

Evaluating Rational Exponents

Evaluate each expression exactly without a calculator. Look for the easiest mental path.

1. Roots

Simplify. Then evaluate the expression.

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|------------------------|------------------------|--------------------------|---------------------|
| 1. $4^{\frac{1}{2}}$ | 5. $27^{\frac{1}{3}}$ | 9. $256^{\frac{1}{4}}$ | 13. $\sqrt{6^4}$ |
| 2. $9^{\frac{1}{2}}$ | 6. $64^{\frac{1}{3}}$ | 10. $625^{\frac{1}{4}}$ | 14. $\sqrt[3]{3^9}$ |
| 3. $36^{\frac{1}{2}}$ | 7. $125^{\frac{1}{3}}$ | 11. $1296^{\frac{1}{4}}$ | |
| 4. $100^{\frac{1}{2}}$ | 8. $81^{\frac{1}{4}}$ | 12. $\sqrt{4^6}$ | |

2. Root or Power

Decide whether to take the root first or the power. Then evaluate the expression.

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|-----------------------|------------------------|------------------------|---------------------------------|
| 1. $8^{\frac{2}{3}}$ | 5. $64^{\frac{2}{3}}$ | 9. $27^{\frac{4}{3}}$ | 13. $81^{\frac{5}{4}}$ |
| 2. $4^{\frac{3}{2}}$ | 6. $25^{\frac{3}{2}}$ | 10. $16^{\frac{5}{4}}$ | 14. $(6^2 + 8^2)^{\frac{3}{2}}$ |
| 3. $9^{\frac{3}{2}}$ | 7. $125^{\frac{2}{3}}$ | 11. $32^{\frac{3}{5}}$ | |
| 4. $16^{\frac{3}{4}}$ | 8. $81^{\frac{3}{4}}$ | 12. $49^{\frac{3}{2}}$ | |

3. Negative Exponents

Decide whether to take the root first or the power. Then evaluate the expression.

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|------------------------|--------------------------|-------------------------|----------------------------------|
| 1. $9^{-\frac{1}{2}}$ | 5. $16^{-\frac{3}{4}}$ | 9. $32^{-\frac{2}{5}}$ | 13. $4^{-\frac{7}{2}}$ |
| 2. $25^{-\frac{1}{2}}$ | 6. $125^{-\frac{2}{3}}$ | 10. $25^{-\frac{3}{2}}$ | 14. $(5^2 - 3^2)^{-\frac{5}{4}}$ |
| 3. $49^{-\frac{1}{2}}$ | 7. $8^{-\frac{4}{3}}$ | 11. $81^{-\frac{3}{4}}$ | |
| 4. $27^{-\frac{1}{3}}$ | 8. $1000^{-\frac{2}{3}}$ | 12. $64^{-\frac{5}{6}}$ | |

4. Fractions, Signs & Mixed Challenges

Use the same strategies as before. Pay careful attention to fractions, decimals, negative bases, and negative signs outside a power.

1. $\left(\frac{1}{25}\right)^{\frac{1}{2}}$

5. $\left(\frac{1}{8}\right)^{\frac{4}{3}}$

9. $(-0.008)^{\frac{2}{3}}$

13. $\left(\frac{16}{81}\right)^{-\frac{3}{4}}$

2. $\left(\frac{1}{27}\right)^{\frac{1}{3}}$

6. $(-8)^{\frac{1}{3}}$

10. $\left(\frac{1}{4}\right)^{-\frac{1}{2}}$

14. $-(-32)^{-\frac{4}{5}}$

3. $(0.04)^{0.5}$

7. $(-27)^{\frac{2}{3}}$

11. $-25^{-\frac{1}{2}}$

4. $\left(\frac{1}{4}\right)^{\frac{3}{2}}$

8. $\left(-\frac{1}{8}\right)^{\frac{2}{3}}$

12. $\left(\frac{9}{4}\right)^{-\frac{3}{2}}$