11-1

Study Guide

Rational Exponents

Example 1 **Simplify each expression.**

a. $\left(\frac{c^5d^3}{c^3d^2}\right)^{\frac{1}{2}}$

$\left(\frac{c^5d^3}{c^3d^2}\right)^{\frac{1}{2}} = (c^2d)^{\frac{1}{2}}$ $\quad \frac{a^m}{a^n} = a^{m-n}$

$= c^{\frac{2}{2}}d^{\frac{1}{2}}$ $\quad (a^m)^n = a^{mn}$

$= |c|\sqrt{d}$

b. $\left(\frac{p^2}{q^3}\right)^{-3}$

$\left(\frac{p^2}{q^3}\right)^{-3} = \frac{p^{-6}}{q^{-9}}$ $\quad \left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

$= \frac{q^9}{p^6}$ $\quad b^{-n} = \frac{1}{b^n}$

Example 2 **Evaluate each expression.**

a. $64^{\frac{2}{3}}$

$64^{\frac{2}{3}} = (4^3)^{\frac{2}{3}}$ $\quad 64 = 4^3$

$= 4^2$ or 16 $\quad (a^m)^n = a^{mn}$

b. $\frac{27^{\frac{2}{3}}}{27^{\frac{1}{3}}}$

$\frac{27^{\frac{2}{3}}}{27^{\frac{1}{3}}} = 27^{\frac{2}{3}-\frac{1}{3}}$ $\quad \frac{a^m}{a^n} = a^{m-n}$

$= 27^{\frac{1}{3}}$ or 3

c. $\sqrt{35} \cdot \sqrt{10}$

$\sqrt{35} \cdot \sqrt{10} = 35^{\frac{1}{2}} \cdot 10^{\frac{1}{2}}$ $\quad \sqrt[n]{b} = b^{\frac{1}{n}}$

$= (7 \cdot 5)^{\frac{1}{2}} \cdot (5 \cdot 2)^{\frac{1}{2}}$

$= 7^{\frac{1}{2}} \cdot 5^{\frac{1}{2}} \cdot 5^{\frac{1}{2}} \cdot 2^{\frac{1}{2}}$ $\quad (ab)^m = a^mb^m$

$= 7^{\frac{1}{2}} \cdot 5 \cdot 2^{\frac{1}{2}}$ $\quad a^ma^n = a^{m+n}$

$= 5 \cdot \sqrt{7} \cdot \sqrt{2}$

$= 5\sqrt{14}$ $\quad \sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$

Example 3 **Express $\sqrt[3]{8x^6y^{12}}$ using rational exponents.**

$\sqrt[3]{8x^6y^{12}} = (8x^6y^{12})^{\frac{1}{3}}$ $\quad b^{\frac{1}{n}} = \sqrt[n]{b}$

$= 8^{\frac{1}{3}}x^{\frac{6}{3}}y^{\frac{12}{3}}$ $\quad (ab)^m = a^mb^m$

$= 2x^2y^4$

Example 4 **Express $16x^{\frac{3}{4}}y^{\frac{1}{2}}$ using radicals.**

$16x^{\frac{3}{4}}y^{\frac{1}{2}} = 16(x^3y^2)^{\frac{1}{4}}$ $\quad (ab)^m = a^mb^m$

$= 16\sqrt[4]{x^3y^2}$

NAME _____ DATE _____ PERIOD _____

Practice

Rational Exponents

Evaluate each expression.

1. $\dfrac{8^{\frac{2}{3}}}{8^{\frac{1}{3}}}$

2. $\left(\dfrac{4}{5}\right)^{-2}$

3. $343^{\frac{2}{3}}$

4. $\sqrt[3]{8^3}$

5. $\sqrt{5} \cdot \sqrt{10}$

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

Simplify each expression.

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

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

9. $(64x^6)^{\frac{1}{3}}$

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

11. $\sqrt{x^2y^3} \cdot \sqrt{x^3y^4}$

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

Express each using rational exponents.

13. $\sqrt{x^5y^6}$

14. $\sqrt[5]{27x^{10}y^5}$

15. $\sqrt{144x^6y^{10}}$

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

17. $\sqrt{1024a^3}$

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

Express each using radicals.

19. $64^{\frac{1}{3}}$

20. $2^{\frac{1}{2}}a^{\frac{3}{2}}b^{\frac{5}{2}}$

21. $s^{\frac{2}{3}}t^{\frac{1}{3}}v^{\frac{2}{3}}$

22. $y^{\frac{3}{2}}$

23. $x^{\frac{2}{5}}y^{\frac{3}{5}}$

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