

Sample Mathematics Learning Plan

Big Idea/ Topic

- Develop an understanding of operations with rational numbers and work with expressions and linear equations.

Standard(s) Alignment

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

MGSE7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

MGSE7.NS.1a Show that a number and its opposite have a sum of 0 (are additive inverses). Describe situations in which opposite quantities combine to make 0. For example, your bank account balance is -\$25.00. You deposit \$25.00 into your account. The net balance is \$0.00.

MGSE7.NS.1b Understand $p + q$ as the number located a distance $|q|$ from p , in the positive or negative direction depending on whether q is positive or negative. Interpret sums of rational numbers by describing real world contexts.

MGSE7.NS.1c Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

MGSE7.NS.1d Apply properties of operations as strategies to add and subtract rational numbers.

MGSE7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

MGSE7.NS.2a 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.

MGSE7.NS.2b Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.

MGSE7.NS.2c Apply properties of operations as strategies to multiply and divide rational numbers.

MGSE7.NS.2d Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

MGSE7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

Diagnostic Assessment

Subitizing Integers

If implementing synchronously:

- Show each subitizing card to students for 3-5 seconds.
- For the subitizing cards, ask students:
 1. What do you see and how do you see it?
 2. Can you represent your thinking using a number line?
 3. Can you represent your thinking using an equation?
 4. Can you represent your thinking as a solution?
- Students should explain how they “see” or determine the quantity on the card.
- Be sure to allot time for students to express their strategies.

If implementing asynchronously:

Consider creating a presentation which self-propels through the slides in order to promote subitizing. Provide students a format for sharing their thinking with you.

If implementing unplugged/offline:

Although the same concept and thinking can be obtained, the dynamics of this diagnostic assessment will change if completed offline. Instead of subitizing, students can explain what each visual represents and explain their thinking.

Instructional Design

Engage (Mathematical Discourse)

Selling 2 packs of pens at \$4 per pack		
Owing \$4 each to 2 friends		
Spending \$2 on 4 packs of pens that cost \$2 each		
Forgiving 2 debts of \$4 each		

The purpose of this activity is to engage students in mathematical discourse. Allot for 3-5 minutes for this activity.

- **Synchronous**

Draw students' attention to the highlighted words. Conduct a conversation about which words may insinuate a gain or positive amount and which words may insinuate a loss or negative amount. Ask students to explain their thinking.

- **Asynchronous**

Consider utilizing a polling activity to allow each student to share their thinking and for all students to view the results of their peers.

- **Unplugged/ Offline**

Consider using a T-chart and card sort structure for this activity. Students could sort the scenarios into two categories similar to the example below:

Gain/Positive	Loss/Negative

Note: The purpose of this activating strategy is to focus on understanding rational numbers in context. Some students may need additional support with this concept. It is intended for this to be

used as a formative assessment and you will work more with this idea during the Apply portion of the lesson.

Explore (Incorporating the 8 Standards of Mathematical Practice)

- **Synchronous**

Provide partners or small groups of students a copy of the [Investigating a Pattern activity](#). Consider using Google Slides to organize the groups and ensure each group has an interactive copy of the activity. Instruct students to examine at each part of the activity, starting with Part I, using the Notice and Wonder technique to provide independent think time. Once students have had a moment to conduct their own notice and wonder, they should engage in a collaborative conversation around any identified patterns. If using Google Slides, consider allowing students to use the Comments feature, to communicate ideas.

As students are engaging with the activity, observe the student thinking shared. Make a note of the strategies students use to determine their solutions.

When time concludes, pull the class back together to discuss the identified strategies.

Possible strategies may include:

Part 1 - First factor the same and positive, second factor begins positive and decreases by 1 into negatives

Part 2- First factor the same and positive, second factor the negatives are increasing by 1

Part 3 - First factor the same and negative, second factor begins positive and decreases by 1 into negatives

Part 4 - First factor the same and negative, second factor begins the negatives are decreasing by 1

- **Asynchronous**

Part A

Provide partners or small groups of students a copy of the [Investigating a Pattern activity](#). Consider using Google Slides to organize the groups and ensure each group has an interactive copy of the activity. Instruct students to examine at each part of the activity, starting with Part I, using the Notice and Wonder technique to provide independent think time. Once students have had a moment to conduct their own notice and wonder, they should engage in a collaborative conversation around any identified patterns. If using Google Slides, consider allowing students to use the Comments feature, to communicate ideas.

