

Math 2550-04

8/21/24



Topic 0 - Sets

Def: A set is a collection of objects. The objects in the set are called elements of the set.

If x is in the set S then we write $x \in S$.

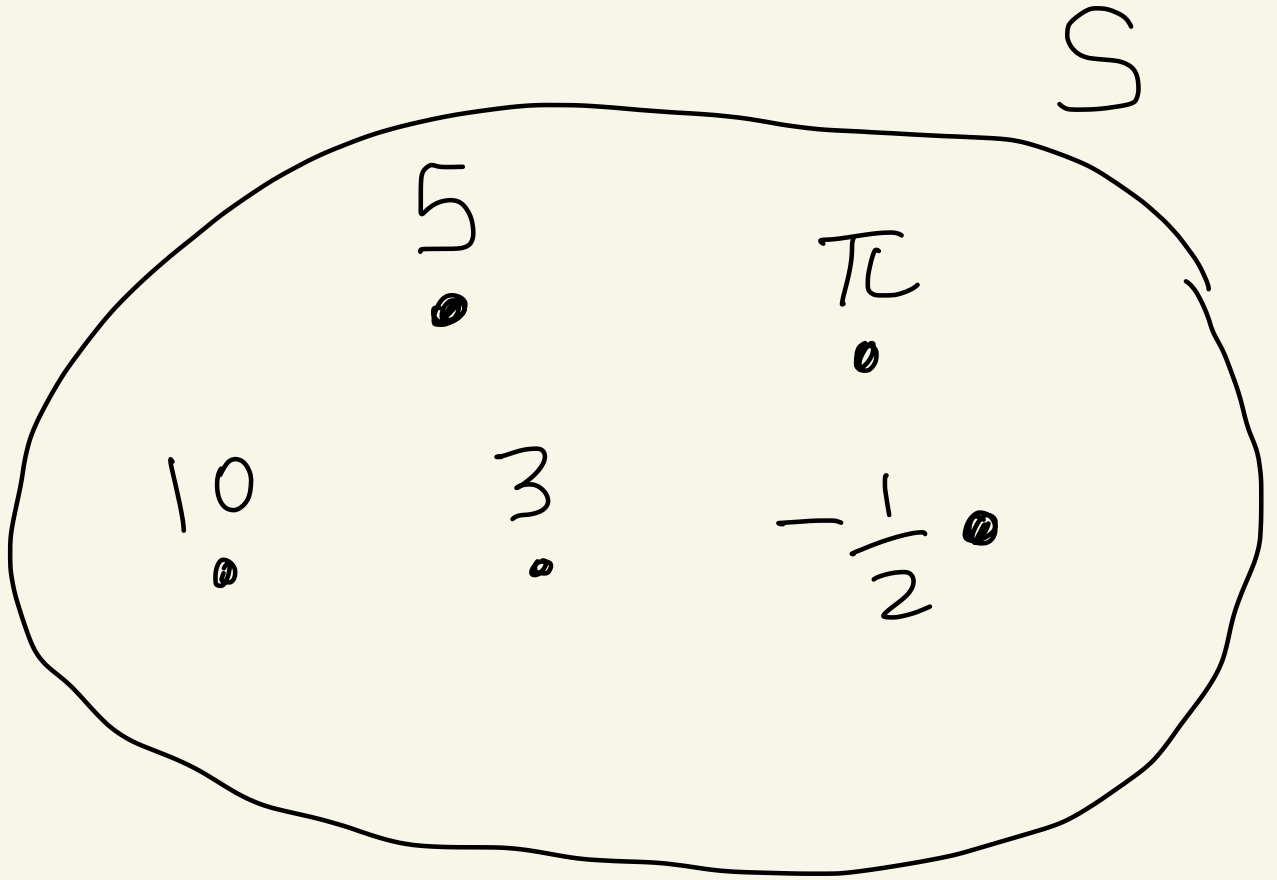
read: "x is in S"

If x is not in the set S then we write $x \notin S$.

read: "x is not in S"

Ex:

$$S = \{5, \pi, 10, 3, -\frac{1}{2}\}$$



$$10 \in S$$

$$47 \notin S$$

Note:

