Warehouse Grade 7 Adding Integers

CCSSM: Grade 7

DOMAIN: The Number System

Cluster: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Standard: 7.NS.1: Apply and extend previous understandings of addition and subtraction to add and subtract **rational numbers**, and represent addition and subtraction on a horizontal or **vertical number line** diagram.
   1a. Describe situations in which opposite quantities combine to make 0.
   1b. Understand $p + q$ as the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are **additive inverses**).

CCSSM: Grade 6

DOMAIN: The Number System

Cluster: Apply and extend previous understandings of numbers to the system of rational numbers.

Standard: 6.NS.5 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, debits/credits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Standard: 6.NS.6 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.
   a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite.

Clarification of Math Discussion Terms

The answer to an addition problem is called the **SUM**. The answer to a subtraction problem is called the **DIFFERENCE**. For example, the sum of 8 and 3 is 11 and the difference between 8 and 3 is 5.

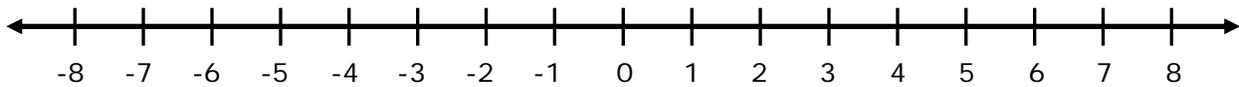**Classroom Example 1**
What is the sum of 27 and 32?
The sum is 59.

What is the difference between 43 and 28?
The difference is 15.

The set of **INTEGERS** includes all of the whole numbers and their opposites. The counting numbers (1, 2, 3, 4, …) are called the **POSITIVE** integers. The opposites of the counting numbers (-1, -2, -3, -4, …) are called the **NEGATIVE** integers. The number 0 is neither positive nor negative.

The integers are often placed on a **NUMBER LINE** as shown below.

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<-----+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+----->
     -8  -7  -6  -5  -4  -3  -2  -1   0   1   2   3   4   5   6   7   8
```

Classroom Example 2
Which of these numbers is not an integer?
3   0   ½   -8
The fraction ½ is not an integer.

To find the sum of two integers with the same sign, add their absolute values and keep the sign. For example, the sum of -8 and -3 is -11.

To find the sum of two integers with different signs, subtract the smaller absolute value from the greater absolute value and take the sign of the number with the greater absolute value. For example, the sum of -1 and 5 is 4 and the sum of 1 and -5 is -4.

Classroom Example 3
What is the sum of -5 and -9?
The sum is -14.

What is the sum of -5 and 9?
The sum is 4.

What is the sum of 5 and -9?
The sum is -4.

The Math in the Puzzle
In the Warehouse puzzle, the player must select two "resonators" for each gate so that the creature will move the correct number of spaces from gate to gate ending in the trap at the bottom. Placing both resonators on the same side of the gate results in a move corresponding to their sum. If both resonators are placed on the left side, the creature moves to the right (as when finding the sum of two positive numbers on a number line,) while placing both on the right side results in a move to the left (as when finding the sum of two negative integers.) Placing the resonators on opposite sides results in a move corresponding to their difference. The number placed on the left side is positive and so, moves the creature to the right; the one on the right side is negative and moves the creature to the left.

In the screen shot above, the creature must move 1 unit to the left in order to move from the first gate to the second. The player must choose two resonators that will result in a sum of -1. Possibilities include -2 + 1 or -3 + 2 or -4 + 3. The screen shot below shows the gate with resonators placed representing -4 + 3, resulting in a move of -1 or one unit to the left.

The player must determine the correct placements that result in the creature moving through all of the gates. The screen shot below shows all of the gates with resonators correctly placed.

In subsequent levels of the puzzle, the values of the resonators increase from 1-4 in Level 2 to 1-8 in Level 3.