

8-5 Adding and Subtracting Rational Expressions

(Last very difficult concept I'll teach you!!! 😊)

A. Recall multiplying and dividing fractions do NOT require a common denominator.

Multiplying - multiply the top times top, bottom times bottom → factor → cancel

Dividing - multiply by the reciprocal...

B. Adding/Subtracting

1. Factor the denominators.
2. Find the *least common denominator* (LCD), which is the smallest denominator containing both original denominators.
3. Multiply what is needed to the top and bottom to acquire the LCD.
4. Foil/Distribute → Add/Subtract the numerators, keeping the denominator the same. (Careful with subtraction!)
5. Be sure the answer is in reduced form.

C. Examples - “Back in the Day...Without a Calculator 😊”

$$\frac{2}{15} + \frac{1}{6} =$$

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

LCD = (3)(5)(2) = 30

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

$$\frac{4}{30} + \frac{5}{30} = \frac{20}{30} = \frac{2}{3}$$

D. Examples – Simplify each expression.

1.

$$\begin{aligned}\frac{3x}{x^2+5x+6} - \frac{2x}{x^2+6x+9} &= \\ \frac{3x}{(x+3)(x+2)} - \frac{2x}{(x+3)(x+3)} &= \\ \frac{3x(x+3)}{(x+3)(x+3)(x+2)} - \frac{2x(x+2)}{(x+3)(x+3)(x+2)} &= \\ \frac{3x^2+9x}{(x+3)(x+3)(x+2)} - \frac{2x^2+4x}{(x+3)(x+3)(x+2)} &= \\ \frac{x^2+5x}{(x+3)(x+3)(x+2)} &= \frac{x^2+5x}{(x+3)^2(x+2)}\end{aligned}$$

2.

$$\begin{aligned}\frac{1}{x^2-4x-12} + \frac{3x}{4x+8} &= \\ \frac{1}{(x-6)(x+2)} + \frac{3x}{4(x+2)} &= \\ \frac{4}{4(x-6)(x+2)} + \frac{3x(x-6)}{4(x+2)(x-6)} &= \\ \frac{4}{4(x-6)(x+2)} + \frac{3x^2-18x}{4(x+2)(x-6)} &= \\ \frac{3x^2-18x+4}{4(x+2)(x-6)} &= \end{aligned}$$

3.

$$\begin{aligned}\frac{4}{8x+8} - \frac{3}{4x} &= \\ \frac{4}{8(x+1)} - \frac{3}{4x} &= \\ \frac{4x}{8x(x+1)} - \frac{2 \cdot 3(x+1)}{2 \cdot 4x(x+1)} &= \\ \frac{4x}{8x(x+1)} - \frac{6x+6}{8x(x+1)} &= \\ \frac{-2x-6}{8x(x+1)} &= \\ \frac{-2(x+3)}{8x(x+1)} &= \\ \frac{-(x+3)}{4x(x+1)} &= \frac{-x-3}{4x(x+1)}\end{aligned}$$

