ST Math Summer Immersion

Grade 3 | Module 3

Topic: Defining and partitioning one and combining unit fractions Module 3 Resources

Students work with puzzles involving partitioning a rectangle into equal areas. They understand that a fraction 1/b (b>0) is the quantity formed by 1 part of a whole partitioned into b equal parts and combine the unit fractions to create a/b (b>0) fractions. Students work with puzzles involving representing fractions as a bar model, moving the bar model to a number line and understanding a fraction as a number on a number line. They represent a fraction 1/b on a number line by defining the interval from 0 to 1 and partitioning it into b equal parts. They recognize each of these parts as 1/b. They represent fractions a/b (b>0) by a length of 1/b from zero.

Module 3 at a Glance

Printed Resources
- **Bookmarks**
  - Problem Solving Process Bookmark
  - Problem Solving Facilitation Bookmark
- **Grades 3–5 Table Games**
  - Number Line Fraction Bingo
  - Final Countdown
  - *Traffic Lights Tic-Tac-Toe (optional)*
  - *Dara (optional)*
  - *Equivalent Fraction Concentration (optional)*
  - *Multiplication Connect Four (optional)*
  - Race to 2 (Day 4)
  - Five for Twenty-Five (Day 4)
- **Math Mat**
  - 0–5 Number Line Math Mat

- **Problem Solving Journal** (pages 14–19)
  - My Thinking Path
  - Problem of the Day
  - Exit Tickets
  - ST Math Reflections

Optional Printed Resources
- Accomplishments Log
- ST Math Activity Pages
- Pre/Post Quizzes

Teacher Resources
- Teacher Planner

Immersion Slide Deck (slides 28–40)
- The Immersion Slide Deck is intended to be projected to the class in a whole group setting.

Supplies for Table Games (per group)
- **Number Line Fraction Bingo** - 1 set of fraction cards, number line for each player, 4 centimeter cubes for each player
- **Final Countdown** - deck of cards, 3 game pieces per player to be used as multiplication chips

My Thinking Path
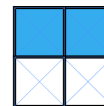- Daily reflection time for students on understanding fractions as parts of a whole

ST Math Puzzle Talks
- Equal Areas
- Equal Division
- Scale Fraction

Problem Solving

Day 1:
- **Problem of the Day** - Show and explain how the shaded part of this picture could represent each of these numbers: 1/2, 2, 1

Day 2:
- **Problem of the Day** -
  - This rectangle is 1/2. Show one whole.
  - This rectangle is 1/3. Show 1/2.

This rectangle is 1/2. Show one whole.

This rectangle is 1/3. Show 1/2.

Day 3:
- **Problem of the Day** - Jayla's and Jayvon's mother made them each a peanut butter sandwich for lunch. Jayla cut her sandwich into 4 equal sized pieces and ate 2 of the pieces. Jayvon cut his sandwich in 2 equal sized pieces and ate one piece. Jayla said she ate more of her sandwich because she ate 2 pieces. Jayvon disagreed. Who is correct? Justify your reasoning.

Day 4:
- **Problem of the Day** - Place 3/4 on this number line. Be as exact as possible.

$$0 \qquad \frac{1}{2}$$
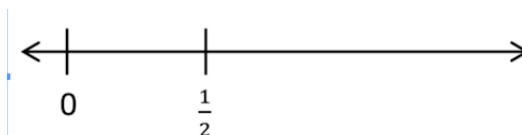
Instructional Stations

On Days 1–3, each student will visit two stations per day following the schedule in the Instructional Stations Overview. *On Day 4, students do not participate in Instructional Stations. Consider assigning students who need additional support to Station 1 to work with the teacher on concepts they are struggling with.*

Station 1: Small Group Instruction
- Students create a set of fraction strips including whole, halves, thirds, fourths, sixths, and eighths and use them to explore fractions.
- Play the game ST Math game Alien Bridge. Discuss unit fractions, a/b (b>0) fractions, and concepts of numerator and denominator and how they are named.

