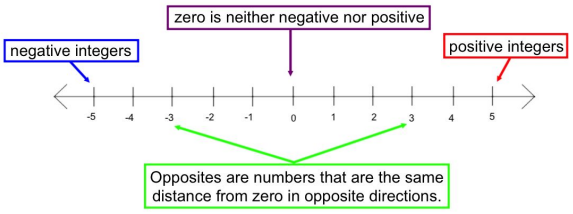
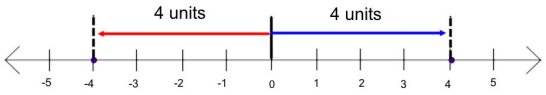
# 6th Grade – Unit 4
# Understanding Positive & Negative Numbers

In this unit, students extend the number line (both horizontally and vertically) to include the opposites of whole numbers. The number line serves as a model to relate integers and other rational numbers to statements of order in real-world contexts. Students also see how the number line model is extended to two-dimensions to create the coordinate plane to model and solve real-world problems involving rational numbers.

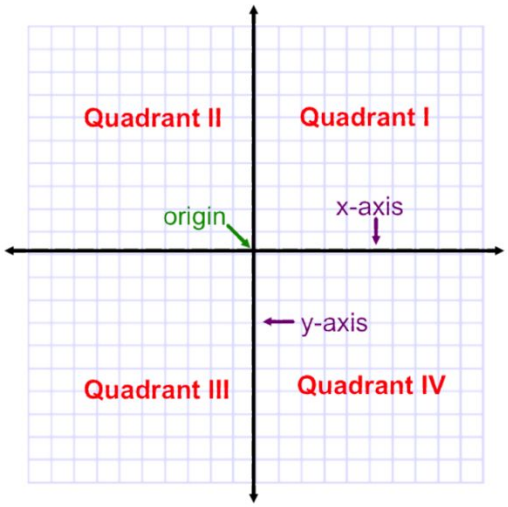
## Key Words

**Rational Numbers** – the set of all numbers that can represented as a ratio including fractions and terminating and repeating decimals.
**Integers** – the numbers ..., –3, –2, –1, 0, 1, 2, 3... on the number line.
**Negative Number** – a number less than zero.
**Positive Number** – a number greater than zero.
**Opposites** – A position on the other side of zero, as in negative numbers are the opposite direction from zero on the number line as positive numbers. Positive numbers are on the opposite side of zero from the negative numbers. (5 is the opposite of –5; –3 is the opposite of 3).
**Absolute Value** – the distance between the number and zero on the number line.
**Coordinate Plane** – formed by the intersection of a horizontal number line called the **x-axis** and a vertical number line called the **y-axis**.
**Ordered Pair** – pair of numbers that describes the location of a point in a coordinate plane. The first number in the ordered pair is the x-coordinate and the second number is the y-coordinate.
**Quadrants** – the four sections of the coordinate plane formed by the intersection of the axes.
**Origin** – the coordinate that describes the point where the x-axis and y-axis intersect.




|4| = 4 The absolute value of 4 is 4.
|-4| = 4 The absolute value of -4 is 4.



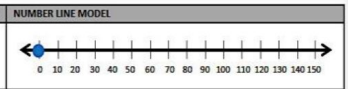
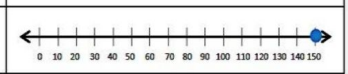
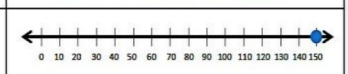
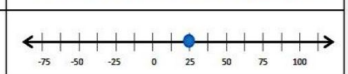
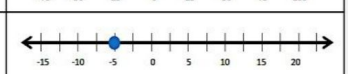
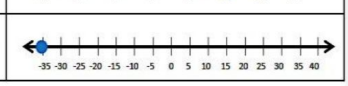

## How can I help at home?

- ★ Ask your child what they learned in school and ask them to show you an example.
- ★ Ask your child to explain the difference between the opposite of a number and the absolute value of a number.
- ★ Discuss with your child where negative numbers are located on a horizontal number line.
- ★ Discuss with your child where negative numbers are located on a vertical number line.
- ★ Ask your child to describe the relationship between 10 and –10.
- ★ Discuss times throughout the day where you can use positive a negative numbers to represent a situation. For example, observe and discuss the temperature changes throughout the day or what is means when a football team gains/loses yards during a game.

## Common Core Standards

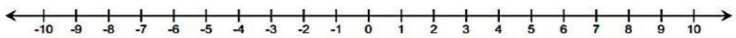
- ★ Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
- ★ Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
- ★ Understand ordering and absolute value of rational numbers.
- ★ Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

## Sample Problems

| EVENT | INTEGER | NUMBER LINE MODEL |
|---|---|---|
| Open a bank account with $0. | 0 |  |
| Make a $150 deposit. | 150 |  |
| Credit an account for $150. | 150 |  |
| Make a deposit of $25. | 25 |  |
| A bank charge of $5. | −5 |  |
| A withdrawal of $35. | −35 |  |

Order the following set of rational numbers from least to greatest, and explain how you determined their order.

$$-3, 0, -\frac{1}{2}, 1, -3\frac{1}{3}, 6, 5, -1, \frac{21}{5}, 4$$



**Solution:**

$$-3\frac{1}{3}, -3, -1, -\frac{1}{2}, 0, 1, 4, \frac{21}{5}, 5, 6$$

I drew a number line and started at zero. I located the positive numbers to the right and their opposites (the negative numbers) to the left of zero. The positive integers listed in order from left to right are $1, 4, 5, 6$. And since $\frac{21}{5}$ is equal to $4\frac{1}{5}$, I know that it is $\frac{1}{5}$ more than $4$ but less than $5$. Therefore, I arrived at $0, 1, 4, \frac{21}{5}, 5, 6$. Next, I ordered the negative numbers. Since $-1$ and $-3$ are the opposites of $1$ and $3$, they are $1$ unit and $3$ units from zero but to the left of zero. And $-3\frac{1}{3}$ is even farther left, since it is $3\frac{1}{3}$ units to the left of zero. The smallest number is farthest to the left, so I arrived at the following order: $-3\frac{1}{3}, -3, -1, -\frac{1}{2}, 0, 1, 4, \frac{21}{5}, 5, 6$.

## Problem to Try at Home

**Jessie and his family drove up to a picnic area on a mountain. In the morning, they followed a trail that led to the mountain summit, which was $2,000$ feet above the picnic area. They then returned to the picnic area for lunch. After lunch, they hiked on a trail that led to the mountain overlook, which was $3,500$ feet below the picnic area.**

a. Locate and label the elevation of the mountain summit and mountain overlook on a vertical number line. The picnic area represents zero. Write a rational number to represent each location.

picnic area: _____0_____

mountain summit: _____

mountain overlook: _____

b. Use absolute value to represent the distance on the number line of each location from the picnic area.

Distance from the picnic area to the mountain summit: _____

Distance from the picnic area to the mountain overlook: _____

c. What is the distance between the elevations of the summit and overlook? Use absolute value and your number line from part (a) to explain your answer.

## Coming Up Next...

Students will extend their arithmetic work to include using letters to represent numbers. Students will explore letters as representations of numbers and see that arithmetic is carried out exactly as it is with numbers. Students will explore operations in terms of verbal expressions and determine that arithmetic properties hold true with expressions because nothing has changed and the arithmetic is the same. Students will determine that letters are used to represent specific but unknown numbers and are used to make statements or identities that are true for all numbers or a range of numbers.