ST Math Summer Immersion

Grade 5 | Module 2

Topic: Adding and subtracting fractions with unlike denominators

Students use benchmark fractions, equivalent fractions, and comparing fractions to create a number line to compare and order fractions, place them on a number line, and justify their reasoning. Then they use what they've learned to assess the reasonableness of answers as they add and subtract fractions with unlike denominators

Module 2 at a Glance

Printed Resources
- **Bookmarks**
  - Problem Solving Process Bookmark
  - Problem Solving Facilitation Bookmark
- **Grades 3-5 Table Games**
  - Equivalent Fraction Concentration
  - Multiplication Connect Four
  - *Traffic Lights Tic-Tac-Toe (optional)*
  - *Dara (optional)*
  - Number Line Fraction Bingo (Day 4)
  - Final Countdown (Day 4)
- **Game Mats**
  - Pie Monster Game Mat 02
  - Estimate Fractions Game Mat

- **Problem Solving Journal** (pages 8–13)
  - 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 15–27)
- The Immersion Slide Deck is intended to be projected to the class in a whole group setting.

Supplies
- Paper fraction strips or other fraction model manipulatives

Supplies for Table Games (per group)
- **Equivalent Fraction Concentration** - 1 deck of Equivalent Fractions cards (2 sheets cut)
- **Multiplication Connect Four** - 2 paper clips, 2 sets of 20 colored game pieces or chips (different colors), 1 printed Multiplication Connect Four Game Board.

My Thinking Path

- This module, students will reflect on adding and subtracting fractions with unlike denominators.

ST Math Puzzle Talks

- Estimate Fractions on a Number Line
- Number Line Equivalence
- Pie Monster
- Scale Fraction Visual

Problem Solving

Day 1:
- **Problem of the Day** - Draw a number line. Place the following fractions on the number line: 3/6, 7/8, 11/12, 8/6, 1/8, 3/4, 25/12, 6/3, 6/12, 6/5, 3/5, and 14/8. Select three of the fractions you placed on the number line and explain how you determined where to place these fractions. Challenge yourself.

Day 2:
- **Problem of the Day** - Partner students. Partner A creates a bar model of fractions that include halves, fourths, and eighths. Partner B creates a bar model of fractions that include thirds, sixths and twelfths. They may use fraction rods, connecting cubes, or paper strips to create their bar model, but they must both use the same manipulative and have the same size "one" whole. Each builds a number line using their bar model. Include numbers up to 3. Partners compare their two number lines. Then, they can use the bars and number lines to help them solve the Problem of the Day.

Day 3:
- **Problem of the Day** - Darla wanted to make 2 gallons of punch to take to the school picnic. She found a recipe that called for 3/4 gallons of fruit punch, 2 quarts of orange juice, 3/8 gallons of lime soda, and 1/2 gallon of water. If Darla makes this recipe, will she have as much punch as she wants? Justify your solution..

Day 4:
- **Problem of the Day** - Kevin filled 4 glasses with different amounts of water so they would make different sounds when he rubbed his finger along the rims. Glass A held 5/8 cup of water, glass B held 3/4 cup of water, glass C held 3/6 cup of water, glass D held 2/6 cup of water. How much water did Kevin use? How much water could he put in a fifth glass, if he had 3 cups of water?

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
- Engage students in a math conversation around more problems that involve different fraction models or work on an ST Math puzzle.

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: Table Games
- Select Equivalent Fraction Concentration or Multiplication Connect Four.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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Grade 5 | Module 2 | Day 1

My Thinking Path (5-10 minutes)

- Remind students about the My Thinking Path page in their Problem Solving Journal. Have them write in the topic, "Adding and subtracting fractions with unlike denominators."
- Have students begin working on the My Thinking Path page.
- Discuss their ideas, and allow students to add to their paper any thoughts they have.
- You'll begin each of Days 1–4 with time for students to reflect on their learning and prepare for the day.
- Have students complete the Pre-Quiz (optional).

