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# Operation on Integers

Unit 1 Lesson 2

# OPERATIONS ON INTEGERS

## Students will be able to:

- Add and subtract integers using the number line.
- Perform operations on integers by applying the appropriate rules.

# OPERATIONS ON INTEGERS

## Key Vocabulary:

Integers

Number Line

Positive Integers

Negative Integer

Addition

Subtraction

Multiplication

Division

## OPERATIONS OF 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.

# OPERATIONS ON INTEGERS

## 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**.

# OPERATIONS ON INTEGERS

## 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**.

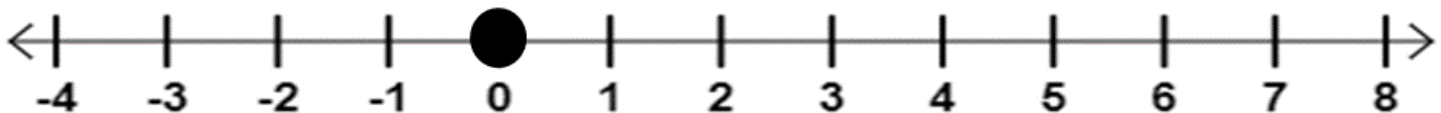
# OPERATIONS ON INTEGERS

## ADDING SAME SIGNED NUMBERS

**Example 1:**  $5 + 2$

Obviously, the answer is positive 7. Let's use a number line to visually show that the answer is really positive 7.

The starting point is at 0.

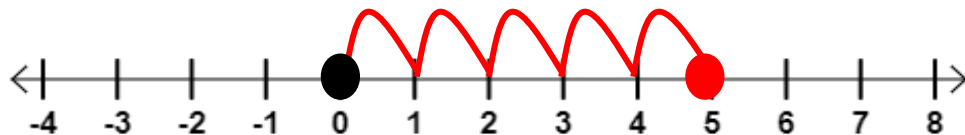


# OPERATIONS ON INTEGERS

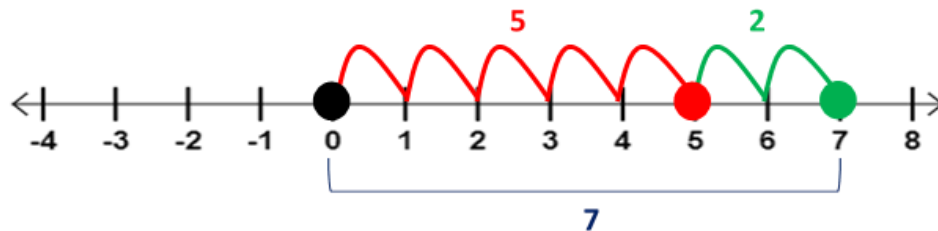
## ADDING SAME SIGNED NUMBERS

### Example 1: $5 + 2$

Since 5 is positive, move 5 units to the right of 0.



Since we were adding positive 2 to positive 5, move 2 more units to the right of 5.



Therefore,  $5 + 2 = 7$ .

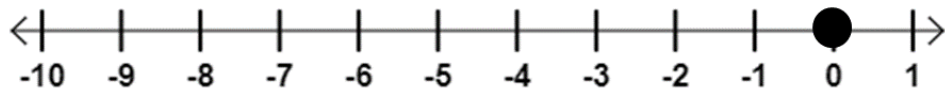


# OPERATIONS ON INTEGERS

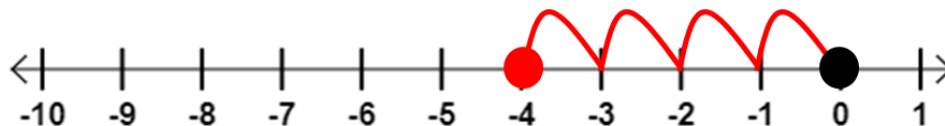
## ADDING SAME SIGNED NUMBERS

**Example 2:**  $(-4) + (-3)$

Here, we are adding negative 4 and negative 3. The starting point is at 0.



Since 4 is negative, move 4 units to the left of 0.

