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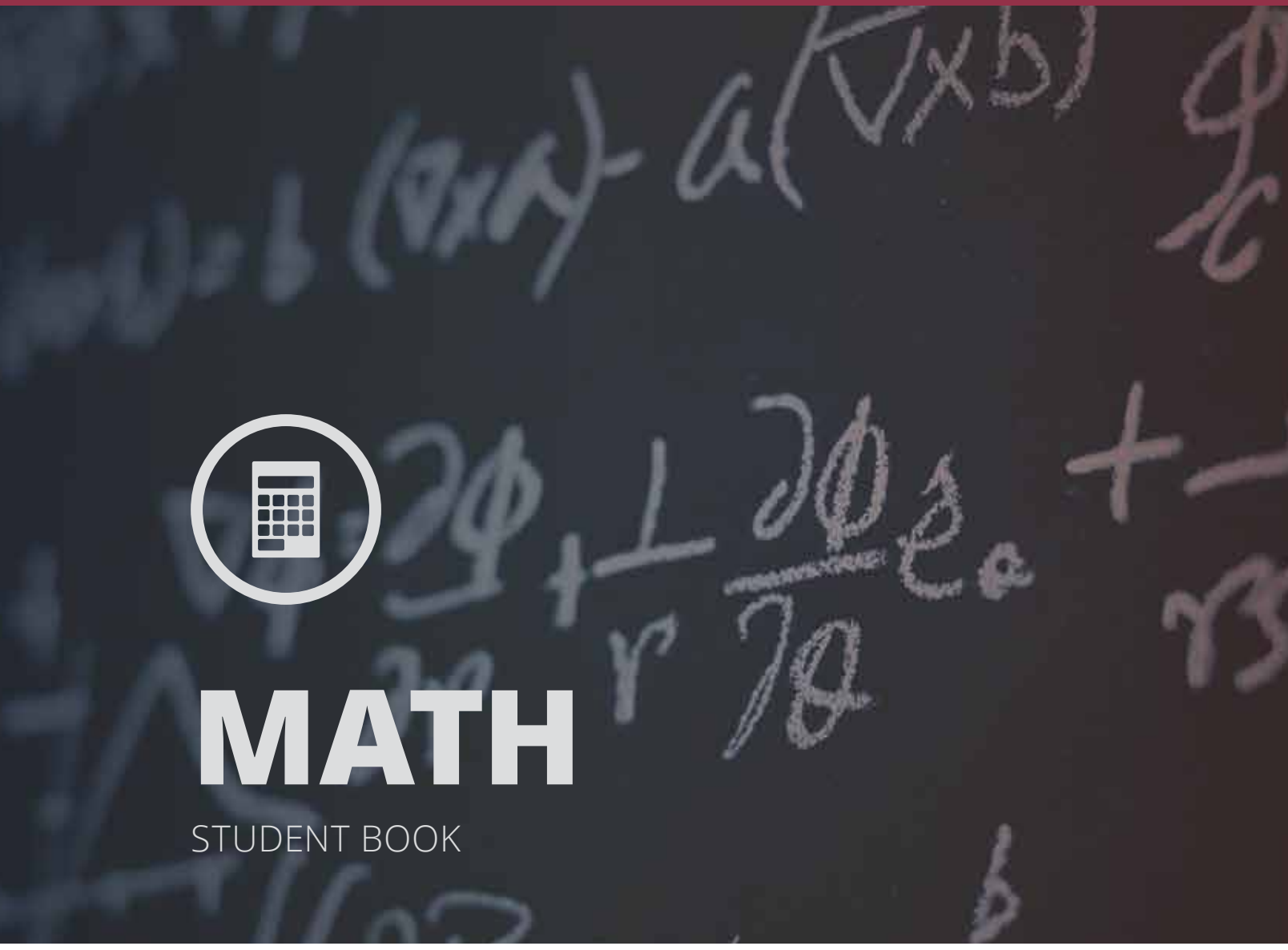

MATH

STUDENT BOOK

6th Grade | Unit 9

Alpha Omega
PUBLICATIONS

MATH 609

Integers and Transformations

LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

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Alpha Omega PUBLICATIONS

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Integers and Transformations

Introduction

In this workbook, you will be introduced to the topic of integers and transformations. The set of numbers that you use for math will grow to include negative numbers. You will use a number line to represent and compare integers. You will learn about absolute value to show the distance of an integer from zero. You will learn the four basic operations for integers (addition, subtraction, multiplication, and division). You will find that operations with integers are similar to operations with whole numbers, but the rules made it easy to determine the sign of the result. For instance, we know that $5 \times 6 = 30$, so $-5 \times 6 = -30$ because the signs of the factors are different.

Your knowledge of the coordinate plane will expand to include all four quadrants and to include negative coordinates. You will learn about three transformations that preserve size and shape while a figure moves in the coordinate plane: translations, reflections, and rotations. You will see similarities between reflections and line symmetry.

You will use integers frequently in your future math studies and learn more about transformations and the coordinate plane as you begin to see the connection between algebra and geometry.

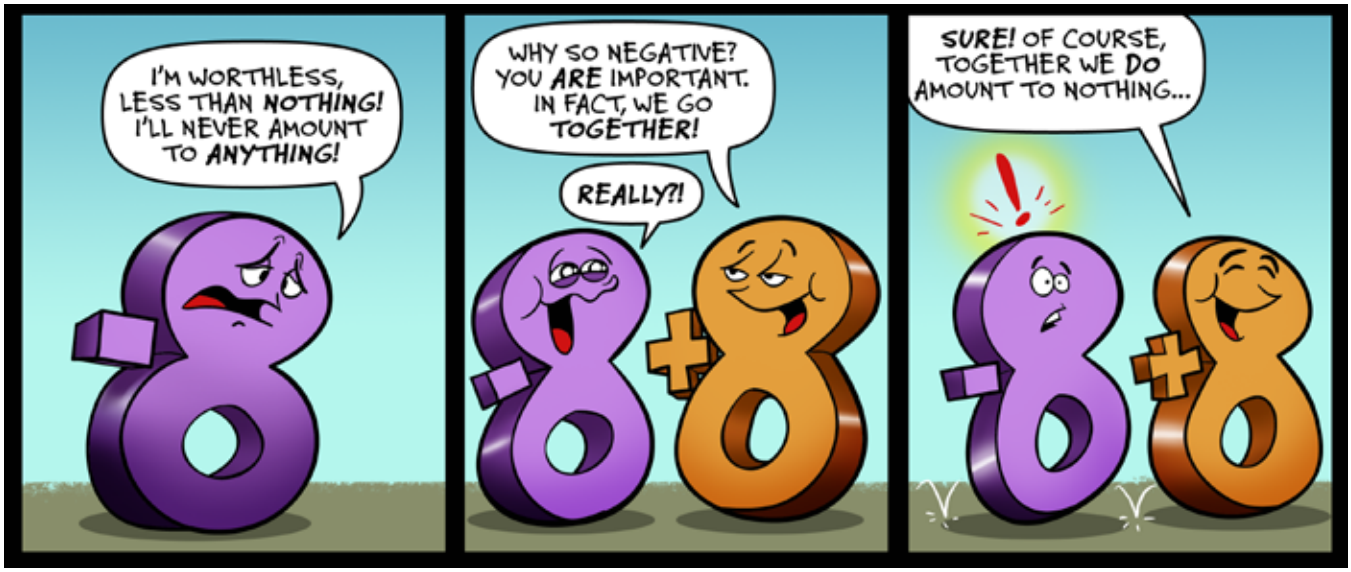
Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC®. When you have finished this LIFEPAC, you should be able to:

- Represent integers as points on the number line.
- Compare and order integers.
- Find the absolute value of a number.
- Add, subtract, multiply, and divide with integers.
- Know that translations, reflections, and rotations preserve size and shape.
- Determine the effect of a translation or a reflection on a point in the coordinate plane.
- Identify whether a figure has been rotated, and the degree of rotation.
- Identify line symmetry.

Survey the LIFEPAC. Ask yourself some questions about this study and write your questions here.

1. INTEGERS



Negative 8 and positive 8 are examples of **integers**, a set of **whole numbers** and their **opposites**. In this lesson, we will explore integers and see how they are used in everyday life. We will also see how numbers like negative 8 and positive 8 go together.

Objectives

Review these objectives. When you have completed this section, you should be able to:

- Represent integers as points on the number line.
- Know that zero pairs are opposite integers and add to zero.
- Represent integers in everyday life.
- Compare and order integers.
- Find the absolute value of a number.
- Compare and order absolute value numbers.
- Use absolute value in order of operations.
- Graph ordered pairs on the coordinate plane, in all four quadrants.