Station 2: ST Math Puzzles
- Have students sign in and play ST Math puzzles.
- Remind students to use manipulatives and/or paper and pencil to help them solve problems.
- With 5 minutes left, have students stop playing and complete their Puzzle Reflection and Accomplishments Log.

Station 3: Number Sense Games
- Select Number Line Fraction Bingo or Final Countdown.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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ST Math Summer Immersion

Grade 3 | Module 3 | Day 1

My Thinking Path (5-10 minutes)

- Have students write in the topic, "Defining and partitioning one (whole) and combining unit fractions."
- Have students work on the My Thinking Path page in their journals.
- Discuss their ideas, and allow students to add to their paper any additional thoughts they have.
- Have students complete the Pre-Quiz (optional).

Puzzle Talk: Equal Areas (20-25 minutes)

¤ Focus on student thinking and developing problem solving skills using the Problem Solving Process.
¤ Provide students with whiteboards/dry-erase markers.

Notice and Wonder

- Display the first puzzle in Level 1. Ask: "What do you notice? What do you wonder?" Allow a few students to share out the differences between the two rectangle choices.

Predict and Justify

- Have students make a prediction about which green rectangle to choose and why. They should think-pair-share their prediction, strategy, and their reasoning.
- Allow some students to share whole group and discuss: "How do you know the parts are equal?"
- Try one of the students' solution strategies. Before trying the strategy, discuss it with the other students (agree/disagree; what do they think will happen).

Test and Observe

- Try a student's solution and watch the feedback. Talk with students about the animation.

Analyze and Learn

- Ask students to think about how what they saw happen compares to their prediction. What did they learn from the feedback about their strategy?
- Solve additional puzzles in Level 1.

Connect and Extend

- Display the first puzzle in Level 2, and ask students which green rectangle would be correct. Discuss how each section of the rectangle would be named. Ask students: "How many parts are in this rectangle? Are all of the parts equal?"
- With the same puzzle, tell students you want to represent the correct rectangle using a unit fraction, but need their help. (A rectangle divided into three equal pieces is 1/3 + 1/3 + 1/3.)
- If needed, explain to students that the top number of a fraction (the numerator) is the counting number. Each of these pieces is one piece so the numerator is 1. Explain that the bottom number (the denominator) is the cutting number. It tells how many equal pieces or parts the whole has been cut or divided into. Ask students: "How many equal parts has this rectangle been divided into?" Write the unit fraction that would represent each piece, and have students write the unit fraction on their whiteboards.
- Highlight the need for each section to cover the same amount of area in the shape. Do not focus on the sections being exactly alike. They do not have to be congruent.
- Repeat with additional puzzles in Level 2.
- Display the first puzzle in Level 3. Say to students: "These rectangles look different from the ones in the last puzzles we solved. Can you select the rectangle with equal parts in this puzzle?"
- Solve additional puzzles in Level 3, and continue asking the same questions as above.

How does the student:
- identify the rectangle with equal parts?
- identify the total number of equal parts?
- discuss the need for each section of the rectangle to cover the same area as the other sections in the rectangle in order for them to be the same fractional part?
- identify each section as a unit fraction and discuss how many unit fractions are in the whole?

Problem Solving (20-25 minutes)

Engage students in problem solving discussions. Read and discuss the problem, share student work, compare strategies, and make connections.

Problem of the Day
- Show and explain how the shaded part of this picture could represent each of these numbers: 1/2, 2, 1.

Instructional Stations (40 minutes)

Students will visit two stations today (20 minutes in each station). See Instructional Stations Overview.

Station 1: Small Group Instruction
- Have students create a set of fraction strips including whole, halves, thirds, fourths, sixths, and eighths.
- Students use the strips to understand fractions 1/b and a/b (b>0), prove equivalence, and compare fractions.
- Have students combine their strips to model fractions greater than 1.
- Ask students questions to lead them to these understandings.
- Be sure students save their fraction strips for activities in later lessons.
- Work with students on the ST Math game, *Alien Bridge*.
- Use the Problem Solving Process to discuss the game with the group.
- Show puzzles from each level.
- Discuss unit fractions, a/b (b>0) fractions, and concepts of numerator and denominator and how they are named.

