

Math 2550-01

8/21/24

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# Topic 0 - Sets

Def: A set is a collection of objects or elements.

If  $x$  is an element of a set  $S$ , then we write

$x \in S$ .

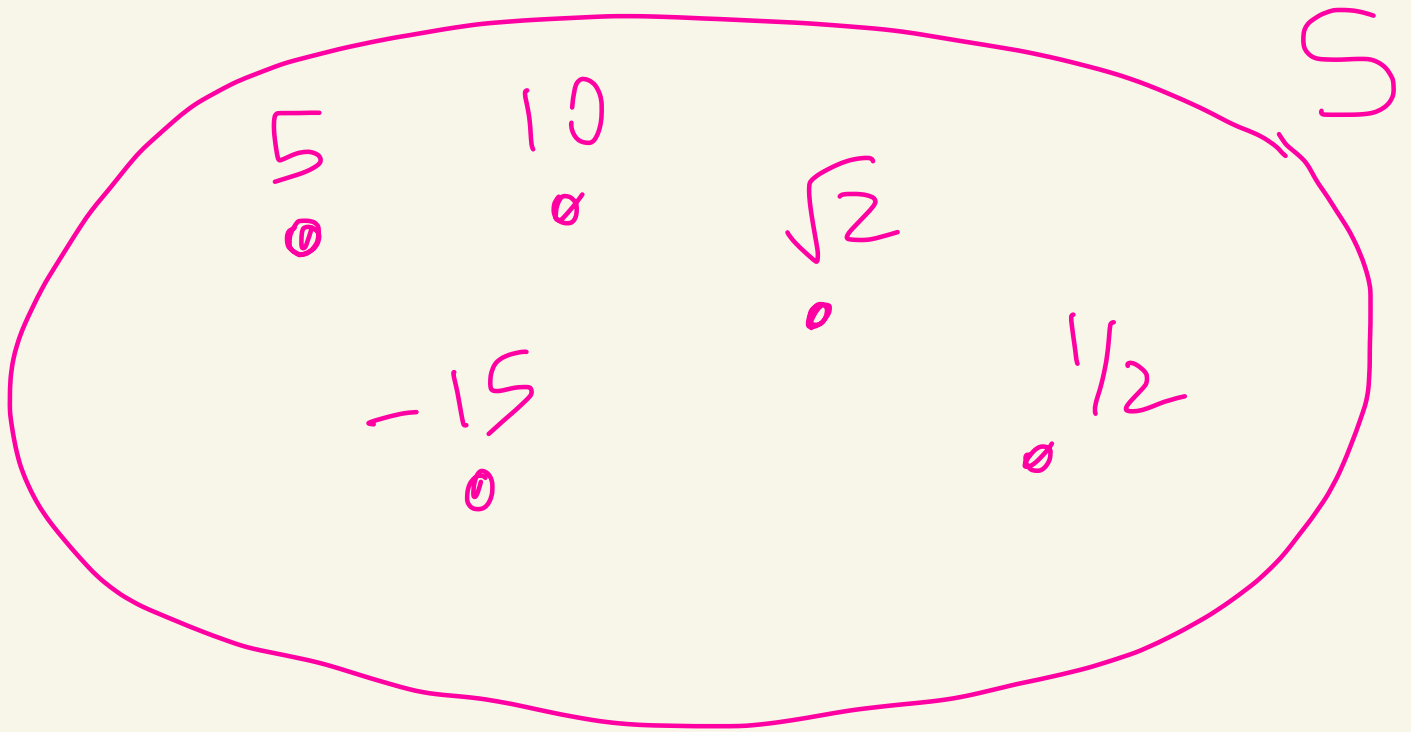
read:

" $x$  is in  $S$ "

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

read: " $x$  is not in  $S$ "

