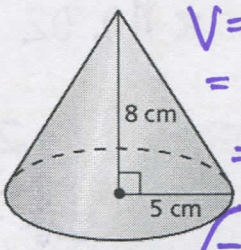
2.




$T = \pi rl + \pi r^2$
$= \pi(9)(10) + \pi(9)^2$
$= 90\pi + 81\pi$
$= 171\pi \text{ m}^2 \approx 537.212 \text{ m}^2$

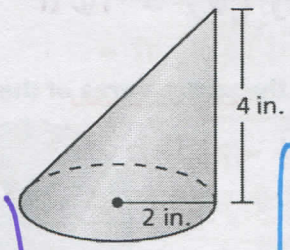
**In Exercises 3 and 4, find the volume of the cone.**

3.




$V = \frac{1}{3}Bh = \frac{1}{3}(\pi r^2)h$
$= \frac{1}{3}\pi(5)^2(8)$
$= \frac{\pi}{3}(200)$
$= \frac{200\pi}{3} \text{ cm}^3$
$\approx 209.440 \text{ cm}^3$

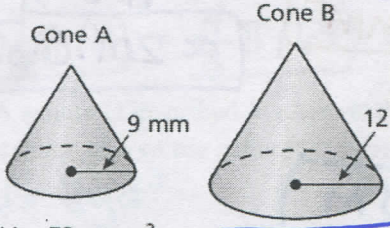
4.




$V = \frac{1}{3}Bh = \frac{1}{3}\pi r^2 h$
$= \frac{1}{3}\pi(2)^2(4)$
$= \frac{16\pi}{3} \text{ in}^3$
$\approx 16.755 \text{ in}^3$

**In Exercises 5 and 6, the cones are similar. Find the volume of Cone B.**

5.

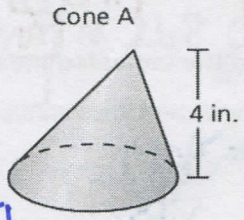



$\frac{r}{V} = \frac{mm}{mm^3}$

$V = 72\pi \text{ mm}^3$

$\frac{(9)^3}{72\pi} = \frac{(12)^3}{x}$
$729x = 124416\pi$
$V \approx 536.165 \text{ mm}^3$
$= \frac{512\pi}{3} \text{ mm}^3$

6.

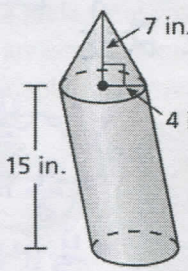



$V = 28\pi \text{ in.}^3$

$\frac{h}{V} = \frac{in}{in^3}$
$\frac{(4)^3}{28\pi} = \frac{(2)^3}{x}$
$64x = 224\pi$
$x = \frac{7\pi}{2} \text{ in}^3$
$\approx 10.996 \text{ in}^3$

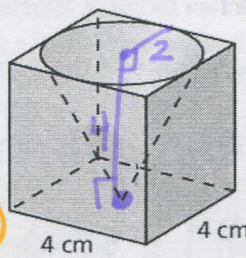
**In Exercises 7 and 8, find the volume of the composite solid.**

7.

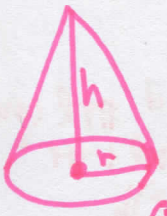



$V_T = V_{Co} + V_{Cy}$
$= \frac{1}{3}Bh + Bh$
$= \frac{1}{3}\pi r^2 h + \pi r^2 h$
$= \frac{1}{3}\pi(4)^2(7) + \pi(4)^2(15)$
$= \frac{112\pi}{3} + \frac{240\pi}{3} = \frac{112\pi}{3} + \frac{720\pi}{3}$
$= \frac{832\pi}{3} \text{ in}^3 \approx 871.268 \text{ in}^3$

8.




$V_T = V_{Cu} - V_{Co}$
$V = Bh - \frac{1}{3}Bh$
$= l \cdot w \cdot h - \frac{1}{3}\pi r^2 h$
$= 4 \cdot 4 \cdot 4 - \frac{1}{3}\pi(2)^2(4)$
$= 64 - \frac{1}{3}\pi(16)$
$= 64 - \frac{16\pi}{3} \text{ cm}^3$
$\approx 47.245 \text{ cm}^3$




**9.** A cone has height $h$ and a base with radius $r$. You want to change the cone so its volume is tripled. What is the new height if you only change the height? What is the new radius if you only change the radius? Explain.

