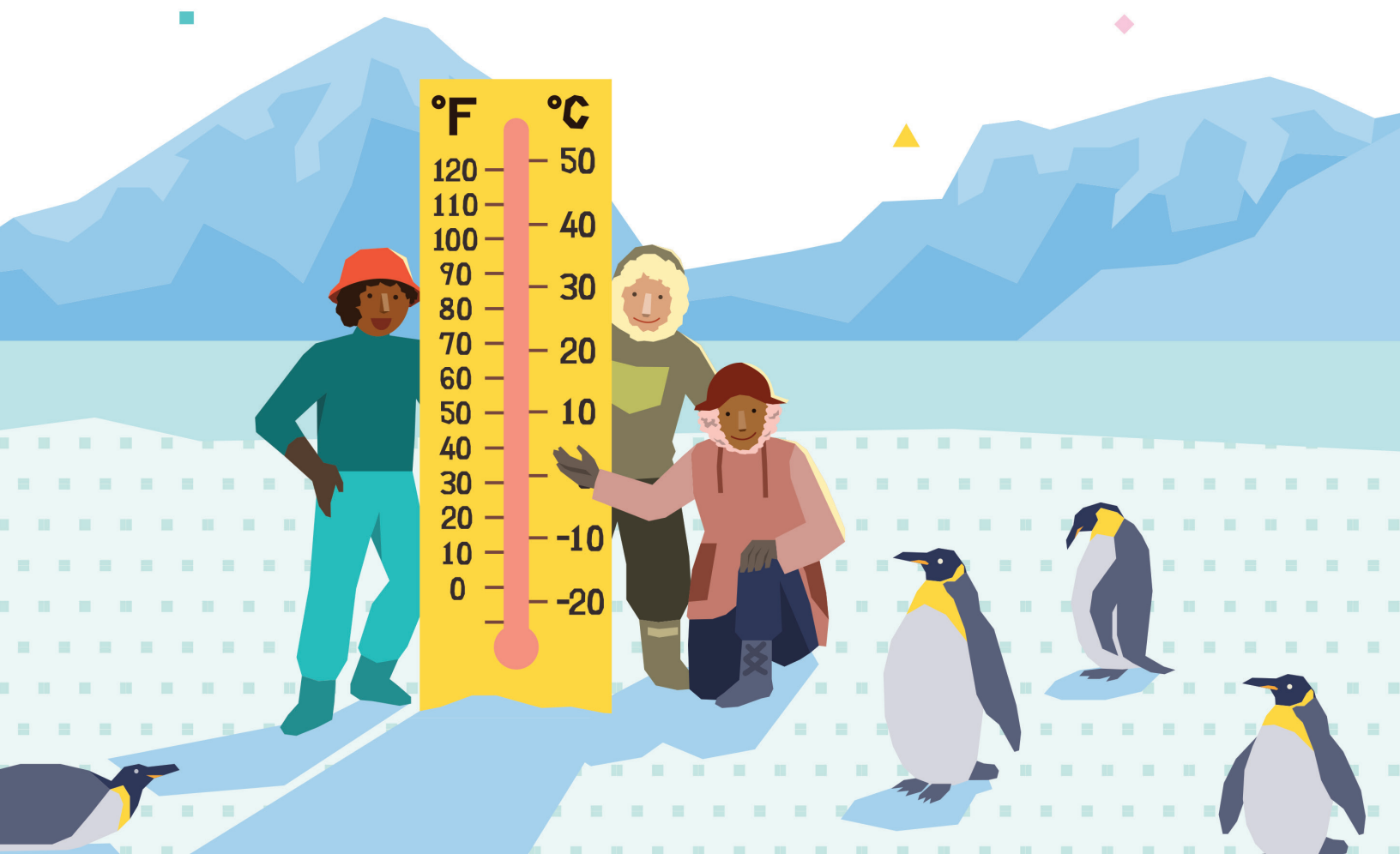


GRADE 7

Sample lesson





Amplify.

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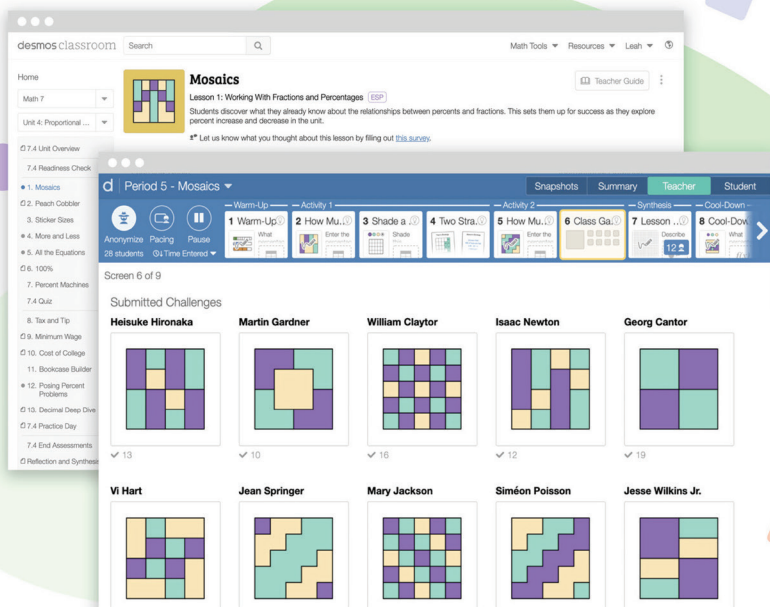
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Welcome to Amplify Desmos Math

Every student is brilliant, but not every student **feels** brilliant in math class. Research shows that students who believe they have brilliant ideas to add to the math classroom learn more.¹ Our aim is for students to see themselves and their classmates as having powerful mathematical ideas. In the words of the NRC report **Adding It Up**, we want students to develop a “productive disposition—[the] habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy.”²

Amplify Desmos Math does this by tapping into students' natural curiosity from the start of every lesson with:

- Low floor, high ceiling tasks
- Relevant, real-world problems
- Diverse mathematical role models
- Collaborative digital experiences



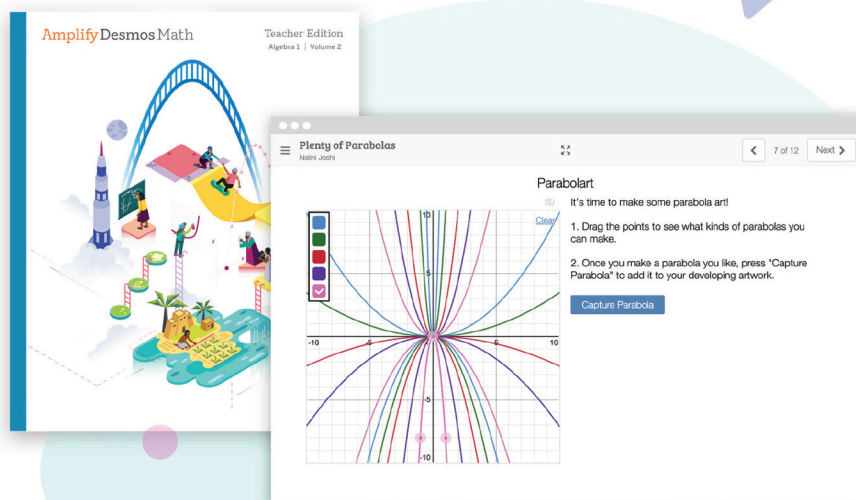
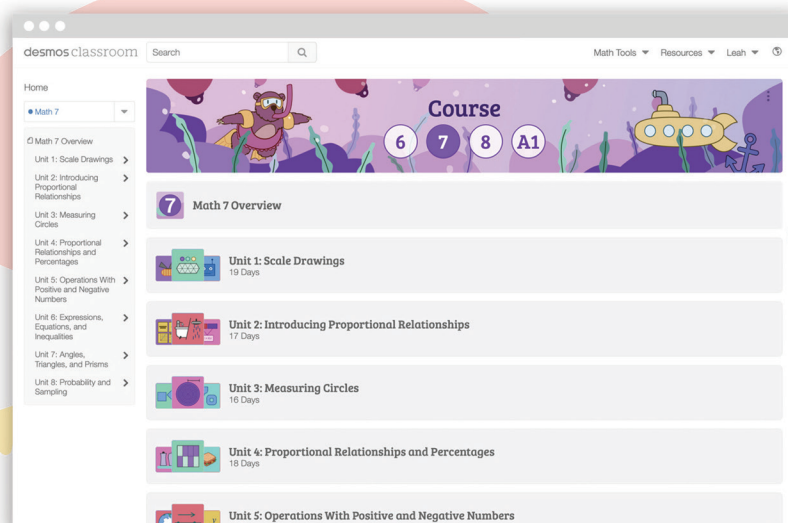
For students

Every student feels connected and a part of the conversation when participating in an Amplify Desmos Math lesson. And when students are actively engaged with the content, they achieve more.