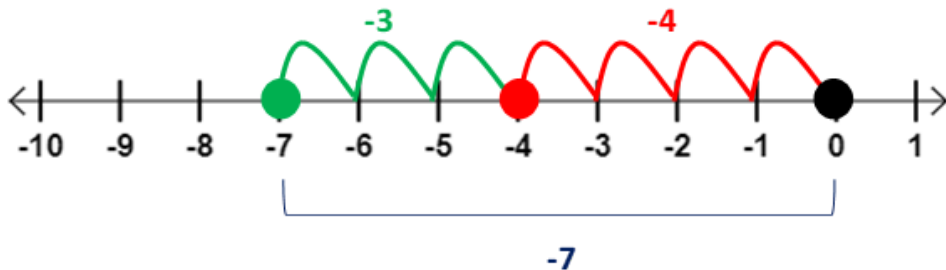


# OPERATIONS ON INTEGERS

## ADDING SAME SIGNED NUMBERS

**Example 2:**  $(-4) + (-3)$

Since we are adding negative 3 to negative 4, move 3 units to the left of -4.



Therefore,  $(-4) + (-3) = -7$ .

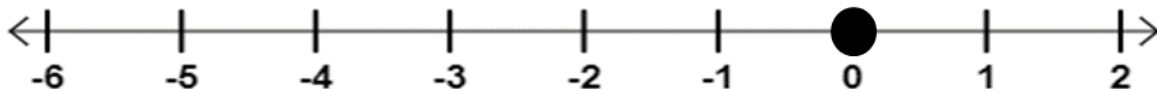
# OPERATIONS ON INTEGERS

## 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:**  $(-5) + 2$

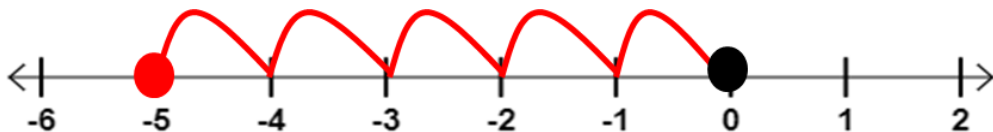
Here we are adding positive 2 to negative 5. The starting point is at 0.



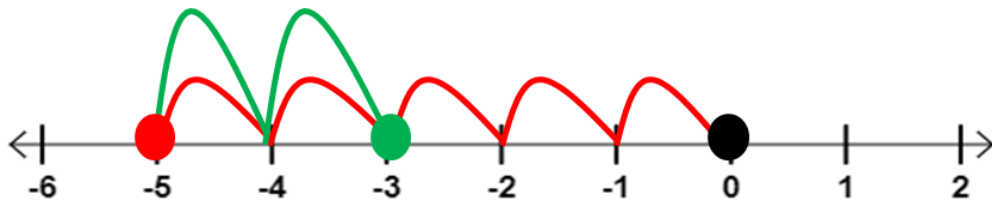
# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED NUMBERS

Since 5 is negative, move 5 units to the left of 0.



Since we are adding positive 2 to negative 5, we move 2 units to the right of -5.

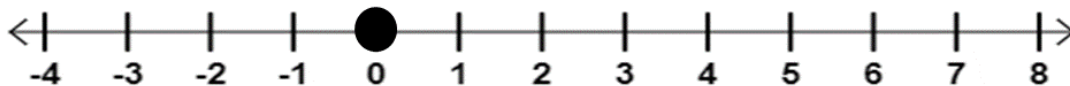


# OPERATIONS ON INTEGERS

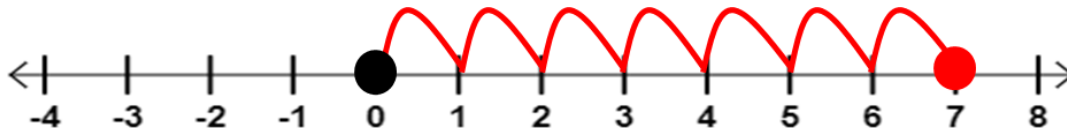
## ADDING DIFFERENT SIGNED NUMBERS

**Example 2:**  $7 + (-3)$

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



Since 7 is positive, move 7 units to the right of 0.

