Here are some helpful key terms for you to know as well as important formulas. Feel free to let me know if you have any questions or anything you think should be added to this doc. Maybe everyone can come up with some examples of topics that we can add to the doc too!

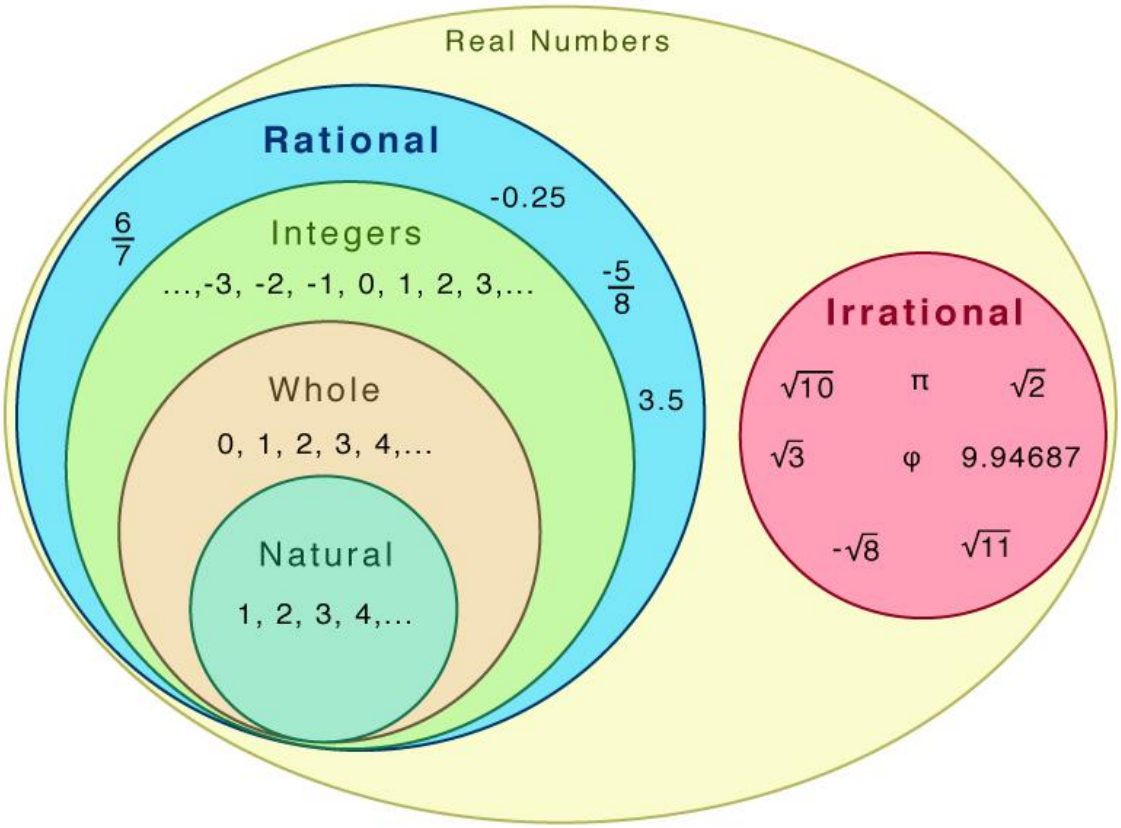
This is also a good source of information:
https://doe.virginia.gov/instruction/mathematics/resources/vocab_cards/2016/alg-1-vocab-cards-2016.pdf#page5

What types of numbers are there?

- Natural numbers: Numbers found in nature. These are whole positive numbers excluding zero.
    - Symbol used to represent natural numbers: $\mathbb{N}$
    - Here are some examples of natural numbers:
        - 1, 2, 3, 100, 1000, 1001
- Integers: whole numbers including positive, negative, and zero.
    - Symbol used to represent integers: $\mathbb{Z}$
    - Here are some examples of integers:
        - -3, -2, -1, 0, 1, 2, 3
- Rationals: All numbers that can be written as a fraction. This will be an integer divided by another integer.
    - Symbol used to represent rationals: $\mathbb{Q}$
    - Here are some examples of rational numbers:
        - ¼, 3/40, 10/51, -⅓, -½, 4/1
    - REMEMBER: you cannot divide by zero.
        - 2/0 is undefined and not a rational number even though both 2 and 0 are technically integers.
- Irrationals: Numbers that cannot be written as an integer divided by an integer. They are also numbers that have decimals that do not terminate (end).
    - There is no symbol to represent this set of numbers.
    - Here are some examples of irrational numbers:
        - π, $\sqrt{2}$
- Real: all numbers besides imaginary.
    - Symbol used to represent real numbers: $\mathbb{R}$

