MCR 3U

SIMPLIFYING RATIONAL EXPRESSIONS

A rational expression is a quotient whose numerator and denominator are polynomials.

Examples: $\frac{3}{x+2}$, $\frac{y-4}{7}$, $\frac{x+1}{x+3}$, $\frac{5y}{y^2-1}$, $\frac{a^2+b^2}{a^2-b^2}$

NOTE: All examples (above) are in a simplified form. Some rational expressions are not reduced and require the process of ***factoring*** to help reduce the expression to a simplified form.

Also, since division by 0 is not defined, we are required to ***state restrictions on the variables*** found in the ***denominator*** of the expression.

STEPS:

① Factor fully.

② State restrictions on the variables in the denominator.

③ Reduce the expression. Only factors that are attached by multiplication can be reduced through division.

ALSO NOTE:

When reducing rational expressions, if ***opposites*** are located in the numerator and denominator, these factors always reduce to -1.

For instance, consider the following rational expressions:

$\frac{-40}{56} = \frac{-8(5)}{8(7)} = \frac{-5}{7}$ Since -8 and 8 are opposites and are factors of the numerator and denominator, they divide (or reduce) to -1.

$\frac{4-2x}{x^2-2x} = \frac{2(2-x)}{x(x-2)} = \frac{-2}{x}$ Since $(2-x)$ and $(x-2)$ are opposites and are factors of the numerator and denominator, they reduce to -1.

EXAMPLES:

1. $\frac{42}{72}$

2. $\frac{-45}{35}$

3. $\frac{4a^2b^3}{10a^2b}$

4. $\frac{12h^2k-4hk^2}{6hk^2}$

5. $\frac{4w^3}{4w^2-8w}$

6. $\frac{6-8x}{12x-9}$

7. $\frac{n^2-5n+6}{n^2-9}$

8. $\frac{8x^2-2x}{8x^2+18x-5}$

9. $\frac{2x^2-xy-15y^2}{25y^2-4x^2}$

10. $\frac{9-4k^2}{2k^2+5k-12}$