Understand Addition of Positive and Negative Integers

💭 Think It Through

When do you add positive and negative integers?

You can use positive and negative integers to represent quantities you see in sports, games, business, science, and in other areas of your life.

For instance, in a game, you might gain 5 points if you answer the question correctly and lose 5 points if you answer the question incorrectly. The numbers 5 and -5 are on opposite sides of the number line and have the same distance from 0 on the number line. This means that the numbers have the same **absolute value**.
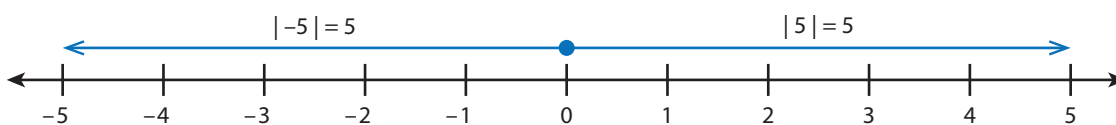

Think What happens when you add an integer to its opposite?

You can use a number line to picture what happens when you add an integer to its opposite.

Look at the number line above. The distance from 0 to -5 is represented by an arrow pointing to the left. The distance from 0 to 5 is represented by an arrow pointing to the right. Because $|5| = |-5|$, you know the distances and arrows are equal in length.

The sum of 5 and -5 is shown on the number line below. If you move 5 units in the positive direction and then move 5 units in the negative direction, you will be back at 0.

✏️ **Circle** the arrow that represents -5 on the number line.
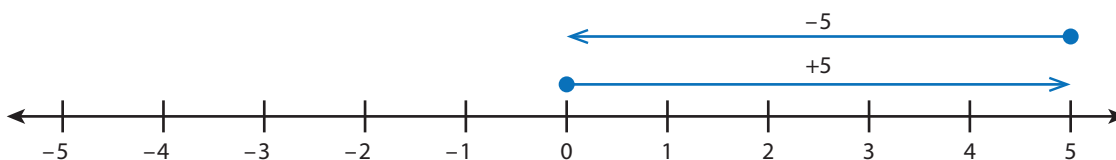
Two numbers that have a sum of zero are **additive inverses**. In this case, -5 is the additive inverse of 5 because $5 + (-5) = 0$. For the same reason, 5 is the additive inverse of -5.
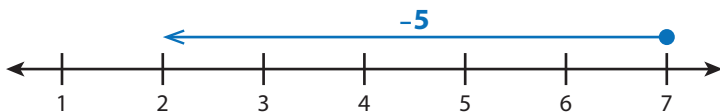
When adding or subtracting a negative number, you write the negative number in parentheses to separate it from the operation symbol.

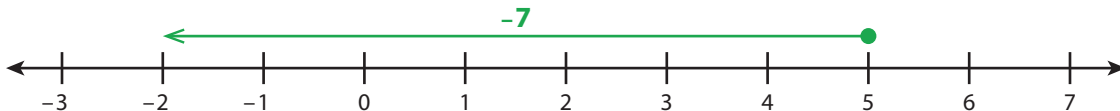| Correct	Incorrect
$3 + (-5)$	$3 + -5$
$4 - (-3)$	$4 - -3$

The number line below represents $-2 + (-4)$. You start at -2 and **move left 4 units**, ending at -6. The sum $-2 + (-4)$ is -6. When adding two negative numbers, you start on the left side of 0 and always move left, so the answer is always negative.
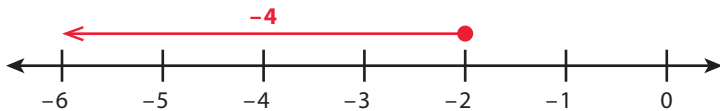
The number line below represents $7 + (-5)$. You start at 7 and **move left 5 units** to add -5. You end at 2, so $7 + (-5) = 2$.

Will the sum of -8 and $+3$ be positive or negative? Explain.

You can use this same process to add $5 + (-7)$. You start at 5 and **move left 7 units**. You end at -2, so $5 + (-7) = -2$.

▶ Reflect

1 How is adding integers similar to adding whole numbers? How is it different?

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Think About **Adding Positive and Negative Integers**

🔍 **Let's Explore the Idea** You can use additive inverses to help you understand how to add integers.
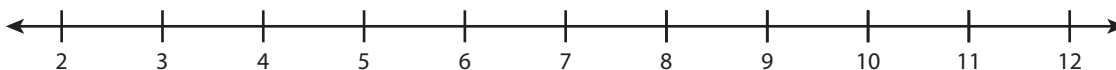
2 A fisherman positions his net to -8 feet relative to the surface of the water. How far does he need to raise the net to bring it to the surface of the water? _____

3 A bird 7 feet in the air flies down to the ground. What integer would you use to represent the change in the bird's position? _____

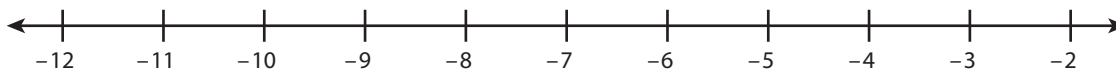**Using a number line helps you to visualize what is happening when adding integers.**

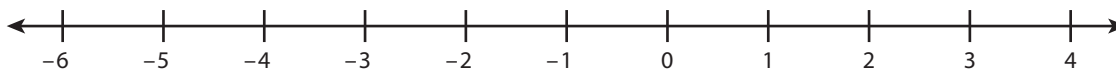**4** Use the number line below to show $6 + (-6)$. The sum $6 + (-6) =$ _____.

