4.1: Simplifying Rational Expressions

Steps: 1) factor ☺
2) replace expressions with their factors
3) cancel factors
4) write factors that are left

* state restrictions → denominator $\neq 0$

Ex 1) $\frac{2x-8}{x^2-6x+8}$

$\frac{2x-8}{2} \quad \frac{}{2}$

$2(x-4)$

x^2-6x+8

$8x^2$

$x^2 - 4x - 2x + 8 \quad -4x + -2x = -6x$

$\frac{x^2}{x} \quad \frac{-4x}{x} \quad \frac{-2x}{-2} \quad \frac{+8}{-2}$

$x(x-4) \quad -2(x-4)$

$(x-4)(x-2)$

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

$\frac{2}{x-2}$

$x-4 \neq 0$
$+4 \quad +4$
$x \neq 4$

$x-2 \neq 0$
$+2 \quad +2$
$x \neq 2$

• Ex 2) $\frac{x^2+3x-28}{x^2-49}$

$x^2+3x-28$

$-28x^2$

$7x + -4x = 3x$

$x^2+7x-4x-28$

$\frac{x^2}{x}$	$\frac{7x}{x}$	$-4x$	$\frac{-28}{-4}$
$x(x+7)$		$-4(x+7)$	

$(x+7)(x-4)$

x^2-49

$\sqrt{x^2} = x$

$\sqrt{49} = 7$

$(x+7)(x-7)$

$\frac{(x+7)(x-4)}{(x+7)(x-7)}$

$x+7 \neq 0$

$x \neq -7$

$x-7 \neq 0$

$x \neq 7$

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

You try: $\frac{x-1}{x^2-1}$

$(x+1)(x-1)$

$\frac{3}{3 \cdot 5}$

$\frac{(x-1)}{(x+1)(x-1)}$

$\frac{1}{x+1}$

$x+1 \quad | \quad x-1$

$x+1 \neq 0$

$x \neq -1$

$x-1 \neq 0$

$x \neq 1$

Ex 3) $\dfrac{9x^2+81x}{3x^4+24x^3-27x^2}$

$\dfrac{9x^2}{9x}+\dfrac{81x}{9x}$

$9x(x+9)$

$\dfrac{3x^4}{3x^2}+\dfrac{24x^3}{3x^2}-\dfrac{27x^2}{3x^2}$

$3x^2(x^2+8x-9)$

$3x^2(x^2+9x-x-9)$

$\dfrac{x^2}{x}+\dfrac{9x}{x}\quad\dfrac{-x}{-1}\quad\dfrac{-9}{-1}$

$x(x+9)\quad -1(x+9)$

$3x^2(x+9)(x-1)$

$-9x^2$

$9x+-x=8x$

$\dfrac{9x(x+9)}{3x^2(x+9)(x-1)}$

$\dfrac{3}{x(x-1)}$

$\dfrac{3x^2}{3}\neq\dfrac{0}{3}$

$x^2\neq 0$

$x\neq 0$

$x+9\neq 0$

$x\neq -9$

$x-1\neq 0$

$x\neq 1$

$\dfrac{3\cdot 3\cdot x\cdot(x+9)}{3\cdot x\cdot x\,(x+9)(x-1)}$

Find pairs for factoring:

$y=\dfrac{\text{first}\cdot\text{last}\#}{x}$