


# Algebraic Fractions


**Algebraic fractions** are fractions that contain at least one variable.

## Examples


$$\frac{x}{12}$$

  $x$  is the numerator



$$\frac{3}{b+1}$$

The denominator is  
an expression in  
terms of  $b$   




$$\frac{2y}{15}$$

 The numerator is a  
multiple of  $y$



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

  
 Both the numerator and the  
denominator contain  
an  $x$  term

$$\frac{3h+4}{2h-5}$$

  
 Both the numerator and the  
denominator contain  
an expression with  $h$

$$\frac{(3x+4)^2}{x^2-9}$$

  
 The numerator and the  
denominator are  
quadratic expressions

# Adding and Subtracting Algebraic Fractions

Adding and subtracting algebraic fractions requires that the fractions have a common denominator.

 Example

$$\frac{5}{a} - \frac{b}{a} = \frac{5-b}{a}$$

The fractions  $\frac{5}{a}$  and  $\frac{b}{a}$  already have a common denominator  $a$ , so we just subtract the numerators.

 Example

$$\begin{array}{ccc} \frac{3}{2a} + \frac{3a}{4b} & & \\ \times 2b \quad \times a & & \\ \frac{6b}{4ab} + \frac{3a^2}{4ab} & = & \frac{3a^2 + 6b}{4ab} \end{array}$$

These fractions **do not** have a common denominator - the first step is to find the LCM of  $2a$  and  $4b$  and use this as a common denominator.

Once there is a common denominator, add the numerators.

# Multiplying and Dividing Algebraic Fractions

**Multiplying and dividing algebraic fractions** involves multiplying the **numerators** together, and multiplying the **denominators** together.

 **Example**

$$\frac{3x^3}{a} \times \frac{5x}{2b} = \frac{3x^3 \times 5x}{a \times 2b} = \frac{15x^4}{2ab}$$

Here we use the multiplication law of indices to multiply the numerators.

To **divide algebraic fractions**, we first write the **reciprocal** of the **dividing fraction** and then multiply the **numerators** and multiply the **denominators**.

 **Example**

$$\frac{4b}{3} \div \frac{7a}{b} = \frac{4b}{3} \times \frac{b}{7a} = \frac{4b \times b}{3 \times 7a} = \frac{4b^2}{21a}$$

To find the reciprocal, flip the fraction.