Lesson 2.1 ~ Ratios

At a Glance

I can simplify and write ratios three ways.

Standards Overview

Focus Content Standard(s): 6.RP.A.1 (Major), 6.RP.A.3a (Major)
Focus Math Practice Standard: SMP5

Materials

Optional: Grid paper for tape diagrams, straight edges, rulers, unifix cubes

Starter Choice Board Overview

Storyboard: Use ratio language to understand a relationship (6.RP.A.1)
Building Blocks: Simplify fractions (4.NF.A.1)
Blast from the Past: Compute with whole numbers in a real-world context (4.OA.A.3)
Fluency Board: Add and subtract decimals, add and subtract fractions, rename fractions

Lesson Planning Overview

Minutes	Day 1
5-10	**Starter Choice Board:** BB or BftP
15-20	**Explore! Activity:** "Mixing Paint"
15-20	**Lesson Presentation**
HW	**Practice:** Student Lesson or Online Practice

Minutes	Day 2
5-10	**Starter Choice Board:** Storyboard
20	**Teacher Gem:** CTL, MATHO or PM
10	**Exit Card or Target Tracker**
HW	**Practice:** Leveled Practice

Learning Outcomes

All students should be able to write ratios in three ways to represent a situation.

Most students should be able to determine the number of items in a set given information using ratios.

Exit Card

1. Simplify the ratio 100 : 40 and write the ratio as a fraction, with a colon and using the word "to".

2. Lucas had a mix of red and purple jelly beans. There were 2 red jelly beans and 3 purple jelly beans. If there are 40 jelly beans in his bag, how many are purple?

Example: Student Lesson Exercise #12
On Thursday, the ratio of strawberry ice cream cones to vanilla ice cream cones sold at Ice Cream World was 2 : 7. The total number of ice cream cones sold was 99. How many of the cones sold were vanilla ice cream cones?

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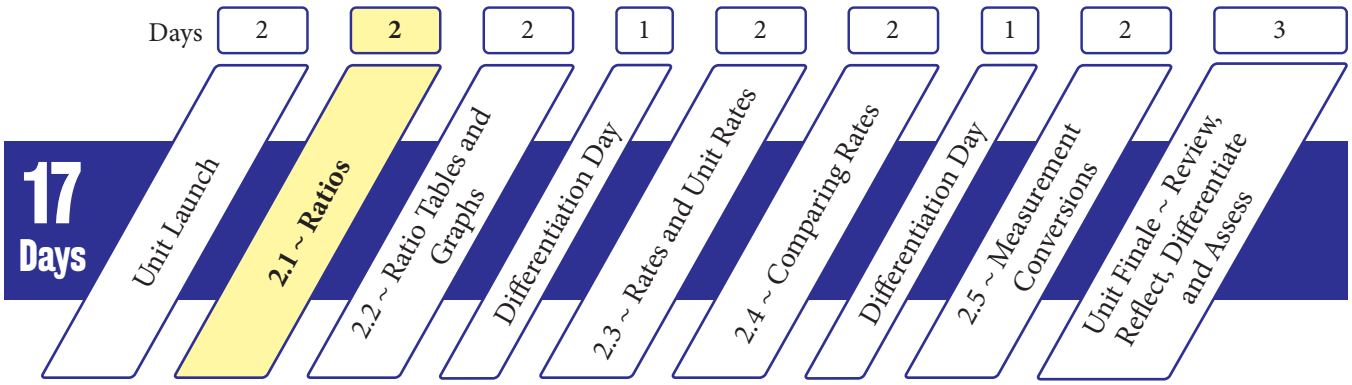
Deep Dive

I can simplify and write ratios three ways.



Focus Content Standards

6.RP.A.1 (Major): Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*

6.RP.A.3a (Major): Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

Lesson Planning Guidance: Day 1

Starter Choice Board: Building Blocks or Blast from the Past (5-10 minutes)

In this lesson, the "Building Blocks" task asks students to access background knowledge on creating equivalent (simplified) fractions. Use this activity if many of your students need support in recalling this skill. Consider using Expert Crayons to have students move around the room supporting each other. As an alternate option, choose the Starter Choice Board's "Blast from the Past" task to give students an opportunity to utilize problem solving skills involving whole number operations.

Explore! Activity: "Mixing Paint" (15-20 minutes)

In "Mixing Paint," students are introduced to the concept of ratios and learn how to represent ratios in a variety of ways, including through the use of tape diagrams. These tape diagrams are then used to find missing parts or totals in real-world ratio problems. The vocabulary of "ratio" and "tape diagram" are introduced in this activity. Students may benefit from recording these definitions on their unit vocabulary resource before starting the activity.

Implementation Option #1: Assign partners or groups of three. Have groups complete one step at a time at their own pace. Once finished with a step, the group should have their work checked for accuracy and stamped prior to moving on to the next step. If there are early finishers, utilize the last step where students create their own ratio problems that can be modeled with a tape diagram.

