

Practice

Rational Exponents

Evaluate each expression.

$$1. \frac{8^{\frac{2}{3}}}{8^{\frac{1}{3}}} = 8^{\frac{1}{3}} = \sqrt[3]{8} = 2$$

$$2. \left(\frac{4}{5}\right)^{-2} = \left(\frac{5}{4}\right)^2 = \frac{25}{16}$$

$$3. 343^{\frac{2}{3}} = (7^3)^{\frac{2}{3}} = 7^2 = 49$$

$$4. \sqrt[3]{8^3} = (8^3)^{\frac{1}{3}} = 8$$

$$5. \sqrt{5} \cdot \sqrt{10} = 5^{\frac{1}{2}} \cdot (5 \cdot 2)^{\frac{1}{2}} = 5^{\frac{1}{2}} \cdot 5^{\frac{1}{2}} \cdot 2^{\frac{1}{2}} = 5 \cdot 2^{\frac{1}{2}} = 5\sqrt{2}$$

$$6. 9^{-\frac{1}{2}} = \frac{1}{9^{\frac{1}{2}}} = \frac{1}{\sqrt{9}} = \frac{1}{3}$$

Simplify each expression.

$$7. (5n^3)^2 \cdot n^{-6} = 25n^6 \cdot n^{-6} = 25n^0 = 25$$

$$8. \left(\frac{x^2}{4y^{-2}}\right)^{-\frac{1}{2}} = \left(\frac{x^2 y^2}{4}\right)^{-\frac{1}{2}} = \left(\frac{4}{x^2 y^2}\right)^{\frac{1}{2}} = \frac{\sqrt{4}}{\sqrt{x^2 y^2}} = \frac{2}{xy}$$

$$9. (64x^6)^{\frac{1}{3}} = 64^{\frac{1}{3}} \cdot x^{6 \cdot \frac{1}{3}} = (4^3)^{\frac{1}{3}} \cdot x^2 = 4x^2$$

$$10. (5x^6 y^4)^{\frac{1}{2}} = 5^{\frac{1}{2}} x^{6 \cdot \frac{1}{2}} y^{4 \cdot \frac{1}{2}} = \sqrt{5} x^3 y^2$$

$$11. \sqrt{x^2 y^3} \cdot \sqrt{x^3 y^4} = x^{\frac{1}{2}} y^{\frac{3}{2}} \cdot x^{\frac{3}{2}} y^{\frac{4}{2}} = x^{\frac{1}{2} + \frac{3}{2}} y^{\frac{3}{2} + \frac{4}{2}} = x^2 y^{\frac{7}{2}} = x^2 y^3 \sqrt{xy}$$

$$12. \left(\frac{p^{6a}}{p^{-3a}}\right)^{\frac{1}{3}} = p^{\frac{6a}{3}} \cdot p^{\frac{3a}{3}} = p^{2a} \cdot p^a = p^{3a}$$

Express each using rational exponents.

$$13. \sqrt{x^5 y^6} = x^{\frac{5}{2}} y^{\frac{6}{2}} = |x|^{\frac{5}{2}} |y|^3$$

$$14. \sqrt[5]{27x^{10}y^5} = 27^{\frac{1}{5}} x^{\frac{10}{5}} y^{\frac{5}{5}} = 27^{\frac{1}{5}} x^2 y$$

$$15. \sqrt{144x^6 y^{10}} = 144^{\frac{1}{2}} x^{\frac{6}{2}} y^{\frac{10}{2}} = 12|x|^3 |y|^5$$

$$16. 21\sqrt[3]{c^7} = 21c^{\frac{7}{3}}$$

$$17. \sqrt{1024a^3} = 1024^{\frac{1}{2}} a^{\frac{3}{2}} = 32a^{\frac{3}{2}}$$

$$18. \sqrt[4]{36a^8 b^5} = 36^{\frac{1}{4}} a^{\frac{8}{4}} b^{\frac{5}{4}} = b^{\frac{1}{2}} a^2 b^{\frac{5}{4}}$$

Express each using radicals.

$$19. 64^{\frac{1}{3}} = \sqrt[3]{64} = 4$$

$$20. 2^{\frac{1}{2}} a^{\frac{3}{2}} b^{\frac{5}{2}} = \sqrt{2a^3 b^5} = |a| b^2 \sqrt{2ab}$$

$$21. s^{\frac{2}{3}} t^{\frac{1}{3}} v^{\frac{2}{3}} = \sqrt[3]{s^2 t v^2}$$

$$22. y^{\frac{3}{2}} = \sqrt[2]{y^3} = |y| \sqrt{y}$$

$$23. x^{\frac{2}{5}} y^{\frac{3}{5}} = \sqrt[5]{x^2 y^3}$$

$$24. (x^6 y^3)^{\frac{1}{2}} z^{\frac{3}{2}} = \sqrt{x^6 y^3} z^{\frac{3}{2}} = |x|^3 y^{\frac{3}{2}} \sqrt{yz}$$