12-2 Simplifying Rational Expressions

Fractions like $\frac{5}{9}$, $\frac{7}{12}$, and $\frac{1}{2}$ are rational numbers. An expression which can be written in the form $\frac{\text{polynomial}}{\text{polynomial}}$ is a **rational expression.** Here are some examples of rational expressions.

$$\frac{1}{x} \qquad \frac{x+2}{x-3} \qquad \frac{x^2-5}{x^2-10x+25}$$

Of course, the value of the expression in the denominator cannot be zero, since division by zero is undefined. For the rest of this chapter, assume that the values of the variables that make the denominator zero are excluded from the domain.

Like rational numbers, a rational expression is in simplest form if the numerator and denominator have no common factors except 1. For example, $\frac{z+5}{10z}$ is in simplest form since no factor of $10z$ is a factor of $z + 5$.

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Simplify Rationals:
1. look for a ***GCF*** in numerator
   look for a ***GCF*** in denominator.

2. if is a ***quadratic***:
   for a trinomial see if it can be factored (bi)(bi)
   by guessing and checking
   Outside + Inside = Middle
   if it is a binomial- ($\sqrt{\text{first}} + \sqrt{\text{last}}$)($\sqrt{\text{first}} - \sqrt{\text{last}}$)

3. If there are any common factors in the numerator or denominator, then they can simplified further.

* GCF's can be simplified and expressions can be simplified.

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1 Simplify each expression.

a. $\frac{15b}{25b^2}$ **b.** $\frac{12c^2}{3c+6}$ **c.** $\frac{4m-2}{2m-1}$ **d.** $\frac{20+4t}{t+5}$

Try#1.

1 EXAMPLE Simplifying a Rational Expression

Simplify $\frac{6x+12}{x+2}$.

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Simplify each expression.

a. $\frac{3x+12}{x^2-x-20}$ **b.** $\frac{2z-2}{z^2-4z+3}$ **c.** $\frac{8a+16}{2a^2+5a+2}$ **d.** $\frac{c^2-c-6}{c^2+5c+6}$

Try#2

2 EXAMPLE Simplifying a Rational Expression

Simplify $\frac{2x-12}{x^2-7x+6}$.

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3 Simplify each expression.

a. $\frac{x-4}{4-x}$ **b.** $\frac{8-m}{m^2-64}$ **c.** $\frac{8-4r}{r^2+2r-8}$ **d.** $\frac{2c^2-2}{3-3c^2}$

Try #3.

3 EXAMPLE Recognizing Opposite Factors

Simplify $\frac{5x-15}{9-x^2}$.

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