



Two Plus You

Unit

2



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Working with Place Value

Integers and Absolute Value

Words to know:

- ✓ place value
- ✓ integers
- ✓ number line
- ✓ absolute value

Sometimes, math uses very large numbers. There is a system for writing and reading these big numbers. Place value is used to read large numbers. It shows how much a digit is worth according to where it is in the number.

- ✓ The value of a digit in a number depends on where it is in the number. This position is called the **place value**.

Example: In the number 357, the 3 is in the *hundreds place*, 5 is in the *tens place* and 7 is in the *ones place*. This number is written and said as, “three hundred fifty seven.” But still, what about really large numbers?

In general, very large numbers are grouped in sets of three digits. Each set of three digits is separated by a comma. This method makes the number easier to see. It also helps to write and say the number. Look at the number below. Notice where the commas have been placed.

Example: 23,463,245,978,031

Start on the right and count by three. The first group of three digits is hundreds. The second group of three is thousands. The third group of three is millions. The fourth group is billions. The last group is trillions!

✓ Each group of three digits is called a **period**. Commas separate each period from another.

The value of a single digit depends on its position in a number. Where a digit is within a period gives it value, too. Look at the chart that follows. The big number has been written in it by period.

Trillions period			Billions period			Millions Period			Thousands Period			Unit Period		
0	2	3	4	6	3	2	4	5	9	7	8	0	3	1
Hundred Trillions	Ten Trillions	Trillions	Hundred Billions	Ten Billions	Billions	Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

To figure out the periods, always start at the far right. After you have figured out the periods, you are ready to write the number with words. Always write a large number starting from the far left.

In words, the number 23,463,245,978,031 is written as “twenty-three trillion, four hundred sixty-three billion, two hundred forty-five million, nine hundred seventy-eight thousand, thirty-one.” Never use the word “and” when writing out or saying a number in words.

Here is the rule to write and say large numbers.

Rule to write out a number:

1. Begin at the far right and put a comma after every 3 digits.
2. Start at the right again. Count the first group as the unit period. The second group is the thousands. The third is the millions. Do this until you have reached the final group at the far left.
3. Start at the far left. Write the numbers as words. Use terms from the Units Period.
4. Write the value of the period (trillion, billion, million, etc.) followed by a comma.
5. Repeat this until you have written the values from the Unit Period.

Now you try!

1. Write the following numbers with words and say them out loud:
 - a. 1,345
 - b. 456,210
 - c. 1,948,111,985
 - d. 1,000,043,000,005

2. The population of the world is six billion, eight hundred twelve million, thirty-four thousand, three hundred ninety three. Write this with numbers.

3. In the number 836,204,124,385,685

a. What is the place value of the zero? _____

b. What is the period value of the digits 124? _____

4. In each of the following, circle or highlight the digit in the place value written on the right.

a. 1,234,567 ten thousands

b. 947,183,208,264,900 hundred millions

c. 608,574 tens

d. 917,333,273,194,732 trillions

e. 1,532 ones

f. 622,948 thousands

5. Write the following numbers with words.

a. 1,009 _____

b. 13,076 _____

c. 100,000,000,000,000 _____

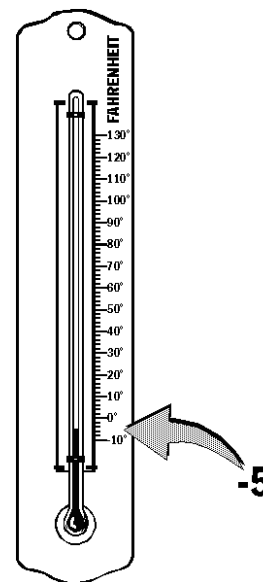
d. 847,256,958,123,732 _____

Integers and Absolute Value

One morning you wake up and look out your window. There is a blizzard! You check the thermometer. The temperature reads -5 degrees. You look closer at your thermometer. You notice that this number is below zero.

When we count, we usually use **whole numbers**.

✓ **Whole numbers** are the numbers 0, 1, 2, 3, 4, 5, 6, 7, ...