Part B

Once students have completed Part A, provide each student with the following reflection questions:

1. What did you notice about the first column of factors in Part I? The second column of factors?
2. After completing Part I and Part II, what conjecture can be made about multiplying a positive number times a negative number?
3. In following the patterns derived from Part II, what conclusions can be made about the products in Part III?
4. Using the results from Investigating a Pattern activity, complete the table below:

Factor	Factor	Product
Positive Number	Positive Number	
	Negative Number	Negative Number
Negative Number		
		Positive Number

- **Unplugged/ Offline**

Part A

Provide each student a copy of the [Investigating a Pattern activity](#). Instruct students to examine each part of the activity, starting with Part I, using the Notice and Wonder technique.

Part B

Once students have completed Part A, students should complete the following reflection questions:

1. What did you notice about the first column of factors in Part I? The second column of factors?
2. After completing Part I and Part II, what conjecture can be made about multiplying a positive number times a negative number?
3. In following the patterns derived from Part II, what conclusions can be made about the products in Part III?

4. Using the results from Investigating a Pattern activity, complete the table below:

Factor	Factor	Product
Positive Number	Positive Number	
	Negative Number	Negative Number
Negative Number		
		Positive Number

Apply

What number sentence could represent the scenario? Write whether the highlighted word in each box is a **Gain/Positive** or a **Loss/Negative** result.

Scenarios	Result (Gain/Loss)	Number Sentence
Selling 2 packs of pens at \$4 per pack		
Owing \$4 each to 2 friends		
Spending \$2 on 4 packs of pens that cost \$2 each		
Forgiving 2 debts of \$4 each		

- **Synchronous**

Provide students with independent think time to consider the following instructions: What number sentence could represent the scenario? Write whether the highlighted word in each box is a Gain/Positive or a Loss/Negative result.

After some time to independently think or write a response, instruct students to share their thinking within their groups. Consider using Google Slides or Padlet for a space to group students. Instruct students to develop a deliverable to share with the entire class. This could be a screenshot of the group's final thinking or a PowerPoint slide of the group's final thinking.

Come together as a whole group discussion for groups to share their consensus response. Listen for students who:

- Understand the meaning of the highlighted words based on the context
- Use signs appropriately
- Use multiplication as the operation

The teacher should make a note of groups who appear to struggle with the ideas listed above. The formative assessment during the Reflect will provide more insight to their understandings and misunderstandings.

- **Asynchronous**

Provide students a window of time to independently think about the following instructions: What number sentence could represent the scenario? Write whether the highlighted word in each box is a Gain/Positive or a Loss/Negative result. During this same time frame students should share their thinking within their teacher determined groups. Consider using Google Slides or Padlet for a space to group students. Instruct students to develop a deliverable to share with the entire class. This could be a voiceover screencast of the group's final thinking or a PowerPoint slide with recorded audio of the group's final thinking. These deliverables could be uploaded to a space accessible to the entire class to review.

When reviewing the group's thinking, listen for students who:

- Understand the meaning of the highlighted words based on the context
- Use signs appropriately
- Use multiplication as the operation

The teacher should make a note of groups who appear to struggle with the ideas listed above. The formative assessment during the Reflect will provide more insight to their understandings and misunderstandings.

- **Unplugged/ Offline**

Provide students with the following questions:

1. a. When I sell something to someone, the money I receive is a _____ (gain/loss)
- b. When I owe someone something, the result for me is a _____ (gain/loss)
- c. When I spend money on something, the result for me is a _____ (gain/loss)
- d. When I forgive someone for something owed to me, the result is a _____ (gain/loss)

2. If you answered:

a. gain for a and d, complete the table below.

What number sentence could represent the scenario? Write whether the highlighted word in each box is a **Gain/Positive** or a **Loss/Negative** result.

Scenarios	Result (Gain/Loss)	Number Sentence
Selling 2 packs of pens at \$4 per pack		
Owing \$4 each to 2 friends		
Spending \$2 on 4 packs of pens that cost \$2 each		
Forgiving 2 debts of \$4 each		

b. gain for b and/or c, complete the modified Illustrative Mathematics Lesson 8 Position, Speed, and Direction task

Part 1

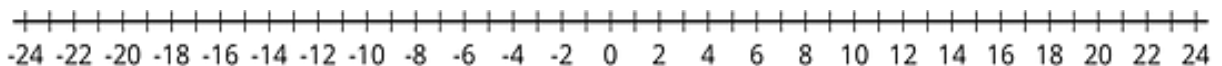
Distance, Rate and Time

1. An airplane moves at a constant speed of 120 miles per hour for 3 hours. How far does it go?
2. A train moves at constant speed and travels 6 miles in 4 minutes. What is its speed in miles per minute?

Part 2

Going Left, Going Right

After each move, record your location in the table. Then, write an expression to represent the ending position that uses the starting position, the speed, and the time. The first row is done for you.