Vocabulary

absolute value. The distance from zero on the number line.

coordinate plane. A two-dimensional system in which a location is described by its distance from two intersecting, perpendicular axes.

integer. A number belonging to the set made up of the whole numbers and their opposites.

natural number. A number belonging to the set made up of the counting numbers: 1, 2, 3, and so on.

negative number. A number that is less than zero.

number line. A line that graphically represents all numbers.

opposite numbers. Two numbers that are the same distance from zero on the number line but in opposite directions.

ordered pair. A group of two numbers written in the order (*x*, *y*), where the first value represents a horizontal position and the second value represents a vertical position.

origin. The intersection of the *x*-axis and *y*-axis.

positive number. A number that is greater than zero.

quadrants. The four sections of the coordinate plane.

whole number. A number belonging to the set made up of zero and the natural numbers.

x-axis. The horizontal axis on the coordinate plane.

x-coordinate. The horizontal distance from the *y*-axis; written first in an ordered pair.

y-axis. The vertical axis on the coordinate plane.

y-coordinate. The vertical distance from the *x*-axis; written second in an ordered pair.

zero pair. A pair of numbers whose sum is zero.

Note: *All vocabulary words in this LIFEPAC appear in* **boldface** *print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.*

INTEGERS

When you began your math education long ago, perhaps before you were in school, you learned to count:

1, 2, 3, 4, ...

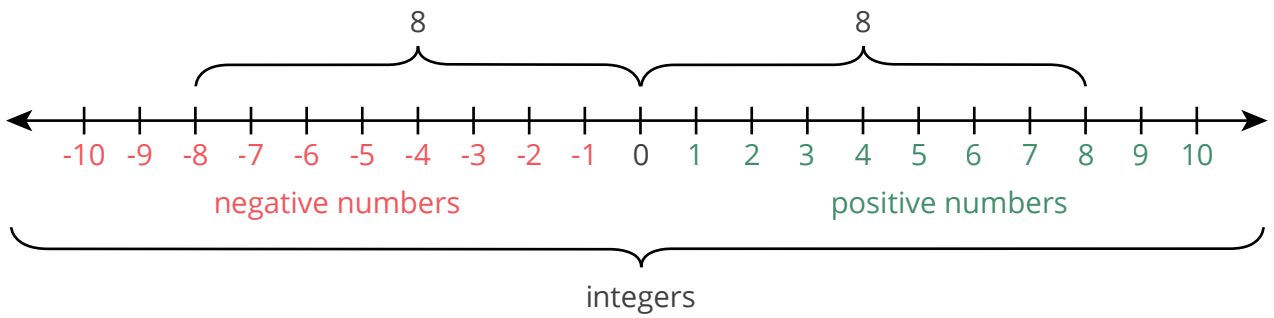
This group of numbers is called the set of **natural numbers**, or counting numbers.

Somewhere along the way, probably when you learned to add and subtract, you used a number line to help you see the distance between numbers. You also learned about a special number called zero.

This group of numbers is called the set of whole numbers. It includes the natural numbers and zero.

Now we will add another group of numbers to the set of whole numbers: the opposites of all the natural numbers. Together, with zero, the set of natural numbers and their opposites is called the set of integers.

So, natural numbers, (or **positive numbers**), their opposites (**negative numbers**), and zero, make up the set of integers. Each positive number and its opposite negative number, is the same distance from zero. For example, 8 is 8 more than zero, and -8 is 8 less than zero.

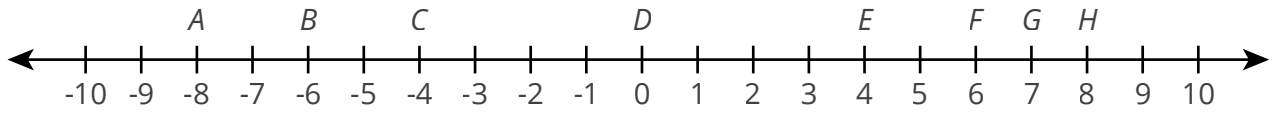


This might help!

Just as a minus sign is shown in front of a number to show that it is negative (-8), a plus sign can be shown in front of a number to show that it is positive (+8). However, since positive integers are natural numbers and we're used to seeing them without a plus sign, it usually isn't shown.

Example:

Where are the following integers located on the number line: -8, -4, 0, 7?



Solution:

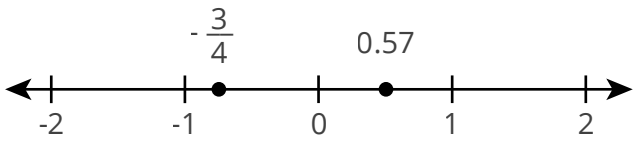
Negative numbers are to the left of zero and positive numbers are to the right of zero.

-8 is located at *A* because it is 8 units to the left of 0.

-4 is located at *C* because it is 4 units to the left of 0.

0 is located at *D* because it is in the middle of the number line. It is neither negative nor positive.

7 is located at *G* because it is 7 units to the right of 0.



Connections

Although integers are labeled on the number line, we can also locate any number between the integers such as decimals and fractions.

ZERO PAIRS

Together, integer opposites add to zero and are called **zero pairs**.

If you had $8 (+8) and then spent $8 (-8), you'd have $0. Or, if you owed someone $8 (-8) and repaid that person $8 (+8), you'd now owe $0.

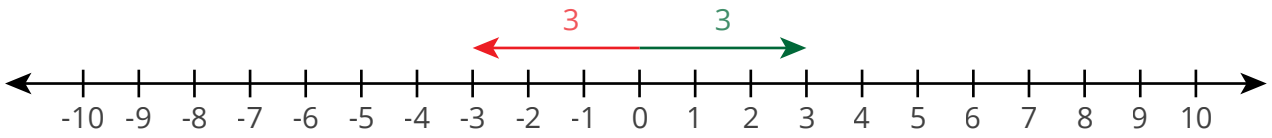
Example:

Find the opposite of each number on the number line:

-3, 5, -9

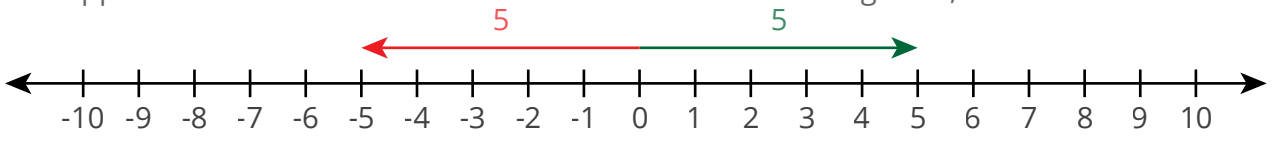
SOLUTION:

We can use the number line to locate the numbers and find the opposite number the same distance from 0.



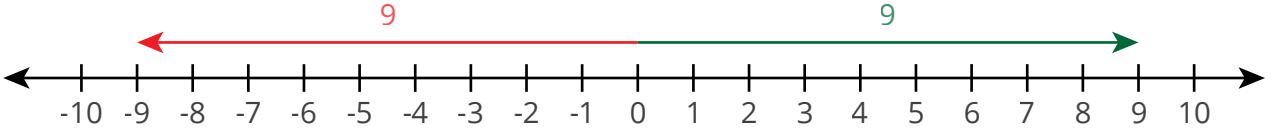
- -3

The opposite of -3 is 3 because each number is 3 from zero. Together, -3 and 3 make 0.



- 5

The opposite of 5 is -5 because each number is 5 from zero. Together, 5 and -5 make 0.



- -9

The opposite of -9 is 9 because each number is 9 from zero. Together, -9 and 9 make 0.

INTEGERS IN EVERYDAY LIFE

Integers are used in many situations in everyday life. We've already looked at one common example: money. Money owed or spent is negative. Money earned is positive. Here are a few other examples:

1. Temperature is measured relative to zero degrees. It could be 72° (72° above 0) on a warm day, or -5° (5 degrees *below zero*) on a cold day.

2. Elevation is measured compared to sea level. A mountain might have an elevation of 10,000 feet above sea level, and a valley could have an elevation of -1,200 feet (1,200 feet below sea level).

3. Football measures progress forward down the field in positive yards. If there is a penalty, it is measured in negative yards and the ball is moved backwards.

Example:

Name the integer that goes with each situation:

1. A deposit of $30 in a bank account.

2. A fish swimming 200 feet below the surface of the ocean.

3. Julius Caesar was born in 100 BCE.

4. An airplane flying at an elevation of 20,000 feet.

Solution:

1. +30: $30 is *added* to the account.