- In a set, order doesn't matter. For example:

$$\{5, \pi, 10, 3, -\frac{1}{2}\}$$
$$= \{\pi, 3, 10, -\frac{1}{2}, 5\}$$

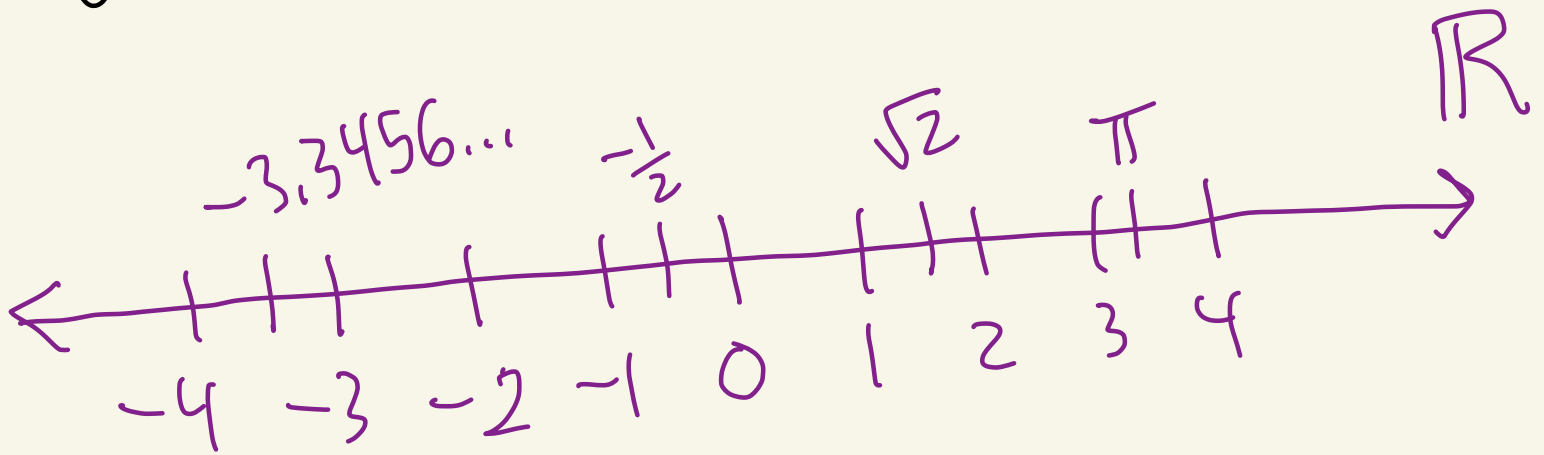
← equal

- You can't have duplicates in a set.

So, $\{2, 5, 2\}$
is not a set.

you
can't
have
2
twice

Ex: \mathbb{R} denotes the set of real numbers. Real numbers are the numbers on the number line with decimal expansions.



$$0 \in \mathbb{R}$$

$$\frac{1}{2} \in \mathbb{R}$$

$$\pi \in \mathbb{R}$$

$$i \notin \mathbb{R}$$

$$i = \sqrt{-1}$$

$$4i \notin \mathbb{R}$$

Notation:

$x, y \in S$ means $x \in S$ and $y \in S$

Ex:

$z, \pi \in \mathbb{R}$ means $z \in \mathbb{R}$ and $\pi \in \mathbb{R}$

Ex:

$5, \frac{1}{2}, 3, 10 \in \mathbb{R}$ means $5 \in \mathbb{R}$
 $\frac{1}{2} \in \mathbb{R}$
 $3 \in \mathbb{R}$
 $10 \in \mathbb{R}$

General way to describe a set

description
of what
the elements
look like

conditions
that the
elements
must satisfy
to be in
the set

Vertical line is read:
"such that"
or "where"

Ex:

$$T = \{ x \mid x \in \mathbb{R} \text{ and } x^2 = 1 \}$$

read: T consists of all x where x is a real number and $x^2 = 1$

Then,

$$T = \{ 1, -1 \}$$

Ex:

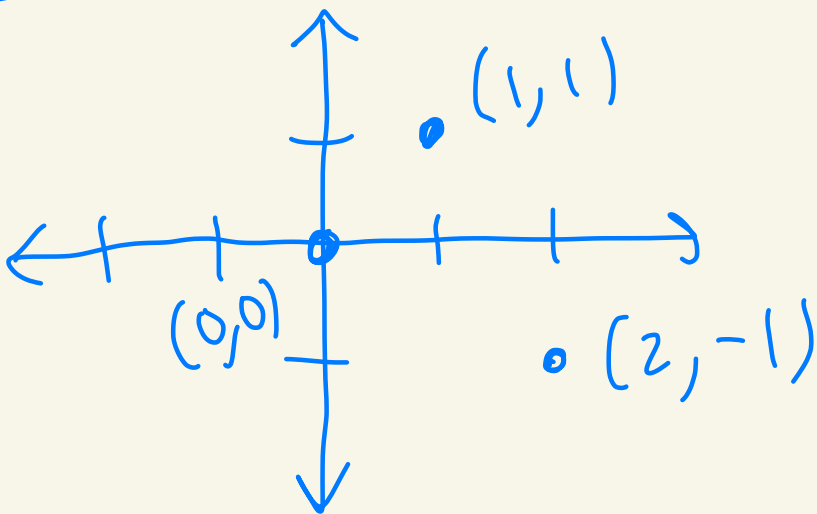
$$S = \{ (x, y) \mid x, y \in \mathbb{R} \}$$

read: S consists of all (x, y) where x and y are real numbers.

