Name: _____

Simplifying Rationals

You've learned how to simplify rational expressions when they've been factored for you. Today, you will follow the same process with one extra step: before you start, you need to factor the expressions in the numerator and the denominator.

Simplify.

EXAMPLE

$$\frac{19x^2-3x+5}{8x-13}-\frac{-7x^2-12x}{8x-13}$$

They already have a common denominator… subtract across the top.

$$\frac{(19x^2-3x+5)-(-7x^2-12x)}{8x-13}$$

$$\frac{19x^2-3x+5+7x^2+12x}{8x-13}$$

$$\frac{26x^2+9x+5}{8x-13}$$

Check to see if there are factors that can be canceled…the bottom can't be factored and neither can the top. SO…

$$\boxed{\frac{26x^2+9x+5}{8x-13}}$$

1.

$$\frac{-17x^2+10x+9}{13x+16}-\frac{14x^2+20}{13x+16}$$

2.

$$\frac{8x^2+16x-1}{3x-5}-\frac{17x^2-14x-12}{3x-5}$$

EXAMPLE

$$\frac{x-1}{x+10}+\frac{x-5}{x^2+13x+30}$$

They need a common denominator.

Factor the bottom of the 2nd fraction.

$x^2+13x+30 \ldots AC=30, B=13$

$3\cdot 10=30, 3+10=13$

$x^2+3x+10x+30$

$=x(x+3)+10(x+3)$

$=(x+3)(x+10)$

Write it using the factors.

$$\frac{x+1}{x+10}+\frac{x-5}{(x+3)(x+10)}$$

1st fraction is missing (x+3)-multiply!

$$\frac{(x+3)}{(x+3)}\cdot\frac{(x+1)}{(x+10)}+\frac{x-5}{(x+3)(x+10)}$$

$$\frac{x^2+4x+3}{x^2+13x+30}+\frac{x-5}{x^2+13x+30}$$

$$\frac{x^2+5x-2}{x^2+13x-30}$$

The top can't be factored, so there are no matching factors to cancel.

$$\boxed{\frac{x^2+5x-2}{x^2+13x-30}}$$

3.

$$\frac{x+2}{x-4}+\frac{5x+15}{x^2-x-12}$$

4.

$$\frac{x+4}{x-7}+\frac{3x+18}{x^2-x-42}$$

EXAMPLE

$$\frac{x^2+8x+15}{x^2+7x+10}\cdot\frac{x^2+6x+8}{x^2-4x-21}$$

Factor each part.

$\boldsymbol{x^2+8x+15}$	$\boldsymbol{x^2+6x+8}$
$AC=15, B=8$	$AC=8, B=6$
3&5!	2&4!
$x^2+3x+5x+15$	$x^2+2x+4x+8$
$x(x+3)+5(x+3)$	$x(x+2)+4(x+2)$
$\boldsymbol{(x+3)(x+5)}$	$\boldsymbol{(x+2)(x+4)}$

$\boldsymbol{x^2+7x+10}$	$\boldsymbol{x^2-4x-21}$
$AC=10, B=7$	$AC=-21, B=-4$
2&5!	-7&3!
$x^2+2x+5x+10$	$x^2-7x+3x-21$
$x(x+2)+5(x+2)$	$x(x+7)+3(x-7)$
$\boldsymbol{(x+5)(x+2)}$	$\boldsymbol{(x-7)(x+3)}$

Plug in the factors.

$$\frac{(x+3)(x+5)}{(x+5)(x+2)}\cdot\frac{(x+2)(x+4)}{(x-7)(x+3)}$$

Cancel and multiply.

$$\frac{\cancel{(x+3)(x+5)}}{\cancel{(x+5)(x+2)}}\cdot\frac{\cancel{(x+2)}(x+4)}{(x-7)\cancel{(x+3)}}$$

$$\boxed{\frac{x+4}{x-7}}$$

6.

$$\frac{x^2-3x}{x^2-18x+45}\cdot\frac{x^2-11x-60}{x^2+12x+32}$$

7.

$$\frac{x^2-13x+12}{x^2-11x-12}\cdot\frac{x^2+11x+10}{x^2-16x+15}$$

EXAMPLE

$$\frac{x^2-x-6}{x^2+x-12}\div\frac{x^2+8x+12}{x^2+9x+20}$$

Flip the 2nd fraction.

$$\frac{x^2-x-6}{x^2+x-12}\cdot\frac{x^2+9x+20}{x^2+8x+12}$$

Factor and cancel.

$\boldsymbol{x^2-x-6}$	$\boldsymbol{x^2+9x+20}$
$AC=-6, B=-1$	$AC=20, B=9$
-3&2!	4&5!
$x^2-3x+2x-6$	$x^2+4x+5x+20$
$x(x-3)+2(x-3)$	$x(x+4)+5(x+4)$
$\boldsymbol{(x-3)(x+2)}$	$\boldsymbol{(x+4)(x+5)}$

$\boldsymbol{x^2+x-12}$	$\boldsymbol{x^2+8x+12}$
$AC=-12, B=1$	$AC=12, B=8$
-3&4!	2&6!
$x^2-3x+4x-12$	$x^2+2x+6x+12$
$x(x-3)+4(x-3)$	$x(x+2)+6(x+2)$
$\boldsymbol{(x+4)(x-3)}$	$\boldsymbol{(x+2)(x+6)}$

$$\frac{(x-3)(x+2)}{(x+4)(x-3)}\cdot\frac{(x+4)(x+5)}{(x+2)(x+6)}$$

$$\frac{\cancel{(x-3)(x+2)}}{\cancel{(x+4)(x-3)}}\cdot\frac{\cancel{(x+4)}(x+5)}{\cancel{(x+2)}(x+6)}$$

$$\boxed{\frac{x+5}{x+6}}$$

8.

$$\frac{x^2+x-20}{x^2-5x-24}\div\frac{x^2+17x+60}{x^2+4x-96}$$

9.

$$\frac{x^2-13x+12}{x^2-3x+2}\div\frac{x^2-20x+96}{x^2-x-2}$$