2. -200: the distance is *below* sea level.

3. -100: the date is 100 years before the Common Era.

4. +20,000: the airplane is flying 20,000 feet above sea level.

Thinking of integers in real-life situations is a good way to understand integer relationships.

Let's Review!

Before going on to the practice problems, make sure you understand the main points of this lesson.

- ✓ Integers are the set of natural numbers, their opposites, and zero.
- ✓ Negative integers are the same distance from zero as their opposite.
- ✓ Together, integer opposites make zero.

Match the following items.

1.1

_____ a number belonging to the set made up of the whole numbers and their opposites

_____ a number belonging to the set made up of the counting numbers: 1, 2, 3, and so on

_____ a number that is less than zero

_____ a line that graphically represents all numbers

_____ two numbers that are the same distance from zero on the number line but in opposite directions

_____ a number that is greater than zero

_____ a number belonging to the set made up of zero and the natural numbers

_____ a pair of numbers whose sum is zero

a. positive number
b. number line
c. natural number
d. integer
e. opposite numbers
f. negative number
g. whole number
h. zero pair

Circle the letter of each correct answer.

1.2 Which of the following is *not* the same set of numbers?

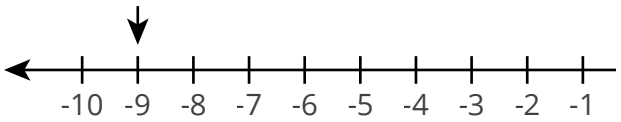
a. natural numbers b. whole numbers c. positive integers d. counting numbers

1.3 Which of the following is *not* an integer?

a. 17 b. -45 c. 0.54 d. 0

1.4 What integer does the arrow indicate?

a. 6 b. -14
c. -9 d. -3



1.5 What is the opposite of -3?

a. $\frac{1}{9}$ b. 3 c. $-\frac{1}{3}$ d. -3

1.6 Which situation would be represented by the integer -8?

a. You earn $8.
b. A hole 8 feet deep.
c. A temperature of 8° F.
d. An 8-yard pass.

1.7 Which of the following is *not* the same as positive 7?

a. 7
b. the opposite of -7
c. +7
d. 7 units to the left of 0 on a number line

Place a check mark next to each correct answer (you may select more than one answer).

1.8 Which numbers are 5 units from zero on a number line?

- ☐ -5
- ☐ 10
- ☐ 5
- ☐ $\frac{1}{5}$

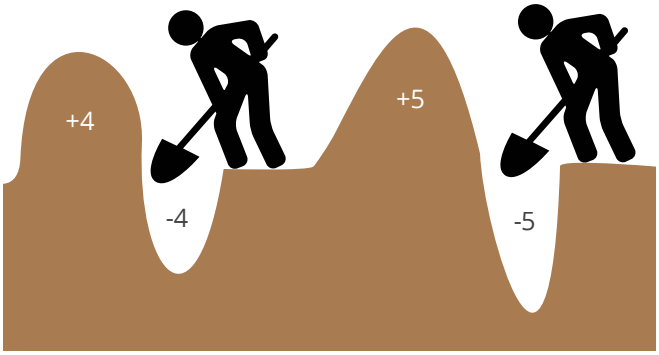
1.9 Which of the following statements is true of 12 and -12?

- ☐ They are opposites.
- ☐ They are a zero pair.
- ☐ They are equivalent.
- ☐ They are the same distance from zero.

COMPARING AND ORDERING INTEGERS

Doug digs a hole 4 feet deep, making a pile of dirt 4 feet high. Don digs a hole 5 feet deep, making a pile of dirt 5 feet high. Don's pile is higher; we know that 5 > 4. Don's hole is also deeper, but is -5 > -4?

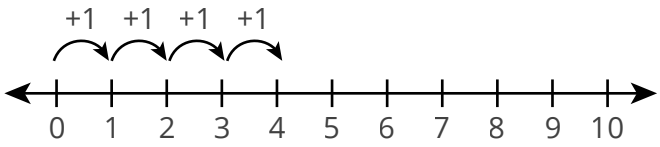
In this lesson we will compare integers and decide when one number is greater than, or less than another number.



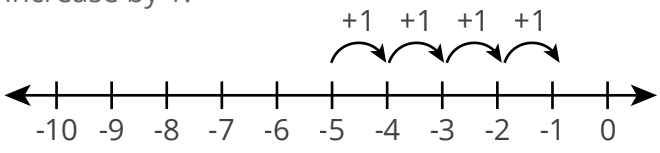
COMPARING INTEGERS

When you first learned to use a number line, you found that the numbers increase from left to right. This is the way that the number line was set up, perhaps because we read from left to right.

Because of this arrangement, each time you move to the right, you add 1 to the previous number; the numbers increase by 1.



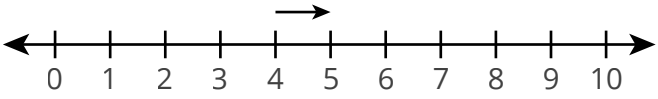
This same arrangement must also be true for the integer number line in order for it to be consistent. So, on the negative side of the number line, as we move to the right, numbers still increase by 1.



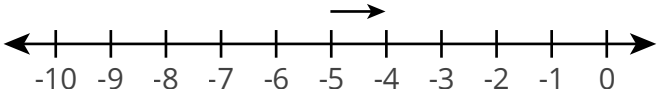
If you owed someone $5 (-5), and paid the person back $1 (+1), you would now owe the person $4 (-4). Each increase of 1 moves us to the right on the number line.

So, we can compare integers by their position on the number line. The number that is to the right is larger.

In our first example with the two holes, 5 > 4 because 5 is to the right of 4.



However, -4 > -5 because -4 is to the right of -5.



A 5-foot hole is deeper than a 4 foot hole; we could say that it is more negative than the 4 foot hole. If we added 1 foot (+1) of dirt to the 5 foot hole (-5), it would be 4 feet deep (-4).

Similarly, it makes sense that if we move to the left on the number line, the numbers decrease by 1; they are each 1 less. So, 4 < 5 and -5 < -4.

Example:

Compare the following integers: 8 and 4, -3 and 6, -5 and -8.

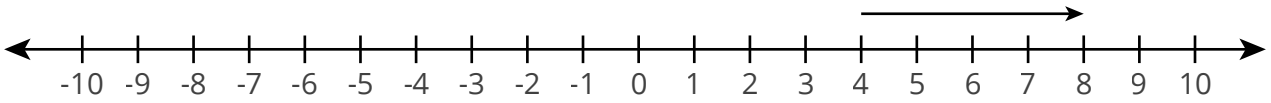
Solution:

We will locate each pair of numbers on the number line and look at their position compared to each other.

This might help!

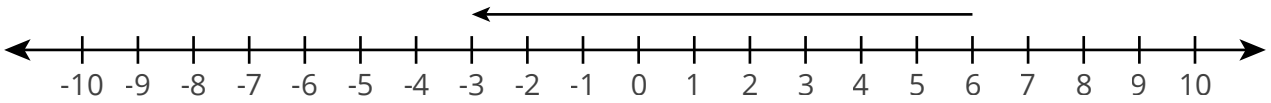
Any positive number will be greater than any negative number because positive numbers are to the right of zero and negative numbers are to the left.

8 and 4



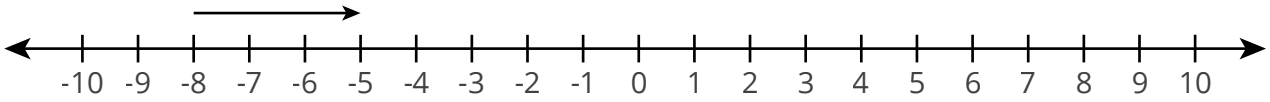
8 > 4 (or 4 < 8) because 8 is to the right of 4 on the number line.

-3 and 6



6 > -3 (or -3 < 6) because 6 is to the right of -3 on the number line.

-5 and -8



-5 > -8 (or -8 < -5) because -5 is to the right of -8 on the number line.

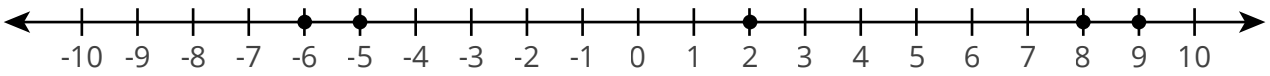
ORDERING INTEGERS

Ordering integers is comparing a number of integers at once. If we are listing integers from least to greatest, we can look at their position on the number line and list them as they appear from left to right.

