

Lesson 7

ADD AND SUBTRACT RATIONAL NUMBERS

NY-7.NS.1, NY-7.NS.1c, NY-7.NS.1d

WORDS TO KNOW

rational number

absolute value

INTRODUCTION

Real-World Connection

When Aram went to bed, it was 14°F outside. When he woke up the following morning, the temperature had dropped to -8°F . How much did the temperature drop overnight? Let's practice the skills in the **Guided Instruction** and **Independent Practice** and, at the end of the lesson, see how much the temperature dropped!

What I Am Going to Learn

- How to subtract rational numbers using the additive inverse
- How to find the distance between two numbers on a number line

What I May Already Know

- I know how to represent integers on a number line.
- I know that opposite numbers are the same distance from 0 on a number line.
- I know that the absolute value of a number is its distance from 0 on a number line.

Vocabulary in Action

A **rational number** is a number that can be written as a ratio of two integers. These numbers can be positive, negative, decimals, or fractions. You can show these numbers on a number line and can use the number line to add and subtract the numbers.

- A number line shows the distance between two numbers when subtracting: $8 - 7 = 1$ because 7 is 1 unit away from 8.
- The **absolute value** of the difference, $|x - y|$, is the distance between x and y . The value of $7 - 8 = -1$, and $|7 - 8| = 1$. The distance between 7 and 8 is 1.
- When subtracting rational numbers, $x - y = x + (-y)$; add the opposite of the second number.



TIPS AND HINTS

When using a number line to add numbers, move left if the number is negative, and move right if the number is positive.

TURN AND TALK

Do $-9 + 5$ and $5 + (-9)$ give the same value?

THINK ABOUT IT

If you think of subtraction as adding the opposite, then you never have to subtract again!

EXAMPLE

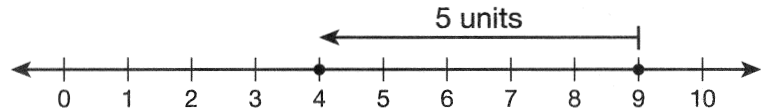
Subtract: $9 - 5$

Step One Rewrite $9 - 5$ as adding the opposite of the second number.

$$9 + (-5)$$

Step Two Start at 9 on the number line.

Step Three Move left 5 units.



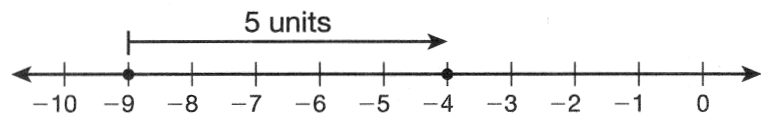
So, $9 - 5 = 4$.

EXAMPLE

Add: $-9 + 5$

Step One Start at -9 on the number line.

Step Two Move to the right 5 units.



So, $-9 + 5 = -4$.

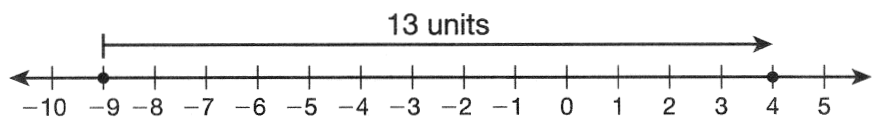
EXAMPLE

Subtract: $-9 - (-13)$

Step One Rewrite $-9 - (-13)$ as $-9 + 13$.

Step Two Start at -9 on the number line.

Step Three Move right 13 units.



So, $-9 - (-13) = 4$.

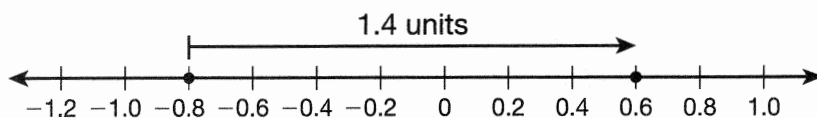
EXAMPLE

Subtract: $-0.8 - (-1.4)$

Step One Rewrite $-0.8 - (-1.4)$ as $-0.8 + 1.4$.

Step Two Start at -0.8 on the number line.

Step Three Move right 1.4 units.



So, $-0.8 - (-1.4) = 0.6$.

TIPS AND HINTS

Subtracting a negative number is the same as adding a positive number.

