MAT2440, Classwork16, Spring2025

ID:_____ Name:_____

1. Definition of A Set:

A Set is an **unordered** collection of **distinct** objects. It is common for sets denoted using uppercase letters. Each object is called members or elements of the set and denoted using lowercase letters.

2. Let $\boldsymbol{A}$ be a set and $\boldsymbol{a}$ and $\boldsymbol{b}$ be two elements. Then we have $\boldsymbol{a} \in \boldsymbol{A}$ means "a" is an element of A (belongs to) or a belongs to A. _____ and $\boldsymbol{b} \notin \boldsymbol{A}$ means b is not an element of A. b doesn't belong to A

3. Unordered and Distinct:

Unordered: $V = \{a, e, i, o, u\}$ $=$ $\{a, i, u, o, e\}$.

Distinct: T= $\{1, 3, 5, 7, 9\}$ $=$ $\{1, 3, 3, 3, 5, 5, 5, 5, 5, 7, 7, 7, 7, 7, 7, 9\}$.

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

4. Let $\boldsymbol{A}$ and $\boldsymbol{B}$ be two sets. Then we say $\boldsymbol{A}$ and $\boldsymbol{B}$ are **equal**, denoted by $A = B$, if and only if $\forall x(x \in A \leftrightarrow x \in B)$.

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

5. How to describe a set: Roster Method and Set Builder → $\{1, 2, 3, \cdots, 98, 99\}$

Roster Method: listing all the elements of a set when this is possible.

Set builder: stating the properties of the elements in the set.

such that $\{x \mid$ (notation) x has property P$\}$ $\{x \mid 0 < x < 100$, and x is an integer$\}$

6. Describe the set of odd positive integers less than 10 by (a) roster method, and (b) set builder.

(a) $\{1, 3, 5, 7, 9\}$

(b) $\{x \mid x$ is an odd integer, $0 < x < 10\}$

7. Some commonly used sets notations:

$\mathbb{N} =$ $\{0,1,2,3,\cdots\cdots\}$, the set of all natural numbers.

$\mathbb{Z} =$ $\{\cdots\cdots,-2,-1,0,1,2,\cdots\}$, the set of all integers.

$\mathbb{Z}^+ =$ $\{1,2,3,4,\cdots\cdots\}$, the set of all positive integers.

$\mathbb{Q} =$ $\{\frac{a}{b} \mid a\in\mathbb{Z}, b\in\mathbb{Z}, b\neq 0\}$, the set of all rational numbers

$\mathbb{R} =$ $\{x \mid x \text{ is a real number}\}$.

$\mathbb{C} =$ $\{x \mid x \text{ is a complex number}\}$.

8. The elements of a set can be sets:

Let $A = \{1\}, B = \{1,2\}$, and $C = \{1,2,3\}$. Then $S = \{A,B,C\} =$ $\{\{1\},\{1,2\},\{1,2,3\}\}$.

9. The Empty Set $\emptyset$:

If a set has no element, then it is called the empty set, or null set. It is denoted by $\emptyset$, and $\emptyset =$ $\{\}$.

10. The **Finite** Set and its **Cardinality**: $S=\{1,3,5,7,9\}$ and the cardinality of S is 5

Let ***S*** be a set. If there are exactly n **distinct** elements in S where n is a nonnegative integer, we say that ***S*** is a finite set and ***n*** is the cardinality of ***S***, and is denoted by $|S|$. Otherwise, it is an infinite set if it is not finite.

11. Find the cardinalities for the given finite sets:

(a) If A is the set of odd positive integers less than 10, then $|A| =$ 5.

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

(b) If S is the set of letters in English alphabet, then $|S| =$ 26.

$\{a,b,c,d,\cdots,x,y,z\}$

(c) The empty set $\emptyset$: $|\emptyset| =$ 0.

(d) If $E = \{\emptyset\}$ which is a set whose element is an empty set, then $|E| =$ 1.

$= \{\{\}\} = \{\emptyset\}$