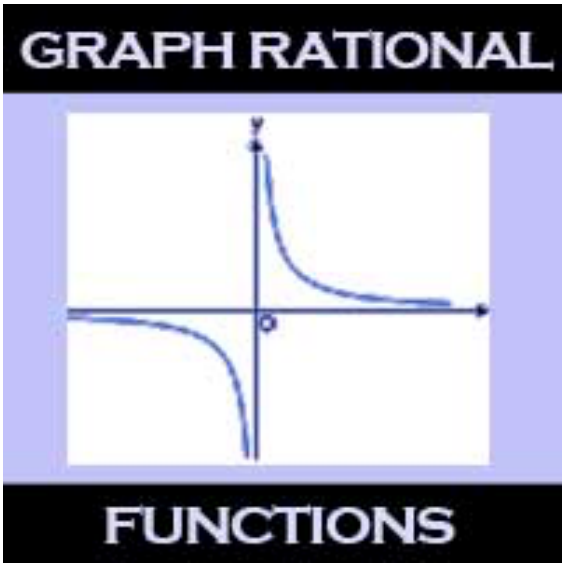
LG #12
Rationals
Part 1

Agenda:


GRAPH RATIONAL
FUNCTIONS

Whenever you use a rational expression, you must identify any values that must be excluded or considered **non-permissible values**.

☆ Non-permissible values are values that make the denominator **zero**.

Topic 1 Example 1

Determine Non-Permissible Values

For each rational expression, determine all non-permissible values.

a) $\frac{-2x^3}{5y^2z}$ b) $\frac{4m}{m(3m-1)}$ c) $\frac{5x+2}{x^2+5x+6}$

1st take the denominator and make it equal zero.

$5y = 0$; $z = 0$ $m = 0$; $3m - 1 = 0$ $x^2 + 5x + 6 = 0$

☆ factor

2nd then solve equation to find non-permissible values.

$y = 0$; $z = 0$ $m = 0$; $m = \frac{1}{3}$ $(x + 2)(x + 3) = 0$

$x = -2$; $x = -3$

Example 2

Simplify a Rational Expression

☆ When simplifying a rational expression, always state the non-permissible values.

Simplify and state the non-permissible values.

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

1st - determine any non-permissible values

$x^2+x-6=0 \Rightarrow (x+3)(x-2)=0 \Rightarrow x=-3,-2 \Rightarrow x\neq -3, 2$

2nd - factor to cancel out equivalent expressions

$$\frac{3x-6}{x^2+x-6} = \frac{3(x-2)}{(x+3)(x-2)} = \frac{3}{x+3} \; ; x\neq -3, 2$$

Example 3

Rational Expressions With Pairs of Non-Permissible Values

Simplify and determine non-permissible values.

$$\frac{16x^2 - 9y^2}{8x - 6y}$$

To simplify:

1 - factor $\frac{(4x+3y)(4x-3y)}{2(4x-3y)}$

$4x - 3y = 0$

$\frac{4x}{4} = \frac{3y}{4}$

$x \neq \frac{3y}{4}$

2 - then look to cancel out equivalent expression

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

Watch out for the "Opposite Rule"

Simplify and state the non-permissibles.

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

Try: Simplify and determine non-permissible values.

$$\frac{2m^2 + 6mn - 36n^2}{6m + 36n}$$

Topic 2

Example 1

Multiplying Rational Expressions

Multiply and write your answer in simplest form.
Identify all non-permissible values.

$$\frac{x^2-x-12}{x^2-9} \times \frac{x^2-4x+3}{x^2-4x}$$

1st factor

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

$$= \frac{(x-4)(x+3)(x-1)(x-3)}{(x-3)(x+3)x(x-4)}$$ ☆ non-permissible values

2nd look to cancel out equivalent expression, then state all non-permissible values

$$= \frac{\cancel{(x-4)}\cancel{(x+3)}(x-1)\cancel{(x-3)}}{\cancel{(x-3)}\cancel{(x+3)}x\cancel{(x-4)}} = \frac{x-1}{x}; \quad x \neq -3,0,3,4$$

Try: Multiply and write your answer in simplest form. Identify all non-permissible values.

a) $\frac{2a-10}{a^2-4a-5} \times \frac{a^2-1}{4a-4}$

b) $\frac{2-x}{m^2} \times \frac{2m}{3n-6}$

Example 2
Divide Rational Expressions

Dividing Rational Expressions is pretty much the same as multiplying, except you must first reciprocate (flip) the rational expression that comes **after** the ÷ sign.

Determine the quotient in simplest form.
Identify all non-permissible values.

$$\frac{b^2-4}{6} \div \frac{b-2}{3}$$

$$= \frac{(b-2)(b+2)}{6_2} \times \frac{{}^{1}3}{b-2} = \frac{b+2}{2} \; ; \; b \neq 2$$

Try: Determine the quotient in simplest form.
Identify all non-permissible values.

$$\frac{c^2-6c-7}{c^2-49} \div \frac{c^2+8c+7}{c^2+7c}$$

Example 3
Multiply and Divide Rational Expressions

Now it is time to put both your multiplying and dividing skills together to simplify a Rational Expression.

Try:

Simplify. What are the non- permissible values?

$$\frac{3x+12}{3x^2-5x-12} \div \frac{12}{3x+4} \times \frac{2x-6}{x+4}$$