

Math 2550-01

1/25/24

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# Topic 0 - Sets

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

If  $S$  is a set and  $x$  is an element of the set  $S$ , then we write  $x \in S$ .

read: "x is in S"

If  $x$  is not an element of  $S$  then we write  $x \notin S$ .

read:  
"x is not in S"

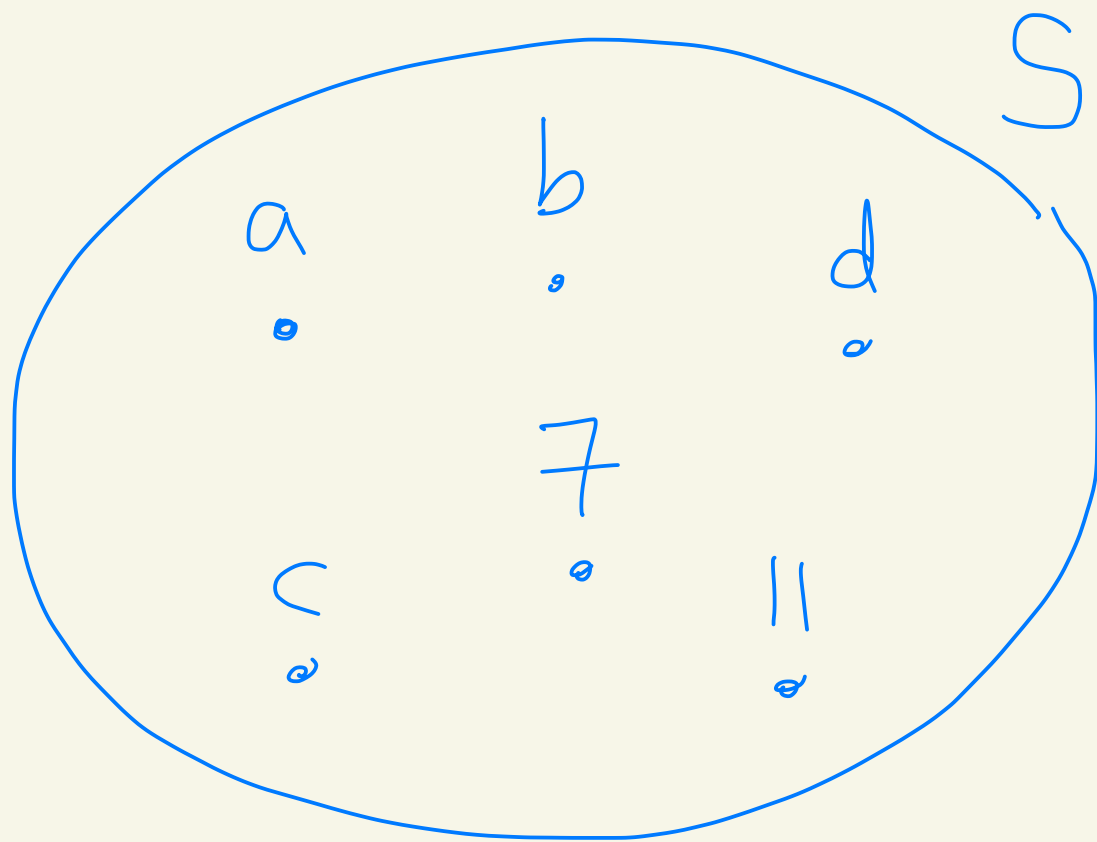
Ex:  $S = \{a, b, c, d, 7, 11\}$

$$a \in S$$

$$11 \in S$$

$$14 \notin S$$

$$\pi \notin S$$




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Note: In a set, order doesn't matter. So,