For teachers

The program delivers what math educators want and need:

- Standards-aligned print and digital lessons that capture students' interests every day
- The right mix of informal and more substantive diagnostic and summative assessments
- Differentiation support
- Additional practice sets
- Spanish language supports



For leaders

The program delivers what school and district leaders want and need:

- A coherent core program based on the industry-leading IM K–12 Math™ by Illustrative Mathematics®
- A unified team from Amplify and Desmos Classroom dedicated to making implementation a success

¹ Uttal, D. H. (1997). Beliefs about genetic influences on mathematics achievement: A cross-cultural comparison. *Genetica*, 99(2–3), 165–172. <https://doi.org/10.1007/bf02259520>

² National Research Council. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press. doi.org/10.17226/9822

What can Desmos Classroom technology do for you?

Our digital lessons (and the technology developed by Desmos Classroom that brings them to life) are designed to make some of the most challenging parts of teaching easier for you. We know it can be difficult to understand what students are thinking while working, and to elevate student voices when there are so many ideas floating around the classroom. If students aren't getting the material, it often feels impossible to keep them engaged.

Repeated Challenges

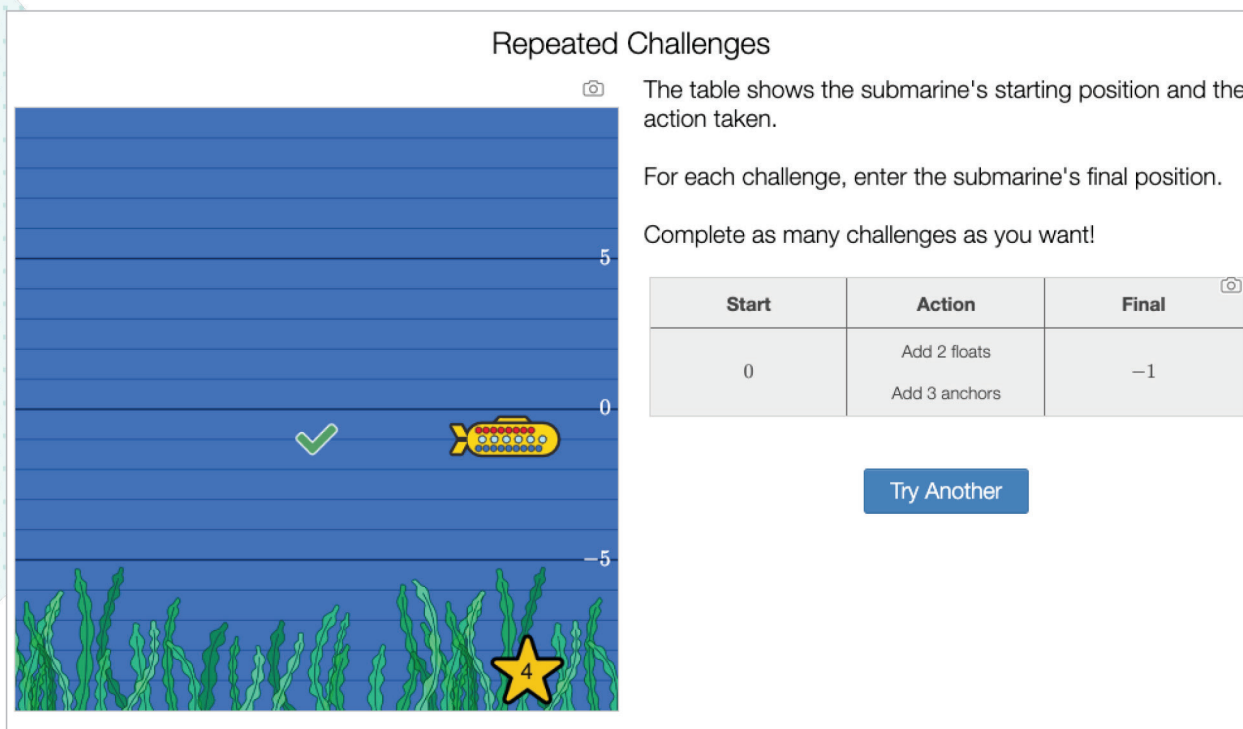
The table shows the submarine's starting position and the action taken.

For each challenge, enter the submarine's final position.

Complete as many challenges as you want!

Start	Action	Final
0	Add 2 floats Add 3 anchors	-1

Try Another




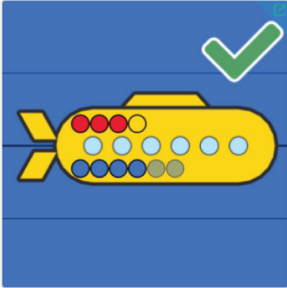
The Desmos Classroom technology found in Amplify Desmos Math works on three different fronts to ensure lessons are memorable and effective:

1. **Students are given interesting problems that show the power and consequences of their thinking and actions** (and we offer opportunities for them to revise their thinking along the way!). Sometimes that can mean showing whether a response is right or wrong, but often it doesn't. What does that mean? In many lessons, students add their thinking to the activity and, rather than tell them whether it's right or wrong, we show them what it implies for the model, later allowing students to interpret and revise their work. We call this interpretive feedback.

2. **Teachers are given more information about what students are thinking during class to make leading conversations easier.** Selecting and discussing student work can be a really powerful teaching move, but it can feel challenging when students are working privately on worksheets. The Desmos Classroom technology essentially underpins each lesson with the power of Peg Smith and Mary K. Stein's *5 Practices for Orchestrating Productive Classroom Discussions*.

What do you notice?



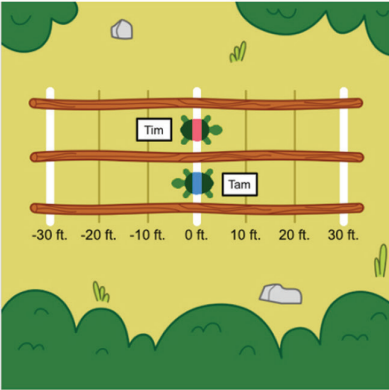


add 5 floats
take away 5 anchors
add 6 floats and take away 1 anchor

Remove 100 floats
Remove 105 anchors

3. **Everyone in the classroom is connected through intuitive interaction tools.** Students can see what others have said on some screens, while teachers can always see where students are and what they're doing, enabling them to make great teaching moves. And, of course, teachers have a lot of control over what students can see and how fast the class is moving.

Screen 1 of 13 Warm-Up: Tell a Story



- Press play to watch a short animation.
- Write a story about Tim and Tam.

Mariel Vázquez
 Tim and Tam are like cars on a highway, heading in opposite directions. They might see just the top of a shell over that branch, but only if they're paying attention. Tam is in a bit of a rush, while Tim is cruising and enjoying the ride.

David Blackwell
 Tam and Tim are twin turtles. They both start a race at the 0 line. The gun fires and the turtles are off...but in opposite directions, who knows why. Tim is walking slowly and Tam is walking more quickly. After a bit of time, Tim has walked forwards 10 feet and Tam has walked backwards 20 feet. The two turtles are now 30 feet apart from each other.

Elbert Frank Cox
 Tim and Tam are brother and sister and they are walking in opposite directions.

