

Section 8 – 4A:**Adding and Subtracting Rational Expressions
with a Common Denominator**

Before two or more fractions can be added or subtracted they **must have a common denominator**. If they do have a common denominator then we **add or subtract the numerators** and **put that results over the common denominator**.

**Adding Rational Expressions
with a Common Denominator**

To add two fractions **with a common denominator**
add the numerators and **put that results over the common denominator**.

$$\frac{\text{first numerator}}{\text{common denominator}} + \frac{\text{second numerator}}{\text{common denominator}}$$

$$\frac{\text{first numerator} + (\text{second numerator})}{\text{common denominator}}$$

Example 1

$$\frac{x-3}{x-1} + \frac{2x-4}{x-1}$$

$$= \frac{x-3+(2x-4)}{x-1}$$

add the numerators
with the second one in brackets
over the common denominator

$$= \frac{x-3+(2x-4)}{x-1}$$

distribute the +

$$= \frac{x-3+2x-4}{x-1}$$

combine like terms

$$= \frac{3x-7}{x-1}$$

Example 2

$$\frac{7}{5x+3} + \frac{2x+6}{5x+3}$$

$$= \frac{7+(2x+6)}{5x+3}$$

add the numerators
with the second one in brackets
over the common denominator

$$= \frac{7+(2x+6)}{5x+3}$$

distribute the +

$$= \frac{7+2x+6}{5x+3}$$

combine like terms

$$= \frac{2x+13}{5x+3}$$

After adding the fractions remember to try and reduce the answer by factoring and canceling like factors

Example 3

$$\frac{4x-5}{6(x-5)} + \frac{2x-3}{6(x-5)}$$

$$= \frac{4x-5+(2x-3)}{6(x-5)}$$

add the numerators
with the second one in brackets
over the common denominator

$$= \frac{4x-5+(2x-3)}{6(x-5)}$$

distribute the +

$$= \frac{4x-5+2x-3}{6(x-5)}$$

combine like terms

$$= \frac{6x-8}{6(x-5)}$$

reduce by factoring
and canceling

$$= \frac{6x-8}{6(x-5)}$$

factor the numerator

$$= \frac{2(3x-4)}{6(x-5)}$$

$$= \frac{2^1(3x-4)}{6^3(x-5)}$$

cancel common factors

$$= \frac{(3x-4)}{3(x-5)}$$

Example 4

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

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

add the numerators
with the second one in brackets
over the common denominator

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

distribute the +

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

combine like terms

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

reduce by factoring
and canceling

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

factor the numerator

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

$$= \frac{3 \cancel{(x-2)}}{(x-2) \cancel{(x-2)}}$$

cancel common factors

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

Subtracting Rational Expressions with a Common Denominator

**To subtract two fractions with a common denominator
SUBTRACT the numerators and put that results over the common denominator.**

$$\frac{\text{first numerator}}{\text{common denominator}} - \frac{\text{second numerator}}{\text{common denominator}}$$

$$\frac{\text{first numerator} - (\text{second numerator})}{\text{common denominator}}$$

Example 5

$$\frac{4x-5}{x-1} - \frac{3x-2}{x-1}$$

$$= \frac{4x-5-(3x-2)}{x-1}$$

subtract the numerators with
the second one in brackets
over the common denominator

$$= \frac{4x-5-(3x-2)}{x-1}$$

distribute the -

$$= \frac{4x-5-3x+2}{x-1}$$

combine like terms

$$= \frac{x-3}{x-1}$$

Example 6

$$\frac{-2x+1}{3(x-8)} - \frac{-2x+3}{3(x-8)}$$

$$= \frac{-2x+1-(-2x+3)}{3(x-8)}$$

subtract the numerators with
the second one in brackets
over the common denominator

$$= \frac{-2x+1-(-2x+3)}{3(x-8)}$$

distribute the -

$$= \frac{-2x+1+2x-3}{3(x-8)}$$

combine like terms

$$= \frac{-2}{3(x-8)}$$

After subtracting the fractions remember to try and reduce the answer by factoring and canceling like factors

Example 7

$$\frac{4x-5}{6(x-5)} - \frac{2x-3}{6(x-5)}$$

$$= \frac{4x-5-(2x-3)}{6(x-5)}$$

subtract the numerators with
the second one in brackets
over the common denominator

$$= \frac{4x-5-2x+3}{6(x-5)}$$

distribute the -

$$= \frac{2x-2}{6(x-5)}$$

combine like terms

$$= \frac{2(x-1)}{6(x-5)}$$

factor the numerator

$$= \frac{2^1 (x-1)}{6^2 (x-5)}$$

cancel like terms

$$= \frac{(x-1)}{3(x-5)}$$

Example 8

$$\frac{4x+5}{(x+1)(x+3)} - \frac{2x+3}{(x+1)(x+3)}$$

$$= \frac{4x+5-(2x+3)}{(x+1)(x+3)}$$

subtract the numerators with
the second one in brackets
over the common denominator

$$= \frac{4x+5-2x-3}{(x+1)(x+3)}$$

distribute the -

$$= \frac{2x+2}{(x+1)(x+3)}$$

combine like terms

$$= \frac{2(x+1)}{(x+1)(x+3)}$$

factor the numerator

$$= \frac{2 \cancel{(x+1)}}{\cancel{(x+1)}(x+3)}$$

cancel common factors

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