

These rational expressions are so much fun! Today we are simplifying them!

Simplifying Rational Expressions

Recall how to write a number as a product of its prime factors + reduce

$$\frac{8}{10} = \frac{\overset{\text{Factored Form}}{\cancel{2} \times 4}}{\cancel{2} \times 5} = \overset{\text{Simplified Form}}{\frac{4}{5}}$$

Note: Rational Expression $\frac{\text{polynomial}}{\text{polynomial}}$

The same can be done for rational expressions

$$\frac{x^2 + 3x - 10}{x^2 + 8x + 15} = \frac{\overset{\text{Factored Form}}{\cancel{(x+5)}(x-2)}}{\cancel{(x+5)}(x+3)} = \overset{\text{Simplified Form}}{\frac{x-2}{x+3}}$$

Not polynomials! Note the following error:

$$\frac{\sqrt{x}}{2^x} = \frac{x^{\frac{1}{2}}}{x^{-3}} = \frac{12-1}{4} = \frac{3^2-1}{14} = \frac{3-1}{1} = 2$$

"cancel-itous"

How should this have gone? *BEDMAS*

$$\frac{12-1}{4} = \frac{11}{4}$$

You CAN ONLY CANCEL ONCE IT IS IN FACTORED FORM!!!!

OR "V" for VOS Rule: $\frac{6x+12}{9}$ *3 goes into each term

$$= \frac{2x+4}{3}$$

Examples// Simplify each rational expression.

Write the non-permissible value(s) for each variable

Steps ① Factor the numerator & denominator

② Determine the non-permissible values of x


③ Cancel common factors.

$$1. \frac{3y^2+5y}{2y} = \frac{y(3y+5)}{2y}$$

$$= \frac{3y+5}{2}$$

Non-Permissible values:
this is where your denominator
= 0

$$\text{NPV: } \frac{2y \neq 0}{2 \quad 2}$$
$$y \neq 0$$

 **NOTE:** Monomial factors reduce monomial factors
and binomial factors reduce with binomial factors.

$$2. \frac{x^2-3x-10}{x^2-4}$$

$$= \frac{(x-5)(\cancel{x+2})}{(x-2)(\cancel{x+2})}$$

$$= \frac{x-5}{x-2}$$

$$= \frac{x-5}{x-2}$$

① factor numerator & denominator

② cancel common factors

③ write simplified answer

NPV:

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

$$x \neq -2 \quad x \neq 2$$

$$3. \frac{16-m^2}{2m^2-5m-12}$$

$$\rightarrow 2(-12) = -24$$

$$= \frac{(4-m)(4+m)}{2m^2-8m+3m-12}$$

$$\begin{array}{r} / \quad | \\ -8 \quad +3 \end{array}$$

$$= \frac{(4-m)(4+m)}{2m(m-4)+3(m-4)}$$

$$= \frac{\cancel{(4-m)}(4+m)}{-\cancel{(4-m)}(2m+3)}$$

$$= \frac{(4-m)(4+m)}{(2m+3)(m-4)}$$

$$= \frac{4+m}{-(2m+3)} = -\frac{4+m}{2m+3}$$

$$= \frac{(4-m)(4+m)}{-(-m+4)(2m+3)}$$

$$\text{NPV: } m-4 \neq 0 \quad 2m+3 \neq 0$$

$$m \neq 4 \quad m \neq -3/2$$

4. Simplify

$$\frac{16x^4 - y^4}{(4x^2 + y^2)^2 (2x^2 + 3xy - 2y^2)}$$

$$2(-2) = -4$$

$$\begin{array}{r} / \quad | \\ 4 \quad -1 \end{array}$$

$$= \frac{(4x^2 - y^2)(4x^2 + y^2)}{(4x^2 + y^2)^2 (2x^2 + 4xy - xy - 2y^2)}$$

$$= \frac{(4x^2 - y^2)(\cancel{4x^2 + y^2})}{(4x^2 + y^2)(\cancel{4x^2 + y^2})(2x(x+2y) - y(x+2y))}$$

$$= \frac{4x^2 - y^2}{(4x^2 + y^2)(2x - y)(x + 2y)}$$

$$= \frac{(2x - y)(2x + y)}{(4x^2 + y^2)(2x - y)(x + 2y)}$$

$$= \frac{2x + y}{(4x^2 + y^2)(x + 2y)}$$