

# 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  $\pi r^2$  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  $\pi$  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  $\pi$ .  
 ⇒ 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  $90\pi$  cubic centimeters. Keeping the  $\pi$  symbol gives an exact answer.

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

## PRACTICE

Find each volume. Leave answers in terms of  $\pi$  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  $\pi$ . \_\_\_\_\_
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  $\pi$ . \_\_\_\_\_
23. A basketball is a sphere with radius 6 inches. Find its volume in terms of  $\pi$ . \_\_\_\_\_
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

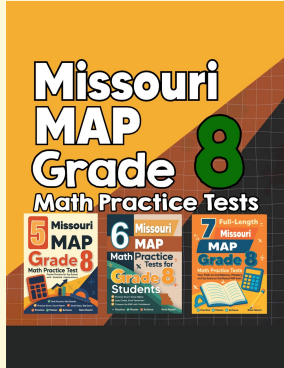
- |              |                           |
|--------------|---------------------------|
| 1. $200\pi$  | 13. $36\pi$               |
| 2. $28\pi$   | 14. $288\pi$              |
| 3. $96\pi$   | 15. $972\pi$              |
| 4. $1000\pi$ | 16. $\frac{4}{3}\pi$      |
| 5. $180\pi$  | 17. $288\pi$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

### 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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