Notation:

$\forall$ = "for all", "for every"

$\exists$ = "there exists"

$\exists!$ = "there exist a unique"

$\in$ = "is an element of"

Sets of Numbers

set of all counting #'s $\{1, 2, 3, 4, 5, \ldots\}$

Natural Numbers = $\mathbb{N}$

the set of positive & negative (and zero) whole #'s = Integers $= \{\ldots,-3,-2,-1,0,1,2,3,\ldots\}$

allow for subtraction $= \mathbb{Z}$

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the set of all #'s that can be written as fractions = Rational Numbers $= \mathbb{Q}$

= the set of all terminating $(\frac{1}{2} = 0.5)$ or repeating $(\frac{1}{3} = 0.\overline{3})$ decimals

$$\pi = \frac{\text{circle's circumference}}{\text{circle's diameter}}$$

3.14159265358979323
846264338327950
2884197|...

Irrational Numbers

non-terminating, non-repeating decimals

$\sqrt{2}, \sqrt{3}, \sqrt[3]{4}$

Real Numbers $\mathbb{R}$

the set of all #'s that can be written as decimals

Properties of Real #'s

$a+b=b+a$	commutative Property of addition
$ab=ba$	commutative Property of multiplication
$(a+b)+c=a+(b+c)$ $(ab)c=a(bc)$	Associative Property

$a(b+c) = ab + ac$

Distributive Property of Multiplication over Addition

$(a+b)c = ac + bc$

Given a real number x, there exists a unique number $-x$ such that

$$x + (-x) = 0$$

$$-x + x = 0$$

$-x$ is called the <u>additive inverse</u> of x.

0 is the additive identity

$x + 0 = x$

$0 + x = x$

(any real # x remains unchanged under addition by 0)

Subtraction is really just adding an additive inverse

1 is the multiplicative identity

$x \cdot 1 = x$

$1 \cdot x = x$

Given x, its multiplicative inverse is $\frac{1}{x}$

$x \cdot \frac{1}{x} = 1$

$\frac{1}{x} \cdot x = 1$

Properties of Equality

$X = X$ Reflexive Property

If $a=b$, then $b=a$ Symmetric Property

If $a=b$, and $b=c$, then $a=c$.
Transitive property
(Substitution property)