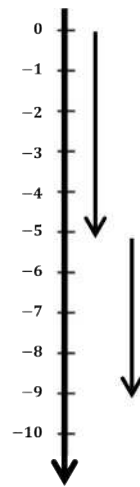Name _____   Date _____

Understanding Addition of Integers

1. Refer to the diagram to the right.
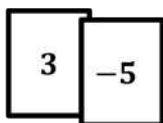
    a. Write an equation for the diagram to the right. _____

    b. Find the sum. _____

    c. Describe the sum in terms of the distance from the p-value. Explain.

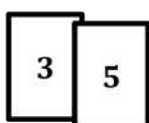   d. What integers do the arrows represent? _____

2. Jenna and Jay are playing the Integer Game. Below are the two cards they selected.

    a. How do the models for these two addition problems differ on a number line? How are they the same?

    Jenna's Hand   Jay's Hand
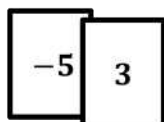
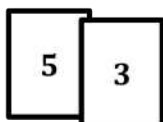 | 3 | −5 | | 3 | 5 |

    b. If the order of the cards changed, how do the models for these two addition problems differ on a number line? How are they the same?

    Jenna's Hand   Jay's Hand

    | −5 | 3 | | 5 | 3 |

1. Below is a table showing the change in temperature from morning to afternoon for one week.

   a. Use the vertical number line to help you complete the table. As an example, the first row is completed for you.

Change in Temperatures from Morning to Afternoon

Morning Temperature	Change	Afternoon Temperature	Number Sentence
$1°C$	Rise of $3°C$	$4°C$	$1 + 3 = 4$
$2°C$	Rise of $8°C$		
$-2°C$	Fall of $6°C$		
$-4°C$	Rise of $7°C$		
$6°C$	Fall of $9°C$		
$-5°C$	Fall of $5°C$		
$7°C$	Fall of $7°C$		

```
 — 10


 —
 —
 — 5
 —

 —
 —
 — 0
 —

 —
 —
 — −5
 —

 —
 —
 — −10
 —
```

   b. Do you agree or disagree with the statement: "A rise of $-7°C$" means "a fall of $7°C$"? Explain. (Note: No one would ever say, "A rise of -7 degrees;" however, mathematically speaking, it is an equivalent phrase.)

For Questions 2–3, refer to the Integer Game.

2. Terry selected two cards. The sum of her cards is -10.

   a. Can both cards be positive? Explain why or why not.

   b. Can one of the cards be positive and the other be negative? Explain why or why not.

   c. Can both cards be negative? Explain why or why not.

3. When playing the Integer Game, the first two cards you selected were -8 and -10.

   a. What is the value of your hand? Write an equation to justify your answer.

   b. For part (a), what is the distance of the sum from -8? Does the sum lie to the right or left of -8 on the number line?

   c. If you discarded the -10 and then selected a 10, what would be the value of your hand? Write an equation to justify your answer.

4. Given the expression $67 + (-35)$, can you determine, without finding the sum, the distance between 67 and the sum? Is the sum to the right or left of 67 on the number line?

5. Use the information given below to write an equation. Then create an "arrow diagram" of this equation on the number line provided below.

   "The p-value is -4, and the sum lies 12 units to the right of the p-value."
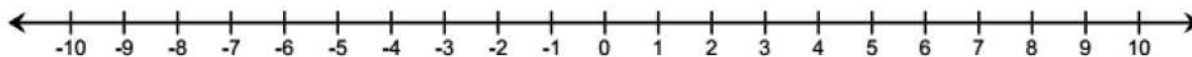
1. Refer to the diagram to the right.

   a. Write an equation for the diagram below.
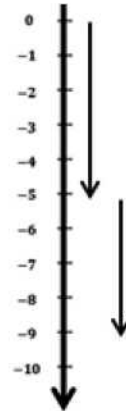
   $-5 + (-4) = -9$

   b. Find the sum.

   -9

   c. Describe the sum in terms of the distance from the p-value. Explain.

   The sum is 4 units below -5 because $|-4| = 4$. I counted down from -5 four times and stopped at -9.

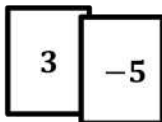   d. What integers do the arrows represent?

