

# Adding & Subtracting Rational Expressions NOTES

\*Adding and subtracting rational expressions is useful for finding rates of change and limits later in this course.

When adding and subtracting rational expressions with unlike denominators:

- 1) Find the LCD. (lowest common denominator)
- 2) Multiply all terms to get common denominator.
- 3) Add or subtract the numerators and carry the denominators.
- 4) Simplify, if necessary.

Example 1:  $\frac{2x+1}{3x+4} - \frac{x+9}{3x+4}$

$$\frac{2x+1 + (x+9)}{3x+4}$$

$$\frac{x-8}{3x+4}$$

Example 2:  $\frac{3}{y+3} + \frac{2y}{y^2+8y+15}$  \*Factor denominators first

$$\frac{(y+5)3}{(y+5)(y+3)} + \frac{2y}{(y+3)(y+5)}$$

$$\frac{3y+15+2y}{(y+3)(y+5)} = \frac{5y+15}{(y+3)(y+5)}$$

$$\frac{5(y+3)}{(y+3)(y+5)} = \frac{5}{y+5}$$

Example 3:  $\frac{15}{2x-4} + \frac{x}{x^2-4}$  LCD  $2(x-2)(x+2)$

$$\frac{(x+2)15}{(x+2)2(x-2)} + \frac{x}{(x+2)(x-2)} \cdot \frac{2}{2}$$

$$\frac{15x+30+2x}{2(x-2)(x+2)}$$

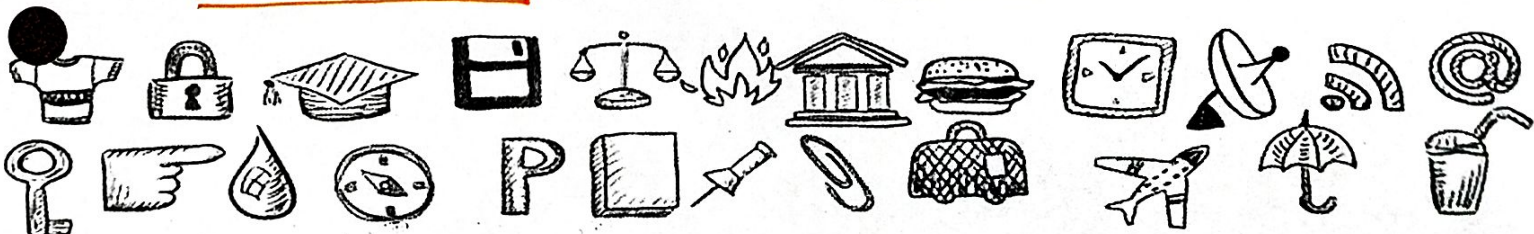
$$\frac{17x+30}{2(x-2)(x+2)}$$

Example 4:  $\frac{1}{x+h+2} - \frac{1}{x+2}$  LCD  $(x+2)(x+h+2)$

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

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

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



# Simplifying Complex Fractions

When simplifying complex fractions:

1. Add or subtract expressions in the numerator and denominator.
2. Multiply the numerator by the reciprocal of the denominator.

Example 1:

$$\frac{\frac{16}{3}}{\frac{3}{3} \frac{1}{3} - \frac{5}{9}}$$

$$\frac{\frac{16}{3}}{\frac{3-5}{9}} = \frac{\frac{16}{3}}{-\frac{2}{9}}$$

$$\frac{8 \cancel{16}}{\cancel{1} \cancel{3}} \cdot \frac{-\cancel{9}^3}{\cancel{2}} = \boxed{-24}$$

Example 2:  $\frac{3x}{9} - \frac{2}{3x}$       Fraction Buster  $\Rightarrow$  LCD =  $3x$

$$\frac{3x \left( \frac{9}{3x} + \frac{2}{3x} \right)}{\frac{3x}{1}}$$

$$\frac{27x}{27+2} = \boxed{\frac{27x}{29}}$$

Example 3:  $\frac{5a}{a^2} - \frac{4}{a}$       Fraction Buster:  $5a$

$$\frac{5a \left( \frac{4}{5} - \frac{4}{a} \right)}{5a}$$

$$\boxed{\frac{5a^3}{4a-20}}$$

Example 4:  $\frac{x}{2(x+h)} - \frac{1}{2x(x+h)}$       LCD:  $2x(x+h)$

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

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

$$\frac{-\cancel{h}}{2x(x+h)} \cdot \frac{1}{\cancel{h}} = \boxed{\frac{-1}{2x(x+h)}}$$

