MathTeacherCoach.com

Algebra 1

UNIT 1 – Interactive Notebook

1-2 Operations on Integers

Name:		Date:	

Common Core Standards	CCSS.MATH.CONTENT.HSA.SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*

OPERATIONS ON INTEGERS

Operations involving **positive** and **negative integers** (like the usual whole numbers that we know) also involve the four operations **ADDITION**, **SUBTRACTION**, **MULTIPLICATION** and **DIVISION**. Operations on integers can be done using the number line, or numerically using different rules.

ADDITION AND SUBTRACTION OF INTEGERS USING THE NUMBER LINE

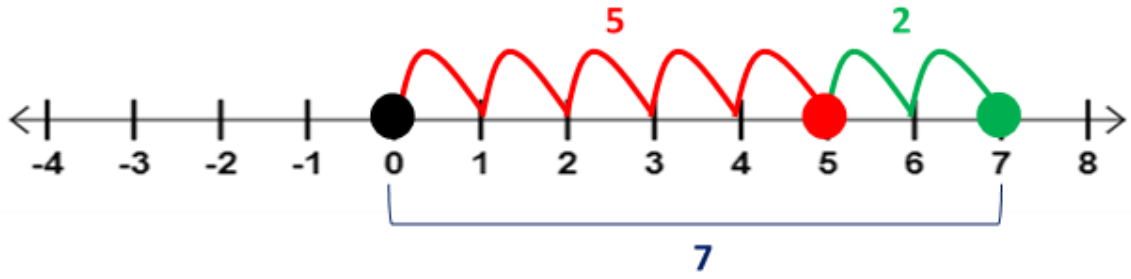
A number line is used as a visual model to show what happens when positive and negative numbers are **added** or **subtracted**.

THINGS TO REMEMBER IN ADDING OR SUBTRACTING INTEGERS USING THE NUMBER LINE:

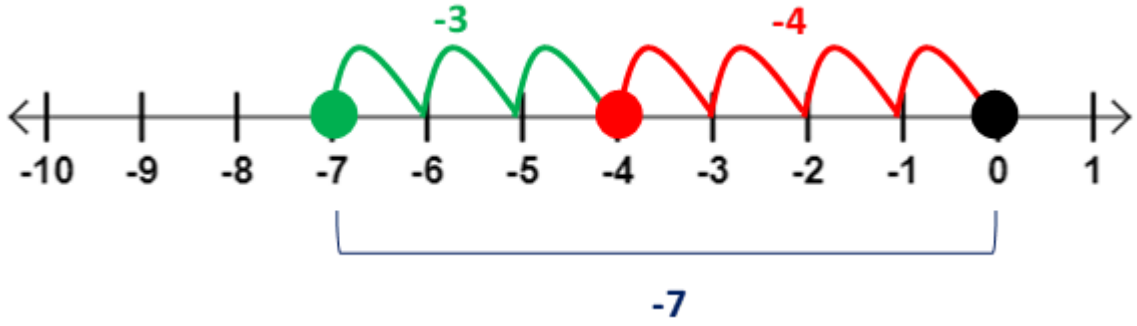
- The starting point is always at **ZERO**.
- If the integer is **positive** the movement on the number line is always to the **RIGHT**.
- If the integer is **negative** the movement on the number line is always to the **LEFT**.

ADDING SAME SIGNED NUMBERS

Example 1: $\mathbf{5 + 2 = 7}$



Example 2: $\mathbf{(-4) + (-3) = -7}$

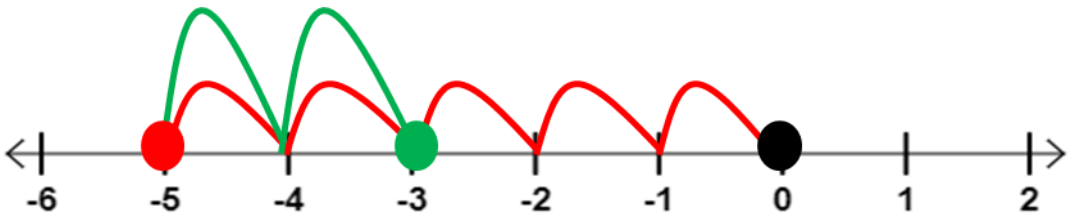


ADDING DIFFERENT SIGNED NUMBERS

Adding different signed numbers means that the addends have different signs. It's when you add a negative number to a positive number; or add a positive number to a negative number. The same rules apply if the number is positive, move to the right; and if the number is negative, move to the left.

