

1

INTEGERS AND RATIONAL NUMBERS

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Topic Essential Question


How can the properties of operations be used to solve problems involving integers and rational numbers?

Topic Overview

- 1-1 Relate Integers and Their Opposites
- 1-2 Understand Rational Numbers
- 1-3 Add Integers
- 1-4 Subtract Integers
- 1-5 Add and Subtract Rational Numbers
- 1-6 Multiply Integers
- 1-7 Multiply Rational Numbers
- 1-8 Divide Integers
- 1-9 Divide Rational Numbers
- 1-10 Solve Problems with Rational Numbers
- 3-Act Mathematical Modeling: Win Some, Lose Some

Topic Vocabulary

- additive inverse
- complex fraction
- multiplicative inverse
- repeating decimal
- terminating decimal



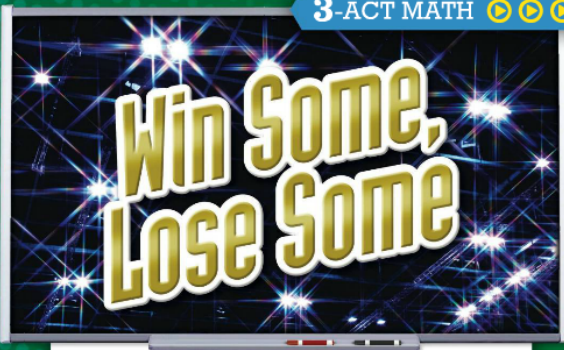
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Lesson Digital Resources

- INTERACTIVE ANIMATION** Interact with visual learning animations.
- ACTIVITY** Use with *Solve & Discuss It*, *Explore It*, and *Explain It* activities, and to explore Examples.
- VIDEOS** Watch clips to support *3-Act Mathematical Modeling Lessons* and *STEM Projects*.
- PRACTICE** Practice what you've learned.

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Topic 1 Integers and Rational Numbers


3-ACT MATH



Win Some, Lose Some

Are you the kind of person who has a lot of knowledge about history, literature, or science? What about pop culture, music, sports, and current events? Some schools have an academic bowl team that competes in tournaments against other schools. The teams are made up of members with strengths in different subject areas.

In any quiz competition, it's important to understand the rules and scoring. Think about this during the 3-Act Mathematical Modeling lesson.



TUTORIALS Get help from *Virtual Nerd*, right when you need it.

KEY CONCEPT Review important lesson content.

GLOSSARY Read and listen to English/Spanish definitions.

ASSESSMENT Show what you've learned.

Additional Digital Resources

MATH TOOLS Explore math with digital tools.

GAMES Play Math Games to help you learn.

ETEXT Interact with your Student's Edition online.

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Topic 1 Integers and Rational Numbers

1
STEM Project

Did You Know?

The lowest recorded temperature in the world, -136°F (-93.2°C), occurred in Antarctica.



The highest recorded temperature in the world, 134°F (56.7°C), occurred in Death Valley, California.



The Celsius scale ($^{\circ}\text{C}$) is commonly used for temperature measurement in most of the world.

Only a small number of nations, including the United States, regularly use the Fahrenheit scale ($^{\circ}\text{F}$).



Windchill, based on the rate of heat loss from exposed skin, can make it feel colder outside than the actual air temperature indicates. Wind chills in some places of the world can dip into the -100°F range.



Your Task: How Cold is Too Cold?

There are many regions of the world with cold temperatures and extreme conditions. How do the inhabitants of these regions adapt and thrive? Do conditions exist that make regions too cold for human living? You and your classmates will explore and describe the habitability of regions with low temperatures.



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Topic 1 STEM Project

TOPIC
1

GET READY!

Review What You Know!

Vocabulary
Choose the best term from the box. Write it on the blank.

1. The _____ explains why $a \times b = b \times a$ and $a + b = b + a$.
2. The _____ of -6 is 6 , because it is 6 units from zero on the number line.
3. The number $\frac{5}{3}$ is a _____ because 5 and 3 are integers and $3 \neq 0$.
4. The set of _____ consists of the counting numbers, their opposites, and zero.
5. The sum of $(a + b) + c$ is equal to the sum of $a + (b + c)$ as explained by the _____.
6. If you evaluate $n \times (y + z)$ by writing it as $(n \times y) + (n \times z)$, you have used the _____.

absolute value
Associative Property
Commutative Property
Distributive Property
Integers
rational number

Add and Subtract Fractions and Decimals

Add or subtract.

7. $2\frac{1}{3} + 6\frac{2}{5}$

9. $19.86 + 7.091$

8. $9\frac{1}{10} - 4\frac{3}{4}$

10. $57 - 10.62$

Multiply and Divide Fractions and Decimals

Multiply or divide.