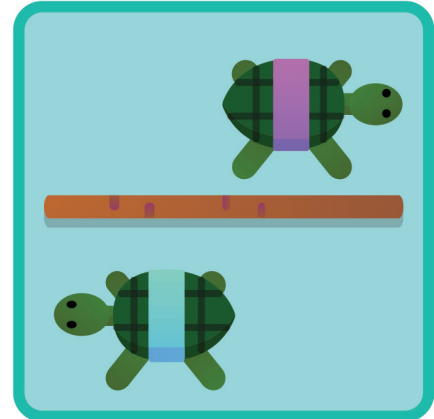
Grade 7 Teacher Edition



Back in Time

Position, Rate, and Time

Let's represent the product of rational numbers using velocity, time, and position.



Focus and Coherence

Today's Goals

- Language Goal:** Explain how rational numbers can be used to represent time, velocity, and position. **(Speaking and Listening, Writing)**
- Write a multiplication expression to represent a situation involving constant speed and time.
- Language Goal:** Generalize that the product of two numbers with the same sign is positive and the product of two numbers with different signs is negative. **(Speaking and Listening)**

Students explore the product of positive and negative numbers by analyzing the location of a turtle traveling at a constant speed. They model movement on the number line, noting the difference between speed and velocity and going forward and backward in time.

◀ Previously

In Lesson 6, students extended the floats and anchors model that they used to add and subtract rational numbers to make sense of multiplying positive and negative integers.

> Coming Soon

In Lesson 8, the context of velocity, time, and position will be extended to making sense of division with rational numbers.

Rigor

- Students use number lines to build **conceptual understanding** of multiplying rational numbers in the context of velocity, time, and position.

Vocabulary

velocity

Standards

Addressing

7.NS.A.2.A

Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. **Interpret products of rational numbers by describing real-world contexts.**

Building Toward

7.NS.A.2.B

7.NS.A.2.C





Math Identity and Community

- In the Warm-up, highlight unique or creative stories that students tell about the turtles Tim and Tam.
- In Activity 2, celebrate the different language students use as they describe what each number means in terms of the turtle's movement.

Lesson at a Glance ~ 45 min

Warm-up

 Pairs |  5 min



Students use rational numbers to reason about the positions of turtles on a number line while traveling at a constant speed.

Instructional Routines:

- [Think-Pair-Share](#)
- [MLR8: Discussion Supports—Press for Reasoning](#)



Activity 1

 Pairs |  10 min

Students use velocity, time, and position to explain why the product of a negative number and a positive number is negative.

Instructional Routines:

- [MLR2: Collect and Display](#)

7.NS.A.2.A
MP2, MP6



Activity 2

 Pairs |  10 min

Students explore the relationship between velocity and time to make sense of the rules of multiplying rational numbers.



Instructional Routines:

- [MLR7: Compare and Connect](#)

7.NS.A.2.A
MP2



Activity 3

 Independent |  10 min

Students determine the products of rational numbers while reasoning about the sign of the product.



Instructional Routine:

- [Poll the Class](#)

7.NS.A.2.A





Synthesis and Summary

 Whole Class |  5 min

Review and synthesize the rules for multiplying rational numbers.



Exit Ticket

 Independent |  5 min

Students demonstrate their understanding of multiplying rational numbers by evaluating expressions.

7.NS.A.2.A



Pacing Modifications


You may want to consider these additional modifications if you are short on time.

Warm-up • May be omitted.


Activity 1 • Have students complete only Parts 1 and 2.
• Consider assigning Part 3 as additional practice.

Activity 3 • Can be completed as a whole class.

Prep Checklist

 All resources are available in print or online.

Every lesson includes:

 Exit Ticket PDF

 Teacher Projection screens

Additional required materials:

Activity 3 Activity 3 PDF, pre-cut cards, one set per pair

Warm-up Tell a Story

Purpose: Students use rational numbers to reason about the positions of turtles on a number line while traveling at a constant speed.

1 Launch

Invite students to use their creativity to tell a story about the turtles Tim and Tam. Clarify that the turtles started to move at the same time with a constant speed. Conduct the **Think-Pair-Share** routine.

2 Connect

Have students share their stories and encourage them to include any details about the position, direction, time, and speed of each movement.

Math Identity and Community

Consider highlighting unique or creative stories.

Define **velocity** as a quantity that represents the speed and the direction of motion. In general, speed, like distance, is always positive but velocity can be either positive or negative.

MLR8 Use the *Discussion Supports* routine.

Highlight that the change in position of the turtles is determined by the product of their speed and time ($d = st$). The initial position and the direction of each turtle's movement determine the final position.

Ask,

- "What are the possible signs of the velocities of Tim and Tam?"
- "If Tim is traveling at a velocity of 2 ft/min, what is a reasonable velocity for Tam?"
- "If there are 2 minutes between the before and after diagrams, what are the velocities of Tim and Tam?"

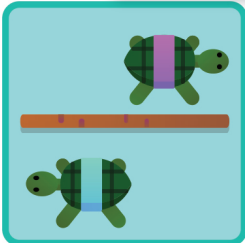
Warm-up Student Screens

Unit 5
Lesson
7

Name: _____ Date: _____

Log In

1. Press play to watch a short animation.



Back in Time

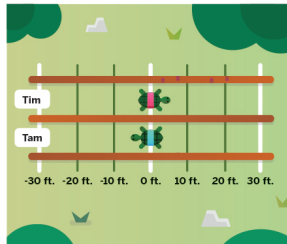
Position, Rate, and Time

Let's represent the product of rational numbers using velocity, time, and position.

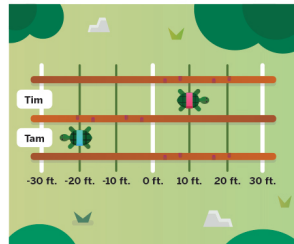
Warm-up Tell a story

The two images show Tim's and Tam's locations at two different moments in time.

Note: Both turtles started to move at the same time at constant speeds.



Before



After

Write a story about Tim and Tam.

Sample response: Tim and Tam met each other on their way home and stopped to talk. After their talk, they continued to move in opposite directions. Tam showed off by walking faster than Tim.

Lesson 7 Back in Time 73

Math Language Development

MLR8: Discussion Supports—Press for Reasoning

During the Connect, after defining velocity, display the following prompt:

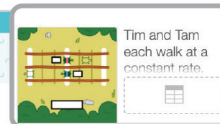
"Two objects can/cannot have the same speed, but different velocities, because ..."

Ask students to complete the prompt, encouraging them to justify their reasoning using examples and nonexamples.

Activity 1 Velocity, Position, and Time

Purpose: Students use velocity, time, and position to explain why the product of a negative number and a positive number is negative.

Activity 1
Student Screens



1 Launch

Arrange students into pairs and ask them if the information in the table in the first problem is consistent with the stories they told (MP2).

2 Monitor

Support Getting Started: Consider asking what patterns they see in the table of values.

Look for points of confusion:

- Not recognizing that the problems are asking about the velocity of each turtle rather than the speed. Display a large number line in the front of the room and ask students to make jumps in both directions to make sense of the positive and negative values shown on the table.

3 Connect

Have pairs of students share how they reasoned about the velocities of Tim and Tam.

MLR2 Use the *Collect and Display* routine.

Ask, “In which direction is Tim walking? Tam? Where would Tim and Tam be after 10 minutes? What distance did they cover and what are their positions now?”

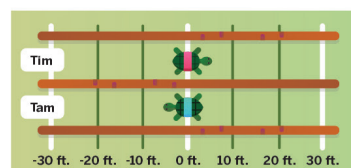
Highlight that Tam’s speed is 5 ft/min, but his velocity is -5 ft/min, meaning Tam moves 5 ft to the left in the negative direction. To determine the final position of Tam, give the speed a negative sign (because he is moving in the negative direction), then multiply his speed by the time (MP6).

Activity

1

Velocity, Position, and Time

Tim and Tam are walking at constant speeds in opposite directions.