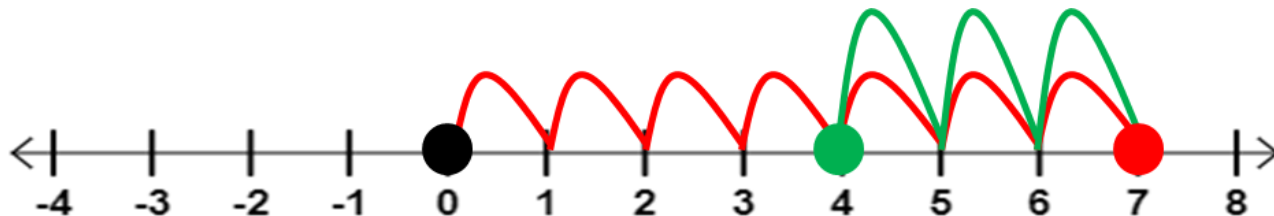


# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED NUMBERS

**Example 2:**  $7 + (-3)$

Since we are adding negative 3 to positive 7, we move 3 units to left of 7.



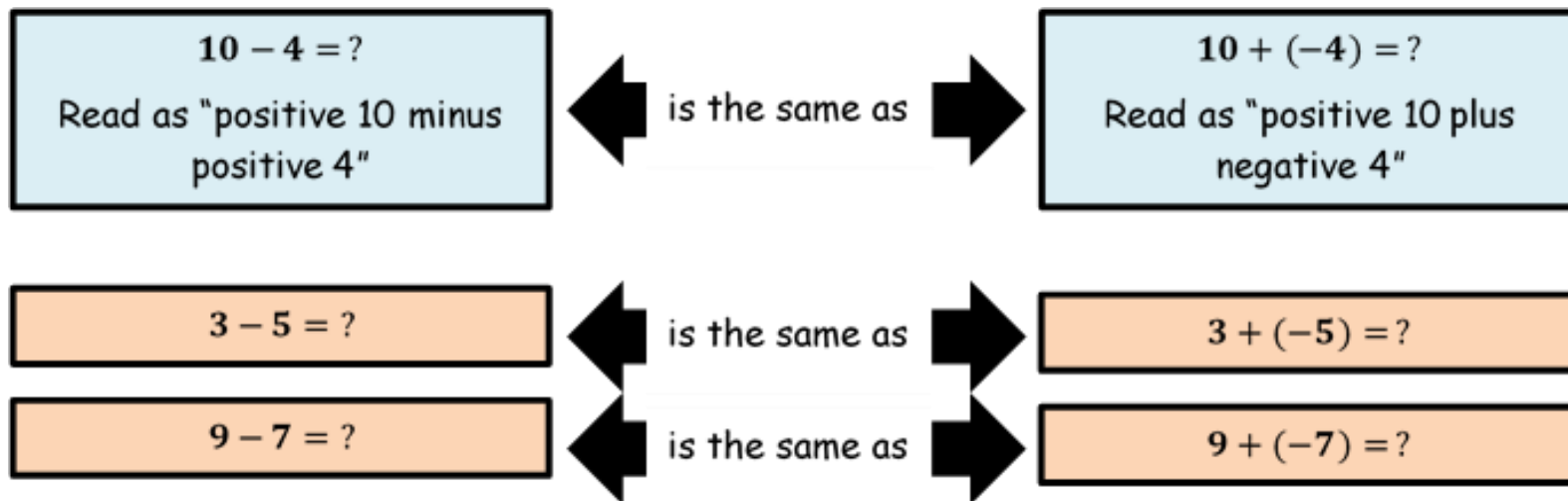
Therefore,  $7 + (-3) = 4$ .

