



Lesson 3: Real-World Positive and Negative Numbers and Zero

Student Outcomes

- Students use positive and negative numbers to indicate a change (gain or loss) in elevation with a fixed reference point, temperature, and the balance in a bank account.
- Students use vocabulary precisely when describing and representing situations involving integers; for instance, an elevation of -10 feet is the same as 10 feet below the fixed reference point.
- Students will choose an appropriate scale for the number line when given a set of positive and negative numbers to graph.

Classwork

Example 1 (10 minutes): A Look at Sea Level

The purpose of this example is for students to understand how negative and positive numbers can be used to represent real-world situations involving elevation. Read the example aloud.

Example 1: A Look at Sea Level

The picture below shows three different people participating in activities at three different elevations. With a partner, discuss what you see. What do you think the word *elevation* means in this situation?

The diagram illustrates three different elevations relative to sea level:

- A scuba diver is underwater, with a thought bubble saying: "I'm scuba diving, and I'm below sea level."
- A sailboat is on the water's surface, with a speech bubble saying: "I'm sailing, so I'm at sea level."
- A hiker is on a hill above the water level, with a speech bubble saying: "I'm hiking, so I'm above sea level."

Teacher should pose questions to the class and define elevation. Students will gain additional practice with elevation by completing Exercise 1 independently.

Possible Discussion Questions:

- Looking at the picture, if you were to draw a vertical number line to model elevation, which person's elevation do you think would be at zero? Explain.
 - *Sea level should represent an elevation of zero. So, the person sailing would be at zero because they are sailing on the surface of the water, which is neither above nor below the surface. On a number line, zero is the point or number separating positive and negative numbers.*
- On the same vertical number line, which person's elevation would be represented above zero?
 - *The elevation of the person hiking would be above zero because she is moving higher above the water. On a vertical number line, this is represented by a positive value above zero because she is above the surface.*
- On the same vertical number line, which person's elevation do you think would be below zero?
 - *The elevation of the person diving would be below zero because he is swimming below the surface of the water. On a vertical number line, this is represented by a negative value below zero because he is below the surface.*
- What does zero represent in this situation?
 - *Zero represents the top of the water (the water's surface).*
- In this example, which numbers correspond to elevations above sea level?
 - *Above sea level means to be above zero, which are positive numbers.*
- In this example, which numbers correspond to elevations below sea level?
 - *Below sea level means to be below zero, which are negative numbers.*
- On a number line, what does it mean to be at sea level?
 - *To be at zero.*
- Elevation is the height of a person, place, or thing above a certain reference point. In this case, what is the reference point?
 - *The reference point is sea level.*

Exercises 1–3 (5 minutes)

Exercises

Refer back to Example 1. Use the following information to answer the questions.

- The diver is 30 feet below sea level.
- The sailor is at sea level.
- The hiker is 2 miles (10,560 feet) above sea level.

1. Write an integer to represent each situation.

Diver: -30

Sailor: 0

Hiker: 2 miles or 10,560 feet

2. Use an appropriate scale to graph each of the following situations on the number line to the right. Also, write an integer to represent both situations.

a. A hiker is 15 feet above sea level.

15

b. A diver is 20 feet below sea level.

-20



Students should identify common misconceptions of how to represent an answer, based on the phrasing of a question. Students will practice this skill in Exercise 3.

MP.6

- How many feet below sea level is the diver?
 - *Students should answer using a positive number, such as 70 feet, because “below” already indicates that the number is negative.*
- Which integer would represent 50 feet below sea level?
 - *Students should answer by saying “-50” and not “-50 below sea level.”*

3. For each statement there are two related statements: *i* and *ii*. Determine which related statement is expressed correctly (*i* and *ii*), and circle it. Then correct the other related statement so that both parts, *i* and *ii*, are stated correctly.

a. A submarine is submerged 800 feet below sea level.

i. The depth of the submarine is -800 feet below sea level.

The depth of the submarine is 800 feet below sea level.

ii. 800 feet below sea level can be represented by the integer -800.

b. The elevation of a coral reef with respect to sea level is given as -250 feet.

i. The coral reef is 250 feet below sea level.

ii. The depth of the coral reef is -250 feet below sea level.

The depth of the coral reef is 250 feet below sea level.

