

## Simplifying Rational Expressions

A rational expression is a fraction made up of polynomials in the numerator and denominator. It could

be as simple as  $\frac{5}{x}$ , or as complicated as something like  $\frac{3x^4 - 25x^2 + 17}{x^3 - 4x^2 + 7x - 12}$ .

In order to write a rational expression in simplest form, both the numerator and denominator should be factored. Then common factors may be divided (canceled) out. This is the same process that is used to simplify fractions of numbers:

1. The original fraction:  $\frac{63}{70}$
2. Numerator and denominator are written as products of prime factors:  $\frac{3^2 \cdot 7}{2 \cdot 5 \cdot 7}$
3. Any common factor divided by itself is equal to 1, so they can be eliminated:  $\frac{3^2 \cdot 7}{2 \cdot 5 \cdot 7}$
4. The remaining prime factors are multiplied to write the reduced or simplified form:  $\frac{9}{10}$

A similar process reduces a rational expression to simplest form.

1. Both numerator and denominator are polynomials written in standard form:  $\frac{x^2 + 11x + 24}{x^2 - 9}$
2. Rewrite both in factored form:  $\frac{(x+3)(x+8)}{(x+3)(x-3)}$
3. Eliminate any factor that appears in both numerator and denominator:  $\frac{(x+3)(x+8)}{(x+3)(x-3)}$
4. The reduced form is equivalent to the original rational expression, except in the case of  $x = -3$ . In the original expression, if  $x = -3$ , the denominator would be 0, so the fraction will not be a real number:  $\frac{(x+8)}{(x-3)}, x \neq -3$
5. Expression, if  $x = -3$ , the denominator would be 0, so the fraction will not be a real number.

Find more examples and practice problems at [Simplifying Rational Expressions](#).\*

Then simplify:  $\frac{3x-21}{x^2-6x-7}$

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