# OPERATIONS ON INTEGERS

## SUBTRACTING INTEGERS

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

**“TO SUBTRACT IS TO ADD ITS OPPOSITE”**

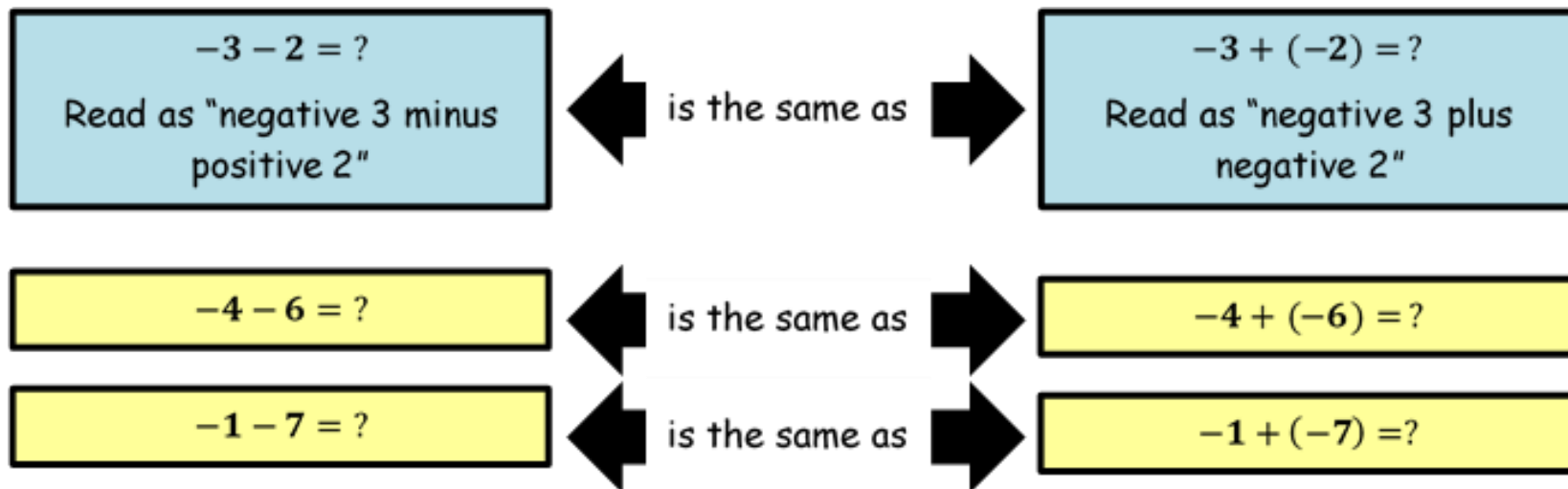


# OPERATIONS ON INTEGERS

## SUBTRACTING INTEGERS

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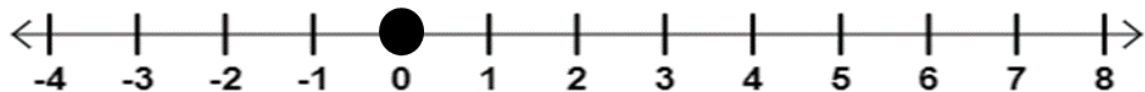


# OPERATIONS ON INTEGERS

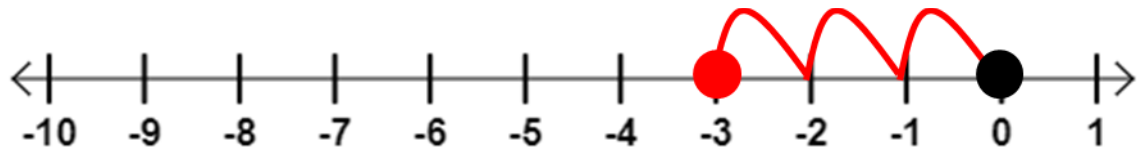
## SUBTRACTING INTEGERS

### Example 1: $3 - 5$

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



Since 3 is positive, move 3 units to the right of 0.