List the following integers in order from least to greatest: -6, 9, 2, -5, 8.

Locating the numbers on the number line, we can see the order. Looking from left to right, least to greatest, in order, they are -6, -5, 2, 8, and 9.

If the numbers we need to order are larger, *and it is not practical to draw a number line*, we can still visualize the number line and think about the relative position of the numbers.



Example:

On a hike to the ocean, there are landmarks at several elevations: 400 feet, -200 feet, 800 feet, -50 feet, and 650 feet. List the elevations in order from least to greatest and find the lowest and highest elevations.

Solution:

We could visualize the number line and think about where the numbers would be located, or perhaps we could imagine what the hike might look like. Let's try it both ways.

There are two negative elevations, -200 feet and -50 feet, which would be to the left of 0 on the number line and be the lowest elevations. -200 feet is the farthest to the left and would be the lowest elevation, followed by -50 feet.

There are three positive elevations, 400 feet, 650 feet, and 800 feet, which would be to the right of 0 and be the higher elevations.

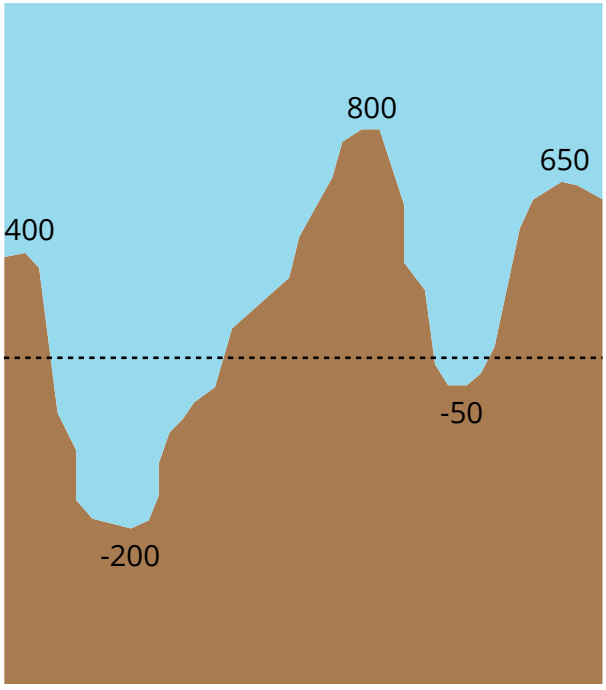
So, in order of lowest to highest, we have -200 feet, -50 feet, 400 feet, 650 feet, and 800 feet.

Now let's visualize the hike itself.

There are two elevations below sea level: -200 feet and -50 feet. These elevations are the only negative heights, so they will be the lowest points. Looking at the drawing, we can see that -200 feet is the lowest point, followed by -50 feet.

There are three elevations above sea level: 400 feet, 650 feet, and 800 feet. 400 feet is the lowest of the positive elevations, followed by 650 feet, and 800 feet.

So, in order, we have -200, -50, 400, 650, and 800. We can see that the lowest point is -200 feet and the highest point is 800 feet.



Let's Review!

Before going on to the practice problems, make sure you understand the main points of this lesson.

- ✓ Integers increase moving from left to right on a number line, and decrease moving from right to left.
- ✓ Integers can be compared and ordered by looking at their relative position to each other on the number line.

Answer true or false

1.10 _____ Doug dug a hole 4 feet deep, making a pile of dirt 4 feet high. Don dug a hole 5 feet deep, making a pile of dirt 5 feet high. Doug dug a deeper hole than Don.

1.11 _____ Any positive number is greater than any negative number.

Circle the letter of each correct answer.

1.12 Which comparison is correct?

a. -5 > -4 b. -8 > -9 c. 5 < 4 d. -8 > 5

1.13 Given that -5 < -3, which statement is *not* true?

a. -5 is to the left of -3 on the number line. b. -3 is less than -5,
c. -3 > -5 d. -3 is to the right of -5 on the number line.

1.14 Which comparison is *not* correct?

a. -7 > -9 b. -2 < -9 c. 8 > -9 d. -8 < -4

1.15 Which group of numbers is listed from least to greatest?

a. -6, -7, -8, 0, 2 b. 9, 7, 5, -4, -9 c. -8, -6, -1, 5, 8 d. -4, 5, -6, 7, -8

1.16 Which group of numbers is listed from greatest to least?

a. -3, -4, -7, -8, -9 b. 8, -6, 5, -4, 1 c. -3, -1, 0, 2, 7 d. 9, 7, 6, -5, -4

1.17 Which temperature is warmest?

a. -34° b. -17° c. 0° d. -12°

1.18 Which elevation is lowest?

a. 220 m b. -80 m c. 45 m d. -120 m

1.19 Choose the list that shows the following numbers in order from least to greatest:
-15, 8, 4, -3, -7

a. 4, 8, -15, -7, -3 b. -15, 8, 4, -3, -7 c. -15, -7, -3, 4, 8 d. -15, -3, 4, -7, 8

1.20 Choose the list that shows the following numbers in order from greatest to least:
-5, 12, 2, -4, 0

a. 12, -5, -4, 2, 0 b. 12, 2, 0, -4, -5 c. 12, 2, -4, 0, -5 d. -5, -4, 0, 2, 12

ABSOLUTE VALUE

Tom and Bob both live 3 blocks from the middle of town—North Street—but in opposite directions. When we describe the location of the houses, we don't say that Tom lives -3 blocks from North Street and Bob lives 3 blocks from North Street. We say that they both live 3 blocks from North Street.

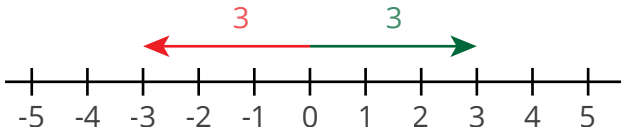
On a number line, however, the direction from the middle does matter. One direction is positive and the opposite direction is negative. Even though +3 and -3 are both 3 from zero, we still consider numbers to the left of zero negative and the numbers to the right of zero positive.

However, **absolute value** is more concerned with *distance* than direction. Absolute value is used with integers and the number line, though. In this lesson we will find out how absolute value relates to our study of integers.

You know that integers are made up of natural numbers and their opposites (plus zero), and that each pair of opposites is the same distance from zero on the number line.

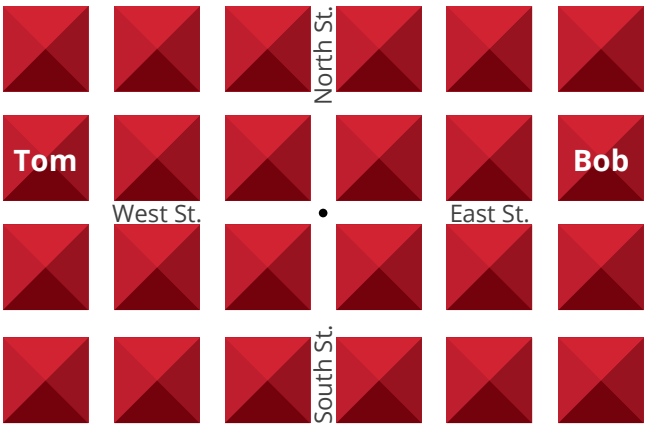
The name for that distance is the absolute value of the number. Because it is a distance, it is a positive number.

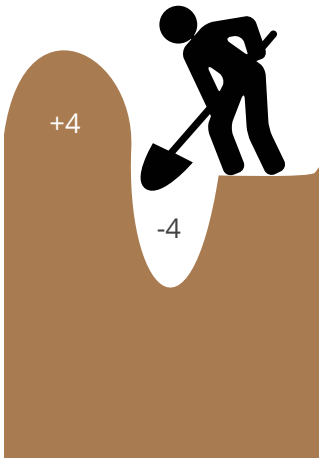
If we compare the location of Tom's house and Bob's house to the number line, Bob, at +3, is 3 from 0 and Tom, at -3, is also 3 from 0. They are the same distance from 0, and have the same absolute value.



So, the absolute value of 3 is 3, and the absolute value of -3 is 3. Two vertical lines on either side of the number indicate absolute value:

$|3| = 3$ $|-3| = 3$





Doug digs a hole 4 feet deep, making a pile of dirt 4 feet high.

