Lesson 3-2
Subtract Integers

LESSON GOAL
Students will solve problems subtracting integers.

1 LAUNCH
Launch the lesson with a warm up and an introduction.

2 EXPLORE AND DEVELOP
Explore: Use Algebra Tiles to Subtract Integers
Learn: Subtract Integers
Example 1: Subtract Integers
Example 2: Subtract Integers
Example 3: Subtract Expressions
Explore: Find Distance on a Number Line
Learn: Find the Distance Between Integers
Example 4: Find the Distance Between Integers
Example 5: Find the Distance Between Integers
Apply: The Solar System
Have your students complete the Checks online.

3 REFLECT AND PRACTICE
Exit Ticket
Practice

DIFFERENTIATE
View reports of student progress of the Checks after each example to differentiate instruction.

Language Development Support
Assign page 15 of the Language Development Handbook to help your students build mathematical language related to subtraction of integers.

Suggested Pacing
90 min 1.5 days
45 min 3 days

Focus
Domain: The Number System
Major Cluster(s): In this lesson, students address major cluster 7.NS.A by subtracting integers.
Standards for Mathematical Practice: MP1, MP2, MP3, MP4, MP5, MP6

Coherence
Vertical Alignment

Previous
Students solved problems involving adding integers.
7.NS.A.1, 7.NS.A.1.B, 7.NS.A.1.D

Now
Students solve problems involving subtracting integers.
7.NS.A.1.C

Next
Students will solve problems involving multiplying integers.

Rigor
The Three Pillars of Rigor

Mathematical Background
Addition and subtraction are inverse operations. To subtract an integer, add its additive inverse (opposite). To find the distance between two integers on a number line, find the absolute value of the difference between the two integers.
**Warm Up**

**Prerequisite Skills**
The Warm-Up exercises address the following prerequisite skill for this lesson:

- subtracting whole numbers (Exercises 1–5)

**Answers**
1. 29  
2. 16  
3. 6  
4. 13  
5. 17

**Launch The Lesson**
The Launch the Lesson feature is designed to engage students with real-world situations that reflect the mathematics of the lesson. This lesson launches with a discussion about integers using an infographic.

Go Online to find additional teaching notes and questions to promote classroom discourse.

**Today’s Standards**
Tell students that they will be addressing these content and practice standards in this lesson. You may wish to have a student volunteer read aloud How can I meet these standards? and How can I use these practices?, and connect these to the standards.

**What Vocabulary Will You Use?**
Use the following question to engage students and facilitate a class discussion.

Ask:
- What are some synonyms for the term absolute? Make a conjecture as to what you think the absolute value of a number might be, based on what the term absolute means. Sample answer: Some synonyms are total, complete, universal, not in relation to other things. The absolute value of a number might mean the total value of the number.
**Explore**  Use Algebra Tiles to Subtract Integers

**Objective**
Students will use algebra tiles to explore how to subtract integers.

**Ideas for Use**

**Recommended Use**  Present the Inquiry Question, or have a student volunteer read it aloud. Have students work in pairs to complete the Explore activity on their devices. Pairs should discuss each of the Talk About It! questions. Monitor student progress during the activity. Upon completion of the Explore activity, have student volunteers share their responses to the Inquiry Question.

**What if my students don’t have devices?**  You may choose to project the activity on a whiteboard. A printable worksheet for each Explore is available online. You may choose to print the worksheet so that individuals or pairs of students can use it to record their observations.

**Summary of Activity**
Students will be presented with algebra tiles representing $1$ and $-1$. Throughout this activity, students will use the algebra tiles to subtract integers with the same sign and integers with different signs. They will see how the algebra tiles illustrate why subtracting integers is the same as adding the additive inverse.

**Inquiry Question**
How can you use algebra tiles to model integer subtraction?  Sample answer: By using tiles to represent positive and negative integers, integer subtraction can be modeled by taking away the number of tiles that represent the integer being subtracted. Sometimes it is necessary to add zero pairs to the workspace before taking away tiles.

**Go Online**  to find additional teaching notes and sample answers for the Talk About It! questions. A sample response for the Talk About It! question on Slide 4 is shown.

**Talk About It!**

**SLIDE 4**

**Mathematical Discourse**
What did you do to be able to subtract two $-1$-tiles from nine $1$-tiles?  Sample answer: I added enough zero pairs so that there were two negative $1$-tiles to take away.

