Introduction to Rational Expressions

A **rational expression** is an expression that can be written in the form $\frac{P}{Q}$, where P & Q are polynomials & Q does not equal zero.

A rational expression is **evaluated** at a value(s) by substituting into the expression for the appropriate variable(s). Remember, the fraction line means divide.

Example:

Evaluate at x = 2: $\frac{x+4}{x+2} \xrightarrow{replace\_x\_with\_2} \frac{(2)+4}{(2)+2} \xrightarrow{Add} \frac{6}{4} \xrightarrow{Always\_Simplify!} \frac{3*2}{2*2} \rightarrow \frac{2}{2}$

A rational expression is **undefined** when Q equals 0, or we say the rational expression is undefined at the values of the variable that cause Q to equal 0. The **domain** of the expression is those values that do not cause Q to equal 0.

Examples:

$\frac{x+4}{x+2}$ In this example Q = x + 2, so if x + 2 equals 0, then the rational expression will be undefined. So if x = -2, the rational expression will have 0 in the denominator and so will be undefined. Thus the domain of this rational expression is (-∞, -2)U(-2, ∞) or { x | x is a Real Number and x ≠ -2).

$\frac{3}{x^2+12}$ In this example the denominator $x^2 + 12$ equals 0 only when $x^2 = -12$, which does not happen with Real Numbers. So the Domain is All Real Numbers.

$\frac{x^2+3}{x-3}$ In this example the denominator x – 3 equals 0 when x = 3. So the Domain is {x| x is a Real Number and x ≠ 3}.