

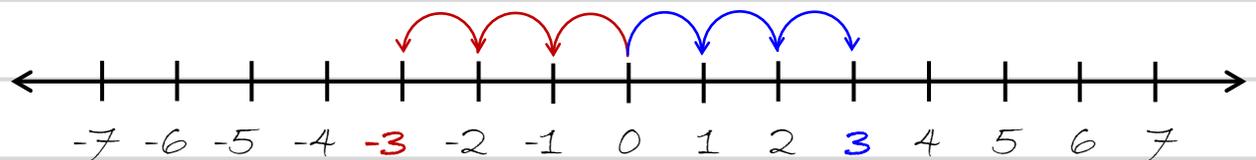
Absolute Value

Objective 1 Understand the Meaning of Absolute Value

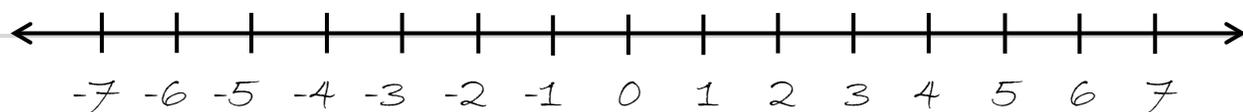
Absolute value is a mathematical representation of distance on the number line.

The mathematical symbol for absolute value is $| \quad |$.

The absolute value of three, written $| 3 |$ represents its distance from 0 on the number line.



On the number line above, notice that -3 is a distance of three units from zero on the number line. Similarly, 3 is also a distance of three units from zero on the number line. In both cases, their absolute values will both equal positive 3. Remember, that we always express distance as a positive quantity. You would never say that the distance from your home to the library is **negative** five miles, would you?



To mathematically represent the distance between -3 and 0 on the number line, we would write $|-3|$ which is said, "the absolute value of negative three".

Finally, we can state that $|-3| = 3$. Similarly, we can state that $|3| = 3$. Notice that both answers are positive! In fact, absolute value answers will always be positive since they represent distances!

Example 1: Evaluate each absolute value.

a) $|-8|$

e) $|-30|$

b) $|8|$

f) $|30|$

c) $|0|$

g) $|-1|$

d) $|14|$

h) $|-100|$

Note: Absolute values should be treated as a grouping symbol in the order of operations. Therefore, you must evaluate the absolute value before moving on with the problem.

Secondly, you must simplify the expression inside the absolute value before you can evaluate it.

Example 2: Find the value of each expression below.

$$a) |5 \cdot 4| + 3$$

$$|20| + 3$$

$$20 + 3$$

$$23$$

$$b) |-3 - 4| - 8$$

$$c) \left| \frac{30}{6} \right|$$

$$d) -4|-2^2 - 3| - 5$$

$$-4|-4 - 3| - 5$$

$$-4|-7| - 5$$

$$-4 \cdot 7 - 5$$

$$-28 - 5$$

$$-33$$

$$e) -8|(-4)^2 - 3^2| + 6$$

Answer the following homework questions.

In Exercises 1 - 6, find the value of each expression.

1) $10 - |-5 - 2|$

4) $-9 - |-4 - 7| - 8$

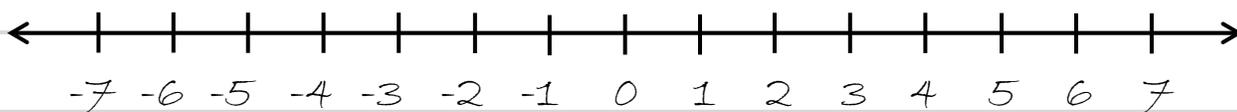
2) $|-4 - 6^2|$

5) $|-2^2 - 3^2|$

3) $5^2 |-4^2 + 3|$

6) $-4 |-3^2 - (2 - 3)^2|$

Objective 2 Understand the Opposite of a Number



On the number line, numbers that are the same distance from zero on opposite sides are called "opposite numbers". -3 and 3 are opposites of each other since they are both a distance of three from zero.

The sum of two opposite numbers is always zero! This is why sometimes they are called "Additive Inverses" of each other.

$$-3 + 3 = 0$$

Example 3: Find the opposite of the given quantity. Note: You must first evaluate the absolute value before you find the opposite.

a) -12

b) 12

c) -8

d) 10

e) $|-2|$

f) $|3|$

g) x

h) $-x$

When you look at a number line, you may realize that the opposite of any negative number is always positive!

Most calculators have an opposite key on the key pad. The calculator key should have a “±” symbol on it or it could have a “(-)” symbol. In either case, pressing this key will always give you the opposite of what displayed on the screen. Give it a try!

Later we will find that multiplying a number by -1 is how we calculate the opposite of a number. Actually, when you press the “±” key on the calculator, it simply multiplies whatever is on the screen by -1 .

So if -3 is displayed on your calculator screen and then you press the “±”, positive three will be displayed. This means that

$$-1(-3) = 3$$

This is why a “negative \cdot negative = positive”!

Answer the following homework questions.

7) What number is its own opposite?

8) What is the opposite of the absolute value of negative 2?

9) What is the opposite of negative 2?

10) What is the opposite of positive 2?

11) Why do all negative numbers have opposites that are positive?

12) How do you tell which calculator key is the opposite key? What does this key do to the number that is displayed on the screen?

In Exercises 13 - 16, find the opposite of the given quantity.

Note: You must first evaluate the absolute value before you find the opposite.

13) $(-7 - 3)$

15) $|-4^2 - 10|$

14) $(-4 - 1^{10})$

16) $|-3^2 - 2^2|$