Thurs_01_27

Thursday, January 27, 2022 2:41 PM

Reminders

1. Sections 1.1, 1.2, 1.3 due on MyMathLab on Fri 01/28

1. Exam 1 on 02/15

   It will cover sections 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4

SET Theory – Chap 2

2.1 Terminologies and symbols

You cannot do math without set theory

Naive Set Theory – Paul Halmos

Build mathematics

Today, we will talk about the numbers we use in a math class

Definition

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

Sets are designated using the following methods

1. Word description
2. Listing method
3. Set builder notation

Examples

1. The set of students in math 1010-002 (word description)
2. Bag = {Notebook, pen, keys, phone} listing method
3. $\{x \mid x \text{ is even and } x > 2\}$ Set builder Notation

{x such that x is even and x is greater than 2}

Exercise

re-write the set in (3) above using listing method

$\{4, 6, 8, 10, 12, \ldots\}$

Most of what we know in set theory is due to Georg Cantor

We use uppercase letters to denote the name of a set and lowercase letters to denote the elements of a set

$$A = \{a, b, e, f\} \quad , \quad B = \{a, b, c, \dots, z\}$$

$$M = \{a, b, c, \dots\}$$

Empty Set - A set containing no elements

(Null set, $\{\}$, $\emptyset$)

Exercise

1. Set of Counting numbers between 3 and 10

$$\{4, 5, 6, 7, 8, 9\}$$

2. $\{7, 8, \dots, 12\}$

$$\{7, 8, 9, 10, 11, 12\}$$

3. $\{x \mid x \text{ is a counting number between } 0 \text{ and } 1\}$

$$\{\}, \emptyset$$

Aside

Counting numbers, we mean numbers in increment of 1

Example of a set that is not well defined

Suppose G is a set of good singers

and Kapoor is a Singer

The Symbol $\in$ (member of)

Example

$A = \{1, 2, 3, 4\}$ $\quad 1 \in A$ $\quad$ (1 is a member of A)

Decide True / False

(1) $4 \in \{1, 2, 3, 4, 5, 6, 7\}$ True

(2) $\frac{1}{6} \in \{\frac{1}{3}, \frac{1}{4}, \frac{1}{5}\}$ False

Consider $B = \{2, 4, 6, 8\}$, $3 \notin B$ (3 is not a member of B)

Numbers

Natural Numbers - Counting numbers $\{1, 2, 3, 4, 5, \ldots\}$

Whole Numbers - $\{0, 1, 2, 3, 4, 5, \ldots\}$

Integers - $\{\ldots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \ldots\}$

Rational Numbers - $\{\frac{p}{q} \mid p \text{ and } q \text{ are integers and } q \neq 0\}$

Examples $\frac{2}{3}, \frac{1}{4}, \frac{2}{5}, \ldots$

Real

Numbers - $\{x \mid x$ is a number that can be expressed as a decimal$\}$

Irrational Numbers - $\{x \mid x$ is a real number that cannot be expressed as a quotient of two integers$\}$

Cardinal number or Cardinality of a Set } This is the number of distinct elements in a set

If A is a set, $n(A)$ is the cardinality of set A

Example

1. $A = \{1, 2, 3, 5\}$, find $n(A) = 4$
2. $B = \{1, 1, 2, 3, 3\}$, find $n(B) = 3$

Finite Set - This is a set whose cardinality is an whole number

Examples, ϕ

Infinite Set - This is a set that is not finite

Example A set of all odd counting numbers

$\{1, 3, 5, 7, 9, \ldots\}$

Equality of a Set

Question when are two sets equal ?

Suppose we have sets A and B, we say

$A = B$ IF

(1) every element in A is in B

(2) every element in B is in A

Example

$A = \{1, 0, 1, 5, 3, 3\}$ $\quad B = \{0, 1, 3, 5\}$

every element in A is in B

every element in B is in A

Exercise

State true / False

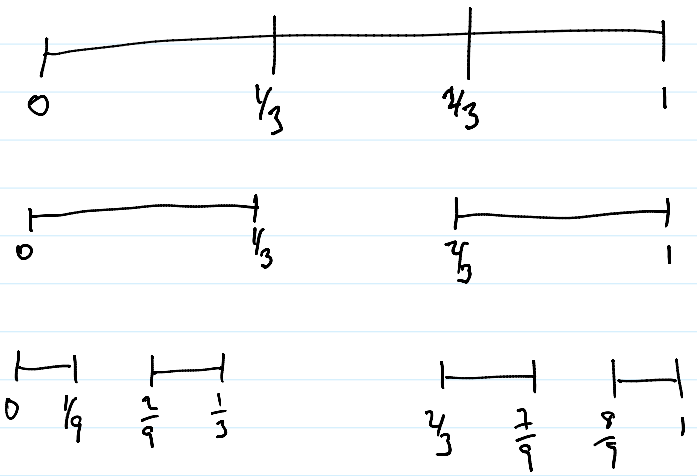
$A = \{2, 4, 6, 8, 10, 12\}$, $B = \{2, 4, 8, 10\}$, $C = \{4, 10, 12\}$

(4) $4 \in A$ True

(5) $5 \in C$ False

Georg Cantor

Cantor Set



I know $0, \frac{1}{3}, \frac{2}{3}, 1, \frac{1}{9}, \frac{2}{9}, \ldots$