(continued on next page)
Explore Use Algebra Tiles to Subtract Integers (continued)

**Teaching the Mathematical Practices**

5 Use Appropriate Tools Strategically  
Encourage students to use algebra tiles to explore integer subtraction. The strategy of using algebra tiles helps build conceptual understanding for why and how subtraction of integers can be represented as addition of the additive inverse.

**Go Online** to find additional teaching notes and sample answers for the *Talk About It!* questions. Sample responses for the *Talk About It!* questions on Slide 8 are shown.

**Talk About It!**

**Mathematical Discourse**

Describe how you would evaluate this expression using algebra tiles. Sample answer: Model 18 by placing 18 positive 1-tiles on the workspace. I need to subtract 13 negative tiles, however there are no negative tiles on the workspace. Add 13 zero pairs to the workspace. Then I can remove 13 negative tiles from the workspace.

Is there another strategy that would be more efficient than using algebra tiles? Explain your reasoning. Sample answer: Yes, using algebra tiles is not necessarily efficient because there are so many tiles to add and subtract. It would be more efficient to evaluate the expression by adding the additive inverse.
Learn Subtract Integers

Objective
Students will understand that they can use a number line to subtract integers.

Teaching the Mathematical Practices
3 Construct Viable Arguments and Critique the Reasoning of Others  As students discuss the Talk About It! question on Slide 4, encourage them to draw number lines and use mathematical reasoning to justify why the Commutative Property does not hold true for subtraction.

Go Online to find additional teaching notes.

Talk About It!
Mathematical Discourse
The Commutative Property is true for addition. For example, $7 + 2 = 2 + 7$. Is the Commutative Property true for subtraction? Does $7 - 2 = 2 - 7$? Explain your reasoning using a number line. No, the Commutative Property does not hold true for subtraction. $7 - 2 = 5$, but $2 - 7 = -5$. See students’ number lines.

Interactive Presentation

DIFFERENTIATE
Reteaching Activity  AL
To help students better understand how to subtract integers, have them write each of the following subtraction expressions as an addition expression using an additive inverse.

$9 - (-6) = 9 + 6$
$-6 - 3 = -6 + (-3)$
$5 - 21 = 5 + (-21)$
$-4 - (-1) = -4 + 1$
Example 1  Subtract Integers

Objective

Students will subtract a negative integer from a positive integer.

Teaching the Mathematical Practices

5 Use Appropriate Tools Strategically  Encourage students to use either method, a number line or the additive inverse, when subtracting two integers. As students discuss the Talk About It! question on Slide 4, encourage them to understand the benefits of each method and how they are related.

Questions for Mathematical Discourse

SLIDE 4

AL  Are we subtracting a positive integer from 5, or a negative integer? We are subtracting a negative integer, −7, from 5.

OL  After pressing Subtract, how does the number line illustrate how to subtract a negative integer? Sample answer: The number line shows that subtracting a negative integer is the same as adding the integer’s additive inverse.

BL  How would the number line change if the expression was 5 + (−7)? Sample answer: Instead of subtracting a negative number, we would add a negative number. Adding a negative number would move to the left on the number line, instead of to the right.

SLIDE 5

AL  Of which integer do we find the additive inverse? Explain. We find the additive inverse of the second integer, −7, because that is the integer that is being subtracted.

OL  Explain why it makes sense that the answer is positive. Sample answer: If I modeled this expression using algebra tiles, I would need to subtract 7 negative tiles from 5 positive tiles. To do so, I would need to add 7 zero pairs. After removing all 7 negative tiles, only positive tiles remain.

BL  Compare and contrast the expressions 5 − (−7), 5 + (−7), and 5 − 7. Sample answer: Two of the expressions are subtraction expressions, 5 − (−7) and 5 − 7. The other expression, 5 + (−7) is an addition expression. In the first two expressions, the second integer is negative. In the last expression, the second integer is positive.