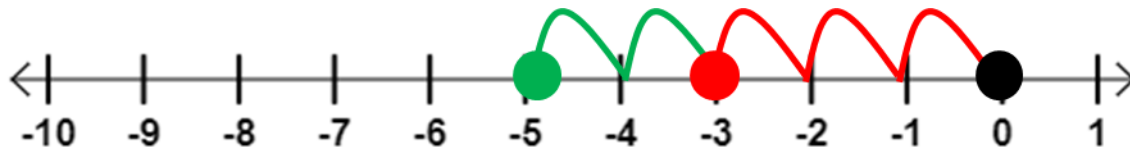


# OPERATIONS ON INTEGERS

## SUBTRACTING INTEGERS

### Example 1: $3 - 5$

Since 2 is negative, move 2 units to the left of -3.



Therefore,  $-3 - 2 = -5$

## OPERATIONS ON INTEGERS

**Sample Problem 1:** Perform the indicated operation using the number line.

1.  $-10 + 6$

2.  $-3 + 5$

3.  $-7 - 5$

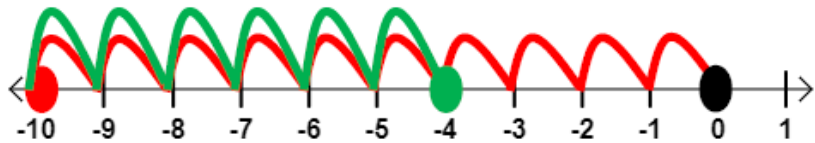
4.  $6 - 10$



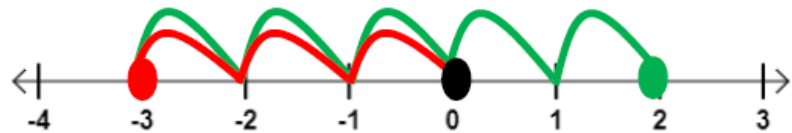
# OPERATIONS ON INTEGERS

## Sample Problem 1: Solution

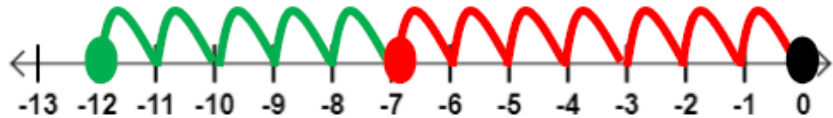
1.  $-10 + 6$



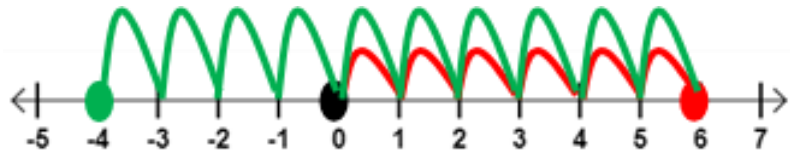
2.  $-3 + 5$



3.  $-7 - 5$



4.  $6 - 10$



# OPERATIONS ON INTEGERS

## 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.



# OPERATIONS ON INTEGERS

## 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.

# OPERATIONS ON INTEGERS

## ADDING SAME SIGNED INTEGERS

Adding Positive Numbers

Positive Number + Positive Number = Positive Number

$$3 + 6 = 9$$

Adding Negative Numbers

Negative Number + Negative Number = Negative Number

$$(-7) + (-1) = -8$$

# OPERATIONS ON INTEGERS

## ADDING SAME SIGNED INTEGERS

### More Examples:

1.  $5 + 19 = 24$

2.  $(-21) + (-19) = -40$

3.  $(-17) + (-31) + (-5) = -53$

4.  $24 + 42 + 8 = 74$





# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

This means that the addends have different signs.

$$(-11) + 5$$

The diagram illustrates the addition of two integers with different signs:  $(-11) + 5$ . The number  $-11$  is written in red, and the number  $5$  is written in green. Below  $-11$  is a callout box with a black border containing the word "negative" in red. Below  $5$  is a callout box with a black border containing the word "positive" in green. Lines connect the boxes to their respective numbers in the equation.

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**.

# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

**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**).



# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

**Example 1:**

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

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.

$$11 - 5 = 6$$



# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

### Example 1:

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

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**”.

# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

### Example 1:

**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**.

# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

**Example 2:** Add  $10 + (-2)$

The absolute value of **10** is **10**.

The absolute value of **-2** is **2**.

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

$$10 - 2 = 8$$

# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

**Example 2:** Add  $10 + (-2)$

Keep the sign of the of the integer with the larger absolute value. The integer with the larger absolute value is 10, and its sign is positive, thus the answer will carry the positive sign.

$$10 + (-2) = 8$$

To make you understand the problem better:

You have **10** and you owe somebody **2**, therefore you still have **8**.



# OPERATIONS ON INTEGERS

## ADDING DIFFERENT SIGNED INTEGERS

### More Examples:

1.  $-5 + 20 = 15$

2.  $10 + (-16) = -6$

3.  $10 + (-5) + (-5) = 10 + (-5) + (-5)$   
 $= 5 + (-5)$   
 $= 0$

4.  $(-16) + 11 + (-10) = (-16) + 11 + (-10)$   
 $= -5 + (-10)$   
 $= -15$





## OPERATIONS ON INTEGERS

**Sample Problem 2:** Perform the indicated operation.

1.  $16 + (-82)$

2.  $(-17) + 25$

3.  $-47 + 19$

4.  $18 + (-55)$

5.  $(-16) + 24 + (-8)$

6.  $25 + (-35) + 5$



## OPERATIONS ON INTEGERS

### Sample Problem 2: Solution

$$1. 16 + (-82) = -66$$

$$2. (-17) + 25 = 8$$

$$3. -47 + 19 = -28$$

$$4. 18 + (-55) = -37$$

$$5. (-16) + 24 + (-8) = 0$$

$$6. 25 + (-35) + 5 = -5$$



# OPERATIONS ON INTEGERS

## 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.



# OPERATIONS ON INTEGERS

## SUBTRACTING SAME SIGNED INTEGERS

**Example 1:**  $5 - 10$

The expression is read as “**positive five minus positive ten**”.

**Step 1:** Copy the first number.

$$5$$

**Step 2:** Change subtraction into addition.

$$5 +$$

**Step 3:** Change the second number into its opposite.

$$5 + (-10)$$

**Step 4:** Apply the rules in adding integers.

$$5 + (-10) = -5$$

# OPERATIONS ON INTEGERS

## SUBTRACTING SAME SIGNED INTEGERS

**Example 2:**  $-8 - (-12)$

The expression is read as “negative eight minus negative twelve”.

**Step 1:** Copy the first number.

$$-8$$

**Step 2:** Change subtraction into addition.

$$-8 +$$

**Step 3:** Change the second number into its opposite.

$$-8 + 12$$

**Step 4:** Apply the rules in adding integers.

$$-8 + 12 = 4$$

# OPERATIONS ON INTEGERS

## SUBTRACTING DIFFERENT SIGNED INTEGERS

**Example 1:**  $-11 - 20$

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.

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

# OPERATIONS ON INTEGERS

## SUBTRACTING DIFFERENT SIGNED INTEGERS

**Example 2:**  $7 - (-17)$

The expression is read as “**positive seven minus negative seventeen**”.

**Step 1:** Copy the first number.

$$7$$

**Step 2:** Change subtraction into addition.

$$7 +$$

**Step 3:** Change the second number into its opposite.

$$7 + 17$$

**Step 4:** Apply the rules in adding integers.

$$7 + 17 = 24$$

# OPERATIONS ON INTEGERS

## SUBTRACTING DIFFERENT SIGNED INTEGERS

### More Examples:

$$\begin{aligned} 1. \quad -19 - 25 &= -19 + (-25) \\ &= \mathbf{-44} \end{aligned}$$

$$\begin{aligned} 2. \quad -11 - (-9) &= -11 + 9 \\ &= \mathbf{-2} \end{aligned}$$

$$\begin{aligned} 3. \quad -32 - 6 &= -32 + (-6) \\ &= \mathbf{-38} \end{aligned}$$