Ex:  $S = \{5, 10, -15, \sqrt{2}, \frac{1}{2}\}$



$$5 \in S$$

$$12 \notin S$$

$$\sqrt{2} \in S$$

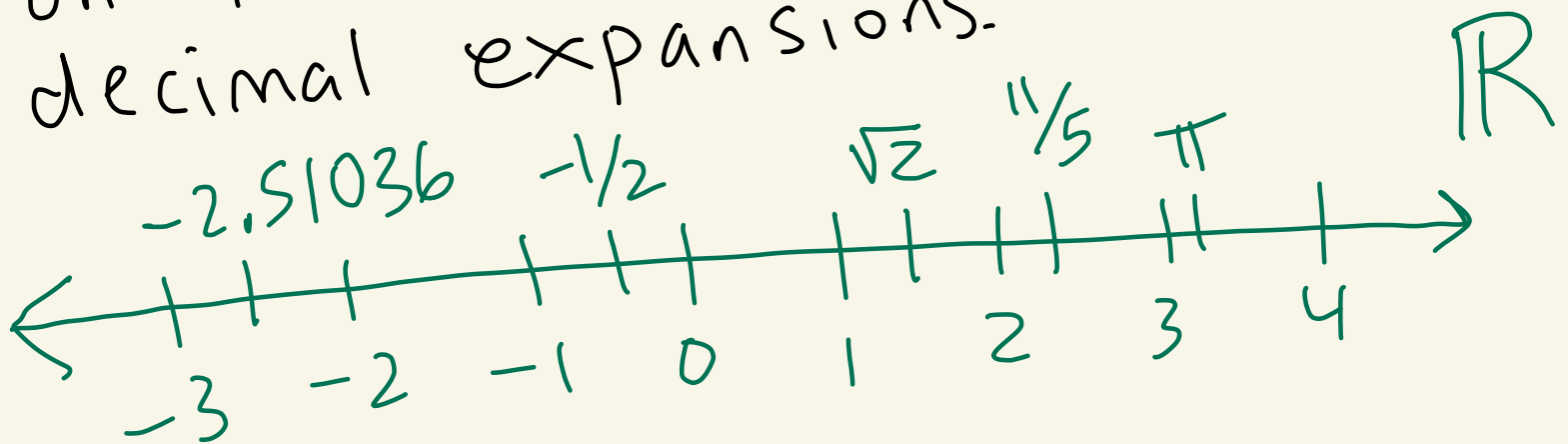
$$1,000,000 \notin S$$

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• In a set the order doesn't matter. For example,  
 $\{5, 10, -15, \sqrt{2}, \frac{1}{2}\} = \{10, \sqrt{2}, \frac{1}{2}, -15, 5\}$

- A set cannot have duplicate elements. So,  $\{1, 2, 1\}$  is not a set because 1 occurs twice.
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Ex: The set of real numbers  $\mathbb{R}$  consists of all the numbers on the number line with decimal expansions.



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

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

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

$$-1/2 \in \mathbb{R}$$

$$-2 \in \mathbb{R}$$

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

## Notation:

$\pi, 0 \in \mathbb{R}$  means  $\pi \in \mathbb{R}$  and  $0 \in \mathbb{R}$

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

## General way to describe a set

{ description of  
what the  
elements look  
like }

{ conditions the  
elements must  
satisfy to  
be in the  
set }

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

Ex:

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

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

$$\text{Then, } A = \{ 1, -1 \}$$

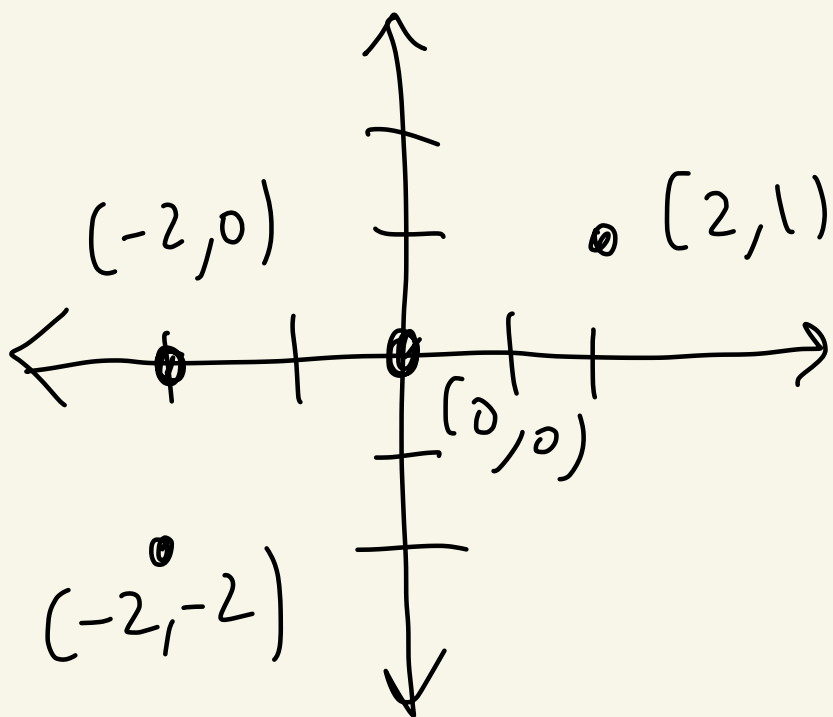
Ex:

