**Lesson 31      Section 6.2**
**Addition or Subtraction of Rational Expressions**

Remember:  Fractions (rationals) can only be added or subtracted if they have a common denominator.  For example:  $\dfrac{3}{8} + \dfrac{2}{8} = \dfrac{5}{8}$

To add or subtract rational expressions with the **same denominator**:
1. Add or Subtract the numerators.
2. Keep the denominator.
3. Factor, if possible.
4. Simplify, if possible.

$$\dfrac{A}{C} \pm \dfrac{B}{C} = \dfrac{A \pm B}{C}$$

Examples:

1)    $\dfrac{6+2x}{x+7} + \dfrac{8}{x+7} =$

2)    $\dfrac{5}{3a} + \dfrac{7}{3a} =$

3)    $\dfrac{4y+2}{y-2} - \dfrac{y-3}{y-2} =$

4)    $\dfrac{3a-2}{a^2-25} - \dfrac{4a-7}{a^2-25} =$

When **denominators are opposites**, the denominators can be made the same polynomial by multiplying both numerator and denominator of one rational expression by $-1$.

Ex 5)  Examine the following.

$$\frac{x-7}{x^2-16}-\frac{x-1}{16-x^2}=$$

$$\frac{x-7}{x^2-16}-\left(\frac{x-1}{16-x^2}\right)\left(\frac{-1}{-1}\right)$$

$$=\frac{(x-7)}{x^2-16}-\frac{-(x-1)}{-(16-x^2)}$$

$$=\frac{(x-7)+(x-1)}{x^2-16}$$

$$=\frac{x-7+x-1}{x^2-16}=\frac{2x-8}{x^2-16}$$

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

When denominators are unlike, a common denominator must be found and the fractions are rewritten by multiplying numerator and denominator by the same nonzero quantity.

> To find the **least common denominator (LCD)**:
> 1. Factor each denominator.
> 2. Find a **product** that contains **each different factor the greatest number of times it occurs in any denominator**.

Examples:

6)    $$\frac{}{(x+2)^2},\frac{}{x(x+2)}$$

7)    $$\frac{}{(x-3)(x+1)},\frac{}{(x+1)(x-5)}$$

8)    $$\frac{}{12x^4+4x^3},\frac{}{54x^4-6x^2}$$

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8.5) $\dfrac{}{x^2+2x}, \dfrac{}{x^2(x+2)^2}, \dfrac{}{x^2-4}$

> To add or subtract rational expressions with **different denominators**:
> 1. Find the LCD as outlined previously.
> 2. Multiply each numerator by the 'missing factor' needed in order to write with the LCD.
> 3. Combine numerator terms together over the common denominator.
> 4. Factor and simplify, if possible.

Examples:

9) $\dfrac{a+3}{a-1}+\dfrac{a-2}{a+4}=$

10) $3+\dfrac{x+2}{x-5}=$

11) $\dfrac{7}{3y^2+y-4}+\dfrac{9y+2}{3y^2-2y-8}=$

12) $\quad \dfrac{6xy}{x^2 - y^2} - \dfrac{x+y}{x-y} =$

13) $\quad \dfrac{x}{x^2 + 11x + 30} - \dfrac{5}{x^2 + 9x + 20} =$

14) $\quad \dfrac{-2}{a+2} + \dfrac{5}{a-2} + \dfrac{a+3}{a^2 - 4} =$