

SIMPLIFYING RATIONAL EXPONENTS

To simplify expressions with rational exponents, the student needs to know the exponent rules and how to add, subtract and multiply fractions.

Exponent Rules (ER)

a) $(x^m)(x^n) = x^{m+n}$

e) $x^{-n} = \frac{1}{x^n}$

b) $\frac{x^m}{x^n} = x^{m-n}$

f) $(a^m)^n = a^{mn}$

c) $(x^m)^n = x^{m \cdot n}$

g) $x^{\frac{m}{n}} = \sqrt[n]{x^m}$

d) $(xy)^m = x^m y^m$

Steps For Adding (or Subtracting) Fractions:

1) Find the Least Common Denominator. LCD = 21

$$\frac{2}{3} + \frac{1}{7}$$

2) Rewrite each fraction with the same denominator.

$$\frac{14}{21} + \frac{3}{21}$$

3) Add (or subtract) the numerators.

$$\frac{17}{21}$$

Steps For Multiplying Fractions:

Case I: Multiply numerators and multiply denominators:

$$\frac{3}{8} \cdot \frac{4}{9} = \frac{12}{72} = \frac{1}{6}$$

or:

Case II: If possible "cross cancel" before multiplying.

$$\frac{3}{8} \cdot \frac{4}{9} = \frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$$

Example: Simplify the following expression using rational (fractional) exponents.

$$\left(\frac{25x^{2/3}y^3}{-1/4y^{1/3}} \right)^{1/2} x$$

Solution: (See exponent rules on first page. These exponent rules are referred to in the steps below.)

$$\left(25x^{2/3} y^3 \right)^{1/2} x^{-1/4} y^{1/3}$$

$$= \frac{\left(25x^{2/3} x^{1/4} y^3 \right)^{1/2}}{y^{1/4}} \quad (\text{ERe})$$

$$= \frac{\left(25x^{11/12} y^3 \right)^{1/2}}{y^{1/3}} \quad (\text{ERa})$$

$$= \left(\frac{25x^{11/12} y^{8/3}}{1} \right)^{1/2} \quad (\text{ERb})$$

$$= (25)^{1/2} (x^{11/12})^{1/2} (y^{8/3})^{1/2} \quad (\text{ERd})$$

$$= 25^{1/2} x^{11/24} y^{4/3} \quad (\text{ERc})$$

$$= \frac{x^{11/12} y^{4/3}}{x^{-1/4}} \quad (\text{ERg})$$

$$= x^{1/4}$$

$$\frac{2}{3} + 4\frac{1}{3} = 12\frac{8}{3} + \frac{3}{12} = \frac{11}{12}$$

$$\frac{3}{1} - 3\frac{1}{3} = \frac{9}{3} - \frac{1}{3} = \frac{8}{3}$$

$$\frac{11}{12} \cdot \frac{1}{2} = \frac{11}{24}$$

$$4 \frac{8}{3} \cdot \frac{1}{3} = \frac{4}{3} \cdot \frac{1}{1} = \frac{4}{3}$$

$$25^{1/2} = \sqrt{25} = 5$$