$$\begin{aligned} 4. \quad 28 - (-2) &= 28 + 2 \\ &= \mathbf{30} \end{aligned}$$



## OPERATIONS ON INTEGERS

**Sample Problem 3:** Perform the indicated operation.

1.  $16 - 20$

2.  $-11 - 29$

3.  $14 - (-15)$

4.  $-28 - (-6)$

5.  $22 - (-38)$

6.  $64 - 100$

7.  $-72 - 22$

8.  $64 - (-100)$

## OPERATIONS ON INTEGERS

### Sample Problem 3: Solution

$$1. 16 - 20 = 16 + (-20) = -4$$

$$2. -11 - 29 = -11 + (-29) = -40$$

$$3. 14 - (-15) = 14 + 15 = 29$$

$$4. -28 - (-6) = -28 + 6 = -22$$

$$5. 22 - (-38) = 22 + 38 = 60$$

$$6. 64 - 100 = 64 + (-100) = -36$$

$$7. -72 - 22 = -72 + (-22) = -94$$

$$8. 64 - (-100) = 64 + 100 = 164$$



# OPERATIONS ON INTEGERS

## 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**.

# OPERATIONS ON INTEGERS

## 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**”.

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



# OPERATIONS ON INTEGERS

## 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**”.

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

# OPERATIONS ON INTEGERS

## MULTIPLYING DIFFERENT SIGNED INTEGERS

In multiplication involving more than two signed factors, multiply the integers one at a time to make sure that the answer is accurate. Of course, take note of the rules in multiplying integers.

**Example:**

$$(9) (-2) (-4) (-5)$$

$$(-18) (-4) (-5)$$

$$(72) (-5)$$

$$-360$$

# OPERATIONS ON INTEGERS

## MULTIPLYING DIFFERENT SIGNED INTEGERS

### More Examples:

1.  $(9)(8) = 72$

2.  $(-15)(-4) = 60$

3.  $(-9)(11) = -99$

4.  $(12)(-3) = -36$

5.  $(4)(-2)(8) = (-8)(8) = -64$

6.  $(5)(-6)(-2) = (-30)(-2) = 60$



## OPERATIONS ON INTEGERS

**Sample Problem 4:** Perform the indicated operation.

1.  $(7)(2)$

2.  $(-6)(-12)$

3.  $(-4)(-10)$

4.  $(-21)(4)$

5.  $(-1)(1)(-1)(-1)(2)(-1)$

6.  $(-10)(2)(-3)(-1)$



# OPERATIONS ON INTEGERS

## Sample Problem 4: Solution

1.  $(7)(2) = 14$

2.  $(-6)(-12) = 72$

3.  $(-4)(-10) = 40$

4.  $(-21)(4) = -84$

5.  $(-1)(1)(-1)(-1)(2)(-1) = 2$

6.  $(-10)(2)(-3)(-1) = -60$

# OPERATIONS ON INTEGERS

## 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**.

# OPERATIONS ON INTEGERS

## DIVIDING SAME SIGNED INTEGERS

**Example 1:**  $16 \div 4$

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

Finding the quotient is the same as doing simple division.

$$16 \div 4 = 4$$

**Example 2:**  $(-24) \div (-12)$

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

$$(-24) \div (-12) = 2$$



# OPERATIONS ON INTEGERS

## 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**”.

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



# OPERATIONS ON INTEGERS

## DIVIDING DIFFERENT SIGNED INTEGERS

### More Examples:

1.  $12 \div 4 = 3$

2.  $-32 \div 8 = -4$

3.  $-45 \div 15 = -3$

4.  $88 \div (-22) = -4$

## OPERATIONS ON INTEGERS

**Sample Problem 5:** Perform the indicated operation.

1.  $-165 \div 15$

2.  $-96 \div 8$

3.  $-384 \div (-12)$

4.  $-420 \div 15$

# OPERATIONS ON INTEGERS

## Sample Problem 5: Solution

$$1. \quad -165 \div 15 = -11$$

$$2. \quad -96 \div 8 = -12$$

$$3. \quad -384 \div (-12) = 32$$

$$4. \quad -420 \div 15 = -28$$