

Grade 8 · Volume of Cylinders, Cones and Spheres · Worksheet Answer Key

Common Core 8.G.C.9 · mathovore.fr

Each solution below shows the formula, the substitution, and the final answer with cubic units. Compare your work step by step, and look especially at whether you halved a diameter before squaring or cubing the radius.

Grade 8 Common Core: 8.G.C.9

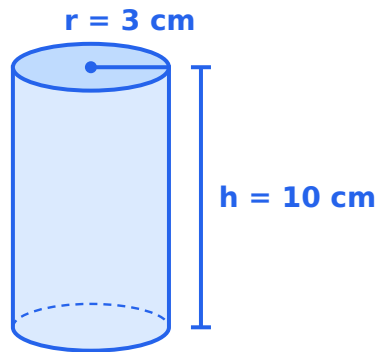
Problem 1: Cylinder with radius and height

Use $V = \pi r^2 h$.

Substitute: $V = \pi(3)^2(10)$.

Square first: $V = \pi \cdot 9 \cdot 10 = 90\pi$.

$90\pi \text{ cm}^3$



$$\begin{aligned} V &= \pi r^2 h \\ &= \pi(3)^2(10) \\ &= \mathbf{90\pi \text{ cm}^3} \end{aligned}$$

The cylinder with the volume worked out.

Problem 2: Cylinder using 3.14

Use $V = \pi r^2 h$.

Substitute: $V = \pi(5)^2(4)$.

Square first: $V = \pi \cdot 25 \cdot 4 = 100\pi$.

Use 3.14: $V \approx 3.14 \cdot 25 \cdot 4 = 314.00$.

$$V \approx 314.00 \text{ in}^3$$

Problem 3: Cylinder from the diameter

The radius is half the diameter: $r = 12 \div 2 = 6 \text{ ft}$.

Use $V = \pi r^2 h$.

Substitute: $V = \pi(6)^2(7)$.

Square first: $V = \pi \cdot 36 \cdot 7 = 252\pi$.

$$252\pi \text{ ft}^3$$

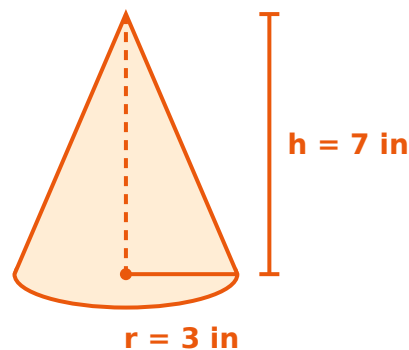
Problem 4: Cone with radius and height

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

Substitute: $V = \frac{1}{3}\pi(3)^2(7)$.

Multiply, then divide by 3: $V = \frac{1}{3}\pi \cdot 63 = 21\pi$.

$$21\pi \text{ in}^3$$



$$\begin{aligned} V &= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \pi \cdot 63 \\ &= 21\pi \text{ in}^3 \end{aligned}$$

The cone with the volume worked out.

Problem 5: Cone using 3.14

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

Substitute: $V = \frac{1}{3}\pi(6)^2(9)$.

Multiply, then divide by 3: $V = \frac{1}{3}\pi \cdot 324 = 108\pi$.

Use 3.14: $V \approx 3.14 \cdot 108 = 339.12$.

$$V \approx 339.12 \text{ cm}^3$$

Problem 6: Cone from the diameter

The radius is half the diameter: $r = 10 \div 2 = 5$ m.

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

Substitute: $V = \frac{1}{3}\pi(5)^2(12)$.

Multiply, then divide by 3: $V = \frac{1}{3}\pi \cdot 300 = 100\pi$.

100π m³

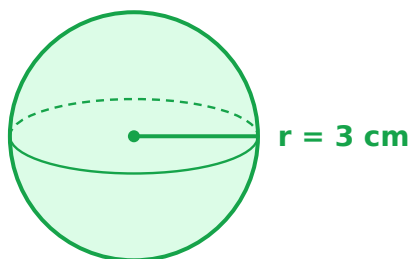
Problem 7: Sphere with a given radius

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

Substitute: $V = \frac{4}{3}\pi(3)^3$.

Cube first: $V = \frac{4}{3}\pi \cdot 27 = 36\pi$.

36π cm³



$$\begin{aligned} V &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3}\pi \cdot 27 \\ &= 36\pi \text{ cm}^3 \end{aligned}$$

The sphere with the volume worked out.

Problem 8: Sphere using 3.14

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

Substitute: $V = \frac{4}{3}\pi(6)^3$.

Cube first: $V = \frac{4}{3}\pi \cdot 216 = 288\pi$.

Use 3.14: $V \approx \frac{4}{3}(3.14)(216) = 904.32$.