Go Online

- Find additional teaching notes, Teaching the Mathematical Practices, and the Talk About It! question to promote mathematical discourse.
- View performance reports of the Checks.
- Assign or present an Extra Example.
**Example 2** Subtract Integers

**Objective**
Students will subtract a negative integer from a negative integer.

**Questions for Mathematical Discourse**

**SLIDE 2**

**AL** What is the additive inverse of $-17$? $17$

**AL** Rewrite the subtraction expression as an addition expression. $-24 + 17$

**OL** What other method could you use to find the difference? Sample answer: Use a number line.

**BL** If the first integer remained the same, what would the second integer need to be in order for the difference to be the least positive integer possible? $-25$

**Example 3** Subtract Expressions

**Objective**
Students will evaluate an algebraic expression that involves subtracting integers.

**Questions for Mathematical Discourse**

**SLIDE 1**

**AL** What integer should replace $x$ in the expression? $-23$

**AL** What integer should replace $y$ in the expression? $19$

**OL** Suppose a classmate substituted the values and wrote the expression $-23 - (-19)$. How can you explain to them their error? Sample answer: The second integer is positive $19$, not negative $19$.

**BL** How would the answer change if the original expression was $y - x$? The answer would be $19 - (-23)$, which equals $42$.

**Go Online**
- Find additional teaching notes, Teaching the Mathematical Practices, and the Talk About It! question to promote mathematical discourse.
- View performance reports of the Checks.
- Assign or present the Extra Examples.
Explore Find Distance on a Number Line

Objective
Students will explore how the distance between integers on a number line is related to their difference.

Ideas for Use

Recommended Use Present the Inquiry Question, or have a student volunteer read it aloud. Have students work in pairs to complete the Explore activity on their devices. Pairs should discuss each of the Talk About It! questions. Monitor student progress during the activity. Upon completion of the Explore activity, have student volunteers share their responses to the Inquiry Question.

What if my students don’t have devices? You may choose to project the activity on a whiteboard. A printable worksheet for each Explore is available online. You may choose to print the worksheet so that individuals or pairs of students can use it to record their observations.

Summary of Activity
Students will use a number line to find the distance that a car travels from one exit to another. Throughout this activity, students will write subtraction expressions to find the difference between two integers on a number line. They will compare these differences to the actual distances between the two numbers on the number line. They should note that, while the difference of a subtraction expression might be negative, the distance between those integers is always positive.

Inquiry Question
How is the distance between two integers on a number line related to the difference between the two numbers? Sample answer: The distance between two rational numbers is the absolute value of their difference. For example, the distance between \(-88\) and \(-11\) is 77 units.

Go Online to find additional teaching notes and sample answers for the Talk About It! questions. A sample response for the Talk About It! question on Slide 2 is shown.

Talk About It!

Mathematical Discourse
Describe how you calculated the distance traveled. Sample answer: I found the difference 191 \(- 165\). Stuart traveled 26 miles.
Explore  Find Distance on a Number Line  
(continued)

Teaching the Mathematical Practices

2 Reason Abstractly and Quantitatively  Encourage students to explore the distance between two integers on a number line, and analyze how the distance compares to the difference of the subtraction expression.

Go Online to find additional teaching notes and sample answers for the Talk About It! questions. A sample response for the Talk About It! question on Slide 6 is shown.

Talk About It!

Mathematical Discourse

Compare and contrast the differences and distance of the integers on the number line. Sample answer: The differences in the values of the expressions are opposites; $-2 - (-5) = 3$ and $-5 - (-2) = -3$. But the distance between the two integers is the same, 3 units.

Interactive Presentation

On Slide 7, students type to make a conjecture about how the distance between two integers on a number line is related to their difference.

On Slide 9, students respond to the Inquiry Question and view a sample answer.
Learn Find the Distance Between Integers

Find the distance between \(-4\) and 5.

1. Use a number line.
   - Plot the integers on a number line. The animation shows two points at \(-4\) and 5.
   - Count the number of units between the two integers.
   - There are 9 units between \(-4\) and 5.

2. Use an expression.
   - The distance between two integers is equal to the absolute value of their difference.
   - Write an expression for the distance.
   - Simplify the expression.
   - The distance between \(-4\) and 5 is 9 units.

You can also use the expression \(5 - (\text{-}4)\) to represent the distance.
Because you find the absolute value of the difference, the order of the integers does not matter. The expressions \(\text{-}4 - 5\) and \(5 - (\text{-}4)\) are both equal to 9.

Talk About It!

Why do we take the absolute value of the difference? Distance is always positive or 0.

Interactive Presentation

Learn, Find the Distance Between Integers, Slide 1 of 2

WATCH

On Slide 1, students watch an animation that explains how to find the distance between two integers on a number line.

DIFFERENTIATE

Enrichment Activity

To challenge students’ understanding of distance between integers, have them find the integer(s) that satisfy each of the following descriptions.