Then,

$$S = \left\{ (1, 2), (5, 7), \left(\frac{1}{2}, \pi^2\right), (1.52, -7.1), \dots \right\}$$

S is the xy -plane

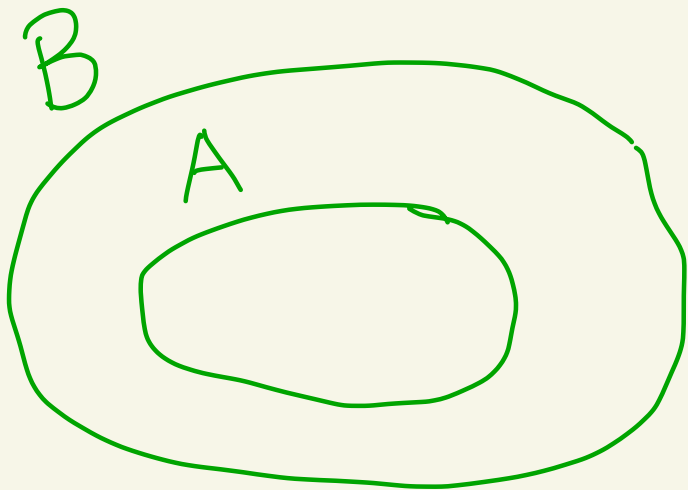


infinately many more

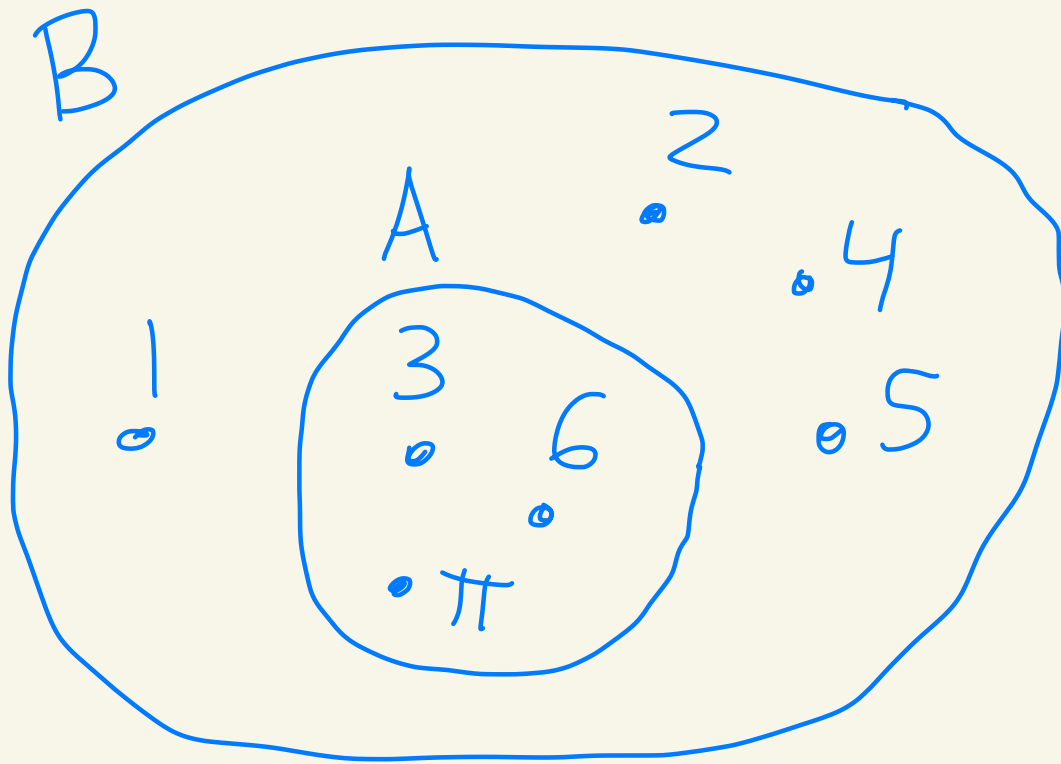
Def: The empty set is the set with no elements. It is denoted by \emptyset or $\{\}$.

Def: Let A, B be sets. We say that A is a subset of B if every element of A is also an element of B . If A is a subset of B , then we write

$$A \subseteq B.$$



Ex: $B = \{1, 2, 3, 4, 5, \pi, 6\}$
 $A = \{6, 3, \pi\}$



We
have
 $A \subseteq B.$