1. Use the table to determine each turtle’s location after 6 minutes of walking. Be prepared to explain your thinking.

Time (minutes)	Tim’s position (ft)	Tam’s position (ft)
0	0	0
1	2.5	-5
2	5	-10
3	7.5	-15
6	15	-30

2. What is Tim’s velocity? Show or explain your thinking.
2.5 feet per minute; Sample responses:
 - The constant of proportionality in the table is found in the row where time is 1. For Tim, 2.5 ft is the corresponding distance for 1 minute.
 - For every 1 minute of time, Tam’s position changes by 2.5 ft from the previous position.
3. What is Tam’s velocity? Show or explain your thinking.
-5 feet per minute; Sample responses:
 - The constant of proportionality in the table is found in the row where time is 1. For Tam, -5 ft is the corresponding distance for 1 minute.
 - For every 1 minute of time, Tam’s position changes by -5 ft from the previous position.

D Differentiation

Accessibility: Visual-spatial processing

Use a think-aloud to demonstrate how Tim’s velocity can be used to determine his position at 6 minutes. Then have students work to determine Tam’s position at 6 minutes.

Extension

Ask:

- “Where would Tam be when Tim has walked 20 ft?”
- “What is the distance between Tim and Tam after one minute? After 6 minutes?”
- “When will Tim and Tam be 150 feet apart?”

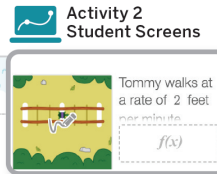
MLD2 Math Language Development

MLR2: Collect and Display

Ask them to review and reflect on the terms and phrases related to the term *velocity* that were added to the display during the lesson. Highlight that velocity can be either positive or negative while speed is always positive. Velocity describes both the magnitude and direction while speed only describes the magnitude. Consider adding a table to the class display, such as the one shown here.

Activity 2 Backward and Forward in Time

Purpose: Students explore the relationship between velocity and time to make sense of the rules of multiplying rational numbers.



1 Launch

Activate students' background knowledge by asking whether they have ever watched a video played in reverse. This will give students a context for thinking about how to interpret time moving both backwards and forwards. Read through the introduction to the activity by adding that they will make predictions about Tam's position at various points in time.

2 Monitor

Support Getting Started: Consider asking, "Where will Tam be after one minute? After 2 minutes? After 3 minutes?"

Look for a variety of strategies:

- Recognizing going back in time rewinds the movement of Tam in the positive direction, and expressing his velocity as 5 ft/min.
- Referring back to Activity 1 and recognizing that multiplication has the commutative property to conclude the product of a positive number and negative number is negative in Part 3.

D Differentiation

Look for early student thinking:

- Not recognizing how to express "3.2 minutes ago" using signed numbers.** Ask, "How could you express going backward in time if the positive direction is forward?"
- In Part 3, adding 20 ft instead of subtracting 20 ft from Tommy's current position.** Have students draw an arrow in the direction of Tommy's movement and ask them to show Tommy's position 10 minutes ago as the left or right side of the initial point.

Name: _____ Date: _____ Period: _____

Backward and Forward in Time

The image shows Tam's position at 0 ft. Tam's velocity is -5 feet per minute.

-30 ft. -20 ft. -10 ft. 0 ft. 10 ft. 20 ft. 30 ft.

Part 1

- What will Tam's position be after 3.2 minutes have passed? Show or explain your thinking.
 -16 ft; **Sample response: The product of his velocity and time gives his position. $-5 \cdot 3.2 = -16$**
- One student wrote the following equation to determine Tam's position.
 $(-5) \cdot 3.2 = -16$
 Explain what each value represents in the scenario.
 -5 represents: **Tam's velocity of -5 feet per minute**
 3.2 represents: **3.2 minutes have passed**
 -16 represents: **Tam's position, in feet**

Part 2

- What was Tam's position 3.2 minutes ago? Show or explain your thinking.
 16 ft;
Sample responses:
 - As the time and speed are the same as in Problems 1 and 2, Tam covered the same distance as above, but in the opposite direction.
 - Going backward in time would be like walking backward, so Tam's velocity would become $+5$ feet per minute. $5 \cdot 3.2 = 16$.
 - 3.2 minutes ago means 3.2 minutes back in time, so it can be represented as -3.2 . So, $(-5) \cdot (-3.2) = 16$.
- One student wrote the following equation to determine Tam's position.
 $(-5) \cdot (-3.2) = 16$
 Explain what each value represents in the scenario.
 -5 represents: **Tam's velocity of -5 feet per minute**
 -3.2 represents: **3.2 minutes back in time**
 16 represents: **Tam's position, in feet**

Lesson 7 Back in Time 75

Activity 2 continued >

D Differentiation

Accessibility: Optimize Access to Technology

Have students use the digital slides for this activity, in which they can use interactive number lines to determine the locations of the turtles as they move at constant speeds both forward and backward in time.

Activity 2 Backward and Forward in Time (continued)

Pairs | 10 min

7.NS.A.2.A
MP2

Purpose: Students explore the relationship between velocity and time to make sense of the rules of multiplying rational numbers.

3 Connect

Display a large number line in the front of the classroom and ask for a student to represent Tommy.

MLR7 Use the *Compare and Connect* routine.

Ask, “What integer value could be used to represent 10 seconds in the future? 10 seconds in the past?” **10; -10**

Have students share their answers for Part 1b and Part 2b. Celebrate the different language students use as they describe what each number means in terms of the turtle’s movement. Then ask students how they determined the location of Tommy on the number line with the student volunteer acting out the movements (**MP2**).

Highlight:

- When traveling back in time, represent time with a negative sign.
- The product of a negative velocity and a negative time is the same as the product of a positive velocity and a positive time.
- The product of a positive velocity and a negative time is the same as the product of a negative velocity and a positive time.

Activity 2 Student Screens



Activity 2 Backward and Forward in Time (continued)

Part 3

5. Tommy walks at a velocity of 2 feet per minute. Right now, Tommy’s position is -60 ft.

a Where was Tommy 10 minutes ago? Show or explain your thinking.
-80 ft; Sample response: After 10 minutes, his distance will change by $2 \cdot (-10)$ or -20 ft. $-60 + (-20) = -80$

b Which of the expressions describe the location of Tommy 10 minutes ago? Select *all* that apply.

A. $-60 + 2 \cdot (-10)$
 B. $-60 + (-2) \cdot (-10)$
 C. $-60 - 20 \cdot 10$
 D. $-60 + (-2) \cdot (10)$
 E. $-60 + 20$

You’re invited to explore more.

Five minutes ago, these turtles were located at the same position.

1. What could their velocities be? Determine several possible pairs. **Answers may vary.**

Turtle	Position (ft)	Velocity (ft/min)	Velocity (ft/min)
Top	0	1	4
Bottom	30	7	10

2. Discuss any patterns you notice with a classmate.
Sample response: The velocities always have a difference of 6 (or -6).

3. When will the distance between them be 90 ft? **10 minutes later**

Math Language Development

MLR7: Compare and Connect

During the Connect, ask students to share their responses to the questions posed in the Student Edition:

- “What do you notice about the locations on the number line that represent Tommy’s position before his current position? After his current position?”

Encourage students to share details about their reasoning by asking:

- “How did your solution to Part 1 help you with Part 2?”

Multilingual Learners

Use a number line to demonstrate how Tommy moves forward and backward in time. Clarify the meaning of the word *ago*.

D Differentiation

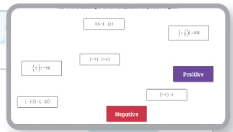
Extension: You’re invited to explore more

Invite students to complete the Stretch activity *You’re invited to explore more* before moving on.

Activity 3 Card Sort: Positive or Negative?

Purpose: Students determine the products of rational numbers while reasoning about the sign of the product.

Activity 3 Student Screens



1 Launch

Distribute Activity 3 PDF. Set an expectation for the amount of time students will have to work in pairs on the activity by reminding them that they need to determine the signs of the products, not the values.

2 Monitor

Help students get started by encouraging them to apply their understanding of velocity and position to reason about the product of rational numbers.

Look for a variety of strategies:

- Summarizing the rules for multiplication as the product of the same sign being positive and product of the opposite signs being negative.

D Differentiation

Look for early student thinking:

- Thinking the sign of the first number determines the product when the factors have opposite signs. Remind students that multiplication has the commutative property.

3 Connect

Display the cards. Conduct the **Poll the Class** routine to determine the signs of each card.

