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? _____

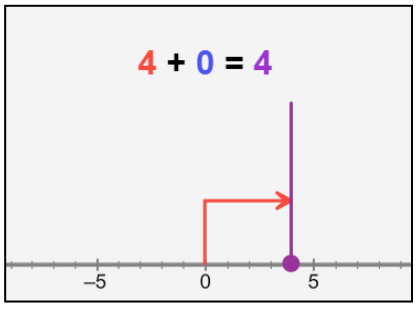
2. At home, Chad finds $5 in the kitchen drawer. If you include the $3 he owes Greg, how much does Chad have, total? _____

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.



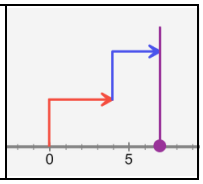

1. To begin, check that **Add integers** is selected. Set the **Value of first integer** to 4 by dragging the slider or by typing "4" into the box to the right of the slider and hitting **Enter**.
   A. Where on the number line is the purple dot representing this number? _____

   _____

   B. In what direction does the red arrow point? _____

2. Now set the **Value of the first integer** to –4. How does the graph change? _____

_____

| | | |
|---|---|---|
| **Activity A:**<br>**Adding integers** | Get the Gizmo ready:<br>• Be sure **Add integers** is selected.<br>• Set the **Value of first integer** to 4 and the **Value of second integer** to 3. |  |

1. After entering the values above, look at how the **sum** 4 + 3 is shown on the number line.

   A. What is the length and direction of the red arrow? _____

   B. What is the length and direction of the blue arrow? _____

   C. What is 4 + 3? _____

2. Set the **Value of the first integer** to –4 to model (–4) + 3.

   A. How does the red arrow change? _____

   B. Does the blue arrow change? _____ C. What is (–4) + 3? _____

3. Set the first integer to 3 and the second integer to –4 to model the sum 3 + (–4).

   A. What is the length and direction of the red arrow? _____

   B. What is the length and direction of the blue arrow? _____

   C. What is 3 + (–4)? _____

   D. 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.

4. Consider the sum (–8) + (–7). Do not input these values into the Gizmo yet.

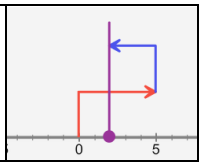
   A. What will be the direction of the red arrow? _____ The blue arrow? _____

   B. What do you think (–8) + (–7) equals? _____

   C. 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) = _____

| **Activity B:**<br>**Subtracting integers** | Get the Gizmo ready:<br>• Select **Subtract integers**.<br>• Set the **Value of first integer** to 5 and the **Value of second integer** to 3. |  |
|---|---|---|

1. Look at how the **difference** 5 – 3 is shown on the number line.
   A. What is the length and direction of the red arrow? _____
   B. What is the length and direction of the blue arrow? _____
   C. What is 5 – 3? _____
   D. What addition expression is equivalent to 5 – 3? _____
   E. 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.
   A. What does 5 – 8 equal? _____
   B. In general, what can you say about the difference when you subtract a larger integer from a smaller integer? _____
   C. What addition expression is equivalent to 5 – 8? _____

3. Set the first integer to –5 to model (–5) – 8.
   A. How does the red arrow change? _____
   B. Does the blue arrow change? _____ C. What is (–5) – 8? _____
   D. What addition expression is equivalent to (–5) – 8? _____

4. Set the first integer to 2 and the second integer to –7 to model the difference 2 – (–7).
   A. What is the length and direction of the blue arrow? _____
   B. What is 2 – (–7)? _____
   C. What addition expression is equivalent to 2 – (–7)? _____

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

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

5. Try subtracting other negative numbers from 2.

   A. In general, what is the direction of the second (blue) arrow when you subtract a negative? _____

   B. Fill in the blank: Subtracting a negative is equivalent to _____ a positive.

6. Consider the difference (–4) – (–9). Do not input these values into the Gizmo yet.

   A. What will be the direction of the red arrow? _____ The blue arrow? _____

   B. What do you think (–4) – (–9) equals? _____

   C. Check your answer using the Gizmo. Were you correct? _____

   D. What addition expression is equivalent to (–4) – (–9)? _____

7. Find the following differences. For the first two, check your answers with the Gizmo.

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

8. Use the Gizmo to compare 5 – (–4) to (–4) – 5.

   A. What is 5 – (–4)? _____ What is (–4) – 5? _____

   B. Does the commutative property apply to subtraction? _____ Explain. _____

   _____

   C. Use the Gizmo to investigate other pairs of differences. In general, if you know the difference of $a - b$, what is $b - a$? _____

9. 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.

| Difference | Equivalent sum |
|---|---|
| $a - b$ | |
| $(-a) - b$ | |

| Difference | Equivalent sum |
|---|---|
| $a - (-b)$ | |
| $(-a) - (-b)$ | |