GUIDED INSTRUCTION

1. Find the difference: $8\frac{3}{5} - 10$

Step One Rewrite subtraction as adding the opposite.

$$8\frac{3}{5} - 10 =$$

$$8\frac{3}{5} + (-10)$$

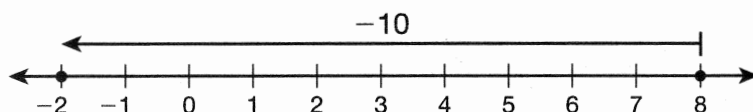
Step Two Rewrite $8\frac{3}{5}$ as $8 + \frac{3}{5}$.

$$8 + \frac{3}{5} + (-10)$$

Step Three Use the Commutative Property to change the number order.

$$8 + (-10) + \frac{3}{5}$$

Step Four Add $8 + (-10)$.

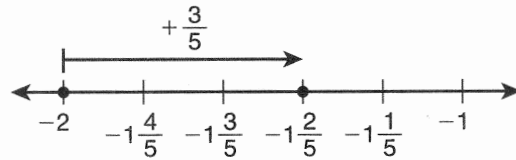


$$8 + (-10) = \boxed{}$$

TIPS AND HINTS

If you subtract a greater number from a lesser number, the result is negative. If you subtract a lesser number from a greater number, the result is positive.

Step Five Add $\frac{3}{5}$ to -2 .



Step Six Write the sum. This is the difference in the original problem.

$$8\frac{3}{5} - 10 = \boxed{}$$

2. Find $21.3 - (-12.5)$.

Subtracting a number is the same as adding its opposite.

The opposite of -12.5 is $\boxed{}$.

$$\text{So, } 21.3 - (-12.5) = 21.3 + \boxed{} = \boxed{}$$

3. What is the value of $-2.13 + 4.5 - (-8.2)$? Show your work.

SKETCH IT

Draw a quick number line showing 0 so you can think about where to start and on which side of 0 you will end.

4. Which expression is equal to 3?

- (A) $3 - 6$
- (B) $7 - (-4)$
- (C) $-12 - (-15)$
- (D) $1 - 2$

Learning Together

Work in a small group of 3 to 5 students. Using a deck of standard playing cards, assume that all the black cards are positive numbers and all the red cards are negative numbers. Choose a value between 1 and 20 for each hand. Take turns drawing one card at a time. Using any desired combination of pluses and minuses, create an expression with the positive and negative numbers you draw. You can change your expression as often as you like. The first player who can make an expression equal to the chosen value wins.



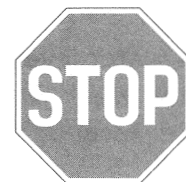
How Am I Doing?

What questions do you have?

How can you change a subtraction problem into an addition problem?

You have used subtraction most of your school years and have gotten positive numbers for the answer. Can you think of a real-life situation where you would get a negative number for the answer?

Circle the sign that shows how you are doing with the skill.



I am stuck.



I almost have it.



I understand the skill.

