

Volume of Cylinders, Cones, and Spheres

Name: _____ Date: _____ Score: _____ / 24

Q Quick Review

Volume measures how much space a solid fills. For a **cylinder**, $V = \pi r^2 h$ — the circle area πr^2 times the height. A **cone** with the same base and height holds exactly *one third* as much: $V = \frac{1}{3} \pi r^2 h$. A **sphere** uses $V = \frac{4}{3} \pi r^3$. Always use the *radius* (half the diameter), and keep your answer in terms of π unless you're told to use $\pi \approx 3.14$. Volume is measured in *cubic* units.

◇ **Example:** Find the volume of a cylinder with radius 3 cm and height 10 cm. Leave your answer in terms of π .
 ⇒ The formula for a cylinder is $V = \pi r^2 h$. Plug in $r = 3$ and $h = 10$: first square the radius, $3^2 = 9$. Then multiply by the height: $9 \times 10 = 90$. So the volume is 90π cubic centimeters. Keeping the π symbol gives an exact answer.

Answer: $V = 90\pi \text{ cm}^3$

PRACTICE

Find each volume. Leave answers in terms of π unless noted.

- | | | | |
|-------------------------------|-------|--------------------------------------------------------|-------|
| 1. Cylinder: $r = 5, h = 8$ | _____ | 11. Cone: $r = 9, h = 4$ | _____ |
| 2. Cylinder: $r = 2, h = 7$ | _____ | 12. Cone: $r = 3, h = 7$ | _____ |
| 3. Cylinder: $r = 4, h = 6$ | _____ | 13. Sphere: $r = 3$ | _____ |
| 4. Cylinder: $r = 10, h = 10$ | _____ | 14. Sphere: $r = 6$ | _____ |
| 5. Cylinder: $r = 6, h = 5$ | _____ | 15. Sphere: $r = 9$ | _____ |
| 6. Cylinder: $d = 6, h = 9$ | _____ | 16. Sphere: $r = 1$ | _____ |
| 7. Cone: $r = 3, h = 9$ | _____ | 17. Sphere: $d = 12$ | _____ |
| 8. Cone: $r = 6, h = 10$ | _____ | 18. Cylinder: $r = 1, h = 9$ | _____ |
| 9. Cone: $r = 5, h = 12$ | _____ | 19. Cone: $r = 6, h = 5$, use $\pi \approx 3.14$ | _____ |
| 10. Cone: $r = 2, h = 6$ | _____ | 20. Cylinder: $r = 2, h = 10$, use $\pi \approx 3.14$ | _____ |

◆ Word Problems

21. A water tank is a cylinder with radius 4 ft and height 6 ft. Find its volume in terms of π . _____
22. An ice cream cone has radius 3 cm and height 9 cm. How much ice cream fills it exactly? Leave your answer in terms of π . _____
23. A basketball is a sphere with radius 6 inches. Find its volume in terms of π . _____
24. A cylindrical can has radius 2 cm and height 10 cm. Using $\pi \approx 3.14$, find its volume to the nearest tenth. _____



Answer Keys

- | | |
|--------------|---------------------------|
| 1. 200π | 13. 36π |
| 2. 28π | 14. 288π |
| 3. 96π | 15. 972π |
| 4. 1000π | 16. $\frac{4}{3}\pi$ |
| 5. 180π | 17. 288π |
| 6. 81π | 18. 9π |
| 7. 27π | 19. 188.4 |
| 8. 120π | 20. 125.6 |
| 9. 100π | 21. $96\pi \text{ ft}^3$ |
| 10. 8π | 22. $27\pi \text{ cm}^3$ |
| 11. 108π | 23. $288\pi \text{ in}^3$ |
| 12. 21π | 24. 125.6 cm^3 |

Step-by-Step Explanations

- | | |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1. $V = \pi r^2 h = \pi(25)(8) = 200\pi$. | 13. $V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(27) = 36\pi$. |
| 2. $V = \pi(4)(7) = 28\pi$. | 14. $V = \frac{4}{3}\pi(216) = 288\pi$. |
| 3. $V = \pi(16)(6) = 96\pi$. | 15. $V = \frac{4}{3}\pi(729) = 972\pi$. |
| 4. $V = \pi(100)(10) = 1000\pi$. | 16. $V = \frac{4}{3}\pi(1) = \frac{4}{3}\pi$. |
| 5. $V = \pi(36)(5) = 180\pi$. | 17. Radius is 6, so $V = \frac{4}{3}\pi(216) = 288\pi$. |
| 6. Radius is 3, so $V = \pi(9)(9) = 81\pi$. | 18. $V = \pi(1)(9) = 9\pi$. |
| 7. $V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(9)(9) = 27\pi$. | 19. $V = \frac{1}{3}(3.14)(36)(5) = 188.4$. |
| 8. $V = \frac{1}{3}\pi(36)(10) = 120\pi$. | 20. $V = (3.14)(4)(10) = 125.6$. |
| 9. $V = \frac{1}{3}\pi(25)(12) = 100\pi$. | 21. Use $V = \pi r^2 h = \pi(4^2)(6) = \pi(16)(6) = 96\pi$ cubic feet. |
| 10. $V = \frac{1}{3}\pi(4)(6) = 8\pi$. | 22. A cone's volume is $V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(9)(9) = 27\pi$ cubic centimeters. |
| 11. $V = \frac{1}{3}\pi(81)(4) = 108\pi$. | 23. A sphere's volume is $V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(6^3) = \frac{4}{3}\pi(216) = 288\pi$ cubic inches. |
| 12. $V = \frac{1}{3}\pi(9)(7) = 21\pi$. | 24. $V = \pi r^2 h \approx 3.14(2^2)(10) = 3.14(4)(10) = 125.6$ cubic centimeters. |



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