Rational and Irrational Numbers

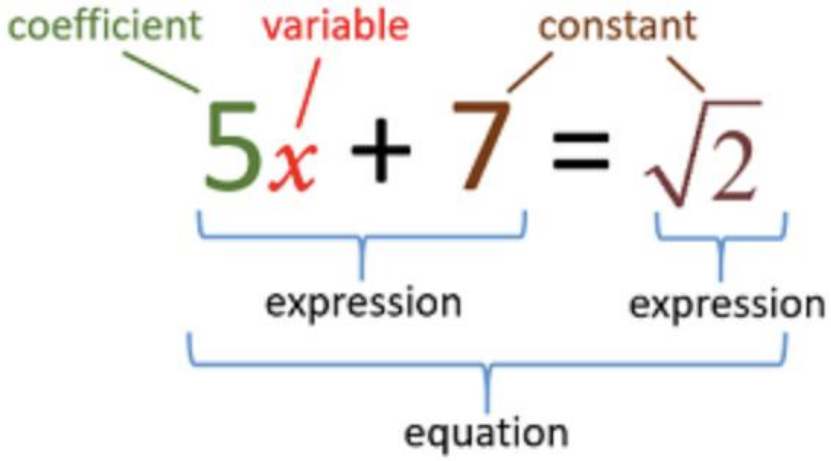
MATH MONKS



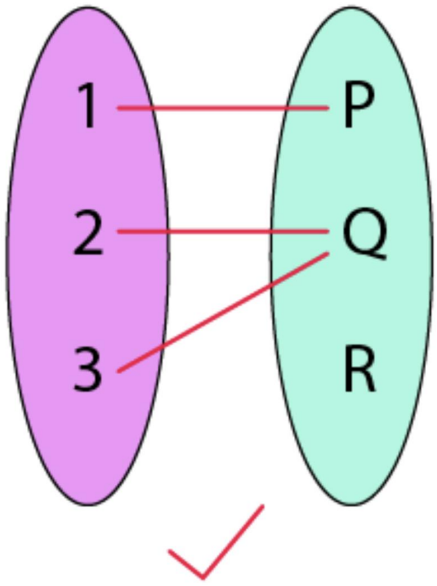
Some words to know:

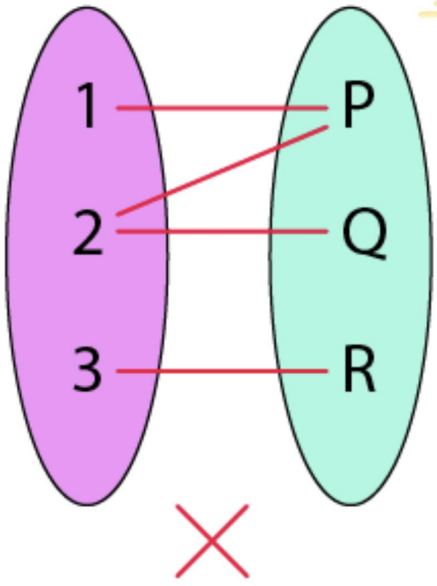
- Vertical: up and down, or what is typically known as the y-axis
- Horizontal: side to side, or what is typically known as the x-axis
- Intercept: a point where a line meets or crosses an axis. You can find these when x or y are zero.
    - x=0 gives us the y intercept
    - y=0 gives us the x intercept
- Domain: how far the graph goes along the horizontal axis. Often represented as x, these are our “inputs” in a function.
- Range: how far the graph goes along the vertical axis. Often represented as y, these are our “outputs” in a function.
- Ordered pair: how a point on a graph is represented. Ex. (x,y)
- Variable: a placeholder often used to represent an unknown number. Anything can be used, but often we see x, y, or z.
- Expression: this is made up of one or more terms.
    - Ex. 2x+4y
- Equation: two expressions that are separated by an equal sign.
    - Ex. 2x+4y=2/3x+7