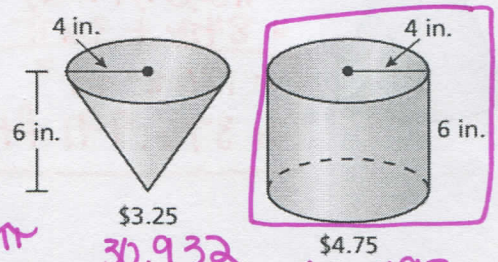
$3h$ $r\sqrt{3}$

The Formula loses the $\frac{1}{3}$.

① $V = \frac{1}{3}\pi r^2 h \Rightarrow 3V = \frac{1}{3}\pi r^2 h$

② $V = \pi r^2 h \quad \frac{9V}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$

**10.** A snack stand serves shaved ice in cone-shaped containers and cylindrical containers. Which container gives you more shaved ice for your money? Explain.




$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(4)^2(6)$

$= \frac{1}{3}\pi(16)\cdot 6 = 32\pi$

$V = \pi r^2 h = \pi(4)^2(6) = 96\pi$

\$3.25 $30.932 \approx \$0.03$

\$4.75 $63.493 \approx \$0.02$ per cubic in

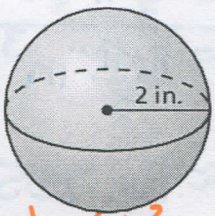
Spheres

$T = 4\pi r^2$

$V = \frac{4}{3}\pi r^3$

**In Exercises 11–13, find the surface area of the sphere.**

**11.**

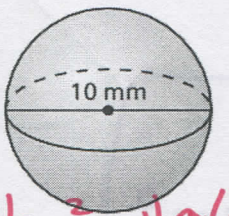



$T = 4\pi(2)^2$

$= 16\pi$ in$^2$

$\approx 50.265$ in$^2$

**12.**

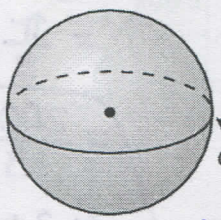



$SA = 4\pi r^2 = 4\pi(5)^2$

$= 4\pi(25) = 100\pi$ mm$^2$

$\approx 314.159$ mm$^2$

**13.**




$C = 2\pi r$

$\frac{8\pi}{2\pi} = \frac{2\pi r}{2\pi}$ $r = 4$

$SA = 4\pi r^2 = 4\pi(4)^2$

$= 4\pi(16) = 64\pi$ ft$^2$

$\approx 201.062$ ft$^2$

**In Exercises 14 and 15, find the indicated measure.**

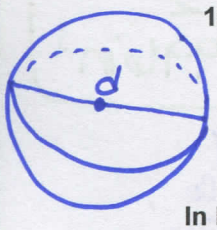
**14.** the radius of a sphere with a surface area of $36\pi$ square meters