Have students share how they reasoned about the signs of each product in Problem 2 using the context of velocity, time, and position.

Highlight that the product of two rational numbers with the same sign is positive. The product of two rational numbers with different signs is negative.

Name: _____ Date: _____ Period: _____

Card Sort: Positive or Negative?

You will be given a set of cards.

1. Sort the cards according to whether the product on each card is positive or negative. Write the card numbers in the table.

Positive	Negative
Card 1, Card 4, Card 6	Card 2, Card 3, Card 5

2. Complete each sentence. Be prepared to explain your thinking.

- The product of a positive number multiplied by a positive number is **positive**.
- The product of a positive number multiplied by a negative number is **negative**.
- The product of a negative number multiplied by a positive number is **negative**.
- The product of a negative number multiplied by a negative number is **positive**.

STOP

Lesson 7 Back in Time 77

D Differentiation

Accessibility: Guide Processing and Visualization

Display these questions that students can ask themselves as they complete the **Card Sort** in Problem 1.

- Do both numbers have the same sign?
- What was the sign of the product of negative velocity and negative time in Activity 2?
- Do the numbers have opposite signs? What was the sign of the product of negative velocity and positive time in Activity 1? Does the multiplication have commutative property?



Math Language Development

Multilingual Learners

Use color coding to annotate the parts of the expression students describe. This will help students visualize the relationships being discussed.

Synthesis and Summary

Key Takeaway: Review and synthesize the rules for multiplying rational numbers.

Synthesis

Invite students to spend 2-3 minutes to respond to the prompt. Ask them to share their thinking with a partner.

Display several students' responses using your dashboard view or snapshot tool. Select and sequence students' responses to share.

Have students share the connections they see between responses.

Summary

Display the Summary.

Have students share real-world examples where the product of two negative numbers is positive.

Highlight that, unlike adding rational numbers, the sign of the product is not based on the sign of the factor with the greater magnitude.

Formalize vocabulary: **velocity**

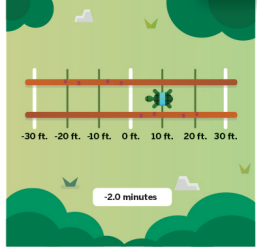
Ask, "Can you think of any other real-world examples of multiplying positive and negative numbers?" **Sample response:** Determining a previous temperature when the temperature has been decreasing at a constant rate.

Synthesis Student Screen

Synthesis

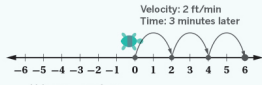
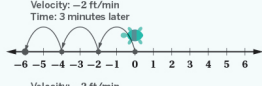
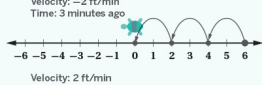

Use the turtle scenario to explain why it makes sense that the value of the expression $(-5) \cdot (-2)$ is positive.

Sample response: "-5" means "moving in the negative direction," and "-2" means "2 minutes ago". So, this expression shows where the turtle was 2 minutes ago. Because the turtle is facing left, it would have been to the right of its current position 2 minutes ago, which is toward the positive numbers.



Summary

Multiplying signed numbers, regardless of the order, is similar to multiplying positive numbers. In the context of velocity, time, and position:

 <p>Velocity: 2 ft/min Time: 3 minutes later</p>	<p>Positive velocity and positive time result in a movement in the "positive" direction.</p> $2 \cdot 3 = 6$
 <p>Velocity: -2 ft/min Time: 3 minutes later</p>	<p>Negative velocity and positive time result in a movement in the "negative" direction.</p> $(-2) \cdot 3 = -6$
 <p>Velocity: -2 ft/min Time: 3 minutes ago</p>	<p>Negative velocity and negative time result in a movement in the "positive" direction.</p> $(-2) \cdot (-3) = 6$
 <p>Velocity: 2 ft/min Time: 3 minutes ago</p>	<p>Positive velocity and negative time result in a movement in the "negative" direction.</p> $2 \cdot (-3) = -6$

The rules of multiplying rational numbers can be summarized as:

- The product of two numbers with the same sign is positive.
- The product of two numbers with different signs is negative.

Sub-unit Story Connection

Sub-unit 1



In the sub-unit story, students read about how an accident at a paper-bag making business led to the creation of the cardboard box. In this lesson, students applied what they learned about surface area to design a take-out container.

Consider asking students to reflect on connections between the sub-unit story and what they learned in this lesson and unit.

- Other than cardboard boxes and take-out containers, what other kinds of containers can you think of? How are they used? **Answers may vary.**
- What information do you need to know to design containers? **Sample response:** I need to know the dimensions of the product it needs to hold and the shape of the product it needs to hold.
- What other information might be important to a company that makes containers? **Sample response:** The cost of the material to produce the container and how many containers are needed.

Exit Ticket

Purpose: Students demonstrate their understanding of multiplying rational numbers by evaluating expressions.

Success looks like . . .

- **Goal:** Using reasoning about place value to calculate percentages that are not whole numbers, and explaining the strategy
 - » Recognizing that 57.5% of one whole can be expressed as 0.575 and calculating 57.5% of 120.
- **Language Goal:** Interpreting tape diagrams that represent situations that involve percentages that are not whole number values. **(Speaking and Listening)**
 - » Explaining whether Diego or Jada is closer to fulfilling the service requirement using the tape diagram.

D Differentiation

Use students' work on the exit ticket to determine what next steps might be.

S Support

- » If students had difficulty comparing 57.5% to 63 hours, guide them through Practice Problem 2 in place of the Warm-up as a lead into the next lesson.
- » Ask, "What does it mean to have worked 6.4 out of 80 hours? How is that related to a percent?"

S Strengthen

- Did you notice whether many students relied on a calculator rather than a tape diagram? That's completely expected at this point!
 - » Continue to provide opportunities to use tape diagrams in Lesson 3 – this will help them build understanding of percent increase and decrease.

Exit Ticket Student Screen

Two of these equations are true. One is false.



Name: _____ Date: _____ Period: _____

Exit Ticket

Two of these equations are true and one is false. Select the false equation. Explain your thinking.

A. $\frac{1}{2} \cdot (-16) = -8$

B. $(-4) \cdot 2.5 = -10$

C. $(-3) \cdot (-8) = -24$

Sample response: The equation $(-3) \cdot (-8) = -24$ is false because when you multiply two negative numbers, the product is positive.

Self-Assess



1

2

3

4

5

a I can explain whether the product of two rational numbers is positive or negative.

1 2 3 4 5

b I can determine the product of two rational numbers.

1 2 3 4 5

Practice

Provide students with sufficient practice to build and reinforce their conceptual understanding, fluency, and application of mathematical topics including connections to STEM, assessment practice, and ongoing spiral review.

Practice Student Screens

Name: _____ Date: _____ Period: _____

Practice

1. Determine whether each product is positive or negative. Choose one expression and explain your thinking.

Expression	Positive	Negative
$4 \cdot (-3)$		✓
$-\frac{1}{8} \cdot (-7)$	✓	
$-4.6 \cdot \frac{4}{5}$		✓
$-69.8 \cdot (-4.5)$	✓	

2. A diver rises toward the surface at a rate of 60ft/minute. She starts off at -340 ft.

a. At what depth is she after:

1 minute? $-340 + 60 = -280$	2 minutes? $-340 + (2 \cdot 60) = -340 + (120) = -220$	3 minutes? $-340 + (3 \cdot 60) = -340 + (180) = -160$
---------------------------------	---	---

b. How long will it take the diver to return to the surface?

After 4 minutes: $-160 + 60 = -100$
 After 5 minutes: $-100 + 60 = -40$
 After 6 minutes: $-40 + 60 = 20$; She will need more than 5 but less than 6 minutes to return to the surface.