Station 2: ST Math Puzzles
- Have students sign in and play ST Math puzzles.
- Remind students to use manipulatives and/or paper and pencil to help them solve problems.
- With 5 minutes left, have students stop playing and complete their Puzzle Reflection and Accomplishments Log.

Station 3: Number Sense Games
- Select Number Line Fraction Bingo or Final Countdown.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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My Thinking Path (5-10 minutes)

- Have students reflect on what they have learned about solving problems involving defining and partitioning one (whole) and combining unit fractions.

Puzzle Talk: Equal Division (20-25 minutes)

¤ Focus on student thinking and developing problem solving skills using the Problem Solving Process.
¤ Provide students with whiteboards/dry-erase markers.

Notice and Wonder

- Display the first puzzle in Level 1. Ask "What do you notice? What do you wonder? How many equal pieces does this rectangle have?" Allow a few students to share out.

Predict and Justify:

- Have some students share their predictions. Discuss.

Test and Observe

- Try a student's solution, and watch the feedback. Talk with students about what happened as they solved the puzzle. Did it match their prediction?

Analyze and Learn

- Replay the puzzle with the same solution. Pause the animation. Ask students to explain what is happening with the bars and the number line.
- Show the next puzzle in Level 1. Ask the students: "Which rectangle do you think is the correct answer and why?"
  - Discuss and solve some puzzles from Level 1. For a few puzzles, move the cursor over the rectangle that students want to choose to solve each puzzle. Talk about how many equal parts are in the rectangle.
  - Discuss concepts of equal area/size and number of partitions. Name each partition as unit fraction 1/b (e.g., 1/3 if rectangle is divided into 3 equal parts).
- Name different numbers of sections a/b (b>0), and discuss how to determine those by counting the unit fractions (e.g., 2/3 = 1/3 + 1/3).

Connect and Extend

- Show a new puzzle, and have students write a unit fraction to name each piece of the rectangle. "How could we name each of the equal pieces with a unit fraction? What would be our numerator and denominator?"
- Display the first puzzle in Level 2. Ask: "How is this puzzle different from the puzzles we just solved? Which direction of the dashed line(s) should we move to create equal pieces? Why?"
- Ask students which arrow they want to choose to move the line to the left or right and why. Predict what will happen with each choice before the arrow is selected. Watch the feedback from the puzzle after the arrow is selected. Discuss whether the resulting rectangle has equal pieces.
- Repeat with the remaining puzzles in Level 2.
- Have students draw more than one whole, partition each into the unit fractions, and then name different a/b (b>0) fractions > 1.
- Discuss the need for each of the wholes to be the same size.

How does the student:
- identify the rectangle with equal pieces?
- discuss the need for each section of the rectangle to cover the same area as the other sections in the rectangle in order for them to be the same fractional part?
- identify each section as a unit fraction and discuss how many unit fractions are in the whole?

Problem Solving (20-25 minutes)

Engage students in problem solving discussions. Read and discuss the problem, share student work, compare strategies, and make connections.

Problem of the Day
- This rectangle is 1/2. Show one whole.
- This rectangle is 1/3. Show 1/2.

This rectangle is 1/2. Show one whole.

This rectangle is 1/3. Show 1/2.

Instructional Stations (40 minutes)

Students will visit two stations today (20 minutes in each station).

Station 1: Small Group Instruction
- Have students create a set of fraction strips including whole, halves, thirds, fourths, sixths, and eighths.
- Students use the strips to understand fractions 1/b and a/b (b>0), prove equivalence, and compare fractions.
- Have students combine their strips to model fractions greater than 1.
- Ask students questions to lead them to these understandings.
- Be sure students save their fraction strips for activities in later lessons.
- Work with students on the ST Math game, *Alien Bridge*.
- Use the Problem Solving Process to discuss the game with the group.
- Show puzzles from each level.
- Discuss unit fractions, a/b (b>0) fractions, and concepts of numerator and denominator and how they are named.

