

# Square Roots and Cube Roots

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

## Q Quick Review

A **square root** undoes squaring:  $\sqrt{49} = 7$  because  $7^2 = 49$ . A number like 49, whose square root is a whole number, is a **perfect square**. A **cube root** undoes cubing:  $\sqrt[3]{27} = 3$  because  $3^3 = 27$ , and 27 is a **perfect cube**. Two helpful facts: every positive number has a positive and a negative square root, so the solutions of  $x^2 = 49$  are  $x = \pm 7$ . But a cube root keeps the *sign* of the number —  $\sqrt[3]{-8} = -2$  because  $(-2)^3 = -8$ . It often helps to memorize the small perfect squares and cubes so you can spot them quickly.

◇ **Example:** Evaluate  $\sqrt{81}$  and  $\sqrt[3]{64}$ .

⇒ For  $\sqrt{81}$ , ask yourself: what number times itself gives 81? Since  $9 \cdot 9 = 81$ , the square root is 9. For  $\sqrt[3]{64}$ , ask: what number used *three* times as a factor gives 64? Try 4:  $4 \cdot 4 \cdot 4 = 64$ , so  $\sqrt[3]{64} = 4$ . The trick is recognizing perfect squares and cubes — once you know them, these become quick mental math.

**Answer:**  $\sqrt{81} = 9$ ,  $\sqrt[3]{64} = 4$

## PRACTICE

Evaluate each root or solve each equation.

- |                     |       |                              |       |
|---------------------|-------|------------------------------|-------|
| 1. $\sqrt{16}$      | _____ | 11. $\sqrt[3]{-27}$          | _____ |
| 2. $\sqrt{25}$      | _____ | 12. $\sqrt{\frac{4}{9}}$     | _____ |
| 3. $\sqrt{100}$     | _____ | 13. $\sqrt{0.49}$            | _____ |
| 4. $\sqrt{144}$     | _____ | 14. $\sqrt[3]{\frac{1}{27}}$ | _____ |
| 5. $\sqrt{169}$     | _____ | 15. $x^2 = 36$               | _____ |
| 6. $\sqrt[3]{8}$    | _____ | 16. $x^2 = 64$               | _____ |
| 7. $\sqrt[3]{27}$   | _____ | 17. $x^2 = 121$              | _____ |
| 8. $\sqrt[3]{125}$  | _____ | 18. $x^3 = 27$               | _____ |
| 9. $\sqrt[3]{1000}$ | _____ | 19. $x^3 = 64$               | _____ |
| 10. $\sqrt[3]{-8}$  | _____ | 20. $x^3 = -125$             | _____ |

### ◆ Word Problems

- A square rug covers an area of 144 square feet. What is the length of one side of the rug? \_\_\_\_\_
- A cube-shaped storage box has a volume of 125 cubic inches. How long is each edge of the box? \_\_\_\_\_
- A square garden plot has an area of 169 square meters. A fence will be built around the whole plot. How many meters of fencing are needed? \_\_\_\_\_
- A cube-shaped tank holds 1000 liters of water, and 1 liter fills 1000 cubic centimeters. The tank's volume is therefore 1,000,000 cubic centimeters. How long is each edge of the tank in centimeters? \_\_\_\_\_



## Answer Keys

- |  |   |
|--|---|
| <p>1. <input type="text" value="4"/></p> <p>2. <input type="text" value="5"/></p> <p>3. <input type="text" value="10"/></p> <p>4. <input type="text" value="12"/></p> <p>5. <input type="text" value="13"/></p> <p>6. <input type="text" value="2"/></p> <p>7. <input type="text" value="3"/></p> <p>8. <input type="text" value="5"/></p> <p>9. <input type="text" value="10"/></p> <p>10. <input type="text" value="-2"/></p> <p>11. <input type="text" value="-3"/></p> <p>12. <input type="text" value="2/3"/></p> | <p>13. <input type="text" value="0.7"/></p> <p>14. <input type="text" value="1/3"/></p> <p>15. <input type="text" value="x = ±6"/></p> <p>16. <input type="text" value="x = ±8"/></p> <p>17. <input type="text" value="x = ±11"/></p> <p>18. <input type="text" value="x = 3"/></p> <p>19. <input type="text" value="x = 4"/></p> <p>20. <input type="text" value="x = -5"/></p> <p>21. <input type="text" value="√144 = 12 feet"/></p> <p>22. <input type="text" value="∛125 = 5 inches"/></p> <p>23. <input type="text" value="side = √169 = 13 m; perimeter = 4 × 13 = 52 meters"/></p> <p>24. <input type="text" value="∛1000000 = 100 centimeters"/></p> |
|--|---|

### Step-by-Step Explanations

- |   |   |
|---|---|
| <p>1. <math>4^2 = 16</math>, so <math>\sqrt{16} = 4</math>.</p> <p>2. <math>5^2 = 25</math>, so <math>\sqrt{25} = 5</math>.</p> <p>3. <math>10^2 = 100</math>, so <math>\sqrt{100} = 10</math>.</p> <p>4. <math>12^2 = 144</math>, so <math>\sqrt{144} = 12</math>.</p> <p>5. <math>13^2 = 169</math>, so <math>\sqrt{169} = 13</math>.</p> <p>6. <math>2^3 = 8</math>, so <math>\sqrt[3]{8} = 2</math>.</p> <p>7. <math>3^3 = 27</math>, so <math>\sqrt[3]{27} = 3</math>.</p> <p>8. <math>5^3 = 125</math>, so <math>\sqrt[3]{125} = 5</math>.</p> <p>9. <math>10^3 = 1000</math>, so <math>\sqrt[3]{1000} = 10</math>.</p> <p>10. Cube roots keep the sign: <math>(-2)^3 = -8</math>, so <math>\sqrt[3]{-8} = -2</math>.</p> <p>11. <math>(-3)^3 = -27</math>, so <math>\sqrt[3]{-27} = -3</math>.</p> <p>12. Take the root of top and bottom: <math>\frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3}</math>.</p> <p>13. <math>0.7^2 = 0.49</math>, so <math>\sqrt{0.49} = 0.7</math>.</p> <p>14. Cube root of top and bottom: <math>\frac{\sqrt[3]{1}}{\sqrt[3]{27}} = \frac{1}{3}</math>.</p> | <p>15. Both 6 and <math>-6</math> square to 36, so <math>x = \pm 6</math>.</p> <p>16. Since <math>8^2 = 64</math> and <math>(-8)^2 = 64</math>, we get <math>x = \pm 8</math>.</p> <p>17. <math>11^2 = 121</math>, so <math>x = \pm 11</math>.</p> <p>18. A cube root gives one answer: <math>\sqrt[3]{27} = 3</math>, so <math>x = 3</math>.</p> <p>19. <math>4^3 = 64</math>, so <math>x = 4</math> (cube roots keep the sign, just one solution).</p> <p>20. <math>(-5)^3 = -125</math>, so <math>x = -5</math>.</p> <p>21. Area of a square is side squared, so the side is <math>\sqrt{144} = 12</math> feet, because <math>12 \cdot 12 = 144</math>.</p> <p>22. Volume of a cube is edge cubed, so the edge is <math>\sqrt[3]{125} = 5</math> inches, since <math>5^3 = 125</math>.</p> <p>23. First find the side: <math>\sqrt{169} = 13</math> m. The perimeter of a square is 4 times the side, so <math>4 \times 13 = 52</math> meters of fencing.</p> <p>24. The edge is the cube root of the volume: <math>\sqrt[3]{1,000,000} = 100</math> cm, because <math>100^3 = 1,000,000</math>.</p> |
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