$f(x) = x^2 + 2$

$f$     function

$f(2)$    integer

$f(x)$    function

I am warm and dry

not a proposition

I am warm ∧ dry

I am dry

Proposal

Proposition

True

False

---

P(x): x is warm

P(me) — Proposition

Predicate

variable

· Proposition w/ blanks

· Prop. Template

· function return T or ⊥

B(x,y): x is better than y

G(x): B(x, nothing)

G(x) means _____

G(sandwich)

G(headache)

$\neg \forall x . P(x) \equiv \exists x . \neg P(x)$

Specific
$\begin{cases} \text{I smile} & S(me) \\ \text{you smile} & S(you) \\ \\ \text{Pres Ryan smiles} & S(ryan) \end{cases}$

~~$S(someone)$~~

general
the whole
set
$\begin{cases} \text{someone smiles} \\ \text{no one smiles} \\ \text{everyone smiles} \end{cases}$

$\neg \forall x . S(x)$

$\exists x . \neg S(x)$

People: $\{ me, \quad you, \quad pes Ryan \}$
$\quad\quad\quad\quad m \quad\quad y \quad\quad P$

exists

$\exists$

| Someone | = | $S(m) \lor S(y) \lor S(P) \lor \dots$ | $\exists x . S(x)$ |

$\forall$

| everyone | = | $S(m) \land S(y) \land S(P) \land \dots$ | $\forall x . S(x)$ |

for all

$\nexists$

| no one | = | $\neg S(m) \textcircled{\land} \neg S(y) \land \neg S(P) \land \dots = \forall x . \neg S(x)$ |

$\neg \exists$

$\neg (someone) \equiv \neg (S(m) \lor S(y) \lor S(P) \lor \dots) = \neg \exists x . S(x)$

universe of discourse

domain: Integers

$P(x)$: x is prime

$$\forall x, \; P(x) \quad \equiv \bot$$

$$\forall x \in \mathbb{Z}. \; P(x) \quad \equiv \bot$$

$O(x)$: x is odd
$E(x)$: x is even

$$\forall x \in \mathbb{Z}. \; \left[ O(x) \lor E(x) \right] \equiv \top$$

$\neg$ first

$\land, \lor, \oplus, \rightarrow, \leftrightarrow$  next

Quantifiers last

$f(x) = x^2$

$g(x) = \sqrt{x}$

$f(2) \, r \, g(4)$

$L(x, y):$ ⊗ likes $y$

$F(x):$ x is famous

I like a famous person

I like x and x is fams

$\exists y. \, L(me, F(y))$

$L(me, T)$

$\forall \Rightarrow$
A  E

mn non         beer wash

$\exists y. \, L(me, y) \land F(y)$