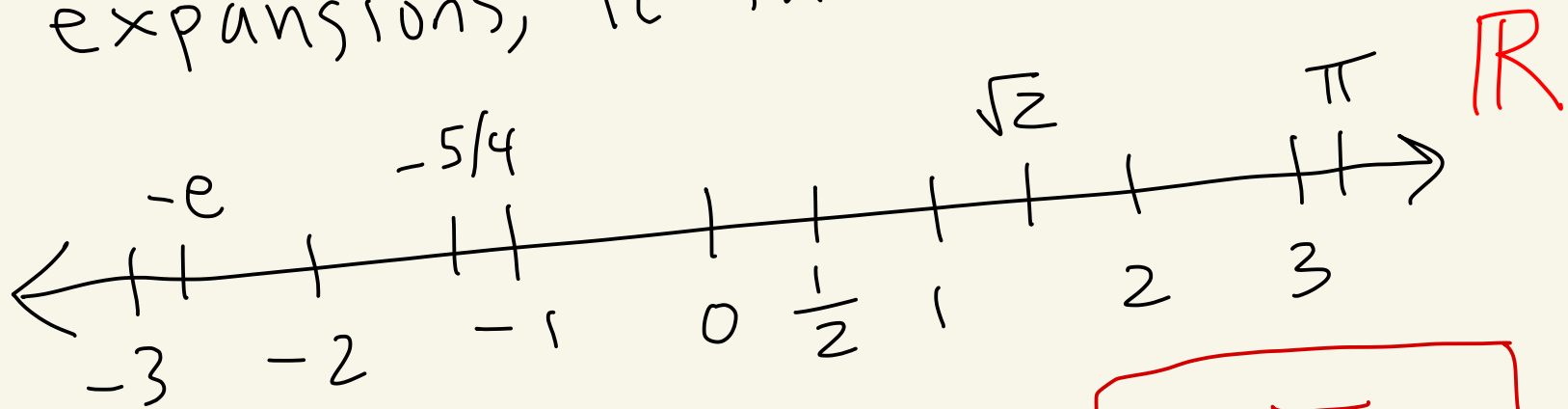
$$\{a, b, c, d, 7, 11\} = \{7, 11, d, a, c, b\}$$

Note: A set can't have any  
duplicates.

So,  $\{1, 1, 2\}$  is not a set.

  
duplicate 1

Ex:  $\mathbb{R}$  denotes the set of real numbers. The real numbers are the numbers with decimal expansions, i.e. the number line.



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

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

$$\frac{2}{3} \in \mathbb{R}$$

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

$$1 + 2i \notin \mathbb{R}$$

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

imaginary  
number

# Notation:

$x, y \in S$  means  $x \in S$  and  $y \in S$   
read: "x and y are in S"

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Ex:  $2, 3 \in \mathbb{R}$

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Ex:  $10, 5, \sqrt{2}, \pi \in \mathbb{R}$

means:  
 $10 \in \mathbb{R}$   
 $5 \in \mathbb{R}$   
 $\sqrt{2} \in \mathbb{R}$   
 $\pi \in \mathbb{R}$