Station 2: ST Math Puzzles
- Have students sign in and play ST Math puzzles.
- Remind students to use manipulatives and/or paper and pencil to help them solve problems.
- With 5 minutes left, have students stop playing and complete their Puzzle Reflection and Accomplishments Log.

Station 3: Number Sense Games
- Select Number Line Fraction Bingo or Final Countdown.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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Grade 3 | Module 3 | Day 3

My Thinking Path (5-10 minutes)

- Have students reflect on what they have learned about solving problems involving defining and partitioning one (whole) and combining unit fractions.

Puzzle Talk: Scale Fractions (20-25 minutes)

¤ Focus on student thinking and developing problem solving skills using the Problem Solving Process.
¤ Provide students with 0–5 Number Line Math Mat and whiteboards/dry-erase markers.

Notice and Wonder

- Display the first puzzle in Level 1. Ask: "What do you notice? What do you see on this number line? What do you wonder?" Allow a few students to share out.

Predict and Justify

- Have some students share their predictions. Discuss.
- Try one of the students' strategies. Before trying the strategy, discuss it with the other students. Ask students if they agree or disagree with each other. Share students' thinking as a whole class.

Test and Observe

- Watch the feedback together, and discuss what they saw.
- Play the puzzle again, choosing the same solution. Ask students: "How could you name the rectangles you see in this puzzle? How many whole numbers are on this number line? How has the number line been divided?"

Analyze and Learn

- Show and have students solve other puzzles from Level 1.
- Now, show a puzzle from Level 2. Have students discuss what they notice with a partner.
- Use the 0-5 Number Line Math Mat. Show another puzzle. Have students represent this puzzle on their game mat. Ask: "How do we show the unit fraction in the last bar on the number line? What is the denominator and numerator for this fraction?"
- Discuss how they knew where to place the yellow ball.

Connect and Extend

- Show a puzzle from Level 3, and have students represent it on their game mat and solve it.
- Ask students about their strategy (visualizing the bars moving on number line, writing numbers as a mixed number or fractions greater than 1, etc.).

How does the student:

- discuss strategies for finding the location on the number line?
- count by unit fractions?
- write numbers as fractions greater than 1 and mixed numbers?
- determine the denominator for the unit fraction?
- determine the numerator when it is not a unit fraction?

Problem Solving (20-25 minutes)

Engage students in problem solving discussions. Read and discuss the problem, share student work, compare strategies, and make connections.

Problem of the Day
- Jayla's and Jayvon's mother made them each a peanut butter sandwich for lunch. Jayla cut her sandwich into 4 equal sized pieces and ate 2 of the pieces. Jayvon cut his sandwich in 2 equal sized pieces and ate one piece. Jayla said she ate more of her sandwich because she ate 2 pieces. Jayvon disagreed. Who is correct? Justify your reasoning.

Instructional Stations (40 minutes)

Students will visit two stations today (20 minutes in each station).

Station 1: Small Group Instruction
- Have students create a set of fraction strips including whole, halves, thirds, fourths, sixths, and eighths.
- Students use the strips to understand fractions 1/b and a/b (b>0), prove equivalence, and compare fractions.
- Have students combine their strips to model fractions greater than 1.
- Ask students questions to lead them to these understandings.
- Be sure students save their fraction strips for activities in later lessons.
- Work with students on the ST Math game, *Alien Bridge*.
- Use the Problem Solving Process to discuss the game with the group.
- Show puzzles from each level.
- Discuss unit fractions, a/b (b>0) fractions, and concepts of numerator and denominator and how they are named.