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

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

$$= \{ (1, 5), (0, 0), (-1, \pi), \dots \}$$

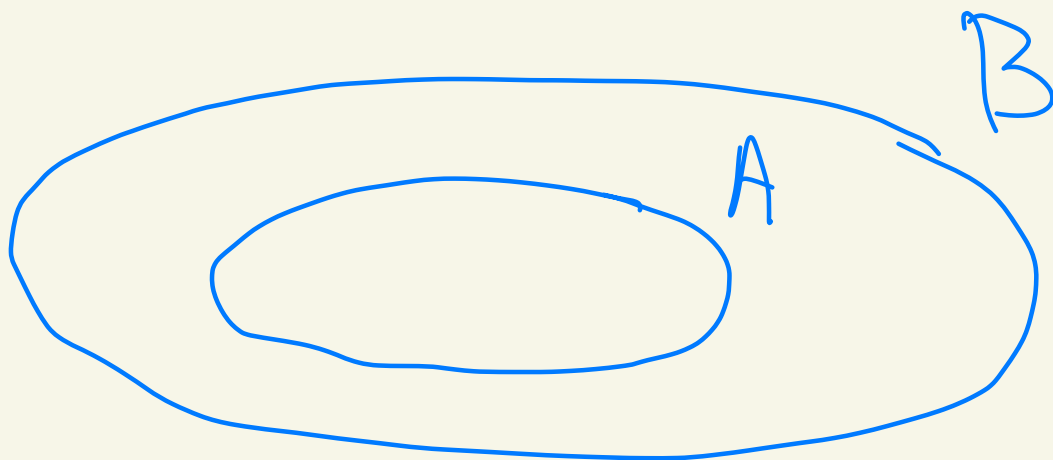
↑  
infinitely many more



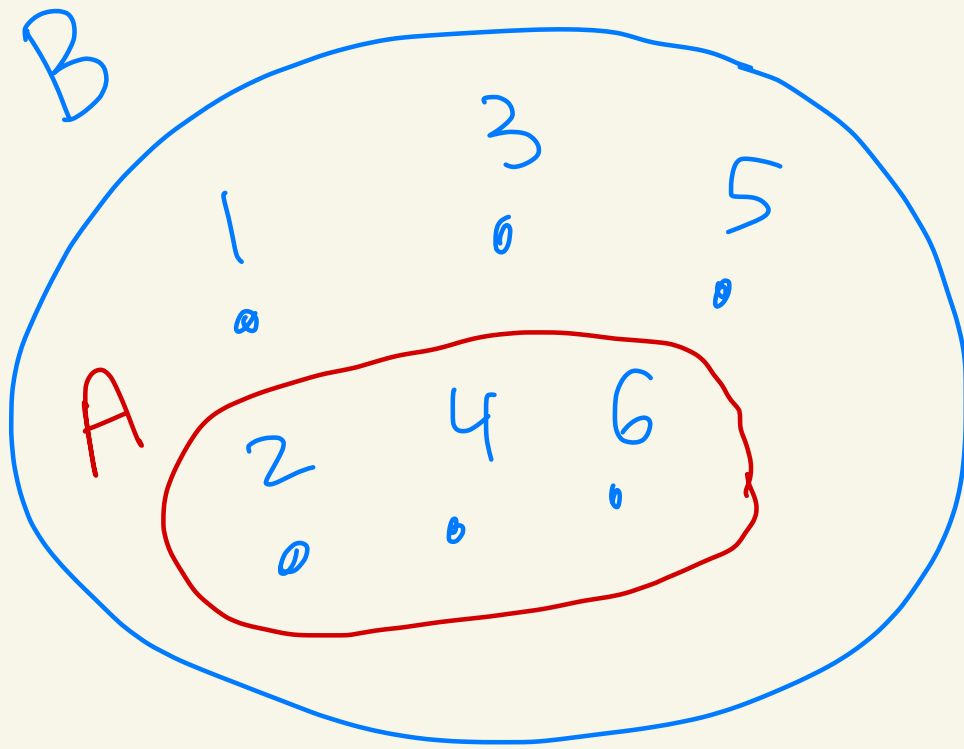
S is  
the  
xy-plane

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Def: Let A and B be sets.  
We say that A is a subset  
of B, and write  $A \subseteq B$ , if  
every element of A is also  
an element of B.



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



We have  
 $A \subseteq B.$