You may count that you have four pencils. You may see that there are zero eggs in your refrigerator. The smallest whole number is zero. There is no largest whole number. You can always count higher than any number you can think of.

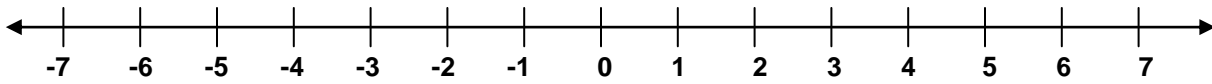
Sometimes you need to count things that are less than zero. For instance, Tiger Woods scored -1 in the 2008 PGA Golf Tournament. The temperature in the beginning of the story was -5 degrees. Numbers less than zero are called **negative numbers**.

✓ **Negative numbers** are all the numbers that are less than zero.
 $-1, -2, -3, -4, -5, -6, \dots$

The group of all positive and all negative whole numbers together, plus zero, is called **integers**.

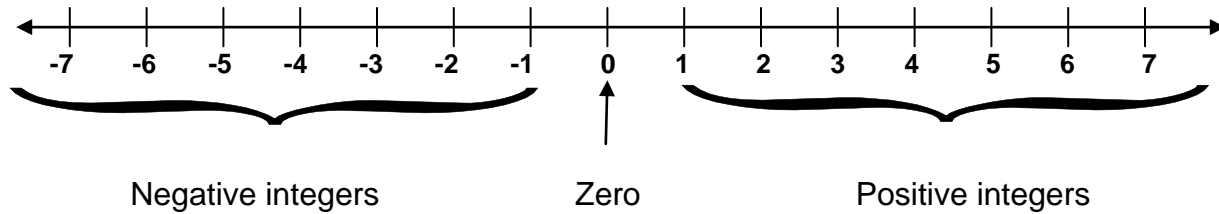
Zero is neither positive nor negative. It is just zero! The equator separates the northern and southern hemispheres of the Earth. Zero acts the same way. It separates the positive and negative integers.

One way to understand integers is to see them on a **number line**.

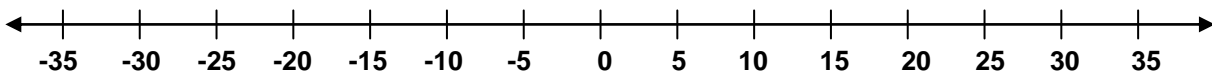


The number line is a way to show every single number. Notice that there are spaces between the integers. They show that there are numbers between the integers. We will talk about these numbers later. For now, look only at the integers.

The groups of numbers that make up integers are shown with brackets on the number line below.

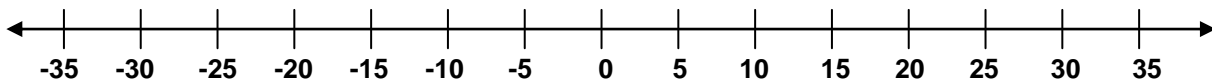


Number lines do not always show every integer. For example, look at this number line.

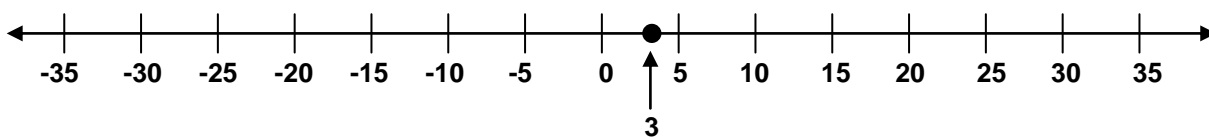


Here, the number line increases by 5 every time. As long as you always increase by the same amount, you may label your number line however you like. Not every integer is labeled, but they are still there on the line. Remember: Number lines show every number, even if they are not labeled.

