7.1 Rational Expressions & Simplifying

Definition 7.1.1 (rational expression)**.** the quotient of two polynomials; $\dfrac{x-3}{2}$, $\dfrac{-3}{x^2+4x}$

Rational expressions are *undefined* for a value of x if the denominator becomes 0.

Example 7.1.1. Find the numbers which make the given rational expressions undefined.

1. $\dfrac{7x-28}{8x-4}$

2. $\dfrac{8x-40}{x^2+3x-28}$

Simplifying Rational Expressions

A rational expression is considered *simplified* when the numerator and denominator share no factors, much like a reduced fraction.

Process

1. factor both the numerator and denominator fully
2. divide & cancel any common factors

Example 7.1.2. Simplify fully:

$$\frac{7x+28}{21x}$$

Example 7.1.3. Simplify fully:

$$\frac{x^3-x^2}{7x-7}$$

Example 7.1.4. Simplify fully:

$$\frac{x^2-1}{x^2+2x+1}$$

Opposite Factors

Remember that there are two values we can always factor out: 1 (boring) and -1 (less boring and sometimes useful).

If we have something similar to $\frac{x-2}{2-x}$ we may notice that there is some similarity between the numerator and denominator. If we were to factor out a -1 from either, we would see that they share a common factor that could be canceled.

Example 7.1.5. Simplify fully:

$$\frac{x-2}{2-x}$$

Example 7.1.6. Simplify fully:

$$\frac{9x^2-49}{28-12x}$$