- 8 units from 3: \(-5, 11\)
- 6 units from \(-2\): \(-8, 4\)
- 10 units from \(-22\): \(-32, -12\)
Lesson 3-2 • Subtract Integers

Example 4  Find the Distance Between Integers

Objective
Students will find the distance between two integers on a number line.

Teaching the Mathematical Practices

2 Reason Abstractly and Quantitatively  Encourage students to make sense of the integers given in the example and the distance between them, whether they use a number line to find the distance or absolute value.

6 Attend to Precision As students discuss the Talk About It! question on Slide 4, encourage them to communicate precisely the similarities and differences of the two methods.

Questions for Mathematical Discourse

SLIDE 2

AL  What do you need to find? the distance between −9 and 8
OL  How many units are between the integers? 17 units
BL  What is the difference of the expression −9 − 8? How does this compare to the distance between the integers? The difference is −17, but the distance between the integers is positive.

SLIDE 3

AL  What is the absolute value of each integer? The absolute value of −9 is 9. The absolute value of 8 is 8.
OL  Why do you need to find the absolute value of the difference? Distance cannot be negative.
BL  Give an example of two integers, on opposite sides of zero, where the distance between them is 25? Sample answer: 15 and −10

Go Online

• Find additional teaching notes and the Talk About It! question to promote mathematical discourse.
• View performance reports of the Checks.
• Assign or present an Extra Example.

Interactive Presentation

Example 4  Find the Distance Between Integers

Method 1  Use a number line.

Go Online  You can use the Web Sketchpad number line.
Start at −9. Move right until you reach 8.

There are 17 units between −9 and 8.

Method 2  Use the absolute value.
To find the distance between integers, you can find the absolute value of their difference.

\[ |−9 − 8| = |−9 + (−8)| \]

Add the additive inverse of 8.

\[ = |−17| \]

Simplify.

So, the distance between −9 and 8 is 17 units.

Check

Find the distance between −5 and 9 on the number line.

14 units

Pause and Reflect

When finding the distance between integers with different signs, which method would you choose to use? Explain.

See students’ responses.

Sample answer: A number line shows the difference as units between each number. Using the absolute value would be more beneficial when the numbers are larger.

WEB SKETCHPAD

On Slide 2, students use Web Sketchpad to find the distance with a number line (Method 1).

TYPE

On Slide 3, students use absolute value to find the distance (Method 2).

CHECK

Students complete the Check exercise online to determine if they are ready to move on.
**Example 5** Find the Distance Between Integers

The highest point in California is Mount Whitney with an elevation of 14,494 feet. The lowest point is Death Valley with an elevation of -282 feet.

What is the distance between the height of Mount Whitney and the depth of Death Valley?

\[
|14,494 - (-282)| = |14,494 + 282| \\
= 14,776
\]

To subtract -282, add its additive inverse.

Add.

Find the absolute value.

So, the distance between the two points is 14,776 feet.

**Check**

The top of an iceberg is 55 feet above sea level, while the bottom is 385 feet below sea level. What is the distance between the top and bottom of the iceberg?

440 feet

**Teaching the Mathematical Practices**

2 Reason Abstractly and Quantitatively Encourage students to use the mathematics they know, finding the distance between two integers, to solve the real-world problem and to make sure their answer makes sense in the context of the problem.

3 Construct Viable Arguments and Critique the Reasoning of Others As students discuss the *Talk About It!* question, encourage them to think logically as they reason about whether a negative answer makes sense.

**Questions for Mathematical Discourse**

**AL** What do you need to find? the distance between the elevations of Mount Whitney and Death Valley

**AL** What does it mean that the elevation of Death Valley is a negative integer? The elevation of Death Valley is below sea level.

**OL** Why do we find the absolute value of the difference? Distance cannot be negative.

**BL** Suppose a classmate stated that the distance between the elevations is 14,212 feet. How can you explain to them that their answer is not reasonable? Sample answer: Mount Whitney is above sea level and Death Valley is below sea level. The distance between them must be greater than either elevation.

**Go Online**

- Find additional teaching notes and the *Talk About It!* question to promote mathematical discourse.
- View performance reports of the Checks.
- Assign or present an Extra Example.
Apply The Solar System

Objective
Students will come up with their own strategy to solve an application problem involving temperature of celestial objects.

Teaching the Mathematical Practices

1 Make Sense of Problems and Persevere in Solving Them, 4 Model with Mathematics
Students will be presented with a task. They will first seek to understand the task, and then determine possible entry points to solving it. As students come up with their own strategies, they may propose mathematical models to aid them. As they work to solve the problem, encourage them to evaluate their model and/or progress, and change directions, if necessary.

