

Rational Expressions and Complex Fractions

example:

$$\frac{\frac{4}{30}}{\frac{6}{15}} = \frac{\frac{2}{15}}{\frac{2}{5}} = \frac{\cancel{2}}{15} \cdot \frac{5}{\cancel{2}} = \frac{5}{15} = \boxed{\frac{1}{3}}$$

- ① simplify numerator
- ② simplify denominator
- ③ multiply by reciprocal
- ④ simplify!

Ex. Simplify.

$$\frac{\textcircled{N} \frac{2x^2 - 8x}{x^2 - 25}}{\textcircled{D} \frac{12x^2 - 48x}{3x - 15}} \rightarrow \frac{2x(x-4)}{(x+5)(x-5)} \cdot \frac{4 \cdot 2x(x-4)}{3(x-5)}$$

① simplify \textcircled{N} ✓

② simplify \textcircled{D} ✓

③ divide $\frac{N}{D}$

④ simplify

$$\frac{\textcircled{N}}{\textcircled{D}} = \frac{\frac{2x(x-4)}{(x+5)(x-5)}}{\frac{4x(x-4)}{(x-5)}} = \frac{1 \cdot \cancel{2} \cdot \cancel{(x-4)} \cdot (x-5)}{(x+5)(x-5) \cdot \frac{4 \cdot \cancel{(x-4)}}{2}} = \boxed{\frac{1}{2(x+5)}}$$

$$\textcircled{N} \quad \frac{x}{6} + \frac{1 \cdot 3}{2 \cdot 3} \rightarrow \frac{(x+3)}{6} = \frac{(x+3)}{6} \cdot \frac{3}{(x+3)}$$

$$\textcircled{D} \quad \frac{\frac{3}{3} \cdot 1 + \frac{x}{3}}{3} \rightarrow \frac{(3+x)}{3}$$

$$= \frac{3(x+3)}{6(x+3)} = \frac{3}{6} = \boxed{\frac{1}{2}}$$

- ① ② } add/subtract
 ③ divide = mult. by reciprocal
 ④ simplify

$$3. \quad \frac{\frac{1}{x} - \frac{x}{x^{-1} + 1}}{\frac{3}{x}} \rightarrow \frac{\frac{x}{1} + \frac{1 \cdot x}{x}}{\frac{(1+x)}{x}} = \frac{x}{1} \cdot \frac{x}{(x+1)} = \frac{x^2}{(x+1)}$$

$$\textcircled{N} \quad \frac{\frac{1 \cdot (x+1)}{x(x+1)} \cdot \frac{x \cdot x^2}{x(x+1)}}{\frac{3}{x}} \rightarrow \frac{(x+1 - x^3)}{x(x+1)} = \frac{(-x^3 + x + 1) \cdot x}{x(x+1) \cdot 3}$$

$$= \boxed{\frac{(-x^3 + x + 1)}{3(x+1)}}$$

$$4. \quad \frac{4}{5-x} \rightarrow \textcircled{N} \frac{4}{-(x-5)} \rightarrow \frac{-4}{(x-5)}$$

$$\frac{2}{5-x} + \frac{1}{3x-15}$$

$$\textcircled{D} \quad \frac{-2 \cdot 3}{3 \cdot (x-5)} + \frac{1}{3(x-5)} \rightarrow \frac{-6+1}{3(x-5)} \rightarrow \frac{-5}{3(x-5)}$$

$$\frac{N}{D} = \frac{\frac{-4}{(x-5)}}{\frac{-5}{3(x-5)}} = \frac{-4}{(x-5)} \cdot \frac{3(x-5)}{-5} = \frac{-12}{-5} = \boxed{\frac{12}{5}}$$

$$5-x = -x+5 = -(x-5)$$