

# Volume of Cones and Spheres

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

Two more volume formulas worth knowing by heart. A **cone** has volume  $V = \frac{1}{3}\pi r^2 h$  — one third of a cylinder with the same radius and height. A **sphere** has volume  $V = \frac{4}{3}\pi r^3$ . In both,  $r$  is the *radius*, so halve the diameter if that's what you're given, and remember to *cube* the radius for a sphere but only *square* it for a cone. Leave  $\pi$  in your answer for an exact value, or use  $\pi \approx 3.14$  when asked for a decimal. Volume is always in *cubic* units.

◇ **Example:** Find the volume of a sphere with radius 3 in. Leave your answer in terms of  $\pi$ .

⇒ The sphere volume formula is  $V = \frac{4}{3}\pi r^3$ . The radius is 3, so cube it first:  $3^3 = 27$ . Now multiply by  $\frac{4}{3} \cdot \frac{4}{3} \times 27 = \frac{108}{3} = 36$ . So the volume is  $36\pi$  cubic inches. Keeping  $\pi$  gives the exact answer.

**Answer:**  $V = 36\pi \text{ in}^3$

## PRACTICE

Find each volume. Leave answers in terms of  $\pi$  unless noted.

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

## ◆ Word Problems

21. A party hat is shaped like a cone with radius 5 cm and height 12 cm. What is its volume in terms of  $\pi$ ? \_\_\_\_\_
22. A bowling ball is a sphere with radius 6 in. Find its volume in terms of  $\pi$ . \_\_\_\_\_
23. A cone-shaped paper cup has radius 3 cm and height 10 cm. Using  $\pi \approx 3.14$ , how much water does it hold, to the nearest tenth? \_\_\_\_\_
24. A cone and a sphere both have radius 6 cm, and the cone's height is also 6 cm. Which holds more, and by how much? Leave answers in terms of  $\pi$ . \_\_\_\_\_



## Answer Keys

- |   |   |
|---|---|
| <p>1. <math>27\pi</math></p> <p>2. <math>120\pi</math></p> <p>3. <math>100\pi</math></p> <p>4. <math>8\pi</math></p> <p>5. <math>108\pi</math></p> <p>6. <math>16\pi</math></p> <p>7. <math>21\pi</math></p> <p>8. <math>300\pi</math></p> <p>9. <math>30\pi</math></p> <p>10. <math>36\pi</math></p> <p>11. <math>288\pi</math></p> <p>12. <math>972\pi</math></p> | <p>13. <math>\frac{32}{3}\pi</math></p> <p>14. <math>2304\pi</math></p> <p>15. <math>\frac{4}{3}\pi</math></p> <p>16. <math>288\pi</math></p> <p>17. <math>36\pi</math></p> <p>18. <math>50\pi</math></p> <p>19. <math>94.2</math></p> <p>20. <math>113.04</math></p> <p>21. <math>100\pi \text{ cm}^3</math></p> <p>22. <math>288\pi \text{ in}^3</math></p> <p>23. <math>94.2 \text{ cm}^3</math></p> <p>24. The sphere; it holds <math>216\pi \text{ cm}^3</math> more</p> |
|---|---|

### Step-by-Step Explanations

- |  |   |
|--|---|
| <p>1. <math>V = \frac{1}{3}\pi(9)(9) = 27\pi.</math></p> <p>2. <math>V = \frac{1}{3}\pi(36)(10) = 120\pi.</math></p> <p>3. <math>V = \frac{1}{3}\pi(25)(12) = 100\pi.</math></p> <p>4. <math>V = \frac{1}{3}\pi(4)(6) = 8\pi.</math></p> <p>5. <math>V = \frac{1}{3}\pi(81)(4) = 108\pi.</math></p> <p>6. <math>V = \frac{1}{3}\pi(16)(3) = 16\pi.</math></p> <p>7. <math>V = \frac{1}{3}\pi(9)(7) = 21\pi.</math></p> <p>8. <math>V = \frac{1}{3}\pi(100)(9) = 300\pi.</math></p> <p>9. Radius is 3: <math>V = \frac{1}{3}\pi(9)(10) = 30\pi.</math></p> <p>10. <math>V = \frac{4}{3}\pi(27) = 36\pi.</math></p> <p>11. <math>V = \frac{4}{3}\pi(216) = 288\pi.</math></p> <p>12. <math>V = \frac{4}{3}\pi(729) = 972\pi.</math></p> <p>13. <math>V = \frac{4}{3}\pi(8) = \frac{32}{3}\pi.</math></p> | <p>14. <math>V = \frac{4}{3}\pi(1728) = 2304\pi.</math></p> <p>15. <math>V = \frac{4}{3}\pi(1) = \frac{4}{3}\pi.</math></p> <p>16. Radius is 6: <math>V = \frac{4}{3}\pi(216) = 288\pi.</math></p> <p>17. Radius is 3: <math>V = \frac{4}{3}\pi(27) = 36\pi.</math></p> <p>18. <math>V = \frac{1}{3}\pi(25)(6) = 50\pi.</math></p> <p>19. <math>V = \frac{1}{3}(3.14)(9)(10) = 94.2.</math></p> <p>20. <math>V = \frac{4}{3}(3.14)(27) = 113.04.</math></p> <p>21. <math>V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(25)(12) = \frac{1}{3}\pi(300) = 100\pi</math> cubic centimeters.</p> <p>22. <math>V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(6^3) = \frac{4}{3}\pi(216) = 288\pi</math> cubic inches.</p> <p>23. <math>V = \frac{1}{3}\pi r^2 h \approx \frac{1}{3}(3.14)(9)(10) = \frac{1}{3}(282.6) = 94.2</math> cubic centimeters.</p> <p>24. Cone: <math>V = \frac{1}{3}\pi(36)(6) = 72\pi \text{ cm}^3.</math> Sphere: <math>V = \frac{4}{3}\pi(216) = 288\pi \text{ cm}^3.</math> The sphere holds <math>288\pi - 72\pi = 216\pi \text{ cm}^3</math> more.</p> |
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