

## 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)  $\left(\frac{b}{a}\right)^n = \frac{b^n}{a^n}$

c)  $(x^m)^n = x^{mn}$

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:

- |  |   |
|--|---|
| <u>case I:</u> Multiply numerators and multiply denominators:  | $\frac{3}{8} \cdot \frac{4}{9} = \frac{12}{72} = \frac{1}{6}$   |
| <u>or:</u>   |   |
| <u>case II:</u> If possible "cross cancel" before multiplying. | $\frac{\overset{1}{\cancel{3}}}{\underset{2}{8}} \cdot \frac{\overset{1}{\cancel{4}}}{\underset{3}{9}} = \frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$ |

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

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

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

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

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

$$= \left( \frac{25x^{11/12}y^3}{y^{1/3}} \right)^{1/2} \quad (\text{ERa}) \quad \frac{2}{3} + \frac{1}{4} = \frac{8}{12} + \frac{3}{12} = \frac{11}{12}$$

$$= \left( \frac{25x^{11/12}y^{8/3}}{1} \right)^{1/2} \quad (\text{ERb}) \quad \frac{3}{1} - \frac{1}{3} = \frac{9}{3} - \frac{1}{3} = \frac{8}{3}$$

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

$$= 25^{1/2} x^{11/24} y^{4/3} \quad (\text{ERc}) \quad \frac{11}{12} \cdot \frac{1}{2} = \frac{11}{24}$$

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

$$= 5 x^{11/12} y^{4/3} \quad (\text{ERg}) \quad 25^{1/2} = \sqrt[2]{25} = 5$$