

4-1 SIMPLIFYING RATIONAL EXPRESSIONS



Simplifying a rational expression into its lowest terms is an extremely useful skill. Its algebra is based on how we simply numerical fractions. The basic principle is developed in the first exercise.

Exercise #1: Recall that to multiply fractions, one simply multiplies their numerators and denominators.

(a) Simplify the numerical fraction $\frac{18}{12}$ by first expressing it as a product of two fractions, one of which is equal to one.

(b) Simplify the algebraic fraction $\frac{x^2 - 9}{2x + 6}$ by first expressing it as the product of two fractions (factor!), one of which is equal to one.

Every time we simplify a fraction, we are essentially finding all common factors of the numerator and denominator and dividing them to be equal to one. Key in this process is that the numerator and denominator **must be factored** and **only common factors cancel each other**. This is true whether our fraction contains monomial, binomial, or polynomial expressions.

Exercise #2: Simplify each of the following monomials dividing other monomials.

(a) $\frac{3x^5y^6}{6x^8y^3}$

(b) $\frac{20x^{10}y^8}{4x^2}$

(c) $\frac{7x^3y}{21x^5y^8}$

Exercise #3: Which of the following is equivalent to $\frac{10x^6y^3}{15x^2y^6}$?

(1) $\frac{2x^3}{3y^2}$

(3) $\frac{2x^4}{3y^3}$

(2) $\frac{3x^8}{2y^9}$

(4) $\frac{3x^2}{2y^3}$

When simplifying rational expressions that are more complex, always factor first, then identify common factors that can be eliminated.

Exercise #4: Simplify each of the following rational expressions.

(a) $\frac{x^2 + 5x - 14}{x^2 - 4}$

(b) $\frac{4x^2 - 1}{10x - 5}$

(c) $\frac{3x^2 + 14x + 8}{x^2 - 16}$

A special type of simplifying occurs whenever expressions of the form $(x - y)$ and $(y - x)$ are involved.

Exercise #5: Simplify each of the following fractions.

(a) $\frac{9 - 6}{6 - 9}$

(b) $\frac{15 - 3}{3 - 15}$

(c) $\frac{a - b}{b - a}$

Exercise #6: Which of the following is equivalent to $\frac{2x - 10}{25 - x^2}$?

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

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

(2) $\frac{2 - x}{5}$

(4) $\frac{2}{x - 5}$

Exercise #7: Which of the following is equivalent to $\frac{x^2 - 6x + 9}{18 - 6x}$?

(1) $\frac{-x - 3}{6}$

(3) $\frac{x + 3}{9}$

(2) $\frac{x - 3}{6}$

(4) $\frac{3 - x}{6}$
