Lesson 1-5
Add and Subtract Rational Numbers

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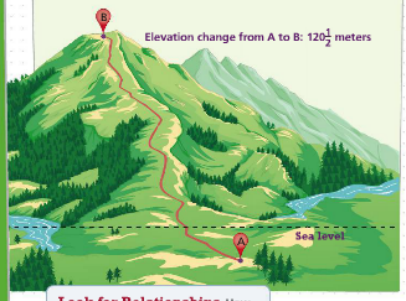
I can...
add and subtract rational numbers.

Solve & Discuss It!

ACTIVITY

Malik hikes Castle Trail from point A to point B. The elevation at point A is below sea level. What are possible beginning and ending elevations of Malik's hike?



Look for Relationships How are elevation values of point A and point B related?

Focus on math practices

Reasoning What would be different about the hike from point B to point A?

31

Essential Question How are adding and subtracting integers related to adding and subtracting other rational numbers?

INTERACTIVE ANIMATION ANIMATION

EXAMPLE 1 Add and Subtract Rational Numbers with Different Signs

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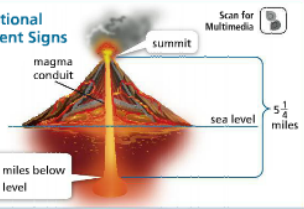
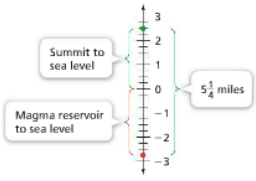
Lava flows from an active volcano's magma reservoir located below sea level through the magma conduit. How far is the summit of the volcano from sea level?



Generalize You can use the rules for adding integers to add all other rational numbers.

Use a number line to represent the distances.



You can use the rules for adding integers to add any other rational numbers.

$\left(-2\frac{3}{4}\right)+5\frac{1}{4}$ Write an expression to represent the distance.

$|-2\frac{3}{4}|=2\frac{3}{4}$ and $|5\frac{1}{4}|=5\frac{1}{4}$

$5\frac{1}{4}-2\frac{3}{4}=2\frac{1}{2}$ When the signs are different, find the difference.

$-2\frac{3}{4}+5\frac{1}{4}=2\frac{1}{2}$ Use the sign of the addend with the greater absolute value.

The summit of the volcano is $2\frac{1}{2}$ miles above sea level.

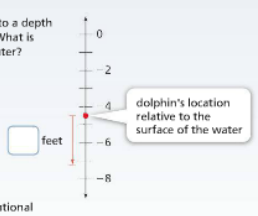
Try It!

A dolphin is at the surface of the water and then descends to a depth of $4\frac{1}{2}$ feet. Then the dolphin swims down another $2\frac{3}{4}$ feet. What is the location of the dolphin relative to the surface of the water?

$-4\frac{1}{2}-$ ☐

$-4\frac{1}{2}+$ ☐ $=$ ☐

The location of the dolphin relative to the surface of the water is ☐ feet.



Convince Me! How are adding and subtracting two rational numbers with different signs related to adding and subtracting two integers with different signs?

EXAMPLE 2 Use Properties of Operations to Add and Subtract

The force of gravity added to the force of thrust is the combined force at work on a model rocket. What is the combined force, in newtons, on the rocket?

$-0.49 + 1\frac{1}{2}$

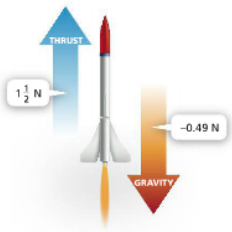
$= 1\frac{1}{2} + (-0.49)$ — Use the Commutative Property and additive inverses as a strategy to add.

$= 1\frac{1}{2} - 0.49$

$= 1.5 - 0.49$

$= 1.01$

The combined force on the rocket is 1.01 newtons.



Try It!

Find the sum or difference of the rational numbers.

a. $-2.5 + \left(-5\frac{6}{10}\right)$ **b.** $-4.4 - \left(-1\frac{1}{2}\right)$ **c.** $-135.4 + 78\frac{1}{2}$

EXAMPLE 3 Find Distances on a Number Line

Ruby looks over the edge of her boat and sees fish 0.4 meter below the surface of the water. If Ruby holds a 1-meter-long net at 0.5 meter above sea level, can she reach the fish? Explain.

ONE WAY

$|0.5 - (-0.4)|$

$= |0.5 + 0.4|$

$= |0.9|$

$= 0.9$

ANOTHER WAY

$|-0.4 - 0.5|$

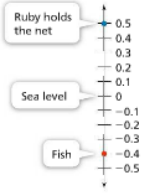
$= |-0.4 + (-0.5)|$

$= |-0.9|$

$= 0.9$

To find the distance between any two points on a number line, find the absolute value of their difference.

