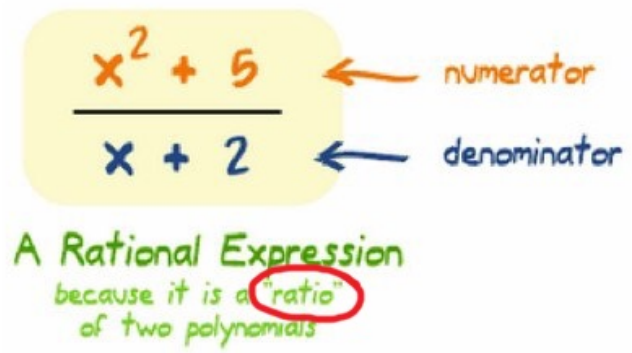
4.1: Simplifying Rational Expressions



A **Rational Expression** is:

A fraction w/ polynomials in the numerator and/or denominator

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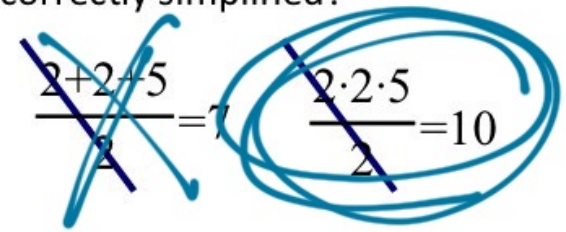
Excluded Values: #s that make the bottom of the fraction = 0

* When simplifying ALWAYS state excluded values

To **Simplify** a rational expression

1) Factor the numerator and denominator.
2) Divide out the common factors
3) Simplify & State any excluded values

set bottom = 0 BEFORE canceling out

*NOTE! Consider the following; which one is correctly simplified?  	The same is true when you are simplifying rational expressions with polynomials. You **CAN NOT** cancel any of the terms out unless they are connected with a multiplication!! (!!!)

EXAMPLE

Simplify the following rational expressions and state any excluded values.

A. $\dfrac{x-1}{5x-5}$ $= \dfrac{1(x-1)}{5(x-1)}$

$\dfrac{1}{5}$, $x \neq 1$

B. $\dfrac{21a^2}{7a^3}$ $= \dfrac{7 \cdot 3a^2}{7a^2 \cdot a}$

$\dfrac{3}{a}$, $a \neq 0$

C. $\dfrac{2n-3}{6n-9} = \dfrac{2n-3}{3(2n-3)}$

$\frac{1}{3}, n \neq \frac{3}{2}$

D. $\dfrac{3x^2-9x}{x-3} = \dfrac{3x(x-3)}{x-3}$

$3x, x \neq 3$

E. $\frac{3x-6}{x^2+x-6}$

$3 \cdot x + -2 \cdot -6$

$3 + -2 = 1$

$\frac{3(x-2)}{(x+3)(x-2)}$

$\frac{3}{x+3}, x \neq -3, 2$

F. $\frac{x-3}{3-x} = \frac{x-3}{-x+3}$

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

$-1, x \neq 3$

G. $\frac{4-x^2}{7x-14} = \frac{-x^2+4}{7(x-2)}$

$= \frac{-1(x^2-4)}{7(x-2)}$

$= \frac{-1(x-2)(x+2)}{7(x-2)}$ $x-2=0$

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

$\frac{-x-2}{7}, x \neq 2$

H. $\frac{y^2-16}{4-y} = \frac{(y-4)(y+4)}{-1(y-4)}$ $y-4=0$

$\frac{y+4}{-1} = -y-4, y \neq 4$

1. $\dfrac{4-w}{w^2-8w+16}$

$= \dfrac{-w+4}{(w-4)(w-4)} = \dfrac{-1(w-4)}{(w-4)(w-4)}$

$w-4=0$

$-x-16$

$-4--8$

$= \boxed{\dfrac{-1}{w-4}, w \neq 4}$

$\dfrac{1}{4-w}$

There are 4 major things to consider when trying to tackle a word problem.			
1) What is the problem asking?	2) What information is given?	3) What do I already know that I can use?	4) Does my answer make sense?

EXAMPLE

J. You are choosing between two wastebaskets. One is cylindrical with a height of $(2a + 8)$ and a radius of a. The other one is a rectangular prism with a square base area of $4a^2$ and a height of h. If both wastebaskets have the same volume, what is the height of the rectangular wastebasket? Give your height in terms of a.

$V = \pi r^2 h$

$V = lwh$

$4a^2 = l \cdot w$

$V_{cyl} = \pi a^2 (2a+8)$

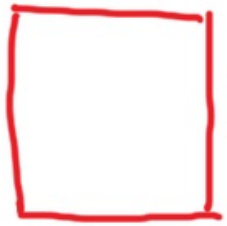
$V_{prism} = 4a^2 \cdot h$

$\frac{\pi a^2 (2a+8)}{4a^2} = \frac{4a^2 h}{4a^2}$

$\frac{2\pi(a+4)}{2 \cdot 2} = \frac{\pi(a+4)}{2} = h$

EXAMPLE

K. A square has side length $6x + 2$. A rectangle with width $3x + 1$ has the same area as the square. What is the length of the rectangle?



Area = $(6x+2)(6x+2)$

Area = $(3x+1)l$

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

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

$l = 2(6x+2)$

$\boxed{l = 12x+4}$