**Lesson 15 Notes: Addition of Integers**

**Answer Key**

-4

4

Negative Integers

-3 -2 -1 0 1 2 3

Positive Integers

**Integers:** Integers are a subset of the real number system that contains all of the whole numbers and their opposites.

Symbol for the set of integers: Z = {…-3,-2,-1, 0, 1, 2, 3…}

**Opposites:** Numbers are considered opposites on the number line when they are the exact distance from zero except in opposite directions.

Negative numbers are the opposite of positive numbers and vise versa.

For example, **\_\_\_\_\_** and \_\_\_\_\_ are opposites.

**Rules for the Addition of Integers**

**Addition of Two Positive Integers: *4 + 5 = \_\_\_\_\_***

* Add the two numbers together and keep the positive sign
* *Example 1:* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Addition of Two Negative Integers: -4 + -5 = \_\_\_\_\_**

* Add the two numbers together and keep the negative sign
* *Example 2:* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Addition of a Positive Integer and a Negative Integer:**

1. **-4 + 5 = \_\_\_\_\_ b. 4 + -5 = \_\_\_\_\_**

* Subtract the largest number from the smallest number and keep the sign of the largest number
* *Example 3a:* **-4 + 5 = \_\_\_\_\_** 5 – 4 = 1 keep the positive sign of the 5
* *Example 3b:* **4 + -5 = \_\_\_\_\_** 5 – 4 = 1keep the negative sign of the 5

4 + 5 = 9

-4 + -5 = -9

1

-1

**Addition of Integers Algorithms**

1. Chip Model
2. Charged-Field Model
3. Number-Line Model
4. Pattern Model

**Chip Model**

* 1. Visual representation of the addition of integers
  2. Use colored chips to represent integers
  3. One color represents a positive addend (such as yellow) and one color represents a negative addend (such as red)
  4. Equal amounts of red and yellow chips cancel each other out to equal zero.



* 1. Determine the amount and color of the remaining chips and write the corresponding integer
* *Example 4:* Model the problem by drawing chips and then solve.

  

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**Key:**

*Positive*

*Negative*

4 + (-6)

Answer: -2

*4 + -6 = ++++ ---- -- = -2*

**Charged-Field Model**

* 1. Visual representation of the addition of integers
  2. Similar to the Chip Model
  3. Use charges instead of chips
* *Example 5: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

Notice that as the “4” stays fixed, the numbers added to “4” decrease by 1 and the sum decreases by 1.

This pattern is verified when -1 is added to “4”. We can continue the pattern to continue adding integers to “4”.

Negative so move to the left 6 units

**Pattern Model**

* Uses patterns of addition of whole number to add integers
* Students should be familiar with whole number addition

|  |
| --- |
| 4 + 3 = 7 |
| 4 + 2 = 6 |
| 4 + 1 = 5 |
| 4 + 0 = 4 |
| 4 + -1 = 3 |
| 4 + -2 = 2 |
| 4 + -3 = 1 |
| 4 + -4 = 0 |

Answer: -2

Positive so move to the right 4 units

-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4

| | | | | | | | | | | |

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**Number Line Model**

* 1. Visual representation of the addition of integers
  2. Uses a number line to add integers
  3. Always start at 0.
  4. If the number is negative, move the arrow on the number line to the left. If the number is positive, move the arrow on the number line to the right.
  5. The distance between the two arrows is the answer.
  6. See if your distance is on the positive side of zero or the negative side of zero.
  7. Use the correct sign for your answer.



**Properties of Integer Addition**

Given integers *a*, *b*, and *c*.

**Closure Property of Addition of Integers**

* *a* + *b* is a unique integer
* The sum of any two integers will always be an integer.

**Commutative Property of Addition of Integers**

* *a* + *b* = *b* + *a*
* A change in the order of the addition of integers does not change the sum.
* *Example 6:* 4 + 8 = 8 + 4 = 12
* *Example 7: Use the commutative property to complete the statement.*
  + 5 + 7 = \_\_\_\_\_ + **\_\_\_\_\_** = 12

**Associative Property of Addition of Integers**

* (*a* + *b*) + *c* = *a* + (*b* + *c*)
* Changing the grouping of the addends does not change the sum.
* Notice, the order of the numbers does not change. The parentheses are simply shifted. The sum remains the same.
* *Example 8:* (5 + 6) + 2 = 5 + (6 + 2) = 13
* *Example 9: Use the associative property to rewrite the sum of the following:*
  + *( 4 + 7 ) + 3 = \_\_4+(7+3)\_\_\_\_\_\_\_\_\_\_\_\_*

**Identity Property of Addition of Integers**

* 0 is the unique integer such that, for all integers *a*, 0 + *a* = *a* = *a* + 0.
* Adding 0 to an integer does not change the integer.
* *Example 10:* 6 + 0 = 6

**Additive Inverse Property of Integers**

* For every integer *a*, there exists a unique integer -*a*, the additive inverse of *a*, such that
* *a* + (-*a)* = 0 = (-*a)* + *a*
* *Example 11:* 7 + (-7) = 0 = (-7) + 7

**Absolute Value**

The ***absolute value*** of a number *a*, written |*a*|, is the distance on the number line from 0 to *a*.

|4| = 4 and |−4| = 4 Absolute value is always positive or zero.