Puzzle Talk: Estimate Fractions on a Number Line (20-25 minutes)

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

Notice and Wonder

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

Predict and Justify

- Have students represent this puzzle on their game mat by sliding the rocket over to the point on the number line and discuss their reasoning with a partner.
- Ask students to think of their strategy for solving the puzzle and predict what will happen when they try it.
- Do a whole group discussion on their strategies, listening for discussions about benchmark fractions or students comparing equivalent fractions. Chart different student responses.
- Select one of the students' strategies to discuss. Discuss the role of the numerator and denominator in their estimates. Ask the students to think about if they agree/disagree with the strategy and why. How does it relate to their own?

Test and Observe

- Try one of the students' ideas. (As you try students' strategies, be sure to try strategies that work and those that don't. Analyze the feedback in both correct and incorrect solutions.)

Analyze and Learn

- Ask students to think about how what they saw happen compares to their prediction. "What does the animation show us? Is there another name for that location on the number line (for a fraction at a half or whole number)?"
- Show another puzzle from Level 2, and ask: "How can the number line help us find the location?" Highlight partitioning the number line into equal parts (the denominator) to locate the fraction (the numerator).
- Freeze animation, and ask: "Where would an additional ½ be located on this number line?"
- Open up the first puzzles in Level 3 and have students discuss what they notice about the differences from other levels.

Connect and Extend

- Show puzzles from Levels 4 and 5, and have students represent them on their game mat.
- Discuss student strategies for locating the fraction on the number line and how they know which two whole numbers the fraction is between.

- Ask questions such as:
  - How can you use fractions that you can easily locate (called *benchmark fractions*) to help you locate this fraction (e.g., 8/3)?
  - How do we add fractions with unlike denominators? (Use equivalent fractions.) Continue to add strategies to the chart, including using fractions equal to one, counting unit fractions for fractions greater than one, and creating mixed numbers from fractions greater than one.

How does the student:
- use benchmarks to locate fractions? (I know 1/2 is here, and this is between 1/2 and 1.)
- decide which whole numbers to locate a fraction between?
- explain fraction equivalence?
- use the number line to add/subtract fractions?

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
- Draw a number line. Place the following fractions on the number line: 3/6, 7/8, 11/12, 8/6, 1/8, 3/4, 25/12, 6/3, 6/12, 6/5, 3/5, and 14/8. Select three of the fractions you placed on the number line and explain how you determined where to place these fractions. Challenge yourself.

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 work with fraction models such as, fraction strips, to answer problems using addition and subtraction of fractions with unlike denominators.
- Ask students problems such as: "Three friends were sharing 2 candy bars. If Mio ate 1/2 of a candy bar and Renee ate 3/4 of a candy bar, how much was left for Charles? Who ate the most? Who ate the least?
- Work with students on the ST Math game, *Alien Bridge*.
- Use the Problem Solving Process to discuss the game with the group.
- Discuss what happens to the partitions when the square is cut in each direction.
- Explore how that shows equivalent fractions and how they are used to add and subtract fractions with unlike denominators. Discuss how this model relates to the number line model.
- Check on students' comfort with fractions.

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: Table Games
- Select Equivalent Fraction Concentration or Multiplication Connect Four.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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Grade 5 | Module 2 | Day 2

My Thinking Path (5-10 minutes)

- Have students reflect on what they have learned about solving problems involving adding and subtracting fractions with unlike denominators.

Puzzle Talk: Number Line Equivalence (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

- Show a puzzle from Level 1 that has the fraction in the sky labeled on the number line. Ask students: "What do you notice? What do you wonder?" Allow students to share.

Predict and Justify

- Have students make a prediction and determine a strategy for solving the puzzle.
- Have students share out. Discuss students' ideas. Briefly discuss fractions on a number line, including the meaning of the numerator (location on number line) and denominator (number of equal parts).
- Ask the students to think about if they agree/disagree with the strategy and why. How does it relate to their strategy?

Test and Observe

- Try one of the students' ideas. (As you try students' strategies, be sure to try strategies that work and those that don't.
- Analyze and discuss the feedback in both correct and incorrect solutions.