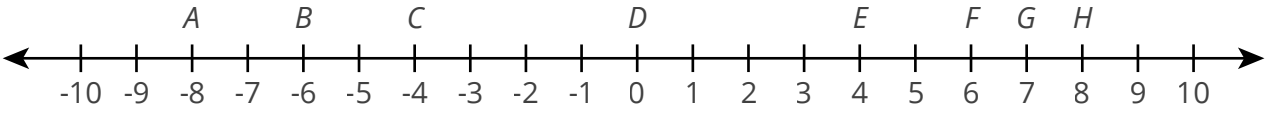
We use integers to indicate the pile of dirt (positive) and the hole (negative). However, Doug's hole is 4 feet deep and the pile of dirt is 4 feet high. In other words, $|-4| = 4$, $|4| = 4$.

Did you know?

Since we've defined opposite numbers as being the same distance from 0, and absolute value is the distance from 0, then any pair of opposite numbers will have the same absolute value.

Example:

Find the absolute value of the numbers indicated on the number line.



Solution:

We will use the number line to find the distance that the number is from 0.

A: |-8| = 8, -8 is 8 from 0.

B: |-6| = 6, -6 is 6 from 0.

C: |-4| = 4, -4 is 4 from 0.

D: |0| = 0, 0 is 0 from 0.

E: |4| = 4, 4 is 4 from 0.

F: |6| = 6, 6 is 6 from 0.

G: |7| = 7, 7 is 7 from 0.

H: |8| = 8, 8 is 8 from 0.

Key point!

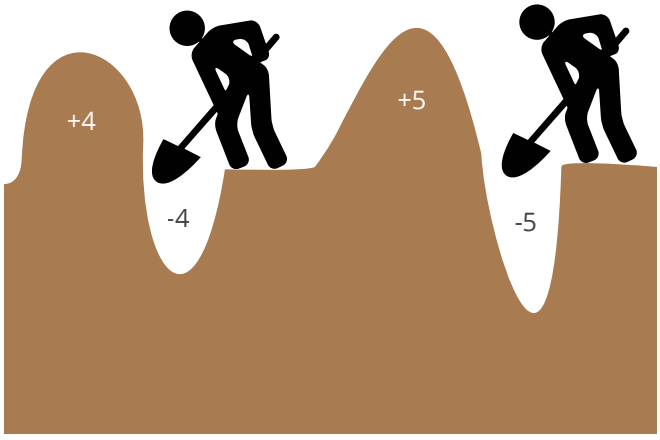
Notice that 0 is the only integer that does not have a positive absolute value.

ORDERING ABSOLUTE VALUE NUMBERS

Next to Doug's hole, Tom digs a hole 5 feet deep. Tom's hole is deeper, but is -5 < -4?

However, |-5| > |-4| because |-5| = 5, and |-4| = 4, and 5 > 4. So, the actual distance, or depth of Tom's hole (5 feet) is greater than Doug's (4 feet); the absolute value of -5 is greater than the absolute value of -4.

Usually when we order numbers, we look at where the numbers are on the number line to compare them. But sometimes, there are situations where we compare and order numbers using absolute value. In this case, we look at the number's distance from 0.

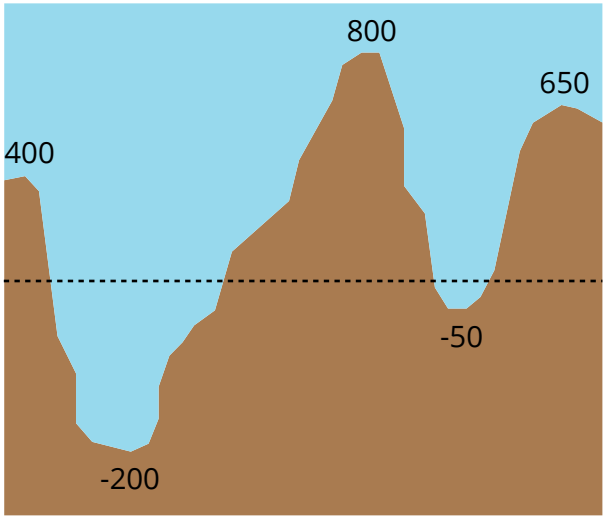


Example:

On a hike to the ocean, there are landmarks at several elevations: 400 feet, -200 feet, 800 feet, -50 feet, and 650 feet. List the elevations in order from least to greatest by their distance from sea level (0 feet).

Solution:

We could visualize the number line and think about where the numbers would be located, or perhaps we could imagine what the hike might look like:



We need to find the distance of each landmark from sea level, or 0 feet. So, we need to find the absolute value of each elevation:

$|400| = 400$, $|-200| = 200$, $|800| = 800$, $|-50| = 50$, $|650| = 650$

In order, we have:

50, 200, 400, 650, and 800

So, the order of the elevations, from least to greatest, *by their distance from sea level is:*

-50 feet, -200 feet, 400 feet, 650 feet, and 800 feet

Be careful!

When ordering integers, pay attention to whether the order is based on the distance from 0 (the absolute value), or the number's relative location on the number line.

Example:

List the following numbers from least to greatest:

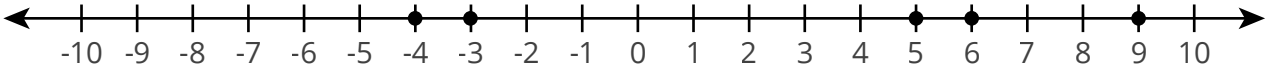
$-4, |-9|, 6, |5|, -3$

Solution:

First, we will find the absolute value of -9 and 5, and then order the numbers from left to right as they appear on the number line.

$|-9| = 9$, and $|5| = 5$

Now, we will locate -4, 9, 6, 5, and -3 on the number line:



From left to right, least to greatest, we have: -4, -3, 5, 6, 9.

Remembering that 9 was given as $|-9|$ and 5 was given as $|5|$, the numbers in order are:

$-4, -3, |5|, 6, |-9|$

ABSOLUTE VALUE IN ORDER OF OPERATIONS

Sometimes we see absolute value in number sentences or expressions. Finding the absolute value just amounts to one more step in the order of operations.

You know that a number sentence or expression is evaluated by an order of operations that all mathematicians have agreed to, often written as the acronym PEMDAS:

Parentheses

Exponents

Multiplication and **D**ivision

Addition and **S**ubtraction

Absolute value is like parentheses, and the vertical lines almost look like parentheses. So, if you see absolute value in an expression, find it first before doing the other operations:

$4 + 3 \times |-6| \div 2 =$

Find the absolute value of -6, then multiply.

$4 + 3 \times 6 \div 2 =$

$4 + 18 \div 2 =$

Now divide, and finally add.

$4 + 9 = 13$

Example:

Evaluate the expression: $10 - |-3| \times 3 + 2$

Solution:

We will use order of operations:

$10 - \|-3\| \times 3 + 2$	
$10 - 3 \times 3 + 2$	Find the absolute value of -3.
$10 - 9 + 2$	Multiply.
$1 + 2$	Subtract.
3	Add.

Think about it!

The opposite of the absolute value of a number will be negative, because the absolute value is positive. For example: $-|-6| = -6$, or $-|6| = -6$.

Let's Review!

Before going on to the practice problems, make sure you understand the main points of this lesson.

- ✓ Absolute value is the distance from 0 on the number line.
- ✓ Absolute value is always positive (except for 0).
- ✓ Opposite numbers have the same absolute value.

Fill in each blank with the correct answer.

1.21 Absolute value is the _____ from zero on the number line.

Answer true or false.

1.22 _____ All numbers have a positive absolute value.

Circle the letter for each correct answer.

1.23 What is the absolute value of -3?

a. $\frac{1}{3}$ b. 3 c. $-\frac{1}{3}$ d. -3

1.24 Given that |-5| > 3, which statement is *not* true?

a. -5 is farther from 0 than 3 is on the number line.
b. -5 is greater than 3.
c. 3 > -5
d. 5 > 3

1.25 Which group of numbers is listed from least to greatest?

a. -6, |-7|, |-8|, 0, 2 b. 9, 7, 5, |-4|, |-3|
c. |-8|, |-6|, -1, 5, 8 d. |-4|, 5, |-6|, 7, |-8|

1.26 Which group of numbers is listed from greatest to least?

a. |-3|, |-4|, |-7|, |-8|, |-9| b. 8, |-6|, 5, |-4|, |1|
c. -3, |-1|, 0, 2, 7 d. 9, 7, |6|, -5, |-4|

1.27 Which temperature is farthest from 0°?

a. -34°F b. -17°F c. 0°F d. -12°F

1.28 Which elevation is farthest from sea level (0 feet)?

a. 220 m b. -80 m c. 45 m d. -120 m

1.29 Which comparison is *not* correct?

a. |-7| > -9 b. |-2| < |-9| c. |8| > |-9| d. -8 < |-4|

1.30 Evaluate the expression: 6 - |-4| + 3 × |-2|

a. 10 b. -26 c. 8 d. 16

1.31 Evaluate the expression: |10| - 3 × |-2| +5

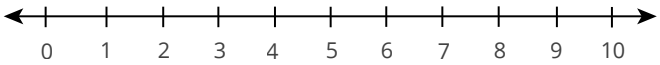
a. 9 b. 49 c. -1 d. 1

COORDINATE PLANE

Often, when a town is planned and then built, the builders use a grid to organize the town. Starting from the center of the grid, any location can be named. Sue lives 2 blocks east and 2 blocks north of the center of town. Ann lives 4 blocks west and 3 blocks south of the center of town.