11. 4.08×29.7

13. $\frac{15}{18} \times 9\frac{1}{5}$

15. Byron has $1\frac{7}{10}$ kilograms of black pepper. He uses $\frac{7}{8}$ of the pepper and splits it between 7 pepper shakers. How much pepper will be in each shaker?

Ⓐ $\frac{119}{80}$ kg
Ⓒ 1.4125 kg

Ⓑ $\frac{1}{8}$ kg
Ⓓ $\frac{17}{80}$ kg

12. $15,183.3 \div 473$

14. $4\frac{2}{9} \div 1\frac{7}{12}$

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Topic 1 Integers and Rational Numbers
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Prepare for Reading Success

Use the following questions to help you understand the new ideas in Topic 1.

Questions Before Reading

What do I know about integers and rational numbers?

What do I know about fractions and decimals?

What does it mean when two things are opposites?
How can numbers be opposites?

Questions During Reading

Why might a number be positive or negative?

Who uses positive and negative numbers?
How are integers and rational numbers used in real life?

Where are opposite numbers located on a number line?

Questions After Reading

When might I use integers and rational numbers in real life?

Why is it important to know whether a number is positive or negative?

How is adding a positive number to a negative number different from adding two positive numbers or two negative numbers?

Solve & Discuss It!

When preparing for a rocket launch, the mission control center uses the phrase "T minus" before liftoff.

...T minus 3, T minus 2, T minus 1, ...

After the rocket has launched, "T plus" is used while the rocket is in flight.

...T plus 1, T plus 2, T plus 3, ...

When does the rocket launch?
What could "T" represent?

Reasoning What integers can you use to represent this situation?

Lesson 1-1
Relate Integers and Their Opposites

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I can...
relate integers, their opposites, and their absolute values.



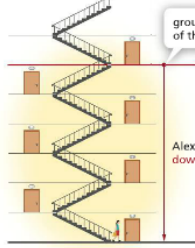
Focus on math practices

Reasoning How are "T minus 4" and "T plus 4" related?

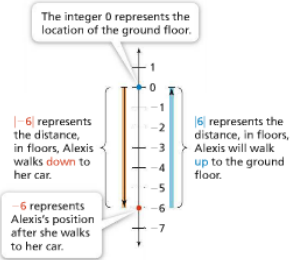
Essential Question How are integers and their opposites related?

EXAMPLE 1 **Combine Opposite Quantities to Make 0**

Alexis was shopping on the ground floor of the mall when she realized she had left her phone in her car. She walks down 6 floors to her car in the underground parking garage. How far will Alexis walk to get back to the ground floor? Use integers to explain.



Use integers on a number line to represent the situation.



The integer 0 represents the location of the ground floor.

-6 represents the distance, in floors, Alexis walks down to her car.

6 represents Alexis's position after she walks to her car.

6 represents the distance, in floors, Alexis will walk up to the ground floor.

-6 and 6 are opposites. Opposite quantities combine to make 0.

$-6 + 6 = 0$

Alexis will walk the same distance, 6 floors, in the opposite direction to get back to the ground floor.

Try It!

Xavier climbs 9 feet up into an apple tree. What integer represents the direction and how far he will climb to get back down to the ground? What does the integer 0 represent in this situation?

The integer represents Xavier's climb down.

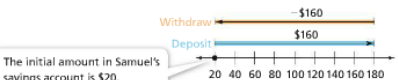
The integer 0 represents .

Convince Me! How are the absolute values of opposite integers related?

8 1-1 Relate Integers and Their Opposites Go Online | PearsonRealize.com

EXAMPLE 2 **Combine Opposite Quantities**

Samuel has \$20 in his savings account before he makes a deposit of \$160. After 2 weeks, he withdraws \$160. How did Samuel's savings account balance change?



The initial amount in Samuel's savings account is \$20.

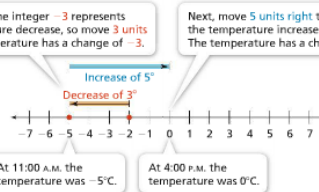
The amounts deposited and withdrawn are opposite quantities and combine to make 0. Samuel's account balance did not change because the amounts deposited and withdrawn combine to make 0.

Try It!

The temperature was 75° . At noon, the temperature increased 7° . By evening, the temperature decreased by 7° . How did the temperature change?

EXAMPLE 3 **Represent Change Using Integers**

One winter morning, the temperature was -2°C . By 11:00 A.M., the temperature had decreased by 3° . At 4:00 P.M., the temperature reached 0°C . What integer represents the temperature change from 11:00 A.M. to 4:00 P.M.?



Start at -2 . The integer -3 represents the temperature decrease, so move 3 units left. The temperature has a change of -3 .

Next, move 5 units right to show the temperature increase to 0°C . The temperature has a change of 5.

At 11:00 A.M. the temperature was -5°C .

