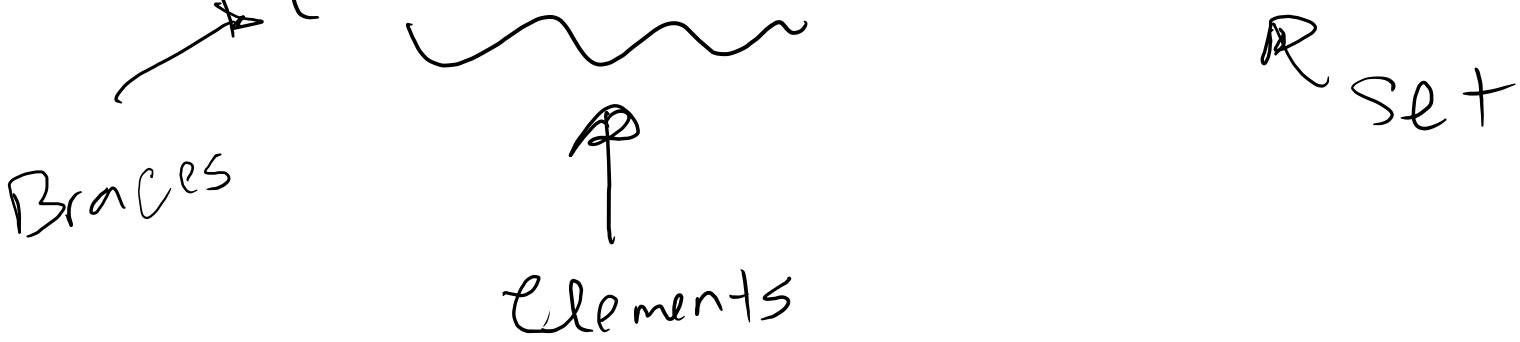
SET Theory

A set is a collection.

$$\{a, b, 1\} = S$$



$\therefore 1 \in S$ $\quad S = \{a, b, 1, 7\}$

$\in$

$\mathbb{N}$ = natural numbers, $\{0, 1, 2, 3 \ldots$

$\mathbb{Z}$ = integers $\quad -1, 2, 9, -4$

$\mathbb{Q}$ — rationals

a/b $\quad 3/7, \; 4/9$

$\mathbb{R}$, $\mathbb{C}$

Set - Roster

$$A = \{a, b, c\}$$

$$B = \{1, 2, 3\}$$

$$C = \{1, 2, 3 \ldots\}$$

Set - Builder

$$D = \{ d \mid d \in \mathbb{Z}, d \geq 4 \}$$

$\mathbb{Z}^+$ positive integers

$\mathbb{Z}^-$, $\mathbb{Z}^{nneg} \equiv \mathbb{N}$

$E = \{2, 4, \ldots\}$

$2 \cdot 1, 6$

$2, 4, 8$ ✗

$\{2, 4, 6 \ldots\}$

$E = \{x^2 \mid x \in \mathbb{Z}\}$

$$\mathbb{Z}^{even} = \{2x \mid x \in \mathbb{Z}, x \geq 0\}$$

$$2 \cdot 0 = 0$$

$$2 \cdot 1 = 2$$

$$\vdots$$

Empty Set!

$$\emptyset = \{\}$$

$$\{0\} \neq \emptyset$$

$$0 \neq \emptyset$$

Cardinality

$$|\{\}| = 0$$

$$|\{1,2,3\}| = 3$$

$$|\{1,2,\{3,4\}\}| = 3$$

$|\mathbb{R}| = ?$

Not with mechanics in this course

$|\{\mathbb{R}\}| = 1$

$\mathbb{R}$

Universal Quantifier

$\forall$ "for all"

$\forall n \in \mathbb{N}$, do something

sum the first 10 integers

$\sum_{n \in N} n$, $N = \{ n \in \mathbb{N}, n \leq 10 \}$

Existential Quantifier

"there exists" or "There exists"

$\exists$

$\exists n \in \mathbb{N}$, s.t. $n' \in \mathbb{N}$, where $n \leq n'$

- $0 \leq 1, 2, 3, 4, 5, \ldots$
- $0 \leq 0$.

improper subsets

$A \subseteq B$ "subset"

$\{1,2\} \subseteq \{1,2,3\}$

$\{1,2\} \subseteq \{1,2\}$

improper

proper subset

$$A \subset B$$

$$\exists\, b \in B \text{ s.t } b \notin A$$

$$\{1,2\} \subset \{1,2,3\}$$

$A \cup B$ set union

$\{1,2,3\} \cup \{a,b,c\} = \{1,2,3,a,b,c\}$

$A \cap B$ set intersection

$\{1,2,3\} \cap \{3,4\} = \{3\}$