The grid that the town uses is an example of a **coordinate plane**, a two-dimensional system used to find locations. The same idea is used in math, using two integer number lines to locate points. In this lesson, we will explore the coordinate plane and extend our use of integers from 1 dimension to 2.

When we first explored integers, a number line was used to help compare numbers. Positive numbers are to the right of zero and negative numbers are to the left of zero.



We can locate integers on the number line and compare them by their location. If a vertical number line is also used, we can locate points by their position from each number line.

The coordinate plane consists of a horizontal number line called the **x-axis**, and a vertical number line called the **y-axis**. The two axes cross at a point called the origin.

The location of a point is its distance and direction (positive or negative) from 0 along each axis:

x-axis:

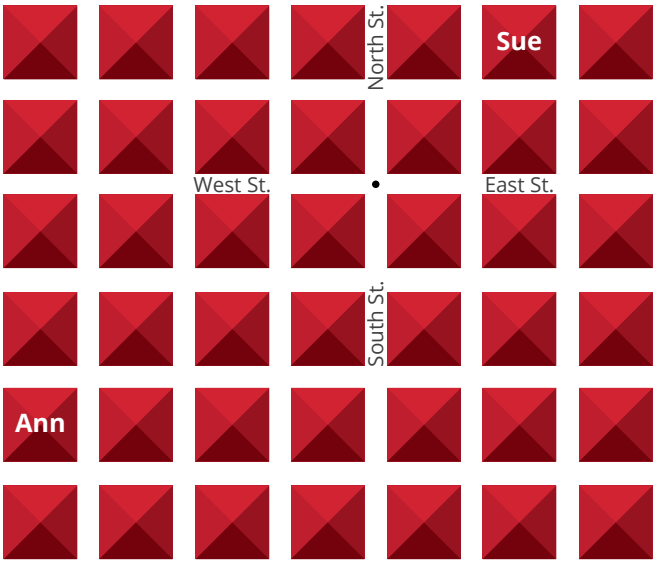
Positive numbers are to the right of 0.

Negative numbers are to the left of 0.

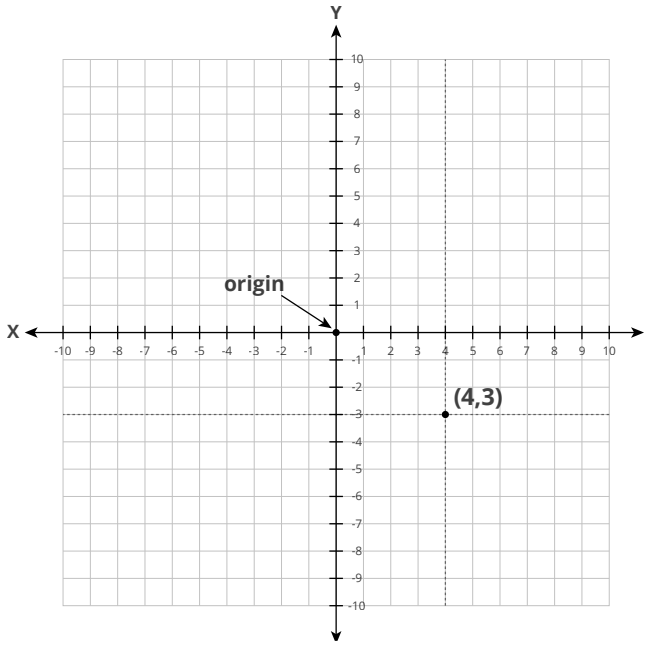
y-axis:

Positive numbers are above 0.

Negative numbers are below 0.



The point shown on the graph is 4 to the right of 0 on the *x*-axis (4) and 3 below the origin line on the *y*-axis (-3).



The first number is called the **x-coordinate** and the second number is called the **y-coordinate**. Together, the coordinates are called an **ordered pair** and are shown in parentheses. Each ordered pair names a unique location.

Let's see if you can give the coordinates for some points in the coordinate plane.

Think about it!

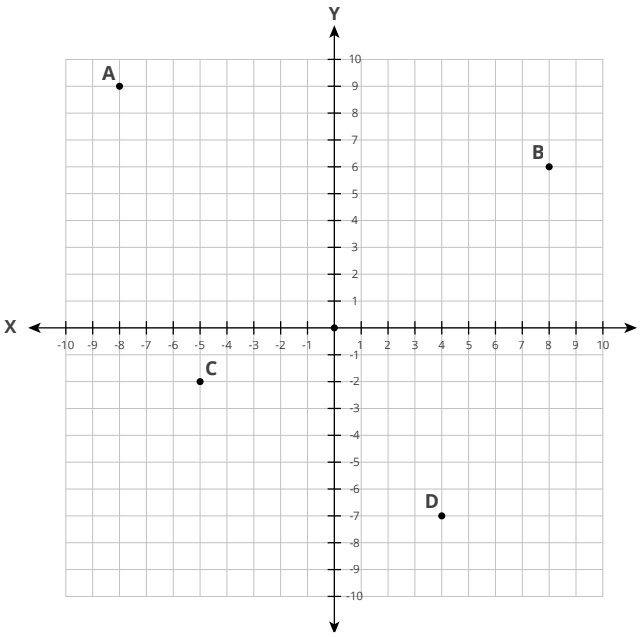
The ordered pair that names the location of the origins is (0, 0) because it is at 0 on each axis.

Example:

Give the coordinates for each point as an ordered pair.

Solution:

We'll look at one point at a time. Remember, the *x*-coordinate comes first, then the *y*-coordinate. For each point, we'll find how far to the left or right of 0 along the *x*-axis the point is, giving us the *x*-coordinate. Then, we'll find how far above or below 0 the point is along the *y*-axis, giving us the *y*-coordinate.



A:
x-coordinate: 8 units to the left of 0 (-8)
y-coordinate: 9 units above 0 (9)
ordered pair: (-8, 9)

B:
x-coordinate: 8 units to the right of 0 (8)
y-coordinate: 6 units above 0 (6)
ordered pair: (8, 6)

C:
x-coordinate: 5 units to the left of 0 (-5)
y-coordinate: 2 units below 0 (-2)
ordered pair: (-5, -2)

D:
x-coordinate: 4 units to the right of 0 (4)
y-coordinate: 7 units below (-7)
ordered pair: (4, -7)

Key point!

The *x*-coordinate always comes first in the ordered pair. The order is something mathematicians have agreed on so that there is no confusion in naming locations.

QUADRANTS

Notice that the axes divide the coordinate plane into four areas. These areas are called **quadrants** and are numbered using Roman numerals: I, II, III, and IV.

Each quadrant uses one half of each axis, so the signs of the coordinates change in each quadrant:

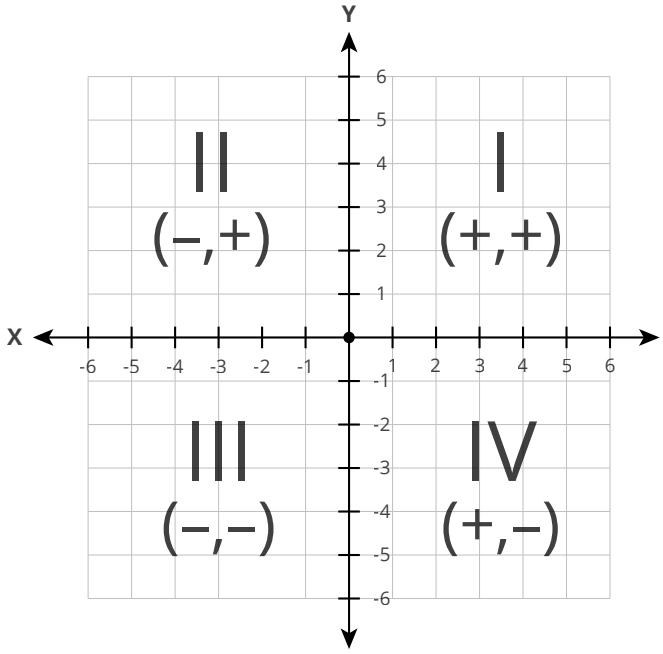
I. Both coordinates are positive.