At 4:00 P.M. the temperature was 0°C .

The integer 5 represents the temperature change from 11:00 A.M. to 4:00 P.M.

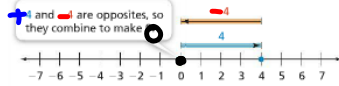
Try It!

Shaniqua has \$45 in her wallet. She spends \$4 on snacks and \$8 on a movie ticket. What integer represents the change in the amount of money in Shaniqua's wallet? How much money does she have left?

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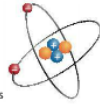
KEY CONCEPT

An integer, n , and its opposite, $-n$, combine to make 0.



Do You Understand?

- Essential Question** How are integers and their opposites related?
- Reasoning** In order for an atom to have a zero charge, every proton, which has a charge of $+1$, must be matched with an electron, which has a charge of -1 . A helium atom has 2 protons and 2 electrons. Explain why a helium atom has a zero charge.
- Model with Math** Explain how to use a number line to show that opposite quantities combine to make 0.



Do You Know How?

- Marcus dives from the surface of the ocean to a reef 18 meters below sea level. What integer represents Marcus's location relative to the surface? How far does Marcus have to go to return to the surface?
- The temperature of the water in Emily's fish tank was 78°F on Sunday. The water temperature changed by -3° on Monday, and then by 3° on Tuesday. What integer represents the temperature change of the water from Sunday to Tuesday? What was the water temperature on Tuesday?
- The scores of players on a golf team are shown in the table. The team's combined score was 0. What was Travis's score?

Golfer	Score
CELIA	-3
JANINE	3
SAMI	1
TED	4
TRAVIS	

Name: _____

Practice & Problem Solving

Leveled Practice In 7-9, write the integer that represents the situation.

- Max spent \$53 and now has no money left. He had \$53 before his purchase.
- The temperature was 8°F . It dropped so that the temperature was 0°F . \square represents the change in temperature.
- An airplane descended 4,000 feet before landing. The integer that represents how many feet the airplane was above the ground before its descent is $+4000$.

descending ↓
"going down"

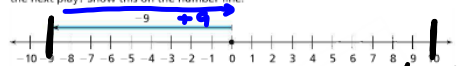
10. Carolyn says that point A and point B represent opposite integers.

- What is the opposite of the integer represented by point A? By point B?



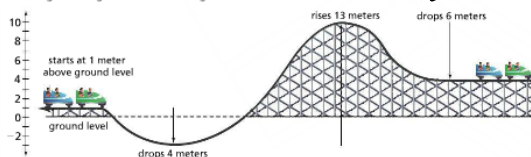
- Construct Arguments** Do you agree with Carolyn? Explain.

11. A football team lost 9 yards during a play. The team had a combined gain or loss of 0 yards after the next play. What integer represents the yards gained or lost on the next play? Show this on the number line.



1st and 10 -9
2nd and 19 +9
3rd and 10 +9

12. A roller coaster car goes above and below ground. Use the number line to show its changes in height. What is the height of the car at the end of the ride?



earn another 1st down

13. Dimitri is buying a car. He chooses Option 1 to add a new sound system to his car. What integer represents the change from the base price of the car to its final price?

Dimitri's Car Price Sheet	
Base Price	-\$700.00
Sale	+\$1,400.00
Opt. 1	+\$1,400.00
Markdown	-\$1,100.00

14. **Make Sense and Persevere** What values do x and y have if $|x| = 16$, $|y| = 16$, and when x and y are combined they equal 0? Explain your reasoning.

Sale -700
 Opt 1 $+1400$
 markdown -1100

} Total change?

-700
 $+1400$
 -1100
 \hline
 -1800 (savings)

15. Write a situation that can be represented by the opposite of -42 .

$+42$ -42

16. **Higher Order Thinking** Three friends all live on the same street that runs west to east. Beth lives 5 blocks from Ann. Carl lives 2 blocks from Beth. If the street is represented by a number line and Ann's house is located at 0, what are the possible locations for Carl's house? Assume that each unit on the number line represents 1 block.

1800
 -1400
 \hline
 $\$-400$

-400 is the change in price from base to final price.

Assessment Practice

17. Which of these situations can be represented with an integer that when combined with the opposite of -9 makes 0? Select all that apply.

- You walk ~~down~~ 9 flights of stairs.
- You climb ~~up~~ 9 flights of stairs.
- The temperature ~~drops~~ 9°F.
- You spend ~~\\$9~~ on a book.
- You earn ~~\\$9~~ from your job.

18. Which of these situations can be represented by the opposite of 80? Select all that apply.

- An airplane descends 80 m.
- An elevator ascends 80 m.
- The cost of a train ticket drops by \$80.
- You remove 80 songs from an MP3 player.
- Suzy's grandmother is 80 years old.