Additional Practice for this lesson is available online. Lesson 7 Back in Time 79

Name: _____ Date: _____

Practice

3. The temperature at a weather station is currently 0°C. It is falling at a constant rate of 3°C per hour.

a. What will the temperature be in 2 hours?
 -6°C ; Sample response: $-3 \cdot 2 = -6$

b. What will the temperature be in 5 hours?
 -15°C ; Sample response: $-3 \cdot 5 = -15$

c. What will the temperature be in a $\frac{1}{2}$ hour?
 -1.5°C ; Sample response: $-3 \cdot \frac{1}{2} = -1.5$

d. What was the temperature 1 hour ago?
 3°C ; Sample response: $-3 \cdot (-1) = 3$

e. What was the temperature 3 hours ago?
 9°C ; Sample response: $-3 \cdot (-3) = 9$

f. What was the temperature 4.5 hours ago?
 13.5°C ; Sample response: $-3 \cdot (-4.5) = 13.5$

4. Determine the missing value in each equation.

a. $-2 \cdot (-4.5) = \boxed{9}$ b. $-8.7 \cdot (-10) = \boxed{87}$

c. $-7 \cdot \boxed{-2} = 14$ d. $\boxed{-9} \cdot (-10) = 90$

Spiral Review

5. Lila's lunch at a restaurant costs \$12.00, without tax. She leaves the waiter a tip of 15%. What is the total cost of the lunch, including the tip, without tax?

A. \$1.80 C. \$13.80
 B. \$12.15 D. \$27.00

6. This is Bard's work for simplifying $-4 - (-3) + 8$. Explain why Bard is incorrect. Then simplify the expression correctly.

Sample response: Bard is incorrect because addition and subtraction should be done in the order they appear from left to right.

$$-4 - (-3) + 8 = -4 + 3 + 8$$

$$= -1 + 8$$

$$= 7$$

80 Unit 5 Operations With Positive and Negative Numbers

Practice Problem Item Analysis

	Problem(s)	DOK	Standard(s)
On-lesson			
	1	1	7.NS.A.2.A
	2	2	7.NS.A.2.A
	3	2	7.NS.A.2.A
Fluency	4	1	7.NS.A.2.A
Spiral Review			
Test Prep	5	2	7.RP.A.3
	6	3	7.NS.A.1

Need more Practice?



Each lesson includes more practice problems in the Additional Practice book and in the online item banks.

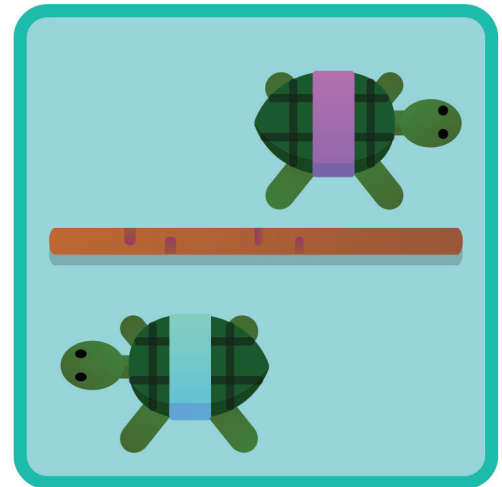
Grade 7

Student Edition

Back in Time

Position, Rate, and Time

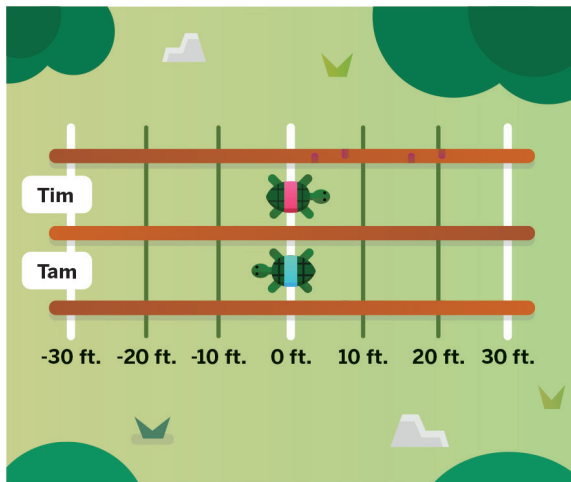
Let's represent the product of rational numbers using velocity, time, and position.



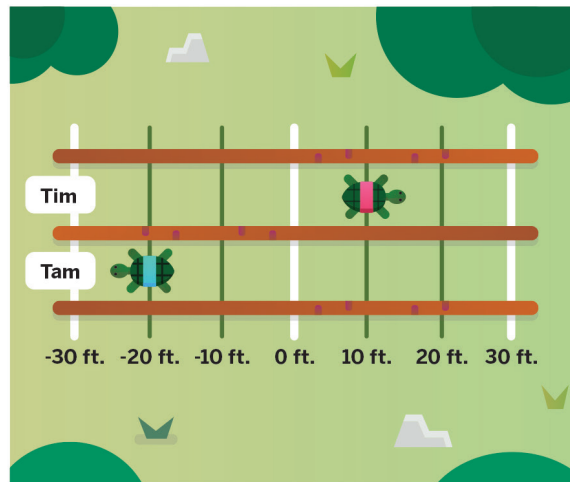
Warm-up Tell a story

The two images show Tim's and Tam's locations at two different moments in time.

Note: Both turtles started to move at the same time at constant speeds.



Before

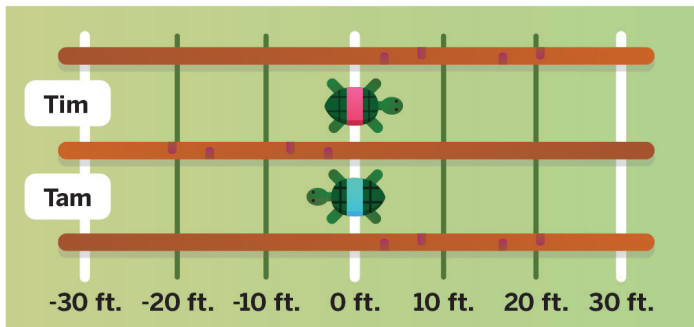


After

Write a story about Tim and Tam.

Velocity, Position, and Time

Tim and Tam are walking at constant speeds in opposite directions.



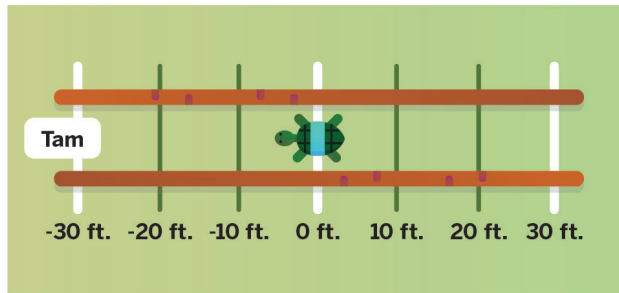
- Use the table to determine each turtle's location after 6 minutes of walking. Be prepared to explain your thinking.

Time (minutes)	Tim's position (ft)	Tam's position (ft)
0	0	0
1	2.5	-5
2	5	-10
3	7.5	-15
6		

- What is Tim's velocity? Show or explain your thinking.
- What is Tam's velocity? Show or explain your thinking.

Backward and Forward in Time

The image shows Tam's position at 0 ft. Tam's velocity is -5 feet per minute.



> Part 1

1. What will Tam's position be after 3.2 minutes *have passed*? Show or explain your thinking.

2. One student wrote the following equation to determine Tam's position.

$$(-5) \cdot 3.2 = -16$$

Explain what each value represents in the scenario.

-5 represents:

3.2 represents:

-16 represents:

> Part 2

3. What was Tam's position 3.2 minutes *ago*? Show or explain your thinking.

4. One student wrote the following equation to determine Tam's position.

$$(-5) \cdot (-3.2) = 16$$

Explain what each value represents in the scenario.

-5 represents:

-3.2 represents:

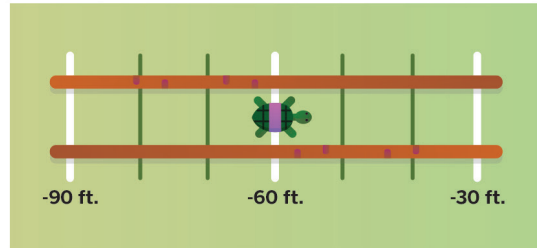
16 represents:

Backward and Forward in Time (continued)

Part 3

5. Tommy walks at a velocity of 2 feet per minute. Right now, Tommy's position is -60 ft.

- a Where was Tommy 10 minutes ago? Show or explain your thinking.



