Introduction to Real Numbers and Sets

Objective A: Using Inequality and Absolute Value Symbols with Real Numbers

Definitions:

- **Set**: It is a collection of objects that we call elements.

Numbers Classification:

- **Natural (N)**: It is comprised by all nonzero positive numbers.
- **Whole (W)**: Included all positive numbers and zero.
- **Integers**: It includes Whole numbers plus negative numbers.
- **Rational (R)**: Numbers that include the division of two integer numbers.
- **Irrational (I)**: Numbers that have decimal representation that neither terminate nor repeat.
- **Real Numbers**: Rational and Irrational Numbers.

The Absolute Value of a number is its distance from zero on the number line. Its symbol is \(| |\).

\[-4 \text{ is 4 units from zero}\]

Note: \(| -4 | = 4\)

Objective B: To Write Sets Using the Roster Method and Set-Builder Notation

1. **Roster Method**: It consists of writing a set, which encloses the list of the elements of the set in braces.

   **EX**:  
   - \(\{0,1,2,3,…\}\) Infinite Sets
   - \(\{-4,-3,0,2,3\}\) Finite Sets.
   - \(\{\}\) or \(\emptyset\) Empty Set or Null Set.

2. **Set-Builder Notation**: The numbers are written in terms of a reference variable, and in terms of an inequality notation.

   **EX**: Write a set of integers that are greater than -3 and smaller than 5.

   \(\{X | -3 < X < 5, X \in \text{integers}\}\)
Graphing: Numbers can be also be graphed on the real number line.

Graph of \( \{X \mid -3 < X < 5, X \in \text{integers}\} \).

Graph of \( \{X \mid X \geq -3, X \in \text{integers}\} \).

**Objective C: To Perform Operations on Sets and Write Sets in Interval Notation**

- Union: Union of Sets are written as \( A \cup B \). It includes set of all elements that belong to either set A or set B.

  EX: Given \( A = \{2,3,4\} \), and \( B = \{-5,-2,3,4\} \). The Union of A and B:

  \[ A \cup B = \{-5,-2,2,3,4\} \]

- Intersection of Two Sets: Written \( A \cap B \), is the set of all elements that are common to both set A and B.

  EX: Given \( A = \{2,3,4\} \), and \( B = \{-5,-2,3,4\} \). The Intersection of A and B:

  \[ A \cap B = \{3,4\} \]

There are two different notations in which sets can be expressed:

1. **Graph:**

   Ex: Graph \( \{x \mid x > -1\} \cap \{x \mid x < 4\} \)

   ![Graph of \{x \mid x > -1\} \cap \{x \mid x < 4\}](image)

   Some Sets can be expressed using interval notation:
2. Sets can be also be expressed using **Interval notation**.

<table>
<thead>
<tr>
<th>Set Notation</th>
<th>Interval Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ x \mid -3 &lt; x &lt; 2}</td>
<td>(-3,2)</td>
</tr>
<tr>
<td>{ x \mid -3 \leq x \leq 2}</td>
<td>[-3,2]</td>
</tr>
</tbody>
</table>

**Objective D: To Use Venn Diagrams**

Definitions:

**Subset**: Symbolized by $\subseteq$, it indicates that a certain smaller set of numbers is included in a bigger set of numbers.

EX: Let $A = \{1,3,5,7,13\}$, and $B = \{\text{odd numbers}\}$.

Because every element of set $A$ is also element of $B$, then $A \subseteq B$.

Every set is a subset of itself.

**Empty set**: A set that doesn’t have any elements.

The empty set and the entire set are subsets of any set!

**Universal Set**: It is the set of all elements that are studied.

Ex: If we study students at San Antonio College, then the universal set is all the students that are taking classes at San Antonio College.

**Venn Diagram**: A visual exhibit showing the universal set and its various subsets.

EX:

![Venn Diagram](image-url)
Set I: Students that are taking a Math Class
Set II: Students that are taking a Geography Class.
Set III: Students that are taking a Math and a Geography class (I ∩ II)
Set IV: Students that are taking a History Class.
Set (I-III): Students that are taking only Math.
Set (II-III): Students that are taking only Geography.
Empty Set (I ∩ IV or II ∩ IV).
Universal Set: All the students.