II. A negative *x*-coordinate and a positive *y*-coordinate.

III. Both coordinates are negative.

IV. A positive *x*-coordinate and a negative *y*-coordinate.

We can use this information to help locate points.

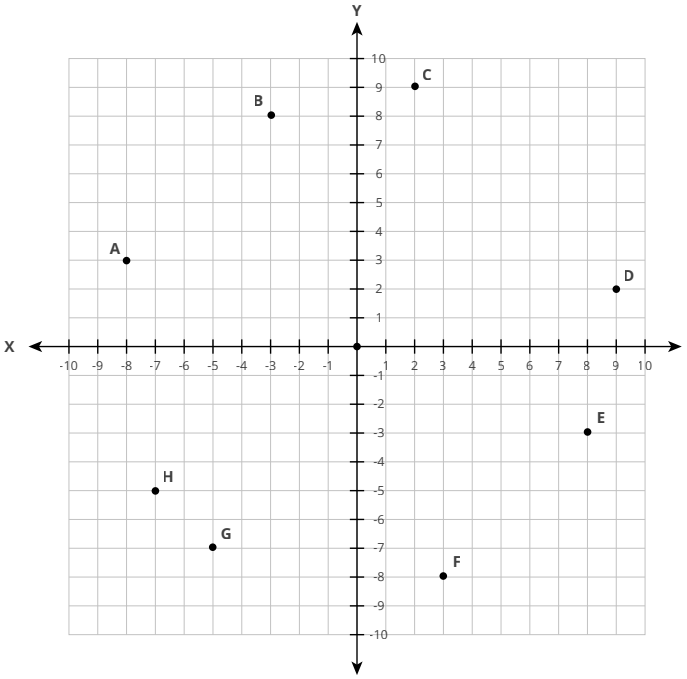


Example:

Which points are located at (-8, 3), (-5, -7), and (2, 9)?

Solution:

For each point, we can first determine which quadrant it is in. Then, starting at the origin, we can follow the coordinates to the location, remembering that the *x*-coordinate comes first.



(-8, 3) – The *x*-coordinate is negative, and the *y*-coordinate is positive, so the point is in the second quadrant.

We will follow the coordinates from the origin, starting with *x*.

x: Move 8 units left of 0.

y: Then, move 3 units above 0. This puts us at point *A*.

(-5, -7) – Both coordinates are negative, so the point is in the third quadrant.

We will follow the coordinates from the origin, starting with *x*.

x: Move 5 units to the left of 0.

y: Then, move 7 units below 0. This puts us at point *G*.

(2, 9) – Both coordinates are positive, so the point is in the first quadrant.

We will follow the coordinates from the origin, starting with *x*.

x: Move 2 units to the right of 0.

y: Then, move 9 above 0. This puts us at point *C*.

Let's Review!

Before going on to the practice problems, make sure you understand the main points of this lesson.

- ✓ The coordinate plane consists of two intersecting number lines, and is used to locate points.
- ✓ A point's location is named by an ordered pair, with the *x*-coordinate followed by the *y*-coordinate.
- ✓ There are four quadrants in the coordinate plane, each with different combinations of signs for the ordered pairs.

Match each word to its definition.

1.32

_____ a two-dimensional system in which a location is described by its distance from two intersecting, perpendicular axes

_____ a group of two numbers written in the order (*x*, *y*), where the first value represents a horizontal position and the second value represents a vertical position

_____ the intersection of the *x*-axis and *y*-axis

_____ the four sections of the coordinate plane

_____ the horizontal axis on the coordinate plane

_____ the horizontal distance from the *y*-axis; written first in an ordered pair

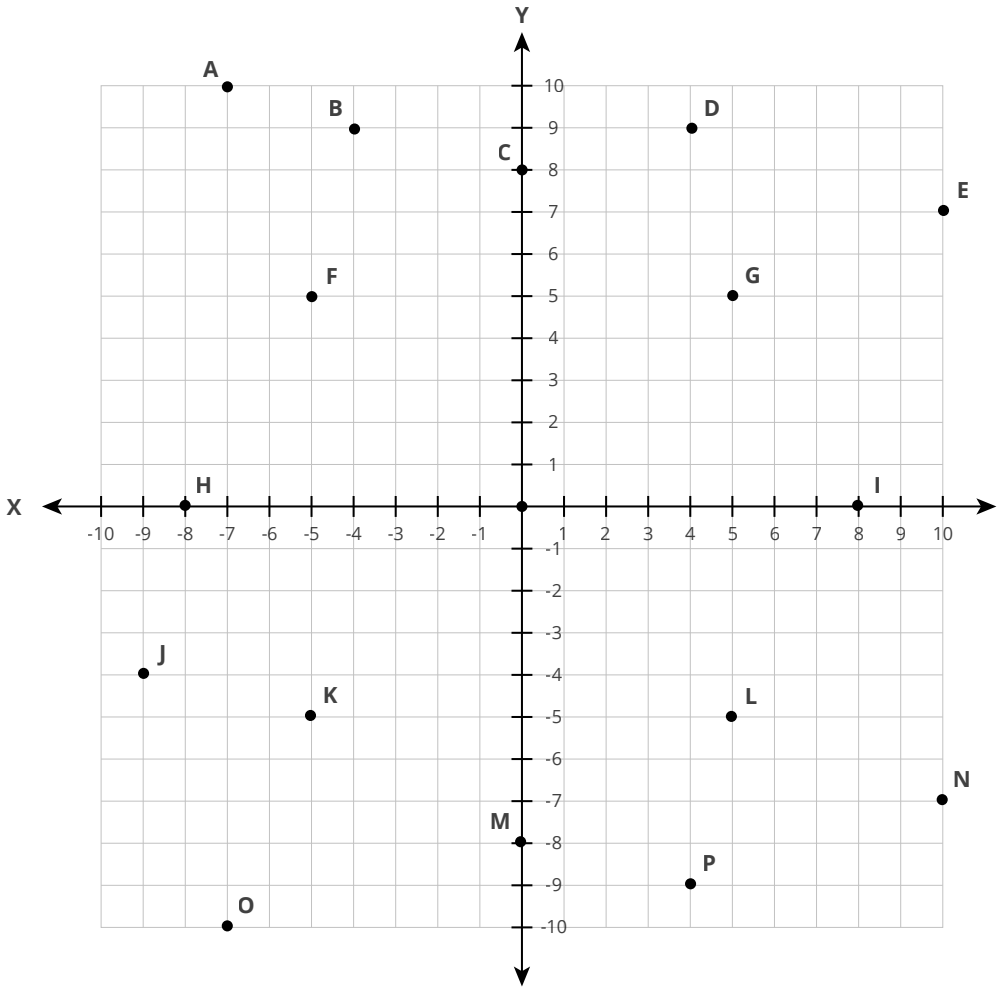
_____ the vertical axis on the coordinate plane

_____ the vertical distance from the *x*-axis; written second in an ordered pair

a. origin
b. ordered pair
c. *x*-axis
d. quadrants
e. coordinate plane
f. *y*-coordinate
g. *y*-axis
h. *x*-coordinate

Circle each correct answer.

Use this coordinate plane to answer questions 1.33 - 1.36.



