

Rational Exponents

If an exponent is a fraction, the numerator represents the **power** and the denominator represents the **root**.

$\sqrt[n]{a^x} = (\sqrt[n]{a})^x = a^{\frac{x}{n}}$	
(base) $\frac{\text{power}}{\text{root}}$	$3^{\frac{3}{2}} = \sqrt{3^3} = \sqrt{3^2 \cdot 3} = 3\sqrt{3}$

1-8: Rewrite each expression using rational exponent notation.

1. $\sqrt[5]{x^2}$ $x^{\frac{2}{5}}$ 2. $\sqrt[3]{5}$ $5^{\frac{1}{3}}$ 3. $\sqrt[6]{16}$ $16^{\frac{1}{6}}$ or $(2^4)^{\frac{1}{6}} = 2^{\frac{4}{6}} = 2^{\frac{2}{3}}$ 4. $\sqrt[10]{x^8}$ $x^{\frac{8}{10}} = x^{\frac{4}{5}}$
5. $\sqrt[3]{36x^5y^7}$ $6x^{\frac{5}{2}}y^{\frac{7}{2}}$ 6. $\sqrt[4]{16a^2b^3}$ $2a^{\frac{1}{2}}b^{\frac{3}{4}}$ 7. $\sqrt[3]{28x^2y^4z^3}$ $28^{\frac{1}{3}}x^{\frac{2}{3}}y^{\frac{4}{3}}z^{\frac{3}{3}}$ 8. $\sqrt[3]{8n^{11}w^2}$ $3 \cdot 8^{\frac{1}{3}}n^{\frac{11}{3}}w^{\frac{2}{3}}$

9-13: Rewrite each expression using radical notation.

9. $5^{\frac{2}{3}}$ $\sqrt[3]{5^2}$ $\sqrt[3]{25}$ 10. $41^{\frac{2}{7}}$ $\sqrt[7]{41^2}$ $\sqrt[7]{1681}$ 11. $(216)^{\frac{4}{3}}$ $\sqrt[3]{216^4}$ $216^3 \sqrt[3]{216}$ $216 \cdot 6 = 1296$ 12. $16^{\frac{5}{3}}$ $\sqrt[3]{16^5}$ $\sqrt[3]{16^3 \cdot 16^2}$ $16^3 \sqrt[3]{16 \cdot 4} = 16 \cdot 4 \sqrt[3]{4} = 64 \sqrt[3]{4}$ 13. $(256)^{\frac{7}{6}}$ $\sqrt[6]{256^7}$ $256^6 \sqrt[6]{64 \cdot 4}$ $512 \sqrt[6]{4}$

14-18: Rewrite each expression USING A CALCULATOR. Round results to the nearest hundredth.

14. $(36)^{\frac{5}{2}}$ 7776 15. $(-12)^{-\frac{1}{3}}$ $\approx .44$ 16. $(\sqrt[3]{28})^7$ 2380.69 17. $(\sqrt[5]{3})^{-4}$ $3^{-\frac{4}{5}}$ $\approx .42$ 18. $(\sqrt[4]{223})^3$ $22^{\frac{3}{4}}$ ≈ 10.16

19-23: Evaluate each expression WITHOUT USING A CALCULATOR.

19. $\sqrt[3]{125}$ $\sqrt[3]{5^3}$ 5 20. $\sqrt[4]{81^3}$ $81^{\frac{3}{4}}$ $(3^4)^{\frac{3}{4}}$ $3^3 = 27$ 21. $49^{-\frac{3}{2}}$ $\frac{1}{49^{\frac{3}{2}}} = \frac{1}{\sqrt{49^3}}$ $\frac{1}{7^3} = \frac{1}{343}$ 22. $-27^{\frac{2}{3}}$ $-(\sqrt[3]{27})^2$ $-(3)^2$ -9 23. $(\sqrt[3]{-64})^2$ $(-4)^2$ 16

24-35: Simplify each expression completely. Write your final answer in simplest radical form.

24. $\sqrt[5]{7a^{10}b^7c^{10}}$

$\sqrt[5]{7a^{10}b^5b^2c^{10}}$
 $a^2bc^2\sqrt[5]{7b^2}$

25. $\sqrt[4]{16d^4e^{10}f^{15}}$

$\sqrt[4]{(4^4)(d^4)(e^8e^2)(f^{12}f^3)}$
 $2de^2f^3\sqrt[4]{e^2f^3}$

26. $\sqrt[4]{(x+2)^4}$

$(x+2)$

27. $\sqrt[6]{128x^4y^{13}z^7}$

$\sqrt[6]{(64)(2x^4)(y^{12})(z^6)z}$
 $2y^2z\sqrt[6]{2x^4yz}$

28. $\sqrt[3]{-64(x-1)^6}$

$-4(x-1)^2$

29. $\sqrt{25(x+6)^{10}}$

$5(x+6)^2$

30. $3^{\frac{1}{3}}x^{\frac{1}{4}}y^{\frac{5}{6}}z^{\frac{4}{3}}$

$3^{\frac{4}{12}}x^{\frac{3}{12}}y^{\frac{10}{12}}z^{\frac{16}{12}}$
 $\sqrt[12]{3^4x^3y^{10}z^{16}}$
 $\sqrt[12]{81x^3y^{10}z^{16}}$
 $z\sqrt[12]{81x^3y^{10}z^4}$

31. $(25g^5h^4)^{\frac{1}{2}}$

$\sqrt{25g^5h^4}$
 $\sqrt{25g^4gh^4}$
 $5g^2h^2\sqrt{g}$

32. $(256j^{16}k^2l^{10})^{\frac{1}{4}}$

$\sqrt[4]{256j^{16}k^2l^{10}}$
 $\sqrt[4]{(4^4)(j^{16})(k^2)(l^8)l^2}$
 $4j^4l^2\sqrt{k^2l^2}$

*** 33. $\frac{\sqrt[3]{36xy^2}}{\sqrt[3]{10xz}}$

$\sqrt[3]{\frac{36y^2}{10z}}$
 $\sqrt[3]{\frac{18y^2}{5z}} \cdot \sqrt[3]{\frac{2z^2}{5z^2}}$
 $\frac{\sqrt[3]{18 \cdot 25y^2z^2}}{\sqrt[3]{5^3z^3}} = \frac{\sqrt[3]{450y^2z^2}}{5z}$

34. $\sqrt[4]{48a^9b^3c^{16}}$

$\sqrt[4]{(16)(3a^8)(b^3)(c^{16})}$
 $2a^2c^4\sqrt[4]{3ab^3}$

35. $\frac{1}{3^{\frac{1}{2}}} \cdot \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{\sqrt{3}}{3}$