Implementation Option #2: Complete Steps 1-3 together as a class. Have students try Step 4 independently (consider using Expert Crayons to provide support to struggling students). Use this same for structure for Step 5. Have students work with neighboring students to create a question for Step 6 to share out with the class.

Lesson Presentation (15-20 minutes)

Have students utilize their interactive textbooks or composition notebooks to participate in guided note taking using the Lesson Presentation. Have students attempt Extra Examples with partners, in small groups or independently. Use "Communication Break" slides as opportunities for meaningful discourse.

Communication Break – Silent Teacher: Use the "Silent Teacher" strategy to have students observe and process Example 1a without any words being said. You can use the provided video or solve the problem yourself silently on the whiteboard or other visual display. Have students use one or more of the sentence stems to share with their partner or group before having some students share with the full class.

Communication Break – Estimation Pause: Use an "Estimation Pause" for Example 2. Have students discuss their ideas in partners or small groups using one of the provided sentence stems so they are ready to share their reasoning with the whole class. After sharing estimates, have students work together to solve the problem and compare their results to their initial estimates.

Independent Practice: Student Lesson Exercises or Online Practice

Have students complete all exercises from the first three sections of the Student Lesson: "Practice My Skills," "Reason and Communicate," and "Apply to the World Around Me." Differentiate based on student need by reducing the exercise set to odd numbers only or extending by only assigning the "Gem" exercises to specific students. If time allows, consider using the Spiral Review as an additional component. If choosing the Online Practice, consider using the Online Practice template for students to record their work and make corrections on either (or both) the Online Practice or Online Challenge Practice.

Lesson Planning Guidance: Day 2

Starter Choice Board: Storyboard Starter (5-10 minutes)

In this Storyboard Starter, students use ratio language to understand a relationship. Consider having students read the Storyboard frame and have silent think time for 1-2 minutes before working with table partners. Another option is to have one or two students in each group read the characters' statements and then work together to answer the prompt.

Teacher Gem: Climb the Ladder, MATHO or Partner Math (20 minutes)

CLIMB THE LADDER

Video Instructions

Best to use when many students are ready to progress to higher depths of knowledge incrementally using the four ladders.

MATHO

Video Instructions

Best to use when most students need additional skill practice on the lesson's learning target.

PARTNER MATH

Video Instructions

Best to use when approximately half of your students are showing proficiency and are partnered with differing ability to coach and/or learn from a variety of partners.

Exit Card and Target Tracker (10 minutes)

Use the pre-printed Exit Card or have students use their own paper with the last slide of the Lesson Presentation. Have students update their Target Tracker using their Exit Card data and their Teacher Gem experience. Use the Exit Card data to provide guidance for Leveled Practice assignments or for an upcoming Differentiation Day.

Independent Practice: Leveled Practice

Hand out the Proficient and Challenge Leveled Practice copied front to back. Have students select the side they feel would be appropriate practice based on their self-reflection or assign specific students to specific sides based on information you have gathered during the lesson. Make answers available, if desired, by printing the answers and posting them in the room or posting them to your online platform so students have access to feedback as they work.

Formative Assessment Guidance

Many components in the EdGems Math program can be used to provide formative assessment data for teachers and students. The recommendations below provide suggested components for this lesson and guidance for using this data to differentiate instruction.

Option 1 – Student Lesson Exercises: Have students complete and self-correct the odd exercises in the "Practice My Skills" section of the Student Lesson. Students who get less than half of the items correct may need to join a small group for the remainder of the class or on an upcoming Differentiation Day. During that session, consider using the Tiered or Proficient Leveled Practice on paper or individual white boards.

Option 2 – MATHO: Have students complete the MATHO Teacher Gem activity in the lesson independently. Play MATHO until all correct answers have been read (a "blackout"). Have students rate themselves using the Target Tracker based on the number of boxes they crossed out (equivalent to correct answers). Use this data to assign differentiated practice such as Leveled Practice or subsets of the Student Lesson exercises.

Option 3 – Student Error Analysis: Select evidence of student thinking from a Teacher Gem activity that illustrates incorrect solution pathways using items such as Climb the Ladder half-sheets (these may be retained prior to having students fix their work so that you have good examples of common errors). Project student work (names not shown) and have students individually try to locate the error in the solution pathway. Afterwards, have students reflect on their own understanding of the concept using the Target Tracker. Use this data to assign differentiated practice such as Leveled Practice or subsets of the Student Lesson exercises.

Focus Math Practice

In this lesson, students will have many opportunities to use a variety of tools strategically (SMP5) to increase understanding and solve problems. Have students use the Mathematical Practices Tracker to reflect on situations where they exhibited this practice (i.e., Explore! activity, Tiered Leveled Practice, Student Lesson Exercise #7).