$V \approx 904.32$ in³

Problem 9: Sphere from the diameter

The radius is half the diameter: $r = 10 \div 2 = 5$ ft.

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

Substitute: $V = \frac{4}{3}\pi(5)^3$.

Cube first: $V = \frac{4}{3}\pi \cdot 125 = \frac{500}{3}\pi$.

$\frac{500}{3}\pi \text{ ft}^3$

Use 3.14: $V \approx \frac{4}{3}(3.14)(125) = 523.33$.

$V \approx 523.33 \text{ ft}^3$

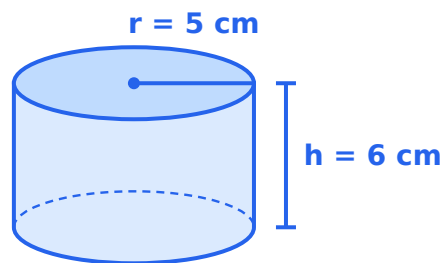
Problem 10: Find the height of a cylinder

Use $V = \pi r^2 h$ and substitute: $150\pi = \pi(5)^2 h$, so $150\pi = 25\pi h$.

Divide both sides by 25π : $h = 150 \div 25 = 6$.

$h = 6 \text{ cm}$

Check: $\pi(25)(6) = 150\pi$.



$$\begin{aligned} 150\pi &= \pi(25)h \\ h &= 150 \div 25 \\ \mathbf{h} &= \mathbf{6 \text{ cm}} \end{aligned}$$

The missing height is 6 cm.

Problem 11: Find the radius of a cylinder

Substitute into $V = \pi r^2 h$: $245\pi = \pi r^2(5)$.

Divide both sides by 5π : $r^2 = 49$.

Take the positive square root: $r = 7 \text{ in.}$

Check: $\pi(49)(5) = 245\pi$.

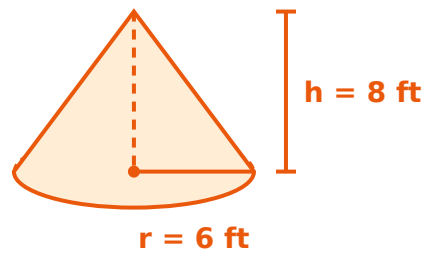
Problem 12: Find the height of a cone

Substitute into $V = \frac{1}{3}\pi r^2 h$: $96\pi = \frac{1}{3}\pi(6)^2 h = 12\pi h$.

Divide both sides by 12π : $h = 96 \div 12 = 8$.

$$h = 8 \text{ ft}$$

$$\text{Check: } \frac{1}{3}\pi(36)(8) = 96\pi.$$



$$96\pi = 12\pi h$$

$$h = 96 \div 12$$

$$h = 8 \text{ ft}$$

The missing height is 8 ft.

Problem 13: Find the radius of a sphere

$$\text{Substitute into } V = \frac{4}{3}\pi r^3: 288\pi = \frac{4}{3}\pi r^3.$$

$$\text{Multiply both sides by } \frac{3}{4} \text{ and divide by } \pi: r^3 = 288 \cdot \frac{3}{4} = 216.$$

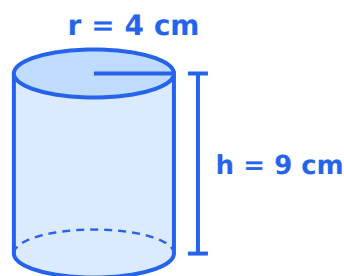
$$\text{Since } 6 \cdot 6 \cdot 6 = 216, r = 6 \text{ cm.}$$

Problem 14: Cylinder versus cone

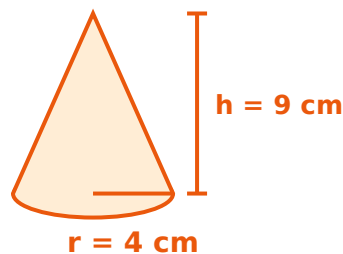
$$\text{Cylinder: } V = \pi(4)^2(9) = \pi \cdot 16 \cdot 9 = 144\pi \text{ cm}^3.$$

$$\text{Cone: } V = \frac{1}{3}\pi(4)^2(9) = \frac{1}{3}\pi \cdot 144 = 48\pi \text{ cm}^3.$$

Cylinder: $144\pi \text{ cm}^3$; **cone:** $48\pi \text{ cm}^3$. Since $144 \div 48 = 3$, the cylinder holds 3 times as much as the cone.



Cylinder



Cone

Cone volume $48\pi \text{ cm}^3$ is one third of cylinder volume $144\pi \text{ cm}^3$.

