

MATH240 – Lecture 1

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January 3, 2023

1 Set Theory

$A = \{0, 1, 5\}$ finite set with 3 elements

1.1 \in (is element of)

Notation: $x \in A \rightarrow x$ is element of A

ex:

$$0 \in A \quad 42 \notin A$$

1.2 Set by extension

$$\emptyset = \{\}$$

$$\mathbb{N} = \{0, 1, 2, \dots\}$$

$$\mathbb{Z} = \{\dots, -2, -1, 0, 1, 2, \dots\}$$

$$\mathbb{Q} = \text{Rational numbers (fractions)} = \{0, \frac{1}{2}, \frac{2}{3}, 5, \frac{-42}{11}, \dots\}$$

1.3 Set by comprehension

Notation: $A = \{x \in U \mid P(x) \text{ is true}\}$ ex:

$$\text{even numbers: } E = \{\dots, -4, -2, 0, 2, 4, \dots\}$$

$$= \{x \in \mathbb{Z} \mid x = 2n \text{ for some } n \in \mathbb{Z}\}$$

$$\text{odd numbers: } O = \{\dots, -3, -1, 3, \dots\}$$

$$= \{x \in \mathbb{Z} \mid x = 2n + 1 \text{ for some } n \in \mathbb{Z}\}$$

$$\text{also: } = \{n + 1 \mid n \in E\}$$

$$= \{x \in \mathbb{Z} \mid x = n + 1 \text{ for some } n \in E\}$$

$$\text{rational numbers: } \mathbb{Q} = \{\frac{a}{b} \mid a \in \mathbb{Z}, b \in \mathbb{Z}, b \neq 0, b > 0, GCD(a, b) = 1\}$$

1.4 Subsets

If every element of set A is also element of set B , then A is subset B
Notation: $A \subseteq B$