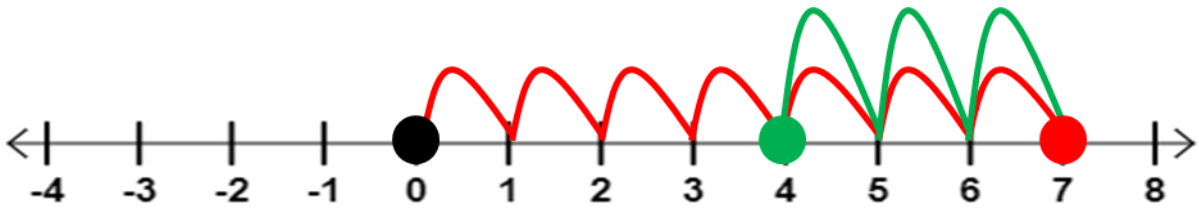
Example 1: $(-5) + 2$

Here we are adding positive 2 to negative 5. The starting point is at 0.



Example 2: $7 + (-3)$

Here we are adding negative 3 to positive 7. The starting point is at 0.



SUBTRACTING INTEGERS

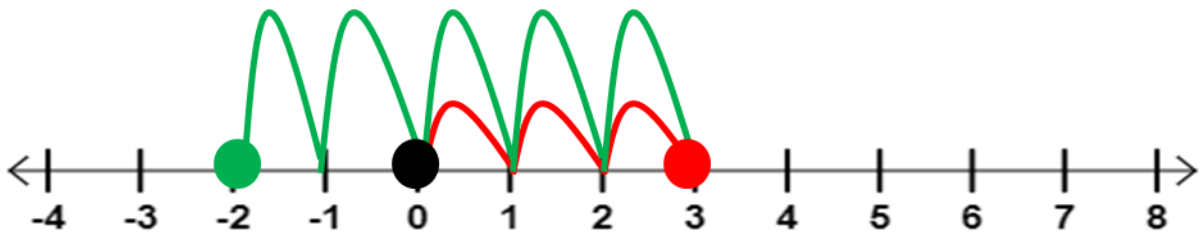
Before subtracting integers using the number line, there is one very important RULE to remember.

"TO SUBTRACT IS TO ADD ITS OPPOSITE"

$10 - 4 = ?$ Read as "positive 10 minus positive 4"	is the same as	$10 + (-4) = ?$ Read as "positive 10 plus negative 4"
$3 - 5 = ?$	is the same as	$3 + (-5) = ?$
$-3 - 2 = ?$ Read as "negative 3 minus positive 2"	is the same as	$-3 + (-2) = ?$ Read as "negative 3 plus negative 2"
$-4 - 6 = ?$	is the same as	$-4 + (-6) = ?$

Example: $3 - 5$

$3 - 5$ can be written as $3 + (-5)$. The starting point is at 0.



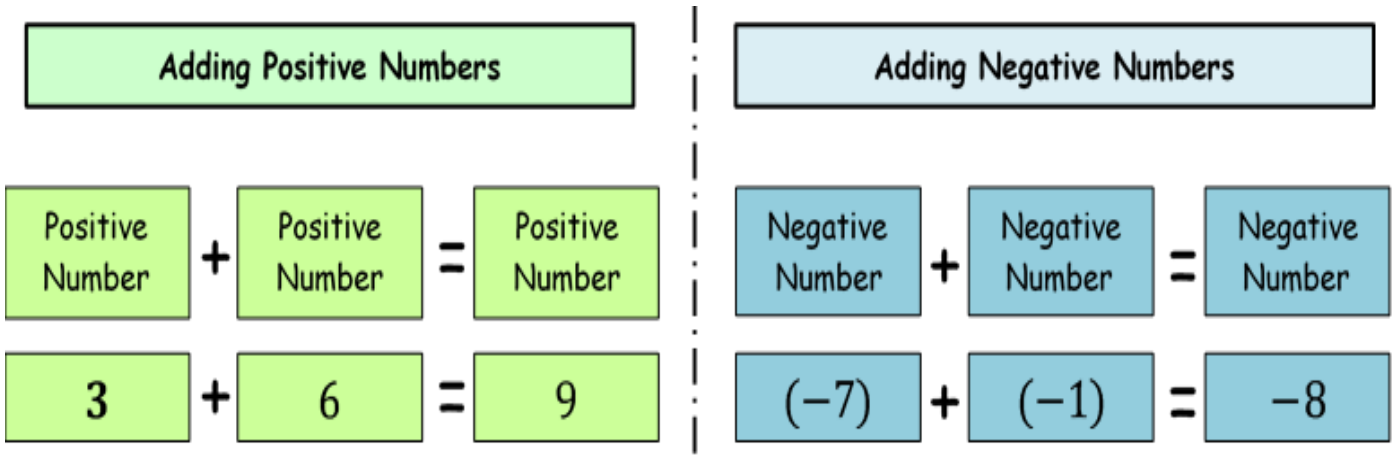
ADDING INTEGERS NUMERICALLY

Creating number lines to perform operations on integers can be a tedious task; but it is a nice way to visually show what happens to integers when they are added or subtracted. To perform operations easier and simpler, we can also do this numerically, using a few sets of rules.

