∀ a, b. ears(a, b) → is (a, b)

"Frogs are flies"

I LEARNED TO LEVITATE...
AND ALL I GOT WAS THIS STUPID SHIRT.
\[ f(x) = x + 1 \]

\[ \{ (0, 1), (1, 2), (17, 18), (\pi, \pi + 1), \ldots \} \]

**Answers:**

What is \( x + 1 \)? \[ \rightarrow \text{function} \]

\( Y/N: \) Is \( y = x + 1 \)? \[ \rightarrow \text{relation} \]

\[ \text{function} \quad f(x) \]

\[ \text{relation} \quad y = f(x) \]

\[ \forall f \in \text{functions}. \]

\[ \exists r \in \text{relations}. \]

\( f \) and \( r \) have the same graph.
\( x < y \)

\[ \{ (3, 11), (-11.2, 13), (0.00001, 0.0001), \ldots \} \]

Predicate \( x < y \) is called a relation

\[ L(x, y) : x < y \]

Graph of relation \( R \) is defined as

\[ \text{graph of relation } R = \{ (a, b) \mid a \leq b \} \wedge R(a, b) \}

The set of \( x \) for which \( R(x, y) \) is defined is called its domain.

the set \( \ldots y \ldots \) \( R(x, y) \ldots \ldots \) is called its codomain.

\[ S(x, y) : x > y^2 \]

Are \( x \) in domain \( S \)? Yes

Are \( y \) in domain \( S \)? No
Course is taught by Person.

Symbols

\{2012-001, Sullivan\}, \{2102-002, Technion\}, \{2102-003, Suhl\}.
\( R(x, y) \) is a relation a function?

- Only one \( y \) per \( x \)

\[
f(x) = \frac{1}{x}
\]

\[
f(x) = \sqrt{x} \quad \text{positive sq. root}
\]

A function is \textbf{inversible} if

- At most 1 \( y \) per \( x \)
- At most 1 \( x \) per \( y \)

\[ \text{Total} = \text{defined all of domain} \]

\[ \text{Partial} = \text{not total} \]
inverse Relation

\[ R(x, y) : x < y \quad (2, 3) \]

\[ R^{-1}(x, y) : y < x \quad (3, 2) \]

graph of \( R^{-1} = \{ (y, x) \mid (x, y) \in \text{graph of } R \} \)
Image of \( \{1, 3, 7\} \) under function \( f \) is \( \{2, 4, 8\} \)

\[ f(x) = x + 1 \]
Types

int
float

What is the type of \texttt{sqrt}

\texttt{funcion}

\texttt{static funcion}

double/float

\texttt{array of bits}

\texttt{\gamma = \sqrt{x}}

\texttt{static double \texttt{sqrt} (double x)
type checker
prove types make sense

\[ \text{sqrt} : \mathbb{R} \rightarrow \mathbb{R} \]

Curry - Haskell Isomorphism

\[ (\mathbb{R} \times \mathbb{R}) \rightarrow \mathbb{R} \]
\[ \mathbb{R} \rightarrow (\mathbb{R} \rightarrow \mathbb{R}) \]