Complete the table using the information provided.

starting position	direction	speed (units per second)	time (seconds)	ending position (units)	expression
0	right	5	3	+15	5×3
0	left	4	6		
0	left	2	8		
0	right	6	2		

Reflect

This is intended to be used to formatively assess students' understanding of multiplying signed numbers.

Write a number sentence to match the context.

1. Forgiving 2 debts of \$10 each.
2. Owing 2 friends \$6 each

- **Synchronous/Asynchronous**

Instruct students to work independently to show their thinking for the two statements. Consider using Google Forms or Microsoft Forms to create a document in which students can respond.

- **Unplugged/ Offline**

Provide students with the following prompt to respond in their math journal or on notebook paper:

Write a number sentence to match the context.

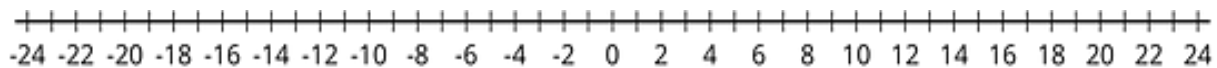
1. Forgiving 2 debts of \$10 each.
2. Owing 2 friends \$6 each

Evidence of Student Success

At least three formative assessments are suggested during the learning process. The first occurs during the Engage portion of the lesson which provides insight on students' understandings and misunderstandings. The second formative assessment occurs during the Apply portion of the lesson when conducted synchronously or asynchronously. The final formative assessment should be collected to inform future instruction.

To summatively assess students' understanding, consider a performance-based assessment such as the example below adapted from Illustrative Mathematics:

- a. How could you distinguish between traveling west at 5 miles per hour and traveling east at 5 miles per hour without using the words "east" and "west"?
- b. Four people are cycling. They each start at the same point. (0 represents their starting point.) Plot their finish points after five seconds of cycling on a number line.



Record an equation to represent the number line:

- Lin cycles at 5 meters per second
- Diego cycles at -4 meters per second
- Elena cycles at 3 meters per second
- Noah cycles at -6 meters per second

Student Learning Supports

At all grades, the mathematics big ideas encourage students to reason mathematically, to evaluate mathematical arguments both formally and informally, to use the language of mathematics to communicate ideas and information precisely, and to make connections among mathematical topics and to other disciplines. The following strategies are intended to support students who are struggling to progress towards this goal:

- **Conceptual Processing:** Utilize the [Concrete-Representational-Abstract instructional sequence](#) to support students in making connections among mathematical ideas, facts and skills, and reflecting upon and refining one's own understanding of relationships, generalizations and connections.
- **Language:** Strategically select [language routines](#) to support students in describing strategies, explaining their reasoning, justifying solutions and making persuasive arguments.
- **Visual-Spatial Processing:** Provide opportunities for students to engage with visual representations and manipulatives (virtual or concrete) as they solve problems, explore concepts and communicate ideas.

- **Organization:** Teach problem-solving strategies and problem types, as seen in the [Mathematics Glossary: K – 12](#), in order to support students in figuring out how to get started, carrying out a meaningful sequence of steps while solving problems, keeping track of the information from prior steps, monitoring their own progress and adjusting strategies accordingly.
- **Memory:** Focus on conceptual strategies and patterns for computation, providing a scaffold for students who struggle with basic facts and carrying out written algorithms.
- **Supports for investigating patterns when multiplying integers:**

Differentiation: Students who struggle with identifying the patterns, may benefit from guiding questions such as:

- *What is the problem about?*
- *How does this situation work?*
- *Is there another way to think of it?*

Extension: Encourage students to record different ways to represent this situation.

- Provide students with a **modified version of the Gain or Loss task**. Consider using an idea such as the one below:

Match each equation with the context it best represents:

1. Selling 2 packs of pens at \$4 per pack	A. $-2 \times -4 = 8$	Justification:
2. Owing \$4 each to 2 friends	B. $2 \times -4 = -8$	Justification:
3. Spending \$2 each on 4 packs of pens	C. $-2 \times 4 = -8$	Justification:
4. Forgiving 2 debts of \$4 each	D. $2 \times 4 = 8$	Justification:

Engaging Families

[Thinkport: Multiplying a Positive Integer with a Negative Integer](#) - Explore integer multiplication by considering the trajectory of a hot air balloon as it rises and falls in this interactive.

[Multiplying and Dividing with Negatives](#) - Deepen your understanding of multiplication and division of rational numbers. This interactive exercise focuses on the rules for finding the products and quotients of positive numbers, negative numbers, and fractions and then finding the solutions on a number line.