INDEPENDENT PRACTICE 1

1 Which of the following inequalities is **not** true?

- A $|5| < |7|$
- B $|-5| > |7|$
- C $|-5| < |-7|$
- D $|5| < |-7|$

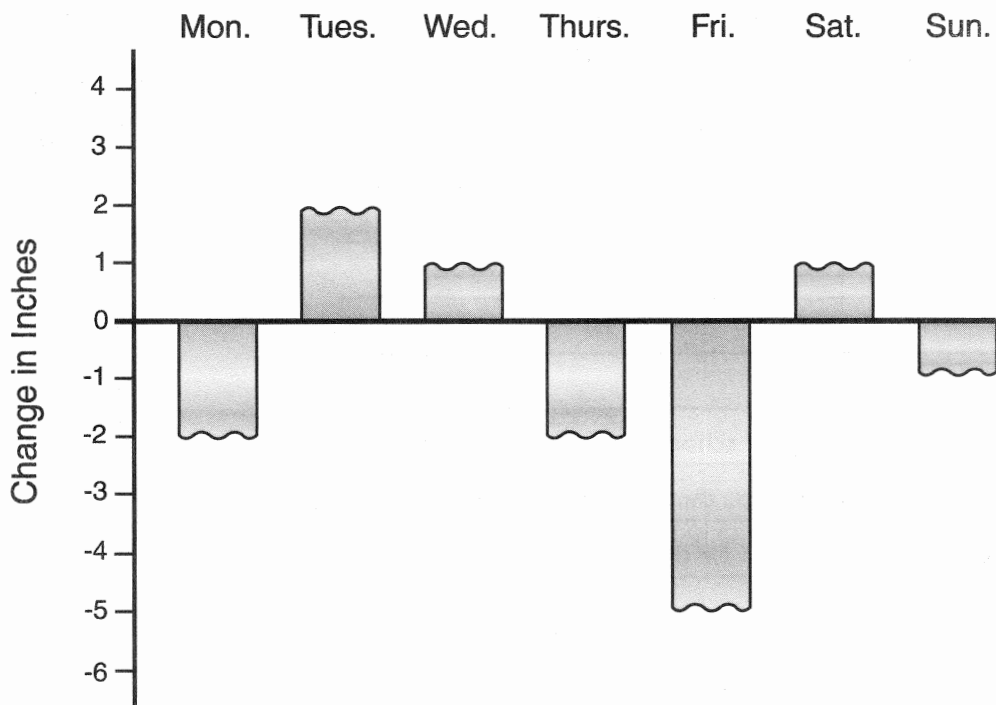
TIPS AND HINTS

Remember that absolute value means distance from zero on a number line.

2 The water level in a pond was at sea level, or 0, at the start of the week. The model below shows the daily changes in the water level of the pond for that week.

TIPS AND HINTS

Note that this model has a number line on the side.



If the weather has the same effect on the pond for a second week, how many inches below zero will the water level be by the end of the second week?

- A 4
- B 6
- C 8
- D 12

3

Which expression is equivalent to $7 - 4\frac{1}{2} - x + \left(-\frac{1}{2}\right) + (-5)$?

- A $7 - 5 + \left(-4\frac{1}{2} - \frac{1}{2}\right) - x$
B $7 - \left(-4\frac{1}{2}\right) + x + \left(-\frac{1}{2} + -5\right)$
C $4\frac{1}{2} + \frac{1}{2} + 7 - 5 - x$
D $7 + x - \left(4\frac{1}{2} - \frac{1}{2}\right) + 5$

THINK ABOUT IT

How can the Commutative and Associative Properties of Addition be useful with this expression?

4

You are investing in the stock market and your starting balance is \$400.00. What expression could you use to find your new balance if, on two consecutive days, you lost \$14.32 and \$6.78?

TIPS AND HINTS

Subtracting a number is the same as adding its opposite.

Explain your answer.

What is the new balance?

Show your work.

Answer \$ _____

INDEPENDENT PRACTICE 2

1 Which number(s) have an absolute value of 6?

- A only 6
- B only -6
- C 6 and -6
- D 6, 0, and -6

2 What is the value of the expression below?

$$-4 - (-12)$$

- A -16
- B -8
- C 8
- D 16

3 Which equation is true?

- A $-7 + 3 = 4$
- B $-3 - 4 = -7$
- C $4 - (-3) = -7$
- D $3 - 7 = 4$

- 4 Which expression is equivalent to $12 - (-4) - 17$?
- A $12 + 4 + 17$
 - B $12 - 4 - 17$
 - C $12 + 4 - 17$
 - D $-12 - 4 - 17$
- 5 A bird is flying 28.5 feet above the surface of the water. A fish is swimming 11.3 feet below the water surface directly below the bird. Which expression shows the distance between the bird and the fish?
- A $|28.5 - 11.3|$
 - B $|28.5 - (-11.3)|$
 - C $|11.3 - 28.5|$
 - D $|-11.3 + 28.5|$
- 6 Carlisha played a card game. On the first hand, she lost 27 points. She won 52 points on the second hand and 79 points on the third hand. On the fourth hand, she lost 36 points, and on the fifth hand she won 25 points. What was Carlisha's score after 5 hands?
- A 219
 - B 147
 - C 93
 - D -65
- 7 Which of the following sets contains the additive inverse of each of its elements?
- A {all positive integers}
 - B $\{-1, 1\}$
 - C {all negative integers}
 - D $\{\frac{1}{2}, 2\}$

8

What is the value of the expression below?

$$-6 - (-2\frac{1}{2})$$

Explain how to use a number line to find the difference between -6 and $-2\frac{1}{2}$.

Explain your answer.

9

Alexandra simplifies the expression $9.1 - 4 + (-3.1)$. The steps she used are shown scrambled below.

$$[9.1 + (-3.1)] + (-4)$$

$$9.1 + (-4) + (-3.1)$$

$$2$$

$$9.1 + (-3.1) + (-4)$$

$$6 + (-4)$$

Copy the steps that Alexandra used in the correct order.

Answer _____

Now simplify the expression a second time using a different set of steps.

Answer _____

EXIT TICKET

NY-7.NS.1, NY-7.NS.1c, NY-7.NS.1d

Now that you have mastered adding and subtracting rational numbers, let's solve the problem in the **Real-World Connection**.

When Aram went to bed, it was 14°F outside. When he woke up the next morning, the temperature had dropped to -8°F . How much did the temperature drop overnight?

