FRACTIONAL EXPRESSIONS AND EQUATIONS

EXPRESSIONS: An expression has no equal sign.

To simplify multiplication or division:

$$\frac{x^2 - 6x + 9}{x^2 - x - 6} \cdot \frac{x^2 + 2x}{x^2 + 2x - 15}$$

1. Factor completely.

$$\frac{(x - 3)(x - 3)}{(x - 3)(x + 2)} \cdot \frac{x(x + 2)}{(x + 5)(x - 3)}$$

2. Reduce common factors on top and bottom, then multiply tops, multiply bottoms.

$$\frac{x}{x + 5}$$

If the problem is a division problem, you have to rewrite the first fraction, change the sign to multiplication, and invert (tip upside down or flip) the second fraction and proceed as you would for a multiplication problem.

To simplify addition or subtraction:

$$\frac{3x - 5}{x^2 - 1} - \frac{2}{x - 1}$$

1. Find the LCD. Make a table out of all the denominators to keep organized.

$$\begin{array}{l} x^2 - 1 = (x - 1)(x + 1) \\ \underline{x - 1 = (x - 1)} \\ \text{LCD} = (x - 1)(x + 1) \end{array}$$

2. Draw new fraction lines and put the LCD under each one. Don't forget to put the operational sign in between the fractions.

$$\frac{}{(x - 1)(x + 1)} - \frac{}{(x - 1)(x + 1)}$$

3. Put the old numerator on top of new fractions. Compare the LCD with each of the old denominators and multiply the top by the part that is missing from the LCD if there is any.

$$\frac{(3x - 5)}{(x - 1)(x + 1)} - \frac{2(x - 1)}{(x - 1)(x + 1)}$$

4. Rewrite the fractions as a single fraction with the LCD on the bottom. DON'T DISTRIBUTE !

$$\frac{(3x - 5) - 2(x - 1)}{(x - 1)(x + 1)}$$

5. Distribute and combine like terms in numerator only.

$$\frac{3x - 5 - 2x - 2}{(x - 1)(x + 1)}$$

6. Factor-Reduce, if possible.

$$\frac{x - 7}{(x - 1)(x + 1)}$$

EQUATIONS: An equation has an equal sign with constants and/or variables on each side. You will solve an equation rather than simplify it.

To solve:

$$\frac{5}{y+1} = \frac{4}{y+2}$$

1. Find the LCD just as before.

   LCD = $(y + 1)(y + 2)$

2. Put each term in ( ) and multiply each side by the LCD. Reduce. This clears all denominators.

$$(y+1)(y+2)\frac{5}{y+1} = \frac{4}{y+2}(y+1)(y+2)$$

3. Multiply. Combine like terms on each side of the equal sign and solve for **y**.

$$5(y+2) = 4(y+1)$$

$$5y + 10 = 4y + 4$$

$$-4y \qquad -4y$$

$$y + 10 = 4$$

$$-10 \quad -10$$

$$y = -6$$

4. If there is a variable in the denominator of the original problem you must check to make sure that the solution is valid. What can **y** not equal?

   In this equation **y** cannot equal -1 or -2 because these two numbers would make the denominators be 0. So our solution is valid.