3 Construct Viable Arguments and Critique the Reasoning of Others
As students respond to the Write About It! prompt, have them make sure their argument uses correct mathematical reasoning. If you choose to have them share their responses with others, encourage the listeners to ask clarifying questions to verify that the reasoning is correct.

Recommended Use
Have students work in pairs or small groups. You may wish to present the task, or have a volunteer read it aloud. Then allow students the time to make sure they understand the task, think of possible strategies, and work to solve the problem.

Encourage Productive Struggle
As students work, monitor their progress. Instead of instructing them on a particular strategy, encourage them to use their own strategies to solve the problem and to evaluate their progress along the way. They may or may not find that they need to change direction or try out several strategies.

Signs of Non-Productive Struggle
If students show signs of non-productive struggle, such as feeling overwhelmed, frustration, or disengagement, intervene to encourage them to think of alternate approaches to the problem. Some sample questions are shown.

• What does variation mean?
• What do you notice about Venus’ temperatures?
• How might thinking about 0°F help you?

Write About It!
Have students share their responses with another pair/group of students or the entire class. Have them clearly state or describe the mathematical reasoning they can use to defend their solution.

Interactive Presentation

Apply The Solar System

The table shows the minimum and maximum temperatures on various celestial objects in the solar system.

<table>
<thead>
<tr>
<th>Celestial Object</th>
<th>Minimum Temperature (°F)</th>
<th>Maximum Temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moon</td>
<td>-387</td>
<td>253</td>
</tr>
<tr>
<td>Mars</td>
<td>-225</td>
<td>70</td>
</tr>
<tr>
<td>Mercury</td>
<td>-279</td>
<td>801</td>
</tr>
<tr>
<td>Venus</td>
<td>864</td>
<td>864</td>
</tr>
</tbody>
</table>

Scientists want to send a probe to study the celestial object with the greatest variation in temperature. To which celestial object should they send the probe?

1 What is the task?
Make sure you understand exactly what question to answer or problem to solve. You may want to read the problem three times. Discuss these questions with a partner.

First Time Describe the context of the problem, in your own words.
Second Time What mathematics do you see in the problem?
Third Time What are you wondering about?

2 How can you approach the task? What strategies can you use?

See students’ strategies.

3 What is your solution?
Use your strategy to solve the problem.

Mercury; See students’ work.

4 How can you show your solution is reasonable?
Write About It! Write an argument that can be used to defend your solution.

See students’ arguments.

Sample answer: Even though Venus has the most stable temperatures, it also has by far the highest temperatures. A human would likely want to choose Mars based on the actual maximum and minimum temperatures. Protection from the colder temperatures would be required.

Go Online
Watch the animation.

Talk About It!
On which celestial object from the table would it be most reasonable to live? Explain.

Sample answer: Even though Venus has the highest temperatures, it also has by far the highest temperatures. A human would likely want to choose Mars based on the actual maximum and minimum temperatures. Protection from the colder temperatures would be required.

CHECK
Students complete the Check exercise online to determine if they are ready to move on.
**Interactive Presentation**

**Foldables**

Have students update their Foldables based on what they learned in this lesson. For this lesson, students could record examples of subtracting integers. You may wish to have students share their Foldables with a partner to compare the information they recorded, discussing and resolving any differences.

**Essential Question Follow-Up**

*How are operations with integers related to operations with whole numbers?*

In this lesson, students learned how to subtract integers by adding the additive inverse. Encourage them to work with a partner to compare and contrast subtracting integers to subtracting whole numbers. For example, have them compare and contrast how they would simplify each of the expressions $-15 - 7$, $-15 - (-7)$, $15 - (-7)$, and $15 - 7$.

**Exit Ticket**

Refer to the Exit Ticket slide. New Orleans is 8 feet below sea level and Britton Hill is 345 feet above sea level. How far apart are the elevations? Explain how to find the distance between the elevations. Write a mathematical argument that can be used to defend your solution.

$353$ feet; Sample answer: Find the absolute value of the difference of the elevations; $|345 - (-8)| = 353$.