- Coefficient: the number placed in front of a variable. Even when there is no obvious coefficient in front of a variable there is always 1.
    - Ex. What are the coefficients of the following variables?
        - 2x -> 2
        - 1/4x -> ¼
        - z -> 1
- Constant: a fixed number that does not change.
    - Ex. In the equation definition the constant is 7.



- Function: defines a relationship between two variables. One input cannot have more than one output, but different inputs can have the same output.
    - Ex. Input or x is my test, output or y or f(x) is my grade on the test. I can only get one grade on the test, but me and another student taking this test can have the same grade.





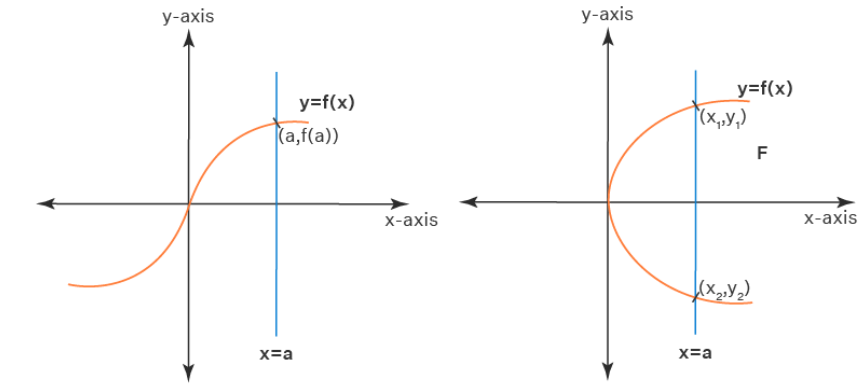
- Quotient: result of division
- Sum: result of addition
- Difference: result of subtraction
- Product: result of multiplication
- Slope: the slope of a line will tell you the steepness of that line. This is found using two points on the graph.
    - Vertical lines have an undefined slope

- Horizontal lines have a zero slope
- Formula of slope:

$$\text{slope} = m = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

- Numerator: the number on top in a fraction
  - The fraction, x/y has a numerator of x
  - For slope it is called the rise, vertical movement of the line.
- Denominator: the number on bottom in a fraction
  - The fraction, x/y has a denominator of y
  - For slope it is called run, horizontal movement of the line.
- Vertical Line Test: when trying to determine if a graph is a function or not, if at any point on the graph you draw a vertical line and it touches your graph at more than one point it is NOT a function.

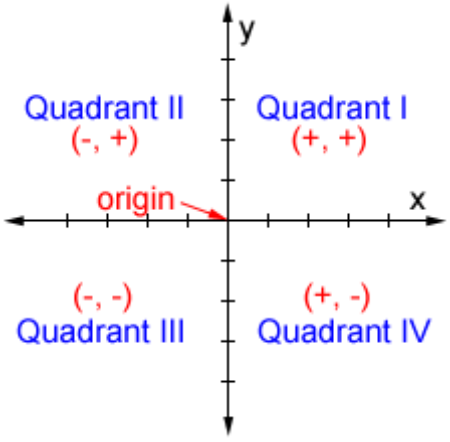
Vertical Line Test



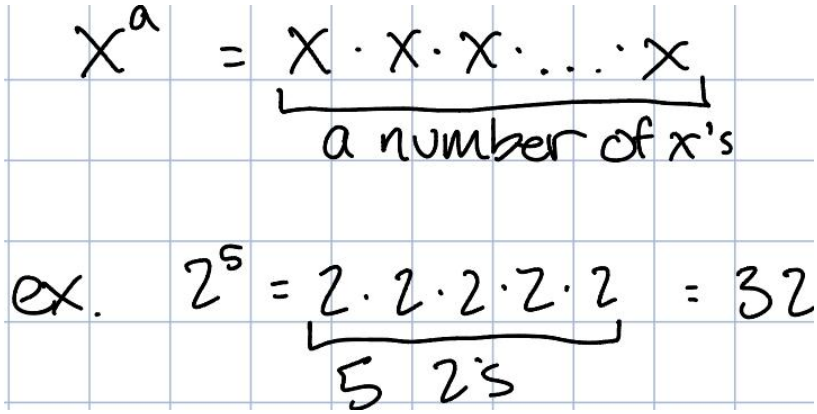
Vertical Line Test- ✓
(It is a function)

