Name: Date:

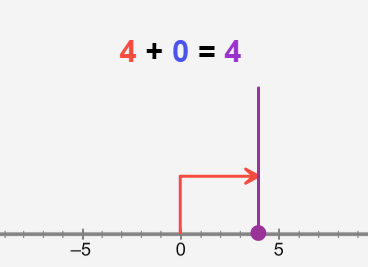
**Student Exploration:** **Adding and Subtracting Integers**

**Vocabulary:** addend, commutative property of addition, difference, integer, sum

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

Chad likes to play Bingo at the nearby American Legion Hall. One day he goes into the hall with $14 in his pocket. When he comes out, he has no money left and owes his friend Greg $3.

1. How much money did Chad lose that night?
2. At home, Chad finds $5 in the kitchen drawer. If you include the $3 he owes Greg, how much does Chad have, total?
3. If Greg forgives Chad’s $3 debt to him, how does that affect how much money Chad has?

**Gizmo Warm-up**

One way to understand negative numbers is to think about money. If you are in debt, you have less than zero dollars, which is a negative amount of money.

Working with negative numbers can be tricky, but using a number line may help. You can explore how to add and subtract positive and negative **integers**, or numbers with no fractional part, in the *Adding and Subtracting Integers* Gizmo.

1. To begin, check that **Add integers** is selected. Set the **Value of first integer** to 4 by dragging the slider or by typing “4” into the box to the right of the slider and hitting **Enter**.
2. Where on the number line is the purple dot representing this number?

1. In what direction does the red arrow point?
2. Now set the **Value of the first integer** to –4. How does the graph change?

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| **Activity A:**  **Adding integers** | Get the Gizmo ready:   * Be sure **Add integers** is selected. * Set the **Value of first integer** to 4 and the **Value of second integer** to 3. | 291SE2 |

1. After entering the values above, look at how the **sum** 4 + 3 is shown on the number line.
   1. What is the length and direction of the red arrow?
   2. What is the length and direction of the blue arrow?
   3. What is 4 + 3?
2. Set the **Value of the first integer** to –4 to model (–4) + 3.
3. How does the red arrow change?
4. Does the blue arrow change?
5. What is (–4) + 3?
6. Set the first integer to 3 and the second integer to –4 to model the sum 3 + (–4).
7. What is the length and direction of the red arrow?
8. What is the length and direction of the blue arrow?
9. What is 3 + (–4)?
10. Compare 3 + (–4) to (–4) + 3. What happens to the sum when the **addends** are reversed?

The **commutative property of addition** states that the order in which numbers are added does not change the sum.

1. Consider the sum (–8) + (–7). Do not input these values into the Gizmo yet.
2. What will be the direction of the red arrow? The blue arrow?
3. What do you think (–8) + (–7) equals?
4. Check your answer using the Gizmo. Were you correct?
5. Find the following sums. For the first two, check your answers with the Gizmo.

(–4) + (–9) = 8 + (–10) = (–8) + 16 = (–11) + (–14) =

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| **Activity B:**  **Subtracting integers** | Get the Gizmo ready:   * Select **Subtract integers**. * Set the **Value of first integer** to 5 and the **Value of second integer** to 3. | 291SE3 |

1. Look at how the **difference** 5 – 3 is shown on the number line.
   1. What is the length and direction of the red arrow?
   2. What is the length and direction of the blue arrow?
   3. What is 5 – 3?
   4. What addition expression is equivalent to 5 – 3?
   5. Try other positive values for the second integer. When subtracting a positive integer, in what direction does the blue arrow point?
2. Set the second integer to 8 to model 5 – 8.
3. What does 5 – 8 equal? ­
4. In general, what can you say about the difference when you subtract a larger integer from a smaller integer?
5. What addition expression is equivalent to 5 – 8?
6. Set the first integer to –5 to model (–5) – 8.
7. How does the red arrow change?
8. Does the blue arrow change?
9. What is (–5) – 8?
10. What addition expression is equivalent to (–5) – 8?
11. Set the first integer to 2 and the second integer to –7 to model the difference 2 – (–7).
12. What is the length and direction of the blue arrow?
13. What is 2 – (–7)?
14. What addition expression is equivalent to 2 – (–7)?

**(Activity B continued on next page)**

**Activity B (continued from previous page)**

1. Try subtracting other negative numbers from 2.
2. In general, what is the direction of the second (blue) arrow when you subtract a negative?
3. Fill in the blank: Subtracting a negative is equivalent to a positive.
4. Consider the difference (–4) – (–9). Do not input these values into the Gizmo yet.
5. What will be the direction of the red arrow? The blue arrow?
6. What do you think (–4) – (–9) equals?
7. Check your answer using the Gizmo. Were you correct?
8. What addition expression is equivalent to (–4) – (–9)?
9. Find the following differences. For the first two, check your answers with the Gizmo.

7 – (–9) = 3 – 10 = (–2) – 12 = (–13) – (–4) =

1. Use the Gizmo to compare 5 – (–4) to (–4) – 5.
2. What is 5 – (–4)? What is (–4) – 5?
3. Does the commutative property apply to subtraction? Explain.

1. Use the Gizmo to investigate other pairs of differences. In general, if you know the difference of *a* – *b*, what is *b* – *a*?
2. Challenge: In this activity, you have compared subtraction expressions (differences) to their equivalent addition expressions (sums). Fill in the table below with the sum that is equivalent to each difference.

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| **Difference** | | **Equivalent sum** | |
| *a* – *b* | |  | |
| (–*a*) – *b* | |  | |
| **Difference** | | **Equivalent sum** | |
| *a* – (–*b*) | |  | |
| (–*a*) – (–*b*) | |  | |