Yes. The fish are 0.9 meter below where Ruby holds the net, so Ruby can reach the fish with a 1-meter-long net.



Try It!

Two divers are swimming at different depths below sea level. One diver is at −25.5 feet. The other diver is at −40.75 feet. How much farther below sea level is the diver who is farthest below sea level?

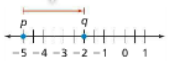
1-5 pp. 34-36

KEY CONCEPT

The rules for adding and subtracting all rational numbers are the same as those for adding and subtracting integers.

The distance between any two rational numbers p and q on a number line is the absolute value of their difference.

The distance between p and q can be written as $|p - q|$ or $|q - p|$.



$|-5 - (-2)| = |-2 - (-5)|$

Do You Understand?

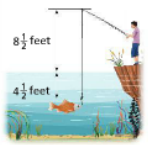
1. **Essential Question** How are adding and subtracting integers related to adding and subtracting other rational numbers?

2. **Reasoning** When finding the distance between two rational numbers on a number line, does the order of the numbers you subtract matter? Explain.

3. **Critique Reasoning** Gwen says that the sum of $-1\frac{3}{4}$ and $2\frac{1}{2}$ is the same as the difference between $2\frac{1}{2}$ and $1\frac{3}{4}$. Is Gwen correct? Explain why or why not.

Do You Know How?

4. What is the distance between the top of the fishing pole and the fish?



5. A shark began at 172.5 meters below sea level and then swam up 137.1 meters. Where is the shark's location now in relation to sea level?

6. Find the sum or difference.

   a. $-12\frac{1}{2} + 4\frac{1}{2}$

   b. $-0.35 - (-0.25)$

+3.2 + (+5.7)

*LCD needed

Name: _____

Practice & Problem Solving

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Leveled Practice In 7–8, complete the expressions to find the sum or difference.

7. $3.2 - (-5.7)$
$= 3.2 + \square$
$+ \square$

8. $\frac{12}{13} + \left(\frac{-1}{13}\right)$
$= \square - \square$
$- \square$

9. **Reasoning** When Tom simplified the expression $-2.6 + (-5.4)$, he got -8. What mistake did Tom likely make?

10. The temperature in a town is 36.6°F during the day and −12.6°F at night. What is the temperature change from day to night?

11. Simplify each expression.

a. $50\frac{1}{2} + (-12.3)$ b. $-50\frac{1}{2} + (-12.3)$ c. $-50\frac{1}{2} + 12.3$

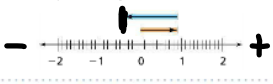
12. At the beginning of the day, the stock market goes up $30\frac{1}{2}$ points. At the end of the day, the stock market goes down $120\frac{1}{2}$ points. What is the total change in the stock market from the beginning of the day to the end of the day?

13. A dolphin is swimming 18 feet below the surface of the ocean. There is a coast guard helicopter 75.5 feet above the surface of the water that is directly above the dolphin. What is the distance between the dolphin and the helicopter?

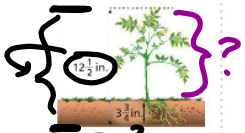
14. A bird flies from its nest to the bottom of the canyon. How far did the bird fly?

15. A scuba diving instructor takes a group of students to a depth of 54.96 feet. Then they ascend 22.38 feet to see some fish. Where are the fish in relation to the surface?

16. **Model with Math** Write an addition expression that is represented by the number line.



17. The roots of a plant reach down $3\frac{3}{4}$ inches below ground. How many inches is the plant above the ground?



18. **Higher Order Thinking**

a. Simplify the expression $(-13.2) + 8.1$.

b. How are $(-13.2) + 8.1$ and $13.2 + (-8.1)$ related? Explain without computing.

c. Using a property of operations, what can you say about the sum of the two expressions?

Assessment Practice

19. The temperatures at sunrise and sunset are shown in the table.

	Temperature at Sunrise (°F)	Temperature at Sunset (°F)
Day 1	−11.31	13.49
Day 2	−7.69	25.25

PART A
What was the temperature change on Day 1? On Day 2?

PART B
On which day did the temperature change more? Explain your reasoning.

20. Mischa dives from a platform that is 5 meters above water. Her dive takes her 2.1 meters below the surface of the water. Which expression could represent the distance, in meters, that Mischa dives? Select all that apply.

- ☐ $|5 - (-2.1)|$
- ☐ $|-(2.1) - (-5)|$
- ☐ $|2.1 - 5|$
- ☐ $|-(2.1) - 5|$
- ☐ $|5 + (-2.1)|$

The height of the plant from ground to the top is $8\frac{3}{4}$ in.