**THE SET OF REAL NUMBERS**

When we were young, we were taught how to count using the set of counting numbers.

**{1, 2, 3, 4, 5, 6, …}**

Little did we know that numbers too have different types. The tree diagram below shows the different types numbers and how each kind is related to one another.



**REAL NUMBERS**

Apparently, any number that you can think of are called **REAL NUMBERS**. These are the set of numbers that is formed by combining the **rational numbers** and the **irrational numbers**.

**Examples:**

**REAL NUMBERS can be IRRATIONAL or RATIONAL.**

**IRRATIONAL NUMBERS**

**Irrational** means “**not rational**”. These are the set of all numbers whose decimal representation are neither terminating nor repeating. It cannot be expressed as a quotient of integers. These numbers cannot be expressed as a ratio of two numbers

**Examples:**

**RATIONAL NUMBERS**

These are the set of all numbers which can be expressed in the form: , where and are integers and is not equal to , written as . It can be expressed as **terminating** or **repeating** decimals.

**Examples:**

**RATIONAL NUMBERS can be NON-INTEGERS or INTEGERS.**

**NON-INTEGERS**

These 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**.

**Examples:**

**INTEGERS**

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

**Examples:**

**INTEGERS can be NEGATIVE or WHOLE NUMBERS.**

**NEGATIVE INTEGERS**

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

**Examples:**

**WHOLE NUMBERS**

These are the set of numbers formed by adding **0** to the set of **natural numbers** (also called as counting numbers).

**Examples:**

**WHOLE NUMBERS include ZERO and POSITIVE INTEGERS.**

**ZERO**

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

**POSITIVE INTEGERS**

These are the set of numbers that include all **natural numbers** (also known as **counting numbers**)

**Examples:**

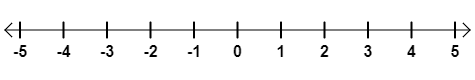
**Sample Problem 1**: Look at the numbers inside the box and classify each according to the type of number described.

|  |  |  |
| --- | --- | --- |
| **a.** | **Real Numbers** |  |
| **b.** | **Irrational Numbers** |  |
| **c.** | **Rational Numbers** |  |
| **d.** | **Non-Integers** |  |
| **e.** | **Integers** |  |
| **f.** | **Negative Integers** |  |
| **g.** | **Whole Numbers** |  |
| **h.** | **Positive Integers** |  |

**REAL NUMBERS ON THE NUMBER LINE**

A **NUMBER LINE** is a straight line with numbers written in equal intervals. It can be used to show the sets of **real numbers** composed of **rational** and **irrational numbers**. On a **REAL NUMBER LINE**:

* There is a point that corresponds for every real number.
* There is a real number for each point.



**0.5**

**-2**

**-4.75**

**OPPOSITES**

The idea of opposites used in real-life can include, but are not limited to the following:

**Direction**

North or South

**Length**

Long Short or South

**Size**

Big or Small

**Temperature**

Warm or Cold

**Height**

Tall or Short

**Altitude**

Low or High

**Quantity**

Many or Few

**Color**

Bright or Dark

In Mathematics, on the other hand, OPPPOSITES are denoted by the following signs:

**Negative Sign**

This symbol is written before a number that is negative.

**Example:** is read as “**negative 7**”

It is very important to write that symbol before a negative number to indicate that it is negative.

**Example:** **-10** is read as “**negative 10**”

**Positive Sign**

This symbol is written before a number that is positive.

**Example:** is read as “**positive 7**”

If there no sign before a number, then that number is considered positive.

**Example:** **7** is understood to be “**positive 7**”

**Also, ZERO IS NEITHER POSITIVE NOR NEGATIVE.**

**REPRESENTATIONS OF OPPOSITES IN REAL LIFE**

|  |  |
| --- | --- |
| **POSITIVE** | **NEGATIVE** |
| An increase of $1 is denoted by . | A decrease of $1 is denoted by -. |
| Walking 10 steps north is denoted by | Walking 10 steps south is denoted by |
| An increase of 6 degrees in temperature is  denoted by . | A decrease of 6 degrees in temperature is  denoted by -. |
| 5 feet above sea level is denoted by . | 5 feet below sea level is denoted by . |
| A deposit of $5000 denotes . | A withdrawal of $5000 denotes -. |

**Sample Problem 2**: Represent the following with integers.

|  |  |  |
| --- | --- | --- |
| a. | A weight loss of 7 kilograms | **-7** |
| b. | Walking 10 blocks north | **+10** |
| c. | 225 meters below sea level. | **-225** |
| d. | Going up the stairs by 6 steps | **+6** |
| e. | The temperature drops 5 degrees | **-5** |
| f. | Losing 10 points in a game | **-10** |
| g. | Moving a table 5 meters forward | **5** |
| h. | A debt of $10,000 | **-10,000** |

**INTEGERS ON THE NUMBER LINE**

Integers, composed of negative whole numbers, positive whole numbers and zero, can be graphed or plotted on a number line.

The starting point of a number line is at its origin, at **ZERO**.

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**-1**

**-2**

**-3**

**-4**

**-5**

**-6**

**-7**

**-8**

**-9**

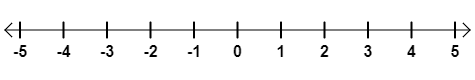
**Negative Intgers**

**Positive Integers**

**POSITIVE INTEGERS** on the number line are the integers that are found to the right of zero. As the number line extends to the right of zero, the integers increase.

**NEGATIVE INTEGERS** on the number line are the integers that are found to the left of zero. As the number line extends to the left of zero, the integers decrease.

**is four units away to the right of 0.**



**is four units away to the left of 0.**



**INCREASING**

**DECREASING**

**Sample Problem 3**: Graph the real numbers and on the number line and write the numbers in increasing order.

**Solution:**

**0**

**1**

**2**

**3**

**4**

**-1**

**-2**

**-3**

**-4**

**Sample Problem 4**: Plot the integers and on the number line and write two inequalities, using the symbols > or <, that compare the two numbers.

**Solution:**

**-4**

**-3**

**-2**

**-1**

**0**

**-5**

**-6**

**-7**

**-8**

**Sample Problem 5**: Arrange the real numbers below in descending order.

**Solution:**

**ABSOLUTE VALUE OF A REAL NUMBER**

**ABSOLUTE VALUE** of a real number is the **distance between the origin and the point representing the real number**. The symbolrepresents the absolute value of a number.

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**-1**

**-2**

**-3**

**-4**

**-5**

**-6**

**5 units**

**5 units**

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

**Sample Problem 6**: Evaluate and graph the numbers and on the number line.

**units**

**2.5 units**

**0**

**1**

**2**

**3**

**4**

**-1**

**-2**

**-3**

**-4**

**Sample Problem 7**: Determine the value of each.

|  |  |  |
| --- | --- | --- |
| a. |  | 0.25 |
| b. |  | 9 |
| c. |  |  |
| d. |  | 11 |
| e. |  | 32 |