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←──┼────┼────┼────┼────┼────┼────┼────┼────┼────┼────┼──→
  −2   −1    0    1    2    3    4    5    6    7    8
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5 Use the number line below to show $11 + (-8)$. The sum $11 + (-8) =$ _____.

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←──┼────┼────┼────┼────┼────┼────┼────┼────┼────┼────┼──→
   2    3    4    5    6    7    8    9   10   11   12
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6 Use the number line below to show $-4 + (-7)$. The sum $-4 + (-7) =$ _____.

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←──┼────┼────┼────┼────┼────┼────┼────┼────┼────┼────┼──→
 −12  −11  −10   −9   −8   −7   −6   −5   −4   −3   −2
```

7 Use the number line below to show $-4 + 7$. The sum $-4 + 7 =$ _____.

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←──┼────┼────┼────┼────┼────┼────┼────┼────┼────┼────┼──→
  −6   −5   −4   −3   −2   −1    0    1    2    3    4
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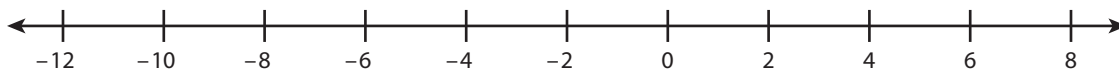
Let's Talk About It
Solve the problems below as a group.

8 Jason's football team lost 6 yards from their starting position and then lost another 5 yards. What number represents a loss of 6 yards? a loss of 5 yards? _____

9 Use a number line to find the team's total loss.

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←——+——+——+——+——+——+——+——+——+——+——+——→
  −12   −10   −8   −6   −4   −2    0    2    4    6    8
```

10 On the next play, the team gains 12 yards. Will the team be at their original starting position? Explain.

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11 A weather forecaster says the temperature will be about −5°C "give or take" 10 degrees.

What is the greatest possible temperature? _____

What is the least possible temperature? _____

12 Explain how you found your answers to problem 11. _____

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▶ **Try It Another Way** **You can add integers by decomposing numbers to form additive inverses that add to 0. For example, to add −8 + 10, you can think of 10 as 8 + 2.**

$$-8 + 10 = -8 + (8 + 2)$$
$$= (-8 + 8) + 2$$
$$= 0 + 2$$
$$= 2$$

Use the method shown above to do the problems below. Show your steps.
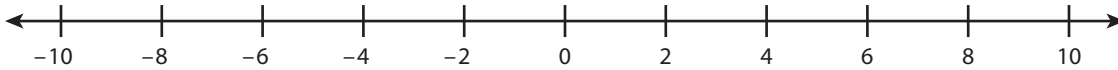
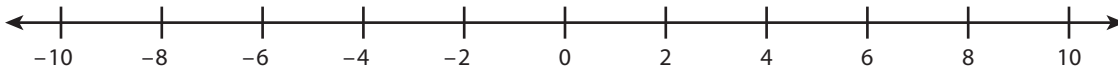**13** $10 + (-4)$ _____

14 $-12 + 7$ _____

Connect **Adding Positive and Negative Integers**

Talk through these problems as a class and write your answers below.

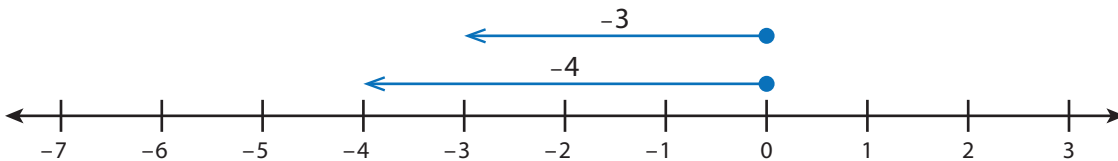**15 Compare** Show $7 + (-3)$ on the number line below.
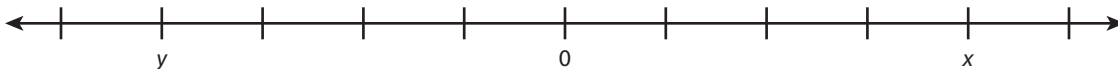

Show $-3 + 7$ on the number line below.

What do you notice about the results? _____

Explain why your number lines end on the same number. _____

_____

16 Explain Chase drew the number line below to show $-4 + (-3)$. Is his model accurate? If not, tell what is wrong with his model.

_____

_____

17 Analyze On the number line below, the numbers x and y are the same distance from 0. What is $x + y$? Explain how you found your answer.

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Apply ▶ **Adding Positive and Negative Integers**

18 Put It Together Use what you have learned in this lesson to complete this task.

> Mari is participating in National Lemonade Stand Day. She spends $18 for start-up costs, which include supplies to make the lemonade, cups, and advertising.

Part A Describe in detail how Mari could end up with the lemonade stand breaking even. ("Breaking even" means "a profit of 0," or that she makes enough money to pay for her start-up costs but has no money left over.) Your description must include:

• the cost of each type of supply (lemonade, cups, and advertising), with each cost represented as a negative number and in dollars

• the price Mari charges for 1 cup of lemonade, in dollars

• the total amount of sales, in dollars

• the money she has left over after covering her start-up costs, in dollars

• a mathematical expression and model that use the concepts in this lesson to show the amount of profit

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Part B Repeat Part A for the situation where Mari's lemonade stand makes a profit (meaning she has enough money to pay for her startup costs and has some money left over). Draw your number line on a separate sheet of paper.

_____

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