Vertical Line Test- X
(Not a function)

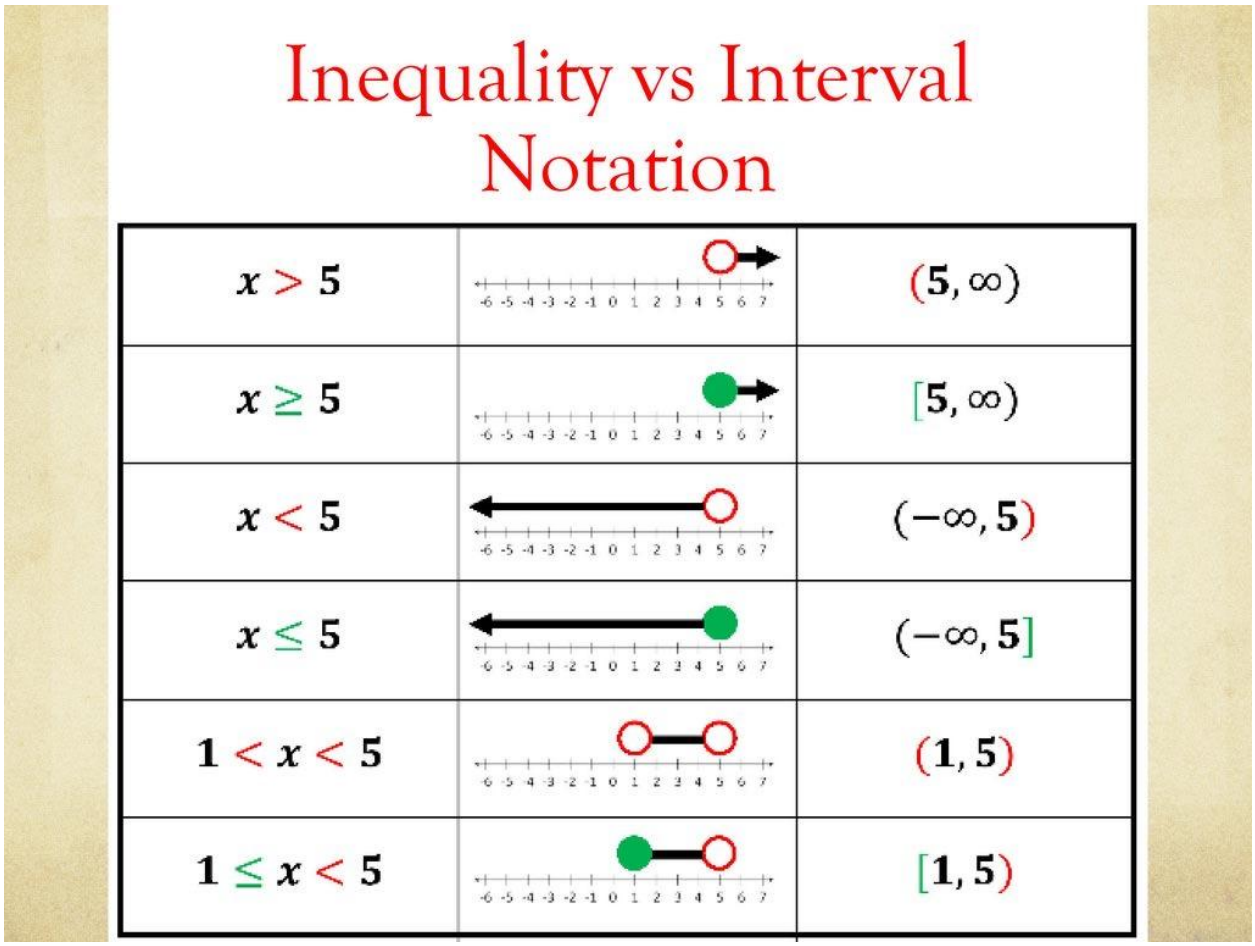
- Quadrants: a graph with 2 axis has 4 quadrants, QI, QII, QIII, QIV.



