Unit 5 / Day 2

## Add and Subtract Rational Expressions

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**Objectives:**

Students will be able to add and subtract rational expressions.

Students will be able to identify all necessary restrictions.

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## What is needed in order to add and subtract fractions?

common denominator

**Add:** $\dfrac{5 \cdot 4}{5 \cdot 3} + \dfrac{1 \cdot 3}{5 \cdot 3}$

$\dfrac{20}{15} + \dfrac{3}{15}$

$\boxed{\dfrac{23}{15}}$

**Subtract:** $\dfrac{4}{3} - \dfrac{1}{5}$

$\dfrac{20}{15} - \dfrac{3}{15} = \boxed{\dfrac{17}{15}}$

## Steps for Solving:

1. Factor the denominators

2. Find a common denominator

3. Multiply the numerator and combine like terms

4. Factor the numerator  (if possible)

5. Simplify (cancel) factors that appear in both the numerator and denominator

6. State restrictions

**Add or subtract each expression.**
**Leave your answers as simplified as possible.**
**State any restriction(s) on the variables.**

EX #1: $\dfrac{x \cdot {}^{6y}}{6y \cdot 6x^2 y} + \dfrac{4 \cdot {}^{4x}}{9xy^2 \cdot 4x} - \dfrac{y \cdot {}^{3xy}}{12xy \, {}^{3xy}}$    CD: $36x^2y^2$

$\dfrac{6xy}{36x^2y^2} + \dfrac{16x}{36x^2y^2} - \dfrac{3xy^2}{36x^2y^2}$

$\dfrac{6xy + 16x - 3xy^2}{36x^2y^2}$

$\dfrac{x(6y + 16 - 3y^2)}{36x^2y^2}$

$\checkmark \quad \dfrac{-3y^2 + 6y + 16}{36xy^2}$

Restrictions:

$x \neq 0$

$y \neq 0$

**EX #2:**

$$\dfrac{1 \cdot 3}{\underset{3(x+4)(x+1)}{x^2 + 5x + 4}} + \dfrac{5x(x+4)}{\underset{3(x+1)(x+4)}{3x + 3}} \quad CP: \; 3(x+1)(x+4)$$

$$= \dfrac{3 + 5x^2 + 20x}{3(x+4)(x+1)}$$

$$= \dfrac{5x^2 + 20x + 3}{3(x+4)(x+1)} \quad *$$
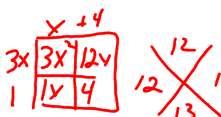
Restrictions: $x \neq -4, -1$

**EX #3:**

$$\dfrac{(2x-1)(x-7)}{\underset{(3x+1)(x+4)(x-7)}{3x^2 + 13x + 4}} + \dfrac{(x+3)(3x+1)}{\underset{(x-7)(x+4)(3x+1)}{x^2 - 3x - 28}}$$

$CP:$
$(3x+1)(x+4)(x-7)$

$(3x+1)(x+4)$

$$= \dfrac{2x^2 - 14x - x + 7 + 3x^2 + x + 9x + 3}{(3x+1)(x+4)(x-7)}$$

$$= \dfrac{5x^2 - 5x + 10}{(3x+1)(x+4)(x-7)}$$

$$= \dfrac{5(x^2 - x + 2)}{(3x+1)(x+4)(x-7)} \quad *$$

Restrictions:

$x \neq -\dfrac{1}{3}, -4, 7$

**EX #4:**

$$\frac{2(x-4)}{(y-4)(x+4)} + \frac{-1(4x-x^2)}{\underset{(x+4)(x-4)}{x^2-16}} \qquad \text{co}: (x+4)(x-4)$$

$$= \frac{2x-8-4x+x^2}{(x-4)(x+4)}$$

$$= \frac{x^2-2x-8}{(x-4)(x+4)} \qquad 2\overset{-8}{\diagup}{}^{-4}_{\cdot 2}$$

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

$*$

$$= \frac{x+2}{x+4}$$

Restrictions:

$$x \neq \pm 4$$

**EX #5:**

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

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

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

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

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

Restrictions:

$$x \neq \pm 2$$

**EX #6:**

$$\frac{x^2 + x - 2}{x^2 + x - 20} + \frac{-2(x+5)}{(x-4)(x+5)}$$

$$(x+5)(x-4)$$

$$= \frac{x^2 + x - 2 - 2x - 10}{(x+5)(x-4)}$$

$$= \frac{x^2 - x - 12}{(x+5)(x-4)}$$

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

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

Restrictions:

$$x = -5, 4$$

$$y = 2x^5 - 7x^4 - 51x^3 + 100x^2 + 196x - 245$$

window $-10 \le x \le 10$     scale 1

$-1500 \le y \le 600$     scale 60

(-3.24, 418.86)

(1.81, 98.68)

(2.48, 0)     (6, 0)

(-4, 0)     (-2.01, 0)     (1.02, 0)

$(0, -$      )

(-0.68, -317.79)

(4.92, -1296.81)