ADDING SAME SIGNED INTEGERS

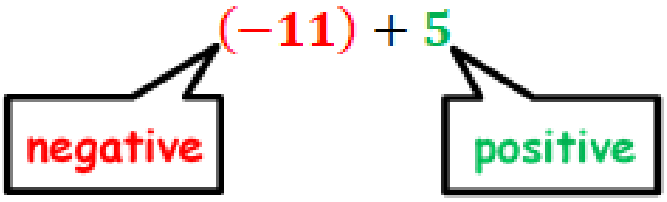
RULE: Simply add the given numbers and then copy the sign of the addends.

Getting the sum of integers having the same signs is like doing a simple addition. Just add the numbers and copy the sign of the addends.



ADDING DIFFERENT SIGNED INTEGERS

This means that the addends have different signs.



To get the sum, follow this rule:

RULE: Subtract the absolute value of the smaller number from the absolute value of the larger number and then keep the sign of the number with the larger absolute value.

The **absolute value** of a number is the distance of the number from zero, without any regard to its direction. So it is safe to say that the absolute value of any integer is always positive (because there is **NO NEGATIVE DISTANCE**).

Example:

$$(-11) + 5 = ?$$

The absolute value of **-11** is **11**.

The absolute value of **5** is **5**

Subtracting the absolute value of smaller integer from the bigger integer.

$$11 - 5 = 6$$

Keep the sign of the of the integer with the larger absolute value. The integer with the larger absolute value is 11, and its sign is negative, thus the answer will carry the negative sign.

$$(-11) + 5 = -6$$

Or to make it even simpler, think of these integers as "**the money you have**" or "**the money you owe**".

Positive integers represent "the money you have".

Negative integers represent "the money you owe".

$$(-11) + 5 = -6$$

You owe somebody 11 and you have 5, therefore you still owe somebody 6.

SUBTRACTING INTEGERS NUMERICALLY

Just like adding integers numerically, subtracting integers also follow specific steps. These include the following:

Step 1: Copy the first number.

Step 2: Change subtraction into addition.

Step 3: Change the second number into its opposite.

Step 4: Apply the rules in adding integers.

SUBTRACTING SAME SIGNED INTEGERS

Example: $\mathbf{5 - 10}$

The expression is read as "positive five minus positive ten".

Step 1: Copy the first number.

$$\mathbf{5}$$

Step 2: Change subtraction into addition.

$$\mathbf{5 +}$$

Step 3: Change the second number into its opposite.

$$\mathbf{5 + (-10)}$$

Step 4: Apply the rules in adding integers.

$$\mathbf{5 + (-10) = -5}$$

SUBTRACTING DIFFERENT SIGNED INTEGERS

Example: $-11-20$

The expression is read as "negative eleven minus positive twenty".

Step 1: Copy the first number.

$$-11$$

Step 2: Change subtraction into addition.

$$-11+$$

Step 3: Change the second number into its opposite.

$$-11+(-20)$$

Step 4: Apply the rules in adding integers.

$$-11+(-20)=-31$$

MULTIPLYING INTEGERS NUMERICALLY

The rules in multiplying integers is less complicated compared to adding and subtracting integers. Below are the rules.

Rule 1: The product of multiplying integers with the same signs is always **POSITIVE**.

Rule 2: The product of multiplying integers with different signs is always **NEGATIVE**.

MULTIPLYING SAME SIGNED INTEGERS

Example 1: $(5)(10)$

The expression is read as "**positive five times positive ten**".

Finding the product is the same as doing simple multiplication.

$$(5)(10) = 50$$

Example 2: $(-16)(-4)$

The expression is read as "**negative sixteen times negative four**".

$$(-16)(-4) = 64$$

MULTIPLYING DIFFERENT SIGNED INTEGERS

Example 1: $(-7)(4)$

The expression is read as **"negative 7 times positive 4".**

$$(-7)(4) = -28$$

Example 2: $(12)(-5)$

The expression is read as "**positive twelve times negative five**".

$$(12)(-5) = -60$$

DIVIDING INTEGERS NUMERICALLY

The rules in multiplying integers also work in dividing integers.

