Understanding Positive and Negative Numbers

Numbers aren't just for counting anymore! In the real world, we need numbers that can show things going in opposite directions - like temperatures dropping below zero or going into debt. Today we'll explore how positive and negative numbers help us describe the world around us.

> **Real-World Connection:** Imagine you're a video game designer creating an underwater adventure game. Your character starts at sea level (0), can dive 50 feet underwater (-50), or jump 30 feet above the water (+30). You need positive and negative numbers to track where your character is at all times - and that's exactly how scientists track real submarines and divers!

The Number Line: Your Mathematical Map

A number line is like a ruler that extends in both directions from zero. Positive numbers go to the right of zero, and negative numbers go to the left. Think of zero as your starting point - like the ground floor of a building.

Example 1: Draw a number line and locate the numbers -3, 0, 2, and -1

Solution: Draw a horizontal line with arrows on both ends. Mark zero in the center. Count 3 spaces left for -3, 1 space left for -1, and 2 spaces right for +2.

The farther left you go, the smaller (more negative) the numbers become. The farther right you go, the larger (more positive) the numbers become.

Example 2: If the temperature starts at 5°F and drops 8 degrees, what's the final temperature?

Solution: Start at +5 on the number line. Move 8 spaces to the left (because temperature is dropping). You end up at -3°F.

Moving left on the number line represents decreasing values, just like how dropping temperature means getting colder.

Key Points:
* Zero is neither positive nor negative - it's neutral
* Numbers get smaller as you move left, larger as you move right
* Every point on the number line represents exactly one number

Opposites: Numbers That Balance Each Other

Opposite numbers are the same distance from zero but on different sides of the number line. They're like perfect balance - if you add them together, they equal zero. Think of it like being 5 floors above ground (+5)

versus 5 floors below ground (-5).

Example 1: What is the opposite of +7?

Solution: The opposite of +7 is -7.

Both numbers are exactly 7 units away from zero, but in opposite directions on the number line.

Example 2: A diver goes 25 feet below sea level, then rises to 25 feet above sea level. How do these positions relate?

Solution: -25 feet and +25 feet are opposites. They're equal distances from sea level (0) but in opposite directions.

In real life, opposites often represent contrasting situations that 'cancel out' - like debt and savings, or going up and down.

Example 3: What number is its own opposite?

Solution: Zero (0) is its own opposite.

Zero is the only number that's the same distance from itself in both directions - which is no distance at all!

Key Points:
* Opposite numbers are equal distances from zero
* The sum of any number and its opposite always equals zero
* Zero is the only number that is its own opposite

Absolute Value: How Far From Home?

Absolute value tells us how far a number is from zero, regardless of direction. It's like asking 'How many steps away from home are you?' - it doesn't matter if you went left or right. We write absolute value using two vertical bars: |number|.

Example 1: Find the absolute value of -6 and +6

Solution: $|-6| = 6$ and $|+6| = 6$

Both -6 and +6 are exactly 6 units away from zero on the number line, so they have the same absolute value.

Example 2: An elevator starts at floor 0. It goes to floor -4, then to floor +3. How far did it travel in total?

Solution: Distance to floor -4: $|-4| = 4$ floors. Distance from -4 to +3: $|+3 - (-4)| = 7$ floors. Total: $4 + 7 = 11$ floors.

Absolute value helps us calculate actual distances traveled, even when moving in different directions.

Example 3: Which has a greater absolute value: -10 or +8?

Solution: $|-10| = 10$ and $|+8| = 8$, so -10 has the greater absolute value.

Even though -10 is less than +8, it's farther from zero, so its absolute value is greater.

Key Points:
* Absolute value is always positive or zero, never negative

* Opposite numbers always have the same absolute value
* Absolute value represents distance, which is always positive

Vocabulary

Integer: Whole numbers that can be positive, negative, or zero (...-3, -2, -1, 0, +1, +2, +3...)
Positive Number: A number greater than zero, located to the right of zero on a number line
Negative Number: A number less than zero, located to the left of zero on a number line
Number Line: A straight line with numbers placed at equal intervals, showing the order and relationship between numbers
Opposite Numbers: Two numbers that are the same distance from zero but on different sides of the number line
Absolute Value: The distance a number is from zero on the number line, always written as a positive number or zero

Summary:

We've discovered that numbers extend beyond counting into the realm of opposites and directions. The number line helps us visualize positive and negative integers, opposites show us perfect balance, and absolute value measures distance from zero. These concepts help us understand everything from temperature changes to financial transactions to elevator movements - proving that math truly describes our world!

Try These:

1. The temperature dropped from 4°F to -7°F. What is the absolute value of the final temperature?

   Answer: _____

2. What is the opposite of -15?

   Answer: _____

3. A submarine is 45 feet below sea level. Write this as an integer.

   Answer: _____

4. Which is farther from zero: -12 or +9?

   Answer: _____