Analyze and Learn

- Ask students to think about how what they saw happen compares to their prediction.
  - Can you name another equivalent fraction?
  - How could you find an equivalent fraction for any given fraction?
- Display a puzzle from Level 2 that does NOT have the fraction in the sky labeled on the number line. Challenge students by asking:
  - How could you prove these two fractions are equivalent?
  - What happens to the size of the pieces as you make an equivalent fraction?
- Share students' strategies for finding the equivalent fraction on the number line. Solve the puzzle, and discuss the animation.

Connect and Extend

- Work through some puzzles in Level 3 and beyond using the Problem Solving Process.
- Record the equivalent fractions on a chart. As you add to the list:
  - Ask students to look for a pattern as they determine where to place equivalent fractions on a number line.
  - Discuss the number and size of the partitions for equivalent fractions.
  - Ask questions, such as:
    - How many twelfths are in one-third?
    - How many one-fourths make 1 whole?

How does the student:
- find an equivalent fraction?
- prove two fractions are equivalent?
- locate a fraction on the number line?

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
- Partner students. Partner A creates a bar model of fractions that include halves, fourths, and eighths. Partner B creates a bar model of fractions that include thirds, sixths and twelfths. They may use fraction rods, connecting cubes, or paper strips to create their bar model, but they must both use the same manipulative and have the same size "one" whole. Each builds a number line using their bar model. Include numbers up to 3. Partners compare their two number lines. Then, they can use the bars and number lines to help them solve the Problem of the Day in their journal.

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 work with fraction models such as, fraction strips, to answer problems using addition and subtraction of fractions with unlike denominators.
- Ask students problems such as: "Three friends were sharing 2 candy bars. If Mio ate 1/2 of a candy bar and Renee ate 3/4 of a candy bar, how much was left for Charles? Who ate the most? Who ate the least?
- Work with students on the ST Math game, *Alien Bridge*.
- Use the Problem Solving Process to discuss the game with the group.
- Discuss what happens to the partitions when the square is cut in each direction.
- Explore how that shows equivalent fractions and how they are used to add and subtract fractions with unlike denominators. Discuss how this model relates to the number line model.
- Check on students' comfort with fractions.

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: Table Games
- Select Equivalent Fraction Concentration or Multiplication Connect Four.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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Grade 5 | Module 2 | Day 3

My Thinking Path (5-10 minutes)

- Have students reflect on what they have learned about solving problems involving adding and subtracting fractions with unlike denominators.

Puzzle Talk: Pie Monster (20-25 minutes)

☐ Focus on student thinking and developing problem solving skills using the Problem Solving Process.
☐ Provide students with Pie Monster Game Mat 02 and whiteboards/dry erase markers.

Notice and Wonder
- Give students the Pie Monster Game Mat 02. Tell them they can divide the pies to represent fractions.
- Display the first puzzle in Level 1. Ask: "What do you notice? What do you wonder?" Allow a few students to share out.

Predict and Justify
- Have students model the puzzle on their game mat and show their prediction.
- Have students turn to a partner and share their prediction and strategies.
- Have students share out. Ask the students to think about if they agree/disagree with each other and why.

Test and Observe
- Try one of the students' ideas. (As you try students' strategies, be sure to try strategies that work and those that don't.). Watch the feedback together and discuss what you saw.

Analyze and Learn
- Ask students to think about how what they saw happen compares to their prediction.
- Display another puzzle from Level 1.
- Have some students share predictions and strategies. (Are they using the visual model? Find a common denominator? If so, how did they find an equivalent fraction with the same denominator? Did they write a mixed number or fraction?)
- Assist students with writing an equation for this puzzle by asking:
  ○ How could we represent what is happening in this puzzle with an equation?
  ○ How did you determine the denominator to represent what the Pie Monster wants to eat as a fraction? The denominator for the pies on the table?

Connect and Extend
- Display the first puzzle in Level 2. On the Pie Monster Game Mat or board, tell students to model the puzzles as well as their prediction of how many pie pieces to choose.
- Have students share out and try different solutions. Be sure to try both correct and incorrect solutions.
- Point out the different visual models on the Monster and table. Do some checks for understanding.
  ○ Which ones have a fraction greater than 1?
  ○ How could we represent this fraction as both a fraction and a mixed number?
- Have students record their answers on their whiteboards. Share the students' fractions and mixed numbers.
- Repeat with some additional puzzles in Level 2 or 3.