**ASSESS AND DIFFERENTIATE**

**IF** students score 90% or above on the Checks, **THEN** assign:

- Practice, Exercises 15, 17, 18–21
- **ALEKS** Addition and Subtraction with Integers

**IF** students score 66–89% on the Checks, **THEN** assign:

- Practice, Exercises 1–14, 16, 19
- Remediation: Review Resources
- Personal Tutor
- Extra Examples 1–5
- **ALEKS** Plotting and Comparing Integers

**IF** students score 65% or below on the Checks, **THEN** assign:

- Remediation: Review Resources
- **AriveMATH** Take Another Look
- **ALEKS** Plotting and Comparing Integers
Practice and Homework

The Practice pages are meant to be used as a homework assignment. Students can complete the practice exercises in their Interactive Student Edition.

The following online homework options are available for you to assign to your students. These assignments include technology-enhanced questions that are auto-scored, as well as essay questions. Many of the Practice exercises on these pages are found in the online assignments, as well as additional exercises.

AL Practice Form B
OL Practice Form A
BL Practice Form C

Suggested Assignments

Use the table below to select appropriate exercises for your students’ needs.

<table>
<thead>
<tr>
<th>DOK</th>
<th>Topic</th>
<th>Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>subtract integers</td>
<td>1–9</td>
</tr>
<tr>
<td>1</td>
<td>evaluate algebraic expressions involving subtraction</td>
<td>10, 11</td>
</tr>
<tr>
<td>1</td>
<td>find the distance between two integers on a number line</td>
<td>12, 13</td>
</tr>
<tr>
<td>2</td>
<td>find the distance between two integers to solve a real-world problem</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>extend concepts learned in class to apply them in new contexts</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>solve application problems that involve subtracting integers</td>
<td>16, 17</td>
</tr>
<tr>
<td>3</td>
<td>higher-order and critical thinking skills</td>
<td>18–21</td>
</tr>
</tbody>
</table>

Common Misconception

Students may have trouble identifying the sign of the difference when subtracting negative integers. In Exercise 7, students may recognize that the distance between −18 and −12 is 6, but fail to realize that subtracting −12 from −18 results in −6, not 6.
**16.** The table shows the maximum and minimum account balances for three college students for one month. Giovanni claimed that he had the least variation (from maximum to minimum) in his account balance that month. Is he correct? Write a mathematical argument to justify your solution.

Giovanni is correct; Sample answer: Giovanni’s variation is $168 − $15, or $153. Jordan’s variation is $145 − (−$25), or $170. Elisa’s variation is $152 − (−$10), or $162.

**17.** The table shows the record high and record low temperatures for certain U.S. states. Which state in the list had the greatest variation in temperature? the least?

Utah, Nevada

**18.** Use a Counterexample Determine if each statement is true or false. If false, provide a counterexample.

a. Distance is always positive.
   true

b. Change is always positive.
   false; Change can be positive or negative. For example, the temperature dropping 2°F would be represented by a −2.

**19.** Find the Error A student is finding 4 − (−2). Find the student’s mistake and correct it.

4 − (−2) = 4 + 2
= 6

The student incorrectly wrote 4 − 2 instead of 4 + 2. The correct solution is 6.

**20.** Create Write a subtraction expression with a positive and negative integer whose difference is negative. Then find the difference.

Sample answer: −3 − 2; −5

**21.** If you subtract two negative integers, will the difference always, sometimes, or never be negative? Explain using examples to justify your solution.

sometimes; Sample answer:
For example, −10 − (−40) = 30 and −28 − (−13) = −15.

---

**Teaching the Mathematical Practices**

**3 Construct Viable Arguments and Critique the Reasoning of Others** In Exercise 18, students use a counterexample if a statement is false.

**3 Construct Viable Arguments and Critique the Reasoning of Others** In Exercise 19, students find the error in another student’s reasoning and correct it.

---

**Collaborative Practice**

Have students work in pairs or small groups to complete the following exercises.

**Interview a student.**

*Use with Exercise 16–17* Have pairs of students interview each other as they complete these application problems. Students take turns being the interviewer and interviewee for each problem. Interview questions should include asking the interviewee to think aloud through their solution process. An example of a good interview question for Exercise 17 might be “How do you find the variation in temperature?”

**Listen and ask clarifying questions.**

*Use with Exercises 20–21* Have students work in pairs. Have students individually read Exercise 20 and formulate their strategy to solve the problem. Assign one student as the coach. The other student should talk through their strategy, while the coach listens, asks clarifying questions, and offers encouragement and/or redirection. Have students switch roles to complete Exercise 21.