- Ordered pair: written as (x,y) typically and shows a point on a graph
- Set: a collection of things related to each other, typically grouped with braces { }
- Exponent: the symbol or number written above and to the right of the number, variable, or expression. “x raised to the power of a”



- Linear: something is linear when the highest power in the equation is 1.
    - Typically in the form of y = mx + b
- Intervals and Interval Notation: a set of real numbers
    - Intervals can be shown as an inequality, interval notation, or a line graph.
    - Interval notation is showing the set of numbers between the lowest and highest values.
        - Ex. If 3 < x ≤ 10 the interval notation is (3,10]



Symbols and how to use them:

- Greater than: >
    - When comparing numbers and using this symbol the larger number goes on the left.
- Greater than or equal to: ≥
    - When comparing numbers and using this symbol the number that is larger or equal to the other one goes on the left.
- Less than: <
    - When comparing numbers and using this symbol the smaller number goes on the right.
- Less than or equal to: ≤
    - When comparing numbers and using this symbol the number that is smaller or equal to the other one goes on the right.
- Open dot: ○
    - Used on graphs when showing a point on it that the function gets really close to but never reaches that number exactly.
- Parentheses: ( )
    - These can be used in several ways:
        - Domain and Range when the number next to it is not included in the set, or for infinity.
        - Ordered pairs
        - PEMDAS- parentheses, exponents, division or multiplication, addition or subtraction
    - Symbols that mean the same thing:
        - ( ) = > or < = ○
- Brackets: [ ]
    - How are these used?:
        - Domain and Range when the number next to it is included in the set. Never used for infinity.
    - Symbols that mean the same thing:
        - [ ] = ≤ or ≥ = ●
- Infinity: ∞/-∞
    - Often used to show the Domain or Range of a graph.
    - It is not a number, but an idea. It implies that whatever you are talking about continues forever.
    - Parentheses can be used with infinity but not brackets.
- Dot: ●
    - This is used in place of x for multiplication. Now that we are using variables (often x) in our problems, we will use a closed dot to represent multiplication.
- Plus or Minus/Positive or Negative: ±
    - This represents most often that there is a positive and negative answer. Typically seen when a square root is the answer to our equation.
    - It can also be used to indicate that we want to solve a problem for the sum as well as the difference.
- Division: ÷ or /

    - Both symbols indicate that we need to divide.
- Squaring a variable: x^2 or y^2 or anything to the power of 2
    - This means we want to multiply the variable or number that is being squared by itself.
    - Ex. Let x= 4 x^2= (4)^2= 16
    - Ex. Let x= -1 X^2
- Slope: m
    - Used when trying to find the equation of a line.
    - Rise / Run: the vertical movement / the horizontal movement
- Union: U
    - Used to connect two sets, often used in range and domain when there is a gap in the graph and the numbers between are not included.

Example 3

Describe and algebraically represent the following:

Describe: All real numbers less than -2 or greater than 4

Inequality: $x < -2 \text{ or } x > 4$

Symbolic: $(-\infty, -2) \cup (4, \infty)$

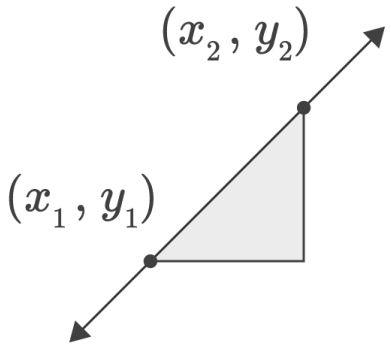
The union or combination of the two sets.