Station 2: ST Math Puzzles
- Have students sign in and play ST Math puzzles.
- Remind students to use manipulatives and/or paper and pencil to help them solve problems.
- With 5 minutes left, have students stop playing and complete their Puzzle Reflection and Accomplishments Log.

Station 3: Number Sense Games
- Select Number Line Fraction Bingo or Final Countdown.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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Grade 3 | Module 3 | Day 4

My Thinking Path (5-10 minutes)

- Have students reflect on what they have learned about solving problems involving defining and partitioning one (whole) and combining unit fractions. Students should complete the My Thinking Path reflection page in their journal.

Puzzle Talk: Scale Fractions (20-25 minutes)

¤ Provide students with whiteboards/dry-erase markers.
¤ It will be helpful to provide manipulatives during this talk (cubes, fraction strips, etc.).

Notice and Wonder

- Display the first puzzle in Level 4. Ask: "What do you notice? What do you wonder? What do you think you need to do to solve this puzzle?"

Predict and Justify

- Have students think-pair-share about what they would like to try, what will happen when they try it, and why they think it will work.
- Ask the students to think about if they agree/disagree with the strategy and why. How does it relate to their own strategy?
- Additional prompts:
  - What do you see on this number line?
  - How could you name the rectangles you see in this puzzle?
  - How many whole numbers are on this number line?
  - How has the number line been divided?

Test and Observe

- Try a student's solution, and watch the feedback. Ask students to describe what happened.

Analyze and Learn

- Ask students to think about how what they saw happen compares to their prediction. What did they learn from the feedback? How does this affect their strategy for solving the next puzzle?
  - What is the denominator for this fraction? Numerator? Why?
  - How did you determine where to place the yellow ball?

Connect and Extend

- Show some more Level 4 puzzles, and have students use their game mats to represent the puzzles.
- Have students build a bar model from a puzzle that has fourths. They may use their fraction strips, connecting cubes, blocks, or other fraction manipulatives.
- Discuss the different models.
  - Does one student's model have to look like another student's model?
  - Do all of the wholes in one student's model have to be the same size?

How does the student:
- discuss strategies for finding the location on the number line?
- count by unit fractions?
- write numbers as fractions greater than 1 and mixed numbers?
- determine the denominator for the unit fraction?
- determine the numerator when it is not a unit fraction?

Problem Solving (20-25 minutes)

Engage students in problem solving discussions. Read and discuss the problem, share student work, compare strategies, and make connections.

Problem of the Day
- Place 3/4 on this number line. Be as exact as possible.
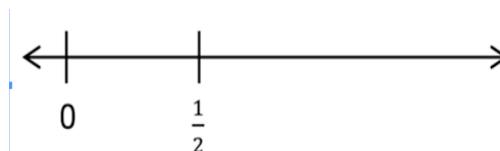
Whole Group Number Sense Games (15-20 minutes)

During this time you will introduce Race to 2 and Five for Twenty-Five. Students will play these games in the next module in Station 3.
- Introduce one of the games.
- After explaining the game and playing it with the whole group, give students time to play it on their own.
- After playing the game, have them discuss:
- What math did they learn or use?
- What strategies did they try to win the game?
- Repeat with the second game.

Optional: ST Math Activity Page (15 minutes)

ST Math Activity Page
- Project the game, *Scale Fractions*.
- Play a few puzzles to help students understand the game.
- Have students turn to the ST Math Activity Page: *Scale Fractions*.
- Ask students what they notice about the content on the page. What do they wonder? Where do they want to start on the page?
- Give them time to complete the page.
- Discuss the page, and have students share their thinking.
- Take the time to compare strategies, and have students share their work.
- Make connections to the game.

Closing (10 minutes)

Thinking and Reflecting Time
- Have students complete the Post-Quiz (optional).
- Engage students in discussions about what they have learned in this module, what they have questions about, and what they would like to learn more about.
- Have students review ST Math Problem Solving Journal pages for the module: My Thinking Path, Problem of the Day, Exit Tickets, and Puzzle Reflections.

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