# General way to define a set

description of what elements look like	conditions that the elements must satisfy to be in the set
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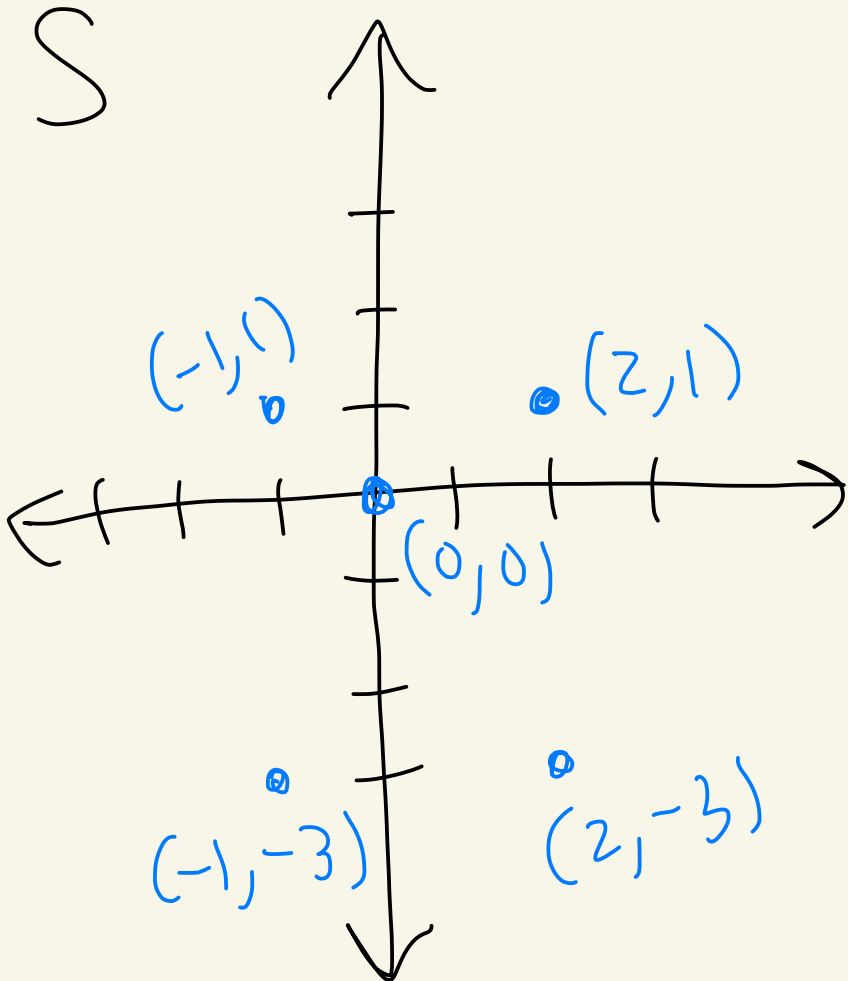
vertical line is read:  
"such that"  
or "where"

Ex:

$$S = \{ (x, y) \mid x, y \in \mathbb{R} \}$$
$$= \{ (x, y) \mid x \text{ and } y \text{ are real \#s} \}$$

read:

"S consists of all elements  $(x, y)$  where  $x$  and  $y$  are real numbers"



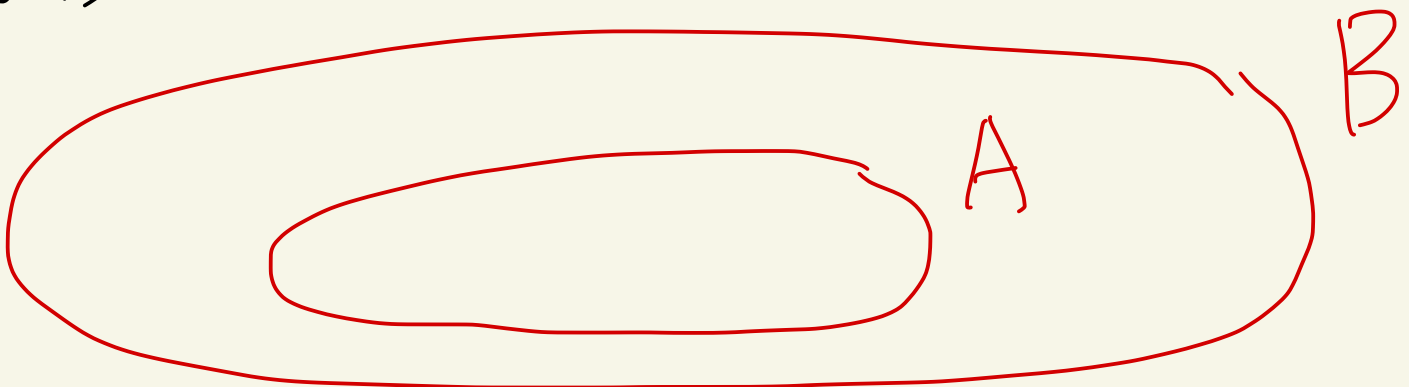


Def: The empty set, denoted by  $\emptyset$  or  $\{\}$ , is defined to be the set with no elements.

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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:  $A = \{4, 8, 12\}$

$$B = \{1, 4, -10, 12, 7, 8\}$$

Then,  $A \subseteq B$ .