I can choose and use math tools appropriately and strategically.

I chose a math tool to help me solve a problem.	I used a math tool to improve my accuracy.	I used a math tool to work more efficiently.

Math Practices: Teacher and Student Moves

Math Practice	Teacher Moves	Student Moves
SMP2 *Reason abstractly and quantitatively.*	To help students understand the importance of identifying and making sense of the quantities in a given situation, use Exercise #1 from Ladder #2 of the Teacher Gem activity Climb the Ladder. Display the first sentence for all students to see. "Seven 5th graders and eleven 6th graders enter a baking competition." Discuss how the scenario might look at first glance, then after taking a closer look, there is more information. Encourage students to take a step back and investigate scenarios to understand the information that is being presented.	For each situation in the Teacher Gem activity Climb the Ladder, identify the quantities and explain their meanings before attempting to solve the problems. After determining the solution for each task, explain the solution in the original context.
SMP3 *Construct viable arguments and critique the reasoning of others.*	Student Lesson Exercise #9b could be used as an opener to the lesson as it builds upon previous knowledge. Groups can discuss if the situation is possible and create arguments for or against to share with classmates.	Participate in discussions around the possibility of an event occurring given a sample ratio. Listen to the arguments of your peers and try to find errors that can be fixed together.
SMP4 *Model with mathematics.*	Tape diagrams are models that students may have used in previous grades to find unknown values. Allow students to choose to use this model when it is helpful for working with ratio situations.	In the Student Lesson Exercises, model each situation with an appropriate representation, such as a table, tape diagram, drawing, etc. Explain how the representation helped to determine the solution.
SMP5 *Use appropriate tools strategically.*	Offer students graph paper, straight edges and rulers to assist in their creation of tape diagrams. Demonstrate how to use unifix cubes to physically model tape diagrams without needing to draw.	Use available tools as needed to precisely draw tape diagrams or to physically model equal sections in tape diagrams.
SMP6 *Attend to precision.*	Throughout the lesson, emphasize the three ways to write ratios and be sure students are using correct phrases when talking about ratios (i.e., 4 : 3 is read "4 to 3" and if the units are animals (cats and dogs), the ratio might read "for every 4 cats there are 3 dogs").	Maintain accuracy when drawing tape diagrams by drawing rectangles in equal size to visually see the equality. When verbally expressing your answer, be clear in the way you read the ratio.
SMP7 *Look for and make use of structure.*	Use the Challenge Leveled Practice to strengthen students' ability to recognize patterns within equivalent ratios.	Create plans and procedures to solve problems in the Challenge Leveled Practice using patterns and structure (i.e. manipulatives, tape diagrams, equivalent fractions).
SMP8 *Look for and express regularity in repeated reasoning.*	When writing ratios in simplest form, encourage students to use the greatest common factor to simplify rather than dividing by two or three repeatedly.	Notice that, instead of repeatedly dividing by two or three to simplify a ratio, the greatest common factor can be used.

Common Misconceptions

Students may mix up the order of the numbers in a ratio. To help address this, have students record words to represent a ratio (such as cats : dogs) and then fill in the words with numbers.

Students may confuse a part-to-part ratio with a part-to-total ratio. Ask students to record what type of ratio they are working with in words before recording numbers (such as boys : all students). Also, if using a printed worksheet or other resource they can write on, have students use highlighters to highlight key words and values from the problem that will help them determine their ratio.

Students may not understand that each section on a ratio tape diagram represents the same amount. Have students attend to precision when drawing their tape diagrams to make the rectangles equal in size so they visually see the equality.

Students may forget to divide both numbers in the ratio by the same value when simplifying a ratio. Connect students to their previous experiences of simplifying fractions.

Mathematical Language Routines

Designed by Stanford Graduate School of Education's Understanding Language, mathematical language routines are structured but adaptable formats designed to help teachers "amplify, assess and develop students' language" in math class. Three language routines specific to this lesson are given below.

MLR 2 – Collect & Display: Prior to beginning the lesson, determine a place where you can keep a display throughout the unit. During partner, small group, or whole group discussions, listen for, and scribe, language (words, phrases, explanations, etc.) that students use to describe ratios and rates using written words, pictures, diagrams, etc. Use the Unit Vocabulary and the Unit Overview to help you decide what should be included on the display. Throughout the unit, reference the displayed language as a model, update and revise the display as student language changes.

MLR 5 – Co-Craft Questions: During Step 6 of the Explore! activity, ask students to write their own questions. Before students solve their own questions, ask them to share their questions and vote on the ones they want to solve as a class. Keep the questions throughout the unit, and go back to answer them when time allows.

MLR 8 – Discussion Supports: While students work in partners through the Teacher Gem activity Climb the Ladder, instruct them to sketch each situation that is described prior to solving the problems. Partners then discuss each other's sketches and use those sketches to solve each problem and create explanations.