

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 π 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 π .
 ⇒ 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 36π cubic inches. Keeping π gives the exact answer.

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

PRACTICE

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

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|--------------------------|-------|--|-------|
| 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 π ? _____
22. A bowling ball is a sphere with radius 6 in. Find its volume in terms of π . _____
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 π . _____



Answer Keys

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

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