

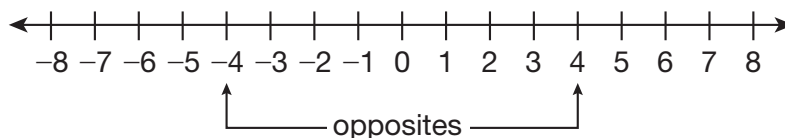
# Absolute Value



## Getting the Idea

The **absolute value** of a number is its distance from 0 on a number line. Since a distance must be either a positive number or zero, the absolute value of a number is always a positive number or zero. The absolute value of a number  $x$  is written as  $|x|$ .

The integers  $-4$  and  $4$  are opposites. You can use the number line below to see that each number is the same distance from 0. So,  $|-4| = 4$  and  $|4| = 4$ .



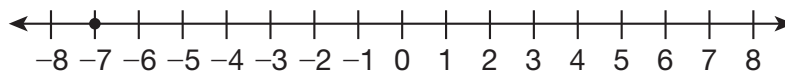
## Example 1

Find the value of  $|-7|$ .

**Strategy** Use a number line.

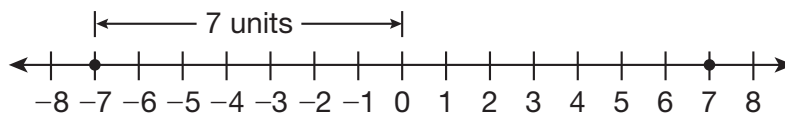
**Step 1**

Plot a point for  $-7$  on a number line.



**Step 2**

Count the number of units from  $-7$  to 0.



The distance is 7 units.

$$|-7| = 7$$

**Solution**  $|-7| = 7$

You can use absolute values to represent and help you understand real-world situations.

For example, if a diver is 20 meters below the ocean's surface, that depth, in meters, can be shown as  $-20$  meters. But the distance the diver would have to swim to get to the surface of the water cannot be represented by a negative number. You can use absolute value instead. The diver must swim  $|-20|$  meters, or 20 meters, to reach the surface.

## Example 2

Hannah wrote a check for more money than she has in her bank account. The balance in her account is now  $-\$60$ . How much does Hannah owe the bank, in dollars?

**Strategy** Use an absolute value to represent the situation.

### Step 1

Is the amount she owes a positive or negative number?

The balance in Hannah's account is  $-\$60$ , but she cannot owe the bank a negative amount of money.

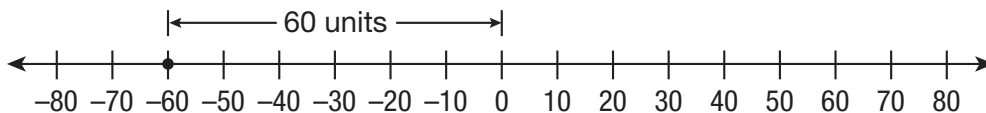
The amount Hannah owes must be shown as a positive number.

### Step 2

Use an absolute value.

The amount she owes, in dollars, is  $|-60|$ , or 60.

The number line below shows that Hannah owes the bank  $\$60$ .



**Solution** Hannah owes the bank  $\$60$ .

Absolute values can also help you understand situations in which an exact number is not known.

### Example 3

A team of mountaineers has climbed to the summit of Mount Everest. The temperature at the summit is less than  $-15^{\circ}\text{F}$ . Describe how many degrees Fahrenheit below  $0^{\circ}\text{F}$  the temperature is.

**Strategy** Use an absolute value to represent and understand the situation.

**Step 1**

Is the number of degrees below  $0^{\circ}\text{F}$  a positive or negative number?

An actual temperature may be negative, but the number of degrees Fahrenheit below  $0^{\circ}\text{F}$  must be a positive number.

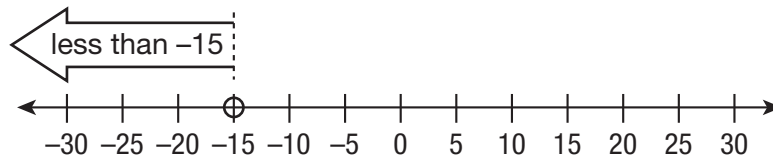
**Step 2**

Use a number line to represent the situation.

The temperature is *less than*  $-15^{\circ}\text{F}$ .

On a number line, a number less than  $-15$  is to the left of  $-15$ .

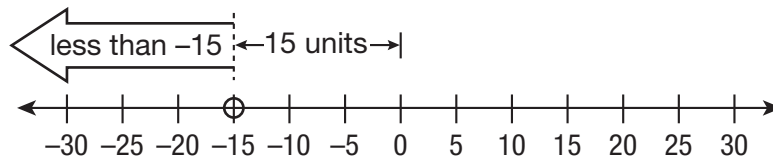
The arrow below shows all the numbers less than  $-15$ .



**Step 3**

Use absolute value to describe the number of degrees Fahrenheit below  $0^{\circ}\text{F}$ .

$$|-15| = 15$$



All the numbers *less than*  $-15$  are *more than* 15 units from 0.

So, if the temperature is *less than*  $-15^{\circ}\text{F}$ , it is *more than*  $15^{\circ}\text{F}$  below  $0^{\circ}\text{F}$ .

**Solution** The temperature at the summit is more than  $15^{\circ}\text{F}$  below  $0^{\circ}\text{F}$ .

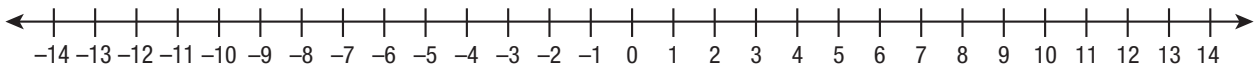


## Coached Example

Yesterday, Marcus bought two different stocks, A and B, each at the same price. From yesterday to today, the change in the price of Stock A was  $-\$12$ , and the change in the price of Stock B was  $\$9$ . From yesterday to today, which stock's price changed by the greatest amount?

The price change with the greatest \_\_\_\_\_ is the greatest change.

On the number line below, plot points for  $-12$  and  $9$ .



Count the units from each integer to 0 to determine its absolute value.

$$|-12| = \underline{\quad}$$

$$|9| = \underline{\quad}$$

Which number has the greater absolute value,  $-12$  or  $9$ ? \_\_\_\_\_

The stock with the price change of \_\_\_\_\_ dollars changed by the greatest amount.

That stock was Stock \_\_\_\_\_.