

L1 Rational Expressions

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L1 Equivalent Rational Expressions

Lesson 1 Rational Expressions

Rational Expression – any algebraic expression that can be written as the quotient of two polynomials.

ie. $\frac{3x-2}{4x-3}$, $\frac{x^2-4}{x^2-x-12}$, $\frac{4x}{x^2+2}$

Rational expressions cannot contain roots of variables or variables in exponents.

ie. $\frac{3x-2}{\sqrt{x+2}}$, $\frac{2+2^x}{x}$ are not rational expressions

Non-permissible Values

Rational expressions are not defined for values of the variable that make the denominator equal to zero (you cannot divide by 0). These values are called non-permissible values or restrictions.

ie. $\frac{x+5}{x-3}$ is not defined for $x = 3$. Therefore, $x = 3$ is a non-permissible value.
($x \neq 3$ is a restriction)

Example 1

State the non-permissible values for the following rational expressions.

- To determine the non-permissible values, set the denominator equal to 0 and solve for x . (npr's)

a) $\frac{5x}{x^2-9}$

$$\begin{aligned} x^2 - 9 &= 0 & \text{npr's} \\ x^2 &= 9 & x = \pm 3 \end{aligned}$$

b) $\frac{3x+2}{x^2-8x+16}$

$$\begin{aligned} x^2 - 8x + 16 &= 0 \\ (x-4)(x-4) &= 0 \\ x &= 4 \end{aligned}$$

Simplifying Rational Expressions

- All rational expressions must be in reduced form. This means that it must be factored first and reduced if applicable.
- The restrictions/non-permissible values for the variable in the denominator must be stated as part of the final answer. Always use the original question to state restrictions

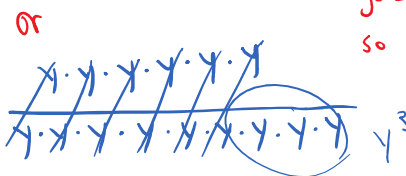
Example 2
Simplify and State Restrictions

a.) $\frac{-25x^4y^6}{35x^2y^9} \quad x, y \neq 0$

$\frac{-5x^2}{7y^3}$

$\frac{y^6}{y^9} = y^{-3}$

← -ve exponent goes to the denominator so it's positive



b.) $\frac{4x-12}{6x-24}$

$\frac{4(x-3)}{6(x-4)}$

$\frac{2(x-3)}{3(x-4)} \quad x \neq 4$

Factor

- 1) GCF
- 2) Difference of Squares
- 3) PSF

c.) $\frac{x^2-x-12}{x-4}$

$\frac{\cancel{(x-4)}(x+3)}{\cancel{x-4}} \quad x \neq 4$

$x+3, \quad x \neq 4$

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d.)

$$\frac{2x^2 - 5x - 3}{x^2 - 9}$$

P -6
S -5
F $\frac{-6}{2}, \frac{1}{1}$
-3 1

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

$$\frac{2x+1}{x+3}$$

$$x \neq \pm 3$$

$$x-3=0 \quad x+3=0$$

$$x=3 \quad x=-3$$

e.)

$$\frac{16-x^2}{2x-8}$$

$$\frac{-(x^2-16)}{2x-8}$$

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

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

$$x \neq 4$$

$$16-x^2$$

$$-(-16+x^2)$$

$$-(x^2-16)$$

$$\frac{16-x^2}{2x-8}$$

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

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

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

$$x \neq 4$$

f.)

$$\frac{(x+y)^2 - (a+b)^2}{x+y+a+b}$$

$$\frac{(\cancel{x+y+a+b})(x+y-(a+b))}{\cancel{x+y+a+b}}$$

$$x+y-a-b$$

$$x+y+a+b=0$$

$$x \neq -y-a-b$$

$$\frac{3x+12}{2x+8}$$

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

$$\frac{(x-3)(x+1)}{(x+4)(x+1)}$$

$$x \neq -4, -1$$

$$\frac{x-3}{x+4} \quad x = -4, -1$$

$$\frac{2x^2 + 5x - 3}{2x^2 + 10x + 12}$$

$$\frac{(2x-1)(x+3)}{2(x^2+5x+6)}$$

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

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

$$x = -3, -2$$