Rule 1: The quotient of dividing integers with the same signs is always **POSITIVE**.

Rule 2: The quotient of dividing integers with different signs is always **NEGATIVE**.

DIVIDING SAME SIGNED INTEGERS

Example 1: $\mathbf{16 \div 4}$

The expression is read as **"positive sixteen divided by positive four".**

Finding the quotient is the same as doing simple division.

$$\mathbf{16 \div 4 = 4}$$

Example 2: $\mathbf{(-24) \div (-12)}$

The expression is read as **"negative twenty-four divided by negative twelve".**

$$\mathbf{(-24) \div (-12) = 2}$$

DIVIDING DIFFERENT SIGNED INTEGERS

Example 1: $(-8) \div 2$

The expression is read as "**negative eight divided by positive two**".

$$(-8) \div 2 = -4$$

Example 2: $(72) \div (-12)$

The expression is read as "**negative seventy-two divided by negative twelve**".

$$(72) \div (-12) = -6$$

WHAT I HAVE AND WHAT I OWE!

Read each statement carefully. Represent each statement numerically and perform the necessary operation using the number line.

1. John owes his friend $10 but John only has $7.

2. Shane owes his mom $9, and an additional $5 more.

3. Tina owes her sister $7, and she gave her sister $9.

Jack and Jill

Solve the riddle below by performing the indicated operation. Match the letters to the blanks below.

J	**A**	**N**
$-6-9$	$(-10)\div(-2)$	$(-5)(-3)$
R	**H**	**S**
$25\div(-5)$	$-24\div-2$	$20-32$
I	**C**	**E**
$-9-9$	$-6+15$	$12-16$
G	**O**	**D**
$(-6)(-3)$	$-4-(-3)$	$9-18$
K	**L**	**F**
$-20\div-5$	$-9-(-9)$	$(-1)(1)(-1)(1)$

Jack and Jill are lying on the floor inside the house, dead. They died from lack of water. There is shattered glass next to them. How did they die?

-15 5 9 4	5 15 -9	-15 -18 0 0
5 -5 -4	18 -1 0 -9	1 -18 -12 12

Task Cards

1.
Adding positive integers always has a positive sum.
TRUE or FALSE

2.
On a number line, if the integer is positive, the movement is always to the right.
TRUE or FALSE

3.
Multiplying negative integers carries the negative sign in the product.
TRUE or FALSE

4.
Dividing different signed integers are has a negative quotient.
TRUE or FALSE

5.
Subtract:

$-25-(-8)$

6.
Add:

$10+(-6)+(-4)$

7.
Multiply:

$(5)(-1)(-2)(3)(-1)$

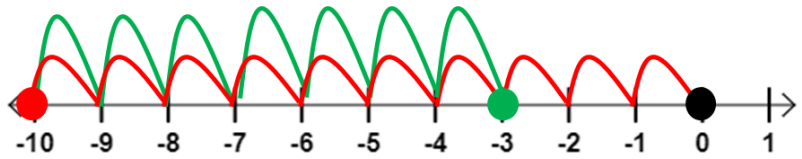
8.
Divide:

$-51 \div -17$

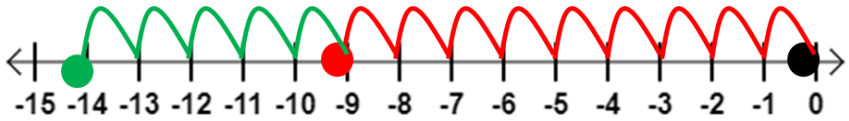
Answers:

What I Have and What I Owe!

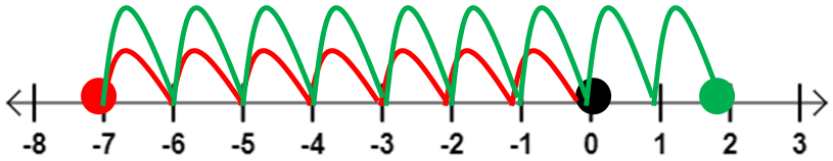
1. $-10 + 7 = -3$



2. $(-9) + (-5) = -14$



3. $-7 + 9 = 2$



Jack and Jill

Jack and Jill are lying on the floor inside the house, dead. They died from lack of water. There is shattered glass next to them. How did they die?

J	A	C	K		A	N	D		J	I	L	L
-15	5	9	4		5	15	-9		-15	-18	0	0

A	R	E		G	O	L	D	F	I	S	H
5	-5	-4		18	-1	0	-9	1	-18	-12	12

Task Cards

1. TRUE
2. TRUE
3. FALSE
4. TRUE
5. -17
6. 0
7. -30
8. 3