**Real Numbers and the Number Line** Guide Notes

**REAL NUMBERS** are the set of numbers that is formed by combining the rational numbers and the irrational numbers.

- **Irrational Numbers**
  - Π, e, \( \frac{22}{7}, \sqrt{2}, \sqrt{3}, \sqrt{7}, \frac{3}{4}, \frac{27}{11}, 9i, -2, -1, 0, 1, 2, 3 \)

- **Rational Numbers**
  - \( \frac{3}{4}, \frac{27}{11}, 9i, -2, -1, 0, 1, 2, 3 \)

- **Non-Integers**
  - \( \frac{3}{4}, \frac{27}{11}, 9i \)

- **Integers**
  - \( ..., -3, -2, -1, 0, 1, 2, 3, ... \)

- **Whole Numbers**
  - \( 0, 1, 2, 3, 4, 5, 6, ... \)

- **Negative Numbers**
  - \( ..., -5, -4, -3, - \)

- **Natural Numbers**
  - \( 1, 2, 3, 4, 5, 6, 7, 8, ... \)

**IRRATIONAL NUMBERS** are the set of all numbers whose decimal representation are neither terminating nor repeating. It cannot be expressed as a quotient of integers.

**RATIONAL NUMBERS** are the set of all numbers which can be expressed in the form \( \frac{a}{b} \), where \( a \) and \( b \) are integers and \( b \) is not equal to 0, written \( b \neq 0 \). It can be expressed as terminating or repeating decimals.

**NON-INTEGERS** are the set of all numbers that is neither a positive whole number, nor a negative whole number, nor zero. These include decimals, fractions, and imaginary numbers.

**INTEGERS** are the set of numbers formed by positive whole numbers, negative whole numbers, and zero.

**NEGATIVE NUMBERS** are numbers less than zero and usually mean a value that is a deficit or shortage.

**WHOLE NUMBERS** are the set of numbers formed by adding 0 to the set of natural numbers.

**ZERO** denotes the absence of all magnitude or quantity.

**NATURAL NUMBERS** are used for counting.
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**Sample Problem 1:** Determine which of the numbers given below are:

\[ -0.2, 1, 0.\overline{4}, 0.717717717771..., \pi, 3, 7, 41, 56 \]

A. **Integers**  
1, 3, 7, 41, 56

B. **Rational Numbers**  
-0.2, 1, 0.4, 3, 7, 41, 56

C. **Irrational Numbers**  
0.717717717771..., \( \pi \)

D. **Real Numbers**  
-0.2, 1, 0.4, 3, 7, 41, 56, 0.717717717771..., \( \pi \)

E. **Natural Numbers**  
1, 3, 7, 41, 56

F. **Non-integers**  
-0.2, 0.4

**NUMBER LINE** is used to show the sets of natural numbers, whole numbers, and integers. Also, it can be used to show the set of rational numbers. The point that corresponds to a number is the **graph** of the number, and drawing the point is called **graphing** the number or **plotting** the point.

**Integers**

- **Whole Numbers**
  - **Natural Numbers**

- **Negative Numbers**
- **Positive Numbers**

**Sample Problem 2:** Graph the numbers \(-2.4\) and \(\frac{3}{2}\) on the number line.

**Sample Problem 3:** Graph the numbers \(-4\) and \(-6\) on the number line and write two inequalities that compare the two numbers.
Real Numbers and the Number Line

**Sample Problem 4**: Graph the numbers $-1, 3, 0, 2, \frac{3}{4}, -\frac{1}{2}$ and $-2.6$ on the number line and write the numbers in increasing order.

-2.6, -1, $-\frac{1}{2}$, 0, $\frac{3}{4}$, 2, 3

**ABSOLUTE VALUE** of a real number is the distance between the origin and the point representing the real number. The symbol $|x|$ represents the absolute value of a number $x$.

$|-5| = 5$

The distance of -5 to the origin is 5 units.

$|5| = 5$

The distance of 5 to the origin is 5 units.

**Sample Problem 5**: Evaluate and graph the numbers $|2.5|$ and $\left| -\frac{1}{2} \right|$ on the number line.

$|2.3| = 2.3 \text{ units}$

$\left| -\frac{1}{2} \right| = \frac{1}{2} \text{ units}$