Problem 15: Volume of a hemisphere

$$\text{First find the volume of the whole sphere: } V = \frac{4}{3}\pi(9)^3 = \frac{4}{3}\pi \cdot 729 = 972\pi.$$

A hemisphere is half of that: $972\pi \div 2 = 486\pi$.

$$486\pi \text{ m}^3$$

Problem 16: Soup can

The radius is half the diameter: $r = 3 \div 2 = 1.5$ in.

Use $V = \pi r^2 h$.

Substitute: $V = \pi(1.5)^2(4)$.

Square first: $V = \pi \cdot 2.25 \cdot 4 = 9\pi$.

Use 3.14: $V \approx 3.14 \cdot 2.25 \cdot 4 = 28.26$.

$$V \approx 28.26 \text{ in}^3$$

The can holds about 28.26 cubic inches of soup.

Problem 17: Water storage tank

(a) $V = \pi(4)^2(10) = 160\pi \approx 3.14 \cdot 160 = 502.4$. The tank holds **about** 502.4 ft³.

(b) Time = $502.4 \div 40 = 12.56$, which rounds to **12.6 minutes**.

Problem 18: Pile of sand

(a) $V = \frac{1}{3}\pi(6)^2(5) = \frac{1}{3}\pi \cdot 180 = 60\pi$ ft³.

(b) $60 \cdot 3.14 = 188.4$, so $V \approx 188.4$ ft³.

(c) $188.4 \div 20 = 9.42$. Nine loads are not enough, so the truck needs **10 loads**.

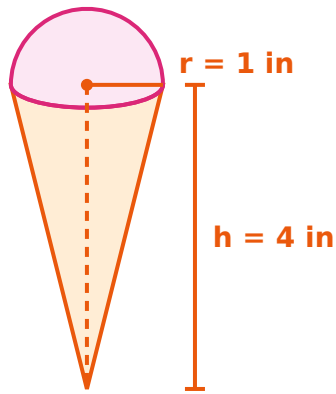
Problem 19: Ice cream cone with a scoop

Cone: $\frac{1}{3}\pi(1)^2(4) = \frac{4}{3}\pi$.

Hemisphere: $\frac{1}{2} \cdot \frac{4}{3}\pi(1)^3 = \frac{2}{3}\pi$.

Total: $\frac{4}{3}\pi + \frac{2}{3}\pi = \frac{6}{3}\pi = 2\pi$. 2π in³.

With 3.14: $2 \cdot 3.14 = 6.28$, so **about** 6.28 in³.



cone: $\frac{4}{3}\pi$
 hemisphere: $\frac{2}{3}\pi$
total: $2\pi \text{ in}^3$

Adding the cone and the hemisphere.

Problem 20: Basketball

The radius is half the diameter: $r = 9 \div 2 = 4.5 \text{ in}$.

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

Substitute: $V = \frac{4}{3}\pi(4.5)^3$.

Cube first: $V = \frac{4}{3}\pi \cdot 91.125 = \frac{243}{2}\pi$.

Use 3.14: $V \approx \frac{4}{3}(3.14)(91.125) = 381.51$.

$V \approx 381.51 \text{ in}^3$

The basketball holds about 381.51 cubic inches of air.

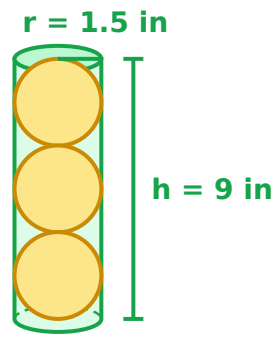
Problem 21: Tennis ball can

Can: $\pi(1.5)^2(9) = \pi \cdot 2.25 \cdot 9 = 20.25\pi$.

One ball: $\frac{4}{3}\pi(1.5)^3 = \frac{4}{3}\pi \cdot 3.375 = 4.5\pi$. Three balls: 13.5π .

Empty space: $20.25\pi - 13.5\pi = 6.75\pi \text{ in}^3$.

With 3.14: $6.75 \cdot 3.14 = 21.195$, so **about** 21.2 in^3 of empty space.



can: 20.25π
 balls: 13.5π
empty: 6.75π

The empty space is $6.75\pi \text{ in}^3$.

Problem 22: Filling paper cups

Jug: $\pi(3)^2(8) = 72\pi \text{ in}^3$.

Cup: $\frac{1}{3}\pi(2)^2(3) = 4\pi \text{ in}^3$.

Number of cups: $72\pi \div 4\pi = 18$. **18 cups.**

Problem 23: Reshaping a ball of clay

Ball: $\frac{4}{3}\pi(3)^3 = 36\pi \text{ cm}^3$.

Cylinder with the same volume: $\pi(3)^2h = 9\pi h = 36\pi$, so $h = 36 \div 9 = 4$.

The cylinder is 4 cm tall.