- b Which of the expressions describe the location of Tommy 10 minutes ago? Select *all* that apply.

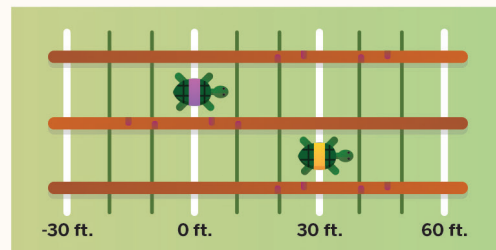
- A. $-60 + 2 \cdot (-10)$
 B. $-60 + (-2) \cdot (-10)$
 C. $-60 - 20 \cdot 10$
 D. $-60 + (-2) \cdot (10)$
 E. $-60 + 20$

You're invited to explore more.

Five minutes ago, these turtles were located at the same position.

1. What could their velocities be? Determine several possible pairs.

Turtle	Position (ft)	Velocity (ft/min)	Velocity (ft/min)
Top	0		
Bottom	30		



2. Discuss any patterns you notice with a classmate.
3. When will the distance between them be 90 ft?

Card Sort: Positive or Negative?

You will be given a set of cards.

- Sort the cards according to whether the product on each card is positive or negative. Write the card numbers in the table.

Positive	Negative

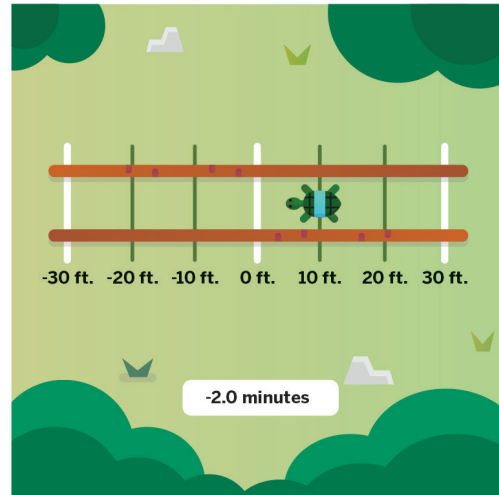
- Complete each sentence. Be prepared to explain your thinking.

- The product of a positive number multiplied by a positive number is
- The product of a positive number multiplied by a negative number is
- The product of a negative number multiplied by a positive number is
- The product of a negative number multiplied by a negative number is



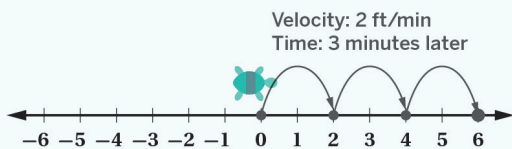
Synthesis

Use the turtle scenario to explain why it makes sense that the value of the expression $(-5) \cdot (-2)$ is positive.



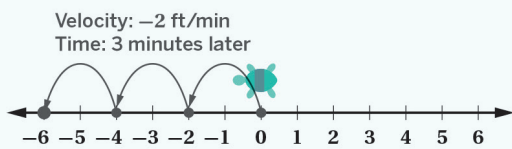
Summary

Multiplying signed numbers, regardless of the order, is similar to multiplying positive numbers. In the context of velocity, time, and position:



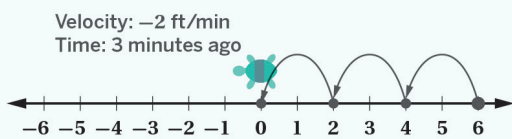
Positive velocity and positive time result in a movement in the “positive” direction.

$$2 \cdot 3 = 6$$



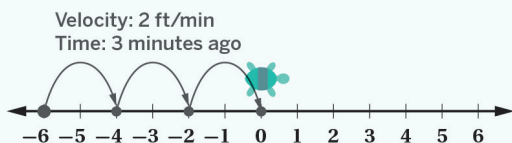
Negative velocity and positive time result in a movement in the “negative” direction.

$$(-2) \cdot 3 = -6$$



Negative velocity and negative time result in a movement in the “positive” direction.

$$(-2) \cdot (-3) = 6$$



Positive velocity and negative time result in a movement in the “negative” direction.

$$2 \cdot (-3) = -6$$

The rules of multiplying rational numbers can be summarized as:

- The product of two numbers with the same sign is positive.
- The product of two numbers with different signs is negative.

1. Determine whether each product is positive or negative. Choose one expression and explain your thinking.

Expression	Positive	Negative
$4 \cdot (-3)$		
$-\frac{1}{8} \cdot (-7)$		
$-4.6 \cdot \frac{4}{5}$		
$-69.8 \cdot (-4.5)$		

2. A diver rises toward the surface at a rate of 60ft/minute. She starts off at -340 ft.

a At what depth is she after:

1 minute?

2 minutes?

3 minutes?

b How long will it take the diver to return to the surface?

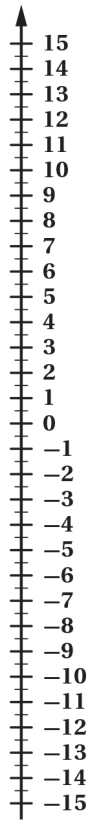


Practice

Name: _____ Date: _____ Period: _____

3. The temperature at a weather station is currently 0°C . It is falling at a constant rate of 3°C per hour.

- a What will the temperature be in 2 hours?
- b What will the temperature be in 5 hours?
- c What will the temperature be in a $\frac{1}{2}$ hour?
- d What was the temperature 1 hour ago?
- e What was the temperature 3 hours ago?
- f What was the temperature 4.5 hours ago?

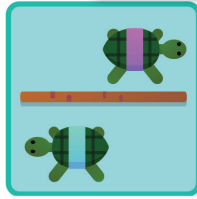


4. Determine the missing value in each equation.

- a $-2 \cdot (-4.5) = \square$
- b $-8.7 \cdot (-10) = \square$
- c $-7 \cdot \square = 14$
- d $\square \cdot (-10) = 90$

Spiral Review

5. Lila's lunch at a restaurant costs \$12.00, without tax. She leaves the waiter a tip of 15%. What is the total cost of the lunch, including the tip, without tax?
- A. \$1.80
 - B. \$12.15
 - C. \$13.80
 - D. \$27.00
6. This is Bard's work for simplifying $-4 - (-3) + 8$. Explain why Bard is incorrect. Then simplify the expression correctly.



Back in Time

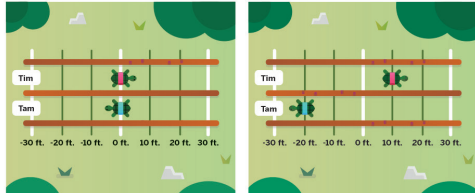
Position, Rate, and Time

Let's represent the product of rational numbers using velocity, time, and position.

Warm-up Tell a story

The two images show Tim's and Tam's locations at two different moments in time.

Note: Both turtles started to move at the same time at constant speeds.



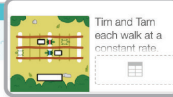
Before

After

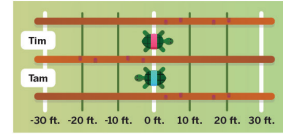
Write a story about Tim and Tam.

Sample response: Tim and Tam met each other on their way home and stopped to talk. After their talk, they continued to move in opposite directions. Tam showed off by walking faster than Tim.

Velocity, Position, and Time



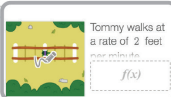
Tim and Tam are walking at constant speeds in opposite directions.



- Use the table to determine each turtle's location after 6 minutes of walking. Be prepared to explain your thinking.

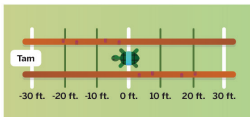
Time (minutes)	Tim's position (ft)	Tam's position (ft)
0	0	0
1	2.5	-5
2	5	-10
3	7.5	-15
6	15	-30

- What is Tim's velocity? Show or explain your thinking.
2.5 feet per minute; Sample responses:
 - The constant of proportionality in the table is found in the row where time is 1. For Tim, 2.5 ft is the corresponding distance for 1 minute.
 - For every 1 minute of time, Tam's position changes by 2.5 ft from the previous position.
- What is Tam's velocity? Show or explain your thinking.
-5 feet per minute; Sample responses:
 - The constant of proportionality in the table is found in the row where time is 1. For Tam, -5 ft is the corresponding distance for 1 minute.
 - For every 1 minute of time, Tam's position changes by -5 ft from the previous position.