How does the student:
- add fractions and mixed numbers with unlike denominators?
- write fractions as mixed numbers?
- write mixed numbers as equivalent fractions?
- write equations to represent the puzzle?
- explain the strategy they used to solve the puzzle?

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
- Darla wanted to make 2 gallons of punch to take to the school picnic. She found a recipe that called for 3/4 gallons of fruit punch, 2 quarts of orange juice, 3/8 gallons of lime soda, and 1/2 gallons of water. If Darla makes this recipe, will she have as much punch as she wants? Justify your solution.

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 work with fraction models such as, fraction strips, to answer problems using addition and subtraction of fractions with unlike denominators.
- Ask students problems such as: "Three friends were sharing 2 candy bars. If Mio ate 1/2 of a candy bar and Renee ate 3/4 of a candy bar, how much was left for Charles? Who ate the most? Who ate the least?
- Work with students on the ST Math game, *Alien Bridge*.
- Use the Problem Solving Process to discuss the game with the group.
- Discuss what happens to the partitions when the square is cut in each direction.
- Explore how that shows equivalent fractions and how they are used to add and subtract fractions with unlike denominators. Discuss how this model relates to the number line model.
- Check on students' comfort with fractions.

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: Table Games
- Select Equivalent Fraction Concentration or Multiplication Connect Four.
- Have students play that game.
- Ask students to complete an Exit Ticket during the final 5 minutes.

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Grade 5 | Module 2 | Day 4

My Thinking Path (5-10 minutes)

- Have students reflect on what they have learned about solving problems involving adding and subtracting fractions with unlike denominators. Students should complete the My Thinking Path reflection page in their journal.

Puzzle Talk: Scale Fraction Visual (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
- Show a puzzle from Level 1. Ask students: "What do you notice? What do you wonder?"

Predict and Justify
- Have students predict how to solve the puzzle and share their prediction with a neighbor. Ask students: "Did your predictions match? What strategies did you use?"
- Have students share out. Try one of the students' ideas.

Test and Observe
- Watch the feedback (for correct and incorrect strategies) together and discuss what they saw. Pause and use the annotation tools as necessary to track the yellow ball and how the bars move on the number line.

Analyze and Learn
- Ask students questions, such as:
  - What did you learn from the feedback?
  - Do we need to find a common denominator and if so, why?
  - How did you convert the fraction?
  - What can we convert a whole bar to in this puzzle (e.g., 1 bar = 6/6 or 4/4)?
- Show the next puzzle in Level 1. Discuss the size of partitions and denominators as you move the cursor to select how the number line will be partitioned.
  - How did you determine how to divide/partition the number line?
  - How did you determine your solution?
- Have them share why they select a particular denominator to partition the number line. "Could a different denominator be selected?" Explain and prove.

Connect and Extend
- Have students build a bar model from a puzzle with fraction strips, connecting cubes, blocks, or fraction rods. They use their bar model to build a number line.
- Discuss and record the equations shown in the puzzle, using the number line to help them solve.
- Include different ways to write the fractions and mixed numbers.

How does the student:
- use fraction equivalence to help them solve the problems?
- break down the mixed numbers to help them add or subtract the numbers?
- model what is happening in the puzzle?
- express their answer? (Do they use a mixed number? 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
- Kevin filled 4 glasses with different amounts of water so they would make different sounds when he rubbed his finger along the rims. Glass A held 5/8 cup of water, glass B held 3/4 cup of water, glass C held 3/6 cup of water, glass D held 2/6 cup of water. How much water did Kevin use? How much water could he put in a fifth glass, if he had 3 cups of water?

Whole Group Table Games (20 minutes)

During this time you will introduce Number Line Fraction Bingo and Final Countdown. Students will play these games 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 ST Math game, *Scale Fraction.*
- Play a few puzzles to help students understand the game.
- Have students turn to the ST Math Activity Page: *Scale Fraction*.
- 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).
- Have students review their ST Math Puzzle Reflections, Exit Tickets, and Problem Solving work.
- 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.

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