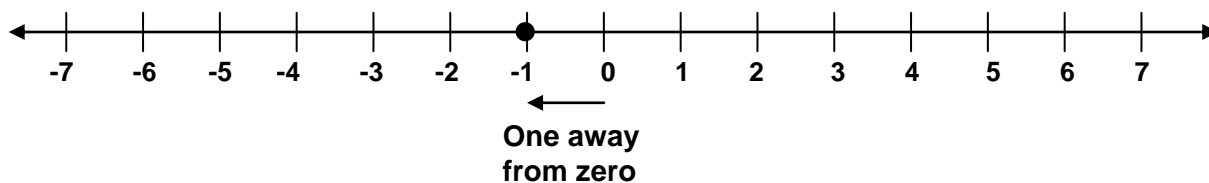
Example: Show where 3 is on the given number line.



Solution: We know that 3 will lie between 0 and 5. We also know that 3 is 3 integers away from zero, and only 2 integers away from 5. So, 3 is closer to 5 than it is to 0. Because of this, we will put a point that is slightly closer to 5 than to zero on the number line.



Notice that zero is right in the middle of the number line. It separates the negative integers from the positive integers. Zero is a very important number in math. We use it to compare with other numbers. For instance, Tiger Woods' golf score of -1 is one away from zero. You can see this on the next number line.

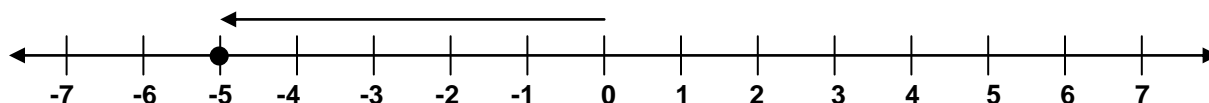


First, put a point on the line where the actual number is. Then, count how far away it is from zero. You are finding the distance from zero. If the number is positive, count to the right. If the number is negative, count to the left.

As you can see, -1 is one place away from zero.

Example: Show -5 on the number line, and then determine its distance from zero.

Solution: On the number line, put a point on -5 to show where it is.



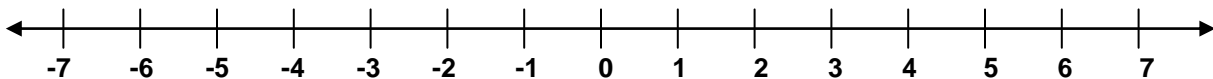
Then, using an arrow, count how many integers it is away from zero.
 It is 5 away from zero. To show this we say that $|-5| = 5$.

✓ The distance a number is from zero is its **absolute value**. The absolute value of a number is shown by vertical lines put to the left and right of the number. Thus, to show the absolute value of -12 , we say $|-12| = 12$. The absolute value of a number is always positive.

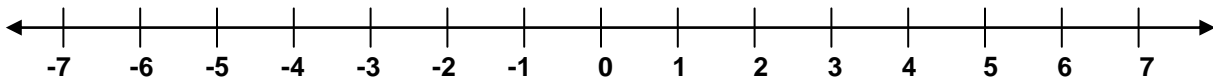
Now you try!

6. Plot the following on the number line. Find how far each number is from zero. Then, state in math writing what the absolute value of the number is.

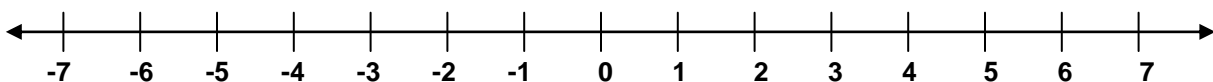
a. -2



b. 4



c. 0



Distance is always positive. The absolute value is always positive. The absolute value of a positive number is that number. The absolute value of a negative number is that number with no negative sign.

Example: $|-3| = 3$ and $|37| = 37$.

Rule to find the absolute value of a number:

1. If the number is positive, the absolute value is that number.
2. If the number is negative, the absolute value is that number without the negative sign.

Now you try!

7. Find the absolute value of the following expressions.

a. $|13|$

b. $|-7|$

c. $|-400|$

d. $|10|$

8. Without doing any math, is $|-(5829 - 4928)|$ positive or negative? How do you know?

Notes:

☞ End of Lesson 1 ☞