Exploratory Challenge (20 minutes)

Materials:

- Copies (one per student) of the *Challenge Exploration Station Record Sheet* (See attached template.)
- Sheets of loose-leaf paper (one per group) for the answer key for their poster
- Rulers or Meter Stick or Yard Stick (one per group)
- Construction Paper or Wall-sized Grid Paper (1 sheet for each group)
- Markers (one set or a few for each group)

Students will work in groups of 3–4 to create their own real world situations involving money, temperature, elevation and other real world scenarios. The teacher gives each group a sheet of wall-sized grid-paper (or construction paper) numbered one to five, markers, and a ruler. Using these materials, each group will present its situation on the paper by including the components in the bulleted list below. Allow students 10 minutes to create their posters and hang them on a wall in the room.

- Title (e.g., Sea Level, Temperature)
- A written situation based on the title (using at least two points)
- A blank vertical number line
- Picture (optional if time permits)
- Answer key (on a separate sheet of paper stapled to the top back right corner)

Scaffolding:

- Allow groups to present their posters to the class, and the class will answer the questions during the presentation.

Groups will rotate every 5 minutes to complete the three tasks on the Station Record sheet of paper while viewing each poster.

- Write the integer for each situation.
- Determine the appropriate scale to graph the points.
- Graph the point on the number line.

Closing (3 minutes)

- How did we record measures of elevation on a number line?
 - *Elevations above sea level are positive numbers, and they are above zero. Elevations below sea level are negative numbers, and they are below zero.*
- Is “–90 feet below sea level” an appropriate answer to a question? Why or why not?
 - *No. You do not need the negative sign to write 90 feet below zero because the word “below” in this case means a negative number.*

Exit Ticket (7 minutes)



Name _____

Date _____

Lesson 3: Real-World Positive and Negative Numbers and Zero

Exit Ticket

1. Write a story problem using sea level that includes both integers -110 and 120 .

2. What does zero represent in your story problem?

3. Choose an appropriate scale to graph both integers on the vertical number line.

4. Graph and label both points on the vertical number line.



Exit Ticket Sample Solutions

1. Write a story problem using sea level that includes both integers -110 and 120 .
(Answers may vary.) On the beach, a man's kite flies at 120 feet above the water's surface. In the ocean, a white shark swims at 110 feet below the water's surface.

2. What does zero represent in your story problem?
Zero represents the water's surface level.

3. Choose and label an appropriate scale to graph both integers on the vertical number line.
I chose a scale of 10.

4. Graph and label both points on the vertical number line

Problem Set Sample Solutions

1. Write an integer to match the following descriptions:

a. A debit of \$40	<u>-40</u>
b. A deposit of \$225	<u>225</u>
c. 14,000 feet above sea level	<u>14,000</u>
d. A temperature increase of 40 degrees	<u>40</u>
e. A withdrawal of \$225	<u>-225</u>
f. 14,000 feet below sea level	<u>-14,000</u>

For questions 2–4, read each statement about a real-world situation and the two related statements in parts (a) and (b) carefully. Circle the correct way to describe each real-world situation; possible answers include either (a), (b), or both (a) and (b).

2. A whale is 600 feet below the surface of the ocean water.

a. The depth of the whale is 600 feet from the water's surface.

b. The whale is -600 feet below the surface of the ocean water.

3. The elevation of an iceberg with respect to sea level is given as -125 feet.
- The iceberg is 125 above sea level.
 - The iceberg is 125 feet below sea level.
4. Alex's body temperature decreased by 2°F .
- Alex's body temperature dropped 2°F .
 - The integer -2 represents the change in Alex's body temperature in degrees Fahrenheit.
5. A credit of \$35 and a debit of \$40 are applied to your bank account.
- What is an appropriate scale to graph a credit of \$35 and a debit of \$40? Explain your reasoning.
I would count by 5's because both numbers are multiples of 5.
 - What integer represents "a credit of \$35" if zero represents the original balance? Explain.
35; a credit is greater than zero, and numbers greater than zero are positive numbers.
 - What integer describes "debit of \$40" if zero represents the original balance? Explain.
-40; a debit is less than zero, and numbers less than zero are negative numbers.
 - Based on your scale, describe the location of both integers on the number line.
35 would be 7 units to the right of zero, and -40 would be 8 units to the left of zero.
 - What does zero represent in this situation?
Zero represents no change being made to the account balance. In other words, no amount is either subtracted or added to the account.



Name _____

Date _____

Exploratory Challenge Station Record Sheet

Poster # _____
 Integer(s): _____
 Number Line Scale _____

Poster # _____
 Integer(s): _____
 Number Line Scale _____

Poster # _____
 Integer(s): _____
 Number Line Scale _____

Poster # _____
 Integer(s): _____
 Number Line Scale _____

Poster # _____
 Integer(s): _____
 Number Line Scale _____