Backward and Forward in Time

The image shows Tam's position at 0 ft. Tam's velocity is -5 feet per minute.



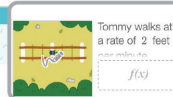
Part 1

- What will Tam's position be after 3.2 minutes have passed? Show or explain your thinking.
-16 ft; Sample response: The product of his velocity and time gives his position. $-5 \cdot 3.2 = -16$
- One student wrote the following equation to determine Tam's position.
 $(-5) \cdot 3.2 = -16$
Explain what each value represents in the scenario.
-5 represents: Tam's velocity of -5 feet per minute
3.2 represents: 3.2 minutes have passed
-16 represents: Tam's position, in feet

Part 2

- What was Tam's position 3.2 minutes ago? Show or explain your thinking.
16 ft;
Sample responses:
 - As the time and speed are the same as in Problems 1 and 2, Tam covered the same distance as above, but in the opposite direction.
 - Going backward in time would be like walking backward, so Tam's velocity would become +5 feet per minute. $5 \cdot 3.2 = 16$.
 - 3.2 minutes ago means 3.2 minutes back in time, so it can be represented as -3.2 . So, $(-5) \cdot (-3.2) = 16$.
- One student wrote the following equation to determine Tam's position.
 $(-5) \cdot (-3.2) = 16$
Explain what each value represents in the scenario.
-5 represents: Tam's velocity of -5 feet per minute
-3.2 represents: 3.2 minutes back in time
16 represents: Tam's position, in feet

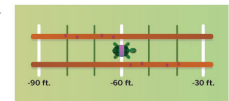
Backward and Forward in Time (continued)



Part 3

- Tommy walks at a velocity of 2 feet per minute. Right now, Tommy's position is -60 ft.

- Where was Tommy 10 minutes ago? Show or explain your thinking.
-80 ft; Sample response: After 10 minutes, his distance will change by $2 \cdot (-10)$ or -20 ft. $-60 + (-20) = -80$



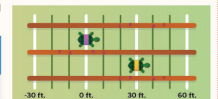
- Which of the expressions describe the location of Tommy 10 minutes ago? Select all that apply.
 - A. $-60 + 2 \cdot (-10)$
 - B. $-60 + (-2) \cdot (-10)$
 - C. $-60 - 20 \cdot 10$
 - D. $-60 + (-2) \cdot (10)$
 - E. $-60 + 20$

You're invited to explore more.

Five minutes ago, these turtles were located at the same position.

- What could their velocities be? Determine several possible pairs. Answers may vary.

Turtle	Position (ft)	Velocity (ft/min)	Velocity (ft/min)
Top	0	1	4
Bottom	30	7	10



- Discuss any patterns you notice with a classmate.
Sample response: The velocities always have a difference of 6 (or -6).
- When will the distance between them be 90 ft? 10 minutes later

Name: _____ Date: _____ Period: _____

Card Sort: Positive or Negative?

You will be given a set of cards.

- Sort the cards according to whether the product on each card is positive or negative. Write the card numbers in the table.

Positive	Negative
Card 1, Card 4, Card 6	Card 2, Card 3, Card 5

- Complete each sentence. Be prepared to explain your thinking.

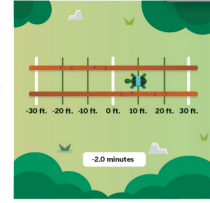
- The product of a positive number multiplied by a positive number is **positive**.
- The product of a positive number multiplied by a negative number is **negative**.
- The product of a negative number multiplied by a positive number is **negative**.
- The product of a negative number multiplied by a negative number is **positive**.



Synthesis

Use the turtle scenario to explain why it makes sense that the value of the expression $(-5) \cdot (-2)$ is positive.

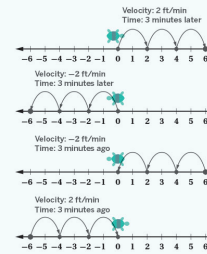
Sample response: “-5” means “moving in the negative direction,” and “-2” means “2 minutes ago”. So, this expression shows where the turtle was 2 minutes ago. Because the turtle is facing left, it would have been to the right of its current position 2 minutes ago, which is toward the positive numbers.



Use the turtle scenario to explain why it makes sense that the value of the expression $(-5) \cdot (-2)$ is positive.

Summary

Multiplying signed numbers, regardless of the order, is similar to multiplying positive numbers. In the context of velocity, time, and position:



Positive velocity and positive time result in a movement in the “positive” direction.
 $2 \cdot 3 = 6$

Negative velocity and positive time result in a movement in the “negative” direction.
 $(-2) \cdot 3 = -6$

Negative velocity and negative time result in a movement in the “positive” direction.
 $(-2) \cdot (-3) = 6$

Positive velocity and negative time result in a movement in the “negative” direction.
 $2 \cdot (-3) = -6$

The rules of multiplying rational numbers can be summarized as:

- The product of two numbers with the same sign is positive.
- The product of two numbers with different signs is negative.

Name: _____ Date: _____ Period: _____

Practice

- Determine whether each product is positive or negative. Choose one expression and explain your thinking.

Expression	Positive	Negative
$4 \cdot (-3)$		✓
$-\frac{1}{8} \cdot (-7)$	✓	
$-4.6 \cdot \frac{4}{5}$		✓
$-69.8 \cdot (-4.5)$	✓	

- A diver rises toward the surface at a rate of 60ft/minute. She starts off at -340 ft.

- At what depth is she after:

1 minute? $-340 + 60 = -280$	2 minutes? $-340 + (2 \cdot 60)$ $= -340 + (120) = -220$	3 minutes? $-340 + (3 \cdot 60)$ $= -340 + (180) = -160$
---------------------------------	--	--
- How long will it take the diver to return to the surface?
 After 4 minutes: $-160 + 60 = -100$
 After 5 minutes: $-100 + 60 = -40$
 After 6 minutes: $-40 + 60 = 20$; She will need more than 5 but less than 6 minutes to return to the surface.

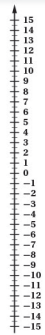
Practice

Name: _____ Date: _____

Problem 1	
Determine the value of each expression.	
Expression	Value
$5(-8)$	
$-2 \cdot 4$	
$(-18) \cdot 3$	
$-3 \cdot (-4)$	

- The temperature at a weather station is currently 0°C . It is falling at a constant rate of 3°C per hour.

- What will the temperature be in 2 hours?
 -6°C ; Sample response: $-3 \cdot 2 = -6$
- What will the temperature be in 5 hours?
 -15°C ; Sample response: $-3 \cdot 5 = -15$
- What will the temperature be in a $\frac{1}{2}$ hour?
 -1.5°C ; Sample response: $-3 \cdot \frac{1}{2} = -1.5$
- What was the temperature 1 hour ago?
 3°C ; Sample response: $-3 \cdot (-1) = 3$
- What was the temperature 3 hours ago?
 9°C ; Sample response: $-3 \cdot (-3) = 9$
- What was the temperature 4.5 hours ago?
 13.5°C ; Sample response: $-3 \cdot (-4.5) = 13.5$



- Determine the missing value in each equation.

- $-2 \cdot (-4.5) = 9$
- $-8.7 \cdot (-10) = 87$
- $-7 \cdot -2 = 14$
- $-9 \cdot (-10) = 90$

Spiral Review

- Lila's lunch at a restaurant costs \$12.00, without tax. She leaves the waiter a tip of 15%. What is the total cost of the lunch, including the tip, without tax?
 A. \$1.80 C. \$13.80
 B. \$12.15 D. \$27.00
- This is Bard's work for simplifying $-4 - (-3) + 8$. Explain why Bard is incorrect. Then simplify the expression correctly.
Sample response: Bard is incorrect because addition and subtraction should be done in the order they appear from left to right.
 $-4 - (-3) + 8 = -4 + 3 + 8$
 $= -1 + 8$
 $= 7$

