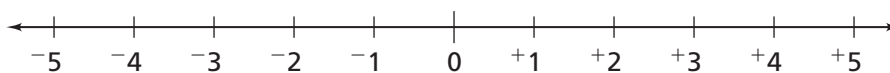


Topic 2: Understanding Integers

for use after *Bits and Pieces I* Investigation 3

Negative numbers are needed when the quantities are less than 0, such as very cold temperatures. Temperatures in winter can easily go below 0°F in some locations. An altitude of 0 feet is referred to as sea level, but there are places in the world that are below sea level.

The counting numbers and zero are called **whole numbers**. The first six whole numbers are 0, 1, 2, 3, 4, and 5. You can extend a number line to the left past zero.



The opposite of a positive number is a **negative number**. For example, the number -2 is the **opposite** of $+2$. The set of whole numbers and their opposites are called **integers**.

Problem 2.1

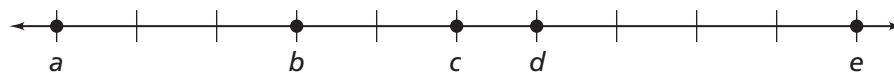
Emily, Sarah, Michael, Jacob, and Austin play a Question and Answer game. A player steps forward for a correct answer, but steps backward for an incorrect answer. During the first round, Michael takes five steps backward. Jacob takes three steps forward. Emily takes three steps backward. Austin does not move. Sarah takes two steps forward.

- A.
 1. Which integer describes Austin's position in the game?
 2. Draw a number line. Represent each player's position on the number line.
 3. Who is in last place?
 4. Which players are represented by opposites?
- B.
 1. In the next round each player moves two steps forward. Place all five players on a new number line.
 2. Are any players that were opposites before still opposites now? Why or why not?
 3. What does it mean when you read the numbers on the number line from the left to the right?
- C. In the final round, Emily stays in the same place, and Michael is at her opposite. How many steps did Michael take in the final round?

Exercises

For Exercises 1–4, place each integer on a number line.
Then identify any opposites.

1. $-1, 4, 2, -4, 3, 1$
2. $2, 0, -3, 4, -1, 3$
3. $-5, 10, -2, 4, 0, -10$
4. $-5, 8, -7, -10, 5, 10$
5. Use an integer to represent each play in a football game.
 - a. The fullback carries the ball for a gain of 6 yards.
 - b. The quarterback is sacked for a loss of 3 yards.
 - c. The play stops at the line of scrimmage for no gain.
6. Use an integer to represent each change to a bank account.
 - a. A deposit of \$20 is made on Monday.
 - b. A check for \$4 is written on Tuesday.
 - c. A check for \$6 is written on Wednesday.
 - d. No transactions are made on Thursday.
7. Use an integer to represent each position of an elevator.
 - a. The elevator leaves the ground floor and arrives at the 12th floor.
 - b. The elevator leaves the ground floor and arrives at the second basement level.
 - c. The elevator leaves the ground floor, arrives at the 7th floor, and then travels down 3 floors.
8. Use an integer to represent time in seconds for a space ship launch.
 - a. Lift off.
 - b. The countdown begins with 10 seconds before lift off.
 - c. The space ship has been in the air for one minute.
 - d. Why do you think a launch countdown starts at *T-minus ten seconds*?
9. Use the number line below.



- a. If a and e are opposites, what integer would you use to represent c ?
- b. Assign integer values to each point in part (a).
- c. If a and d are opposites, is c positive or negative? Explain.

Topic 2: Understanding Integers

PACING 1 day

Mathematical Goals

- Compare and order positive and negative integers.

Guided Instruction

Explore extending the number line. Display a number line from -5 to $+5$ that can be copied by each student. Have students supply the natural numbers of 1, 2, 3, 4, and 5. Add the zero as you mention whole numbers. Use the number line to locate the negative integers as the opposites of the natural numbers. Draw connector arrows between each pair of opposites.

- *What is the sum of opposite integers?* (zero)
- *What is another way that you could define opposites?* (Two numbers that, when added together, have a sum of zero.)

Assign students to represent each of the students of Problem 2.1. These students move forward or backward according to their role.

- *Which integer describes Austin's position in the game?* (0)

Based on this answer, have students assign integer values to each of the other students and answer Question A.

Read Question B, and have all students take two steps forward. Students are now able to order the five integers represented by the players in the game.

Read Question C. Give the students a little time to think about their answer before the student representing Michael counts aloud the steps needed to become Emily's opposite.

Suppose the winner is the first person to reach $+10$.

- *Who has the best chance to win on the next question?* (Jacob)
- *What point value for the question is needed by that player?* (5)
- *Where would that player be located if they got the question wrong?* (0)
- *Who is the new leader?* (Sarah)

You will find additional work on integers in the grade 7 unit *Accentuate the Negative*.

Vocabulary

- whole numbers
- negative number
- opposites
- integer

ACE Assignment Guide for Topic 2

Core 1–9

Answers to Topic 2

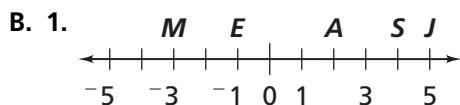
Problem 2.1

A. 1. 0



3. Michael

4. Jacob and Emily

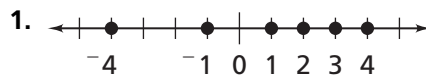


2. No, when Jacob and Emily both moved forward two steps, their relationship to the starting point (0) changed. The new positions of these players are -1 and 5 .

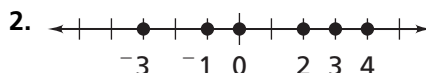
3. You are reading the numbers in order from the least to the greatest.

C. 4 steps; Emily started at -3 , then moved forward 2 steps to -1 . For Michael to be her opposite, Michael needs to be on $+1$. Michael's last move brought him to -3 , so he needs to move forward 4 steps to be Emily's opposite.

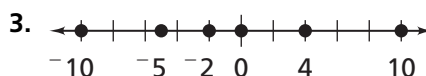
Exercises



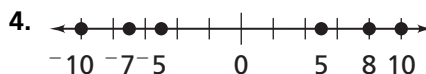
-4 and 4



-3 and 3



-10 and 10



-10 and 10 , -5 and 5

5. a. $+6$

b. -3

c. 0

6. a. $+20$

b. -4

c. -6

d. 0

7. a. $+12$

b. -2

c. $+7, +4$

8. a. 0

b. -10

c. $+60$

d. The time before lift-off is negative ten seconds

9. a. 0

b. $a = -5, c = 0, e = 5$

c. Positive; point b would be zero because it is midway between a and d . Point c is to the right of point b .