

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

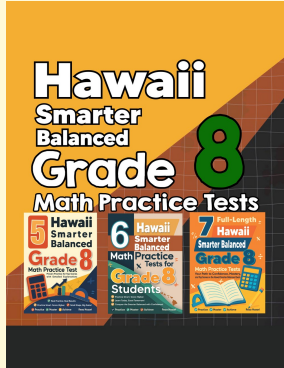
- | | |
|--|---|
| <p>1. <input type="text" value="4"/></p> <p>2. <input type="text" value="5"/></p> <p>3. <input type="text" value="10"/></p> <p>4. <input type="text" value="12"/></p> <p>5. <input type="text" value="13"/></p> <p>6. <input type="text" value="2"/></p> <p>7. <input type="text" value="3"/></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

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