
MODULE 2

2.1 Number Line and Absolute Value

In this lesson, we will learn the concept of negative numbers, and their positions on the number line. We will also learn the concept of absolute value.

2.1.1 Positive and Negative Numbers

Negative numbers are regularly used in every day life. For example:

- The stock market lost 30.2 points yesterday.
- Today's temperature is 10 degrees below zero.
- Mr. Smith overdrew his bank account by \$50.
- The wreck of Titanic is 12,420 feet under water.
- A company lost \$2 million dollars last year.

Each of the above situations can be modeled by a negative number. For example, if today's temperature is 10 degrees below zero, we say the temperature is -10 degrees.

We use the word *integers* to represent the set $\{\dots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \dots\}$. We use a number line to visualize numbers. For example, Figure 2.1 shows the integer -1 on the number line.

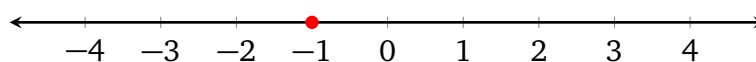


FIGURE 2.1: -1 on the number line

On a number line, the right is the positive direction, and the left is the negative direction. A bigger number is always located to the right side of a smaller number.

Let's quickly review two inequality symbols:

- The symbol " $>$ " is read as "greater than". For example, $2 > 1$ is read as "two is greater than one."
- The symbol " $<$ " is read as "less than". For example, $1 < 2$ is read as "one is less than two."

Look at the number line in Figure 2.2 with four numbers marked:

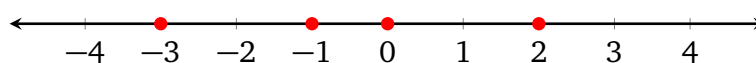


FIGURE 2.2: -3 , -1 , 0 and 2 on the number line

We can observe the following relationship:

- $2 > -3$ since 2 is located to the right of -3 ;

- $0 > -1$ since 0 is located to the right of -1 ;
- $-1 > -3$ since -1 is located to the right of -3 .

Putting together those four numbers, we have $2 > 0 > -1 > -3$. Notice that:

- Positive numbers are bigger than 0 and negative numbers.
- The number 0 is bigger than negative numbers.
- Compare $3 > 1$ and $-1 > -3$. This is because, on the number line, 3 is located to the right of 1, and -1 is located to the right of -3 .

2.1.2 Absolute Value

The absolute value of a number is the distance between the number and 0 on the number line.

How far is the number 2 from 0 on the number line? The distance is obviously two units, so the absolute value of 2 is simply 2.

Similarly, the distance between -2 and 0 on the number line is also two units, so the absolute value of -2 is 2.

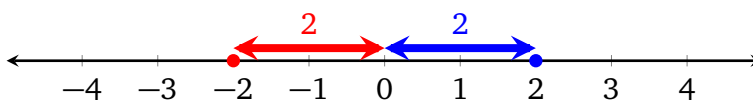


FIGURE 2.3: Absolute Value of 2 and -2

Here is how we write absolute value with its math symbol:

- The absolute value of 2 is 2, written as $|2| = 2$.
- The absolute value of -2 is 2, written as $|-2| = 2$.

Here are a few examples:

$$|0| = 0$$

$$|-1| = 1$$

$$-|1| = -1$$

The absolute value of 0 is simply 0, because the distance between 0 and 0 on the number line is 0.

Note the difference between the last two examples. Absolute value can change a negative number to positive, as long as the number is inside the absolute value symbol, as in $|-1| = 1$.

However, absolute value cannot affect the negative symbol outside the absolute value symbol, as in $-|1| = -1$.