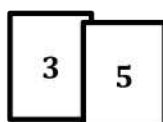   *The arrows represent the integers -4 and -5.*

2. Jenna and Jay are playing the Integer Game. Below are the two cards they selected.

   a. How do the models for these two addition problems differ on a number line? How are they the same?

   Jenna's Hand   Jay's Hand

   `3` `−5`   `3` `5`

   The p-values are the same. They are both 3, so the heads of the first arrows will be at the same point on the number line. The sums will both be five units from this point but in opposite directions.

   b. If the order of the cards changed, how do the models for these two addition problems differ on a number line? How are they the same?

   Jenna's Hand   Jay's Hand

   `−5` `3`   `5` `3`
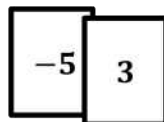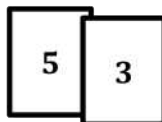
   The p-values are different, so the head of the first arrow in each model will be at different points on the number line. The sums are both three units to the right of the p-values.

Practice problems will help students build fluency and improve accuracy when adding integers with and without the use of a number line. Students need to be comfortable with using vectors to represent integers on the number line, including the application of absolute value to represent the length of a vector.

1. Below is a table showing the change in temperature from morning to afternoon for one week.

   a. Use the vertical number line to help you complete the table. As an example, the first row is completed for you.

   Change in Temperatures from Morning to Afternoon

Morning Temperature	Change	Afternoon Temperature	Equation
1°C	Rise of 3°C	4°C	$1 + 3 = 4$
2°C	Rise of 8°C	10°C	$2 + 8 = 10$
−2°C	Fall of 6°C	−8°C	$-2 + (-6) = -8$
−4°C	Rise of 7°C	3°C	$-4 + 7 = 3$
6°C	Fall of 9°C	−3°C	$6 + (-9) = -3$
−5°C	Fall of 5°C	−10°C	$-5 + (-5) = -10$
7°C	Fall of 7°C	0°C	$7 + (-7) = 0$

   ```
   — 10

   — 5

   — 0

   — −5

   — −10
   ```

   b. Do you agree or disagree with the following statement: "A rise of $-7°C$" means "a fall of $7°C$?" Explain. (Note: No one would ever say, "A rise of -7 degrees;" however, mathematically speaking, it is an equivalent phrase.)

   Sample response: I agree with this statement because a rise of -7 is the opposite of a rise of 7. The opposite of a rise of 7 is a fall of 7.

For Questions 2–3, refer to the Integer Game.

2. Terry selected two cards. The sum of her cards is -10.

   a. Can both cards be positive? Explain why or why not.

   No. In order for the sum to be -10, one of the addends would have to be negative. If both cards are positive, then Terry would count up twice going to the right. Negative integers are to the left of 0.

   b. Can one of the cards be positive and the other be negative? Explain why or why not.

   Yes. Since both cards cannot be positive, this means that one can be positive and the other negative. She could have -11 and 1 or -12 and 2. The card with the greatest absolute value would have to be negative.
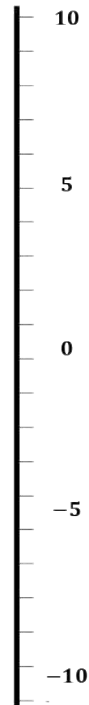
   c. Can both cards be negative? Explain why or why not.

   Yes, both cards could be negative. She could have -8 and -2. On a number line, the sum of two negative integers will be to the left of 0.

3. When playing the Integer Game, the first two cards you selected were -8 and -10.

   a. What is the value of your hand? Write an equation to justify your answer.

   $-8 + (-10) = -18$

     b.   For part (a), what is the distance of the sum from -8? Does the sum lie to the right or left of -8 on the number line?

          The distance is 10 units from -8, and it lies to the left of -8 on the number line.

     c.   If you discarded the -10 and then selected a 10, what would be the value of your hand? Write an equation to justify your answer.

          The value of the hand would be 2. $-8 + 10 = 2$.

4.   Given the expression $67 + (-35)$, can you determine, without finding the sum, the distance between 67 and the sum? Is the sum to the right or left of 67 on the number line?

    The distance would be 35 units from 67. The sum is to the left of 67 on the number line.

5.   Use the information given below to write an equation. Then create an "arrow diagram" of this equation on the number line provided below.

    "The p-value is -4, and the sum lies 12 units to the right of the p-value."

    $-4 + 12 = 8$