1.33 Which point is located at (0, 8)?

a. point *C* b. point *H* c. point *I* d. point *M*

1.34 Which point is located at (-5, 5)?

a. point *F* b. point *G* c. point *K* d. point *L*

1.35 Which point is located at (-7, -10)?

a. point *A* b. point *E* c. point *O* d. point *N*

1.36 Which point is located at (4, -9)?

a. point *B* b. point *D* c. point *J* d. point *P*

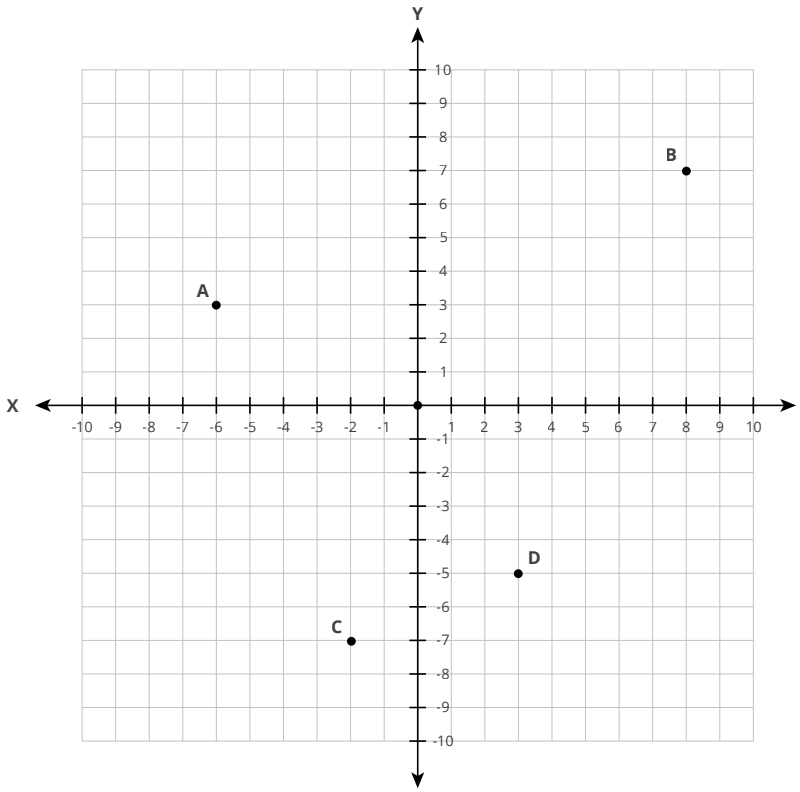
1.37 In what quadrant would the ordered pair (-5, 4) be located?

a. I b. II c. III d. IV

1.38 In what quadrant would the ordered pair (-8, -2) be located?

a. I b. II c. III d. IV

Use this coordinate plane to answer questions 1.39 - 1.42.



1.39 What is the location of point *A*?

a. (3, -6) b. (-6, -3) c. (-6, 3) d. (6, -3)

1.40 What is the location of point *B*?

a. (7, 8) b. (8, 7) c. (8, -7) d. (-7, -8)

1.41 What is the location of point *C*?

a. (-2, -7) b. (-2, 7) c. (-7, -2) d. (-7, 2)

1.42 What is the location of point *D*?

a. (3, 5) b. (-5, 3) c. (-5, -3) d. (3, -5)

TEACHER CHECK _____ initials _____ date

Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

SELF TEST 1: INTEGERS

Place a check mark next to each correct answer (you may select more than one answer; this question, 5 points).

1.01 Which of the following statements is true of 9 and -9?

- ☐ They are a zero pair.
- ☐ They are opposite numbers
- ☐ They have the same absolute value
- ☐ They are equivalent

Circle each correct answer (each answer, 7 points).

1.02 What integer does the arrow indicate?

a. 4 b. -4 c. -6 d. $\frac{1}{4}$

1.03 Which of the following is not the same as positive 8?

a. -|-8| b. 8 units to the right of 0 on a number line
c. +8 d. the opposite of -8

1.04 What is the absolute value of -7?

a. $\frac{1}{7}$ b. 7 c. $-\frac{1}{7}$ d. -7

1.05 Given that |-6| > 5, which statement is *not* true?

a. -6 is farther from 0 than 5 is on the number line
b. -6 is greater than 5
c. 5 > -6
d. 6 > 5

1.06 Which comparison is *not* correct?

a. 2 > -3 b. -7 < -5 c. -9 < 1 d. 0 < -4

1.07 Which group of numbers is listed from least to greatest?

a. -2, |-3|, |-4|, 0, 3 b. 8, 6, 5, |-4|, |-1|
c. |-9|, |-4|, -1, 5, 8 d. |-2|, 3, |-5|, 7, |-9|

1.08 Which temperature is the warmest?

a. -13°F b. -3°F c. -20°F d. -33°F

1.09 Evaluate the expression: |8| - 2 x |-3| + 4

a. 6 b. 22 c. 10 d. 42

1.010 Which comparison is correct?

a. $|-3| > |-4|$ b. $|5| > 7$ c. $7 < |7|$ d. $-5 < -4$

Use this coordinate plane to answer questions 1.011 - 1.012.

1.011 What is the location of point *A*?

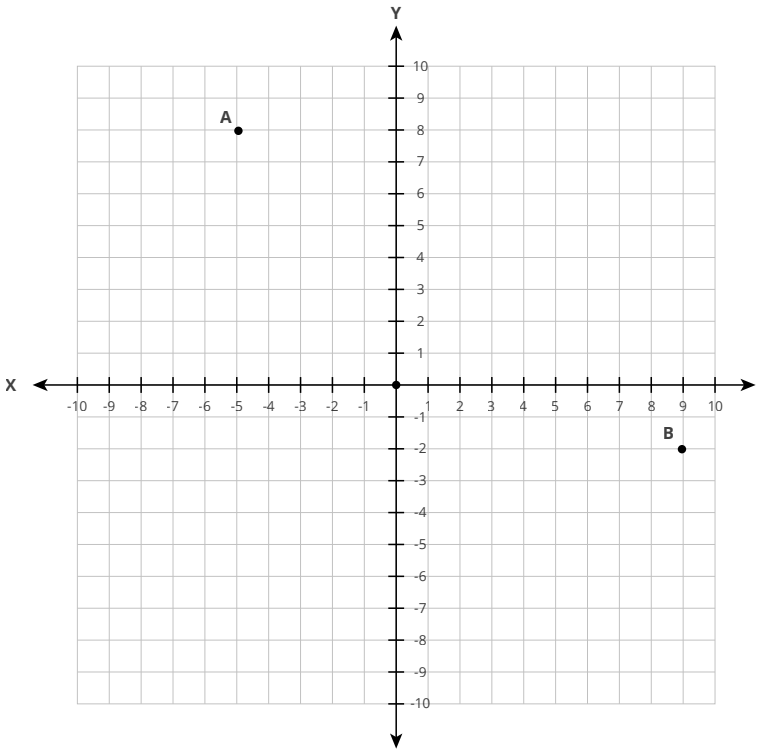
a. (5, -8) b. (-8, 5)

c. (8, -5) d. (-5, 8)

1.012 What is the location of point *B*?

a. (-2, 9) b. (9, -2)

c. (2, -9) d. (9, 2)

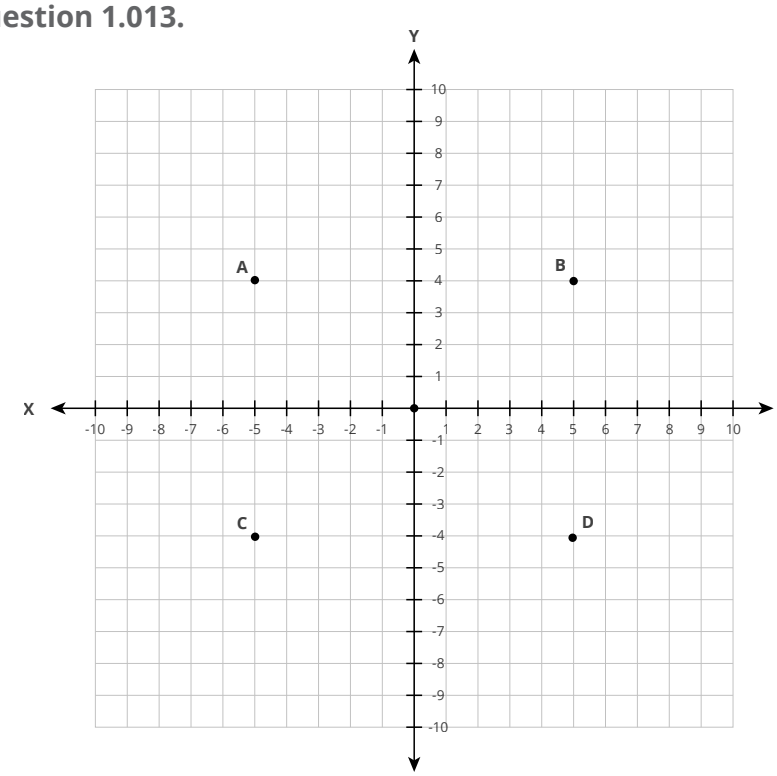


Use this coordinate plane to answer question 1.013.

1.013 Which point is located at (-5, 4)?

a. point *A* b. point *B*

c. point *C* d. point *D*



1.014 In what quadrant would the ordered pair (-6, -9) be located?

a. I b. II c. III d. IV

Answer true or false. (this question, 4 points)

1.015 _____ A point located at (0, -6) is the same distance from 0 as the point located at (0, 6).

80/100 **SCORE** _____ **TEACHER** _____ _____
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