Manipulating Functions:

- f(x): This is read as f of x, x is the input and f(x) (which can also be read as y) is the output.
- f(g(x)) or (f○g)(x): these can be read as f of g of x. In this instance the g(x) function is going to replace our x variable in the f(x) function.
    - CAUTION!!! Do not get this confused with multiplying functions.
    - Ex. f(x)=x^2 g(x)=x+2
        - f(g(x))= f(x+2)= (x+2)^2= x^2+4x+4
        - g(f(x))= g(x^2)= (x)^2+2= x^2+2
- f(x)●g(x): this means we want to know what the product of these two functions is.
- f(x)±g(x): this means we want to know the sum and/or difference of two functions.
- f(x)÷or/g(x): this means we want to know the quotient of two functions.
    - When dividing functions, the function in the denominator CANNOT be equal to 0!

Equations:

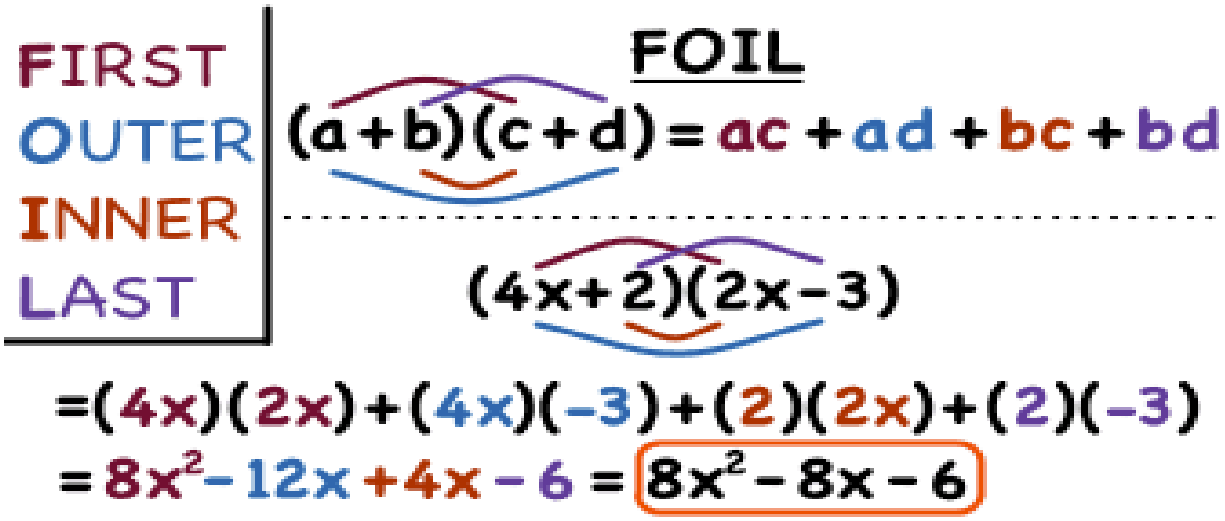
- Equation of a line:
    - y = mx + b
        - y is also written as f(x)
        - m is the slope
        - x is our variable
        - b is our y-intercept
- Speed/Rate:
    - Speed/Rate = distance * time
- Average Rate of Change:
    - [f(b)-f(a)]/(b-a)
        - f(b) is the output with value b, and f(a) is the output with value a
        - a and b are some x value
- Slope of a line:



$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Acronyms:

- PEMDAS: parenthesis, exponents, multiplication, division, addition, subtraction
    - When solving problems we use this to tell us where to start. When it comes to a problem that has both addition and subtraction or multiplication and division we address it from left to right.
        - Ex. 6/2*4-5 = ?
        - This problem will be solved by first dividing 6 by 2 and then multiplying that answer by 4.
- FOIL: first, outside, inside, last
    - This is helpful when an expression is squared, or cubed, etc. or when multiplying expressions together.



Graphing Tips:

- Typically when graphing your horizontal axis will be the x-axis and vertical axis will be the y-axis. A good way to remember this when we start using different variables is:
    - Horizontal Axis: this is the axis of your input
    - Vertical Axis: this is the axis of your output
- When graphing a function the easiest way to begin your graph is to find your x and y intercepts.
    - Ex. (x,0) when y=0 what is x? (0,y) when x=0 what is y?