First-order Logic

(1) Consider: "any object is a square iff it is a rectangle with equal length sides"

$P \Leftrightarrow Q$

P = "any object is a square" ← does this make sense?

Q = "..."

$\Rightarrow$ need variables & predicates

$\Rightarrow$ $\text{Square}(x) \Leftrightarrow \text{Rectangle}(x) \wedge \text{Equal Sides}(x)$

predicate, variable

(2) Quantifiers: $\exists$ = "there exists"

$\forall$ = "for all"

e.g. $\exists x : 2x = 4$

$\forall x : \text{Even}(2x)$

additive inverses exist

TRUE $\forall x \, \exists y : x + y = 0$

FALSE $\exists y \, \forall x : x + y = 0$

TRUE $\exists y \, \forall x : x \cdot y = 0$ $y = 0$

Example

- The sum of two integers is even iff both #s even or both #s odd