$T = \frac{36\pi}{4\pi} = \frac{4\pi r^2}{4\pi}$

$9 = r^2 \quad r = \pm\sqrt{9}$

$r = 3$ m

**15.** the diameter of a sphere with a surface area of $81\pi$ square yards




$T = \frac{81\pi}{4\pi} = \frac{4\pi r^2}{4\pi}$

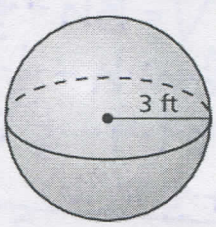
$\sqrt{20.25} = r^2$

$r = \pm\sqrt{\frac{81}{4}}$ $r = \frac{9}{2}$ yd

$d = 2r = 2\frac{9}{2}$ $d = 9$ yd

**In Exercises 16–18, find the volume of the sphere.**

**16.**



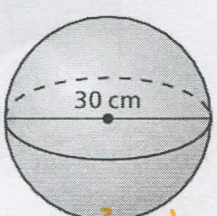

$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi(3)^3$

$= \frac{4}{3}\pi(27)^9$

$= 36\pi$ ft$^3 \approx 113.097$ ft$^3$

**17.**

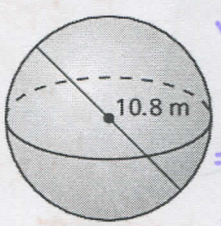



$= \frac{4}{3}\pi(15)^3 = \frac{4}{3}\pi(3375)$

$= 4\pi(1125) = 4500\pi$ cm$^3$

$\approx 14137.167$ cm$^3$

**18.**




$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi(5.4)^3$

$= \frac{4}{3}\pi(157.464)$

$= 4\pi(52.488)$

$= 209.952\pi$ m$^3$

$\approx 659.584$ m$^3$

$V = \frac{4}{3}\pi r^3$ $T = 4\pi r^2$

**In Exercises 19 & 20, find the volume of the sphere with the given surface area.**

**19.** Surface Area $= 4\pi$ in.$^2$

$\frac{4\pi}{4\pi} = \frac{4\pi r^2}{4\pi}$

$1 = r^2$

$r = \pm\sqrt{1}$

$r = 1$ in

$V = \frac{4}{3}\pi(1)^3$

$= \frac{4\pi}{3}$ in$^3$

$\approx 4.189$ in$^3$

**20.** Surface Area $= 676\pi$ km$^2$

$\frac{676\pi}{4\pi} = \frac{4\pi r^2}{4\pi}$

$169 = r^2$

$r = \pm\sqrt{169}$

$r = 13$ km

$V = \frac{4}{3}\pi(13)^3$

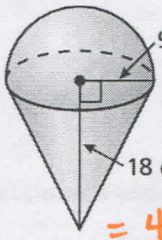
$= \frac{4}{3}\pi(2197)$

$= \frac{8788\pi}{3}$ km$^3$

$\approx 9202.772$ km$^3$

**In Exercises 21 & 22, find the volume of the composite solid.**

**21.**




$V_H + V_C$

$= \frac{1}{2}\left(\frac{4}{3}\pi r^3\right) + \frac{1}{3}\pi r^2 h$

$= \frac{4}{6}\pi(9)^3 + \frac{1}{3}\pi(9)^2(18)$

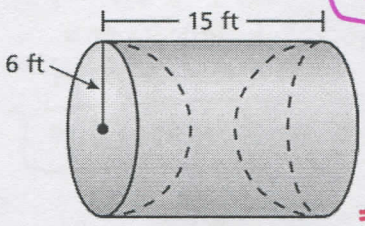
$= \frac{4}{6}\pi(729) + \frac{1}{3}\pi(1458)$

$= 486\pi + 486\pi$

$= 972\pi$ cm$^3$

$\approx 3053.628$ cm$^3$

**22.**




$V_C - V_S$

$= Bh - \frac{4}{3}\pi r^3$

$= \pi r^2 h - \frac{4}{3}\pi r^3$

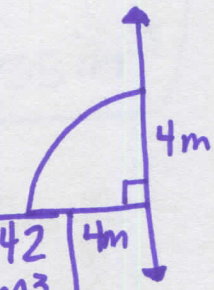
$= \pi(6)^2(15) - \frac{4}{3}\pi(6)^3$

$= 540\pi - 288\pi$

$= 252\pi$ ft$^3$

$\approx 791.681$ ft$^3$

**23.** Find the surface area and volume of the solid produced by rotating the figure at the right around the given axis.




$r = 4$

$T = \frac{4\pi(4)^2}{2} = \frac{4\pi(16)}{2} = \frac{64\pi}{2}$ m$^2$ $\approx 100.531$ m$^2$

$V = \frac{\frac{4}{3}\pi(4)^3}{2} = \frac{\frac{4}{3}\pi(64)}{2} = \frac{\frac{256\pi}{3}}{2}$ m$^3$ $\approx \frac{268.083}{2}$

$\approx 134.142$ m$^3$

**24.** A sphere is inscribed in a cube with a volume of 8 cubic yards. What is the surface area of the sphere? Explain your reasoning.


$V = 8$ yd$^3$

$8 = l \cdot w \cdot h$

$2 \cdot 2 \cdot 2$

$r = 2 \div 2 = 1$

$T = 4\pi r^2$

$= 4\pi(1)^2$

$= 4\pi$ yd$^2$

$\approx 12.566$ yd$^2$

**25.** In 2000, the International Table Tennis Federation changed the official diameter of a table tennis ball from 38 millimeters to 40 millimeters. Without calculating surface areas and volumes, determine how the surface area and volume of the ball changed. Explain your reasoning. Find the surface areas and volumes to check your answer.


19


20

the radius increased by 1mm.

$\left(\frac{20}{19}\right)^2 = \frac{400}{361} \approx 1.11\% \uparrow T$

$\left(\frac{20}{19}\right)^3 = \frac{8000}{6859} \approx 1.17\% \uparrow V$