**Conversions with Ratio Tables**

This lesson is designed for students in 4th through 6th grade and focuses on using one area of mathematics to think about and work with another. Here, students will use what they know about ratios and proportional reasoning to convert among different-sized standard measurement units within a given measurement system. By providing students blank ratio tables, educators help scaffold student thinking into an organized way of solving problems involving conversions. In this lesson, students will engage with ratio tables during whole group instruction, when collaborating with a peer, and when working independently.

**Standards:**

**Common Core State Standards:**

* **Mathematical Practices**
  + **CCSS.Math.Practice.MP1** – Make sense of problems and persevere in solving them.
  + **CCSS.Math.Practice.MP2** – Reason abstractly and quantitatively.
  + **CCSS.Math.Practice.MP5** – Use appropriate tools strategically.
  + **CCSS.Math.Practice.MP7** – Look for and make use of structure.
  + **CCSS.Math.Practice.MP8** – Look for and express regularity in repeated reasoning.
* **4th Grade**
  + **CCSS.Math.Content.4.MD.A.1** – Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the lengths of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), …*
* **5th Grade**
  + **CCSS.Math.Content.5.MD.A.1** – Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5cm to 0.05m), and use these conversions in solving multi-step, real world problems.
* **6th Grade**
  + **CCSS.Math.Content.6.RP.A.1** – Understand the concept of a ratio and use ratio language to describe a ratio relationships 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.”*
  + **CCSS.Math.Content.6.RP.A.2** – Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationships. *For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar.” “We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger.”*
  + **CCSS.Math.Content.6.RP.A.3** – 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.
    - **CCSS.Math.Content.6.RP.A.3.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.
    - **CCSS.Math.Content.6.RP.A.3.D** – Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

**Objectives:**

* Students will be able to use what they know about ratios and proportional reasoning to convert among different-sized standard measurement units within a given measurement system.

**Lesson Duration:** approximately 45-70 minutes

**Materials:**

* The Building Blocks of Math: Moving Beyond Foundations series, specifically Ratios and Proportions as well as Units of Measurement
* Conversions and Ratios Model (teacher copy, optional: provide a copy for students who need more support or who struggle to take organized notes)
* Workout Calculations Assignment (1 per student)
* Pencils
* Optional: Blank Ratio Tables
* Optional: scratch paper
* Optional: personal white boards, markers, and erasers (1 per student)
* Optional: Which Measure? Conversion Chart

**Requisite Prior Knowledge:**

* Prior to engaging in this lesson, it would be beneficial for students to have experience using ratio tables and proportional thinking to solve for unknown quantities. This lesson builds on that thinking and skill, as students are asked to contextualize and decontextualize situations involving a variety of units of measurement.
* It may benefit students to review common conversions, such as inches to feet, prior to engaging in this lesson, however this is not needed as students can use the Which Measure? Conversion Chart throughout the lesson.

**Vocabulary:**

* Ratio – a comparison between two amounts or quantities
* Proportional Relationship – occurs when the ratio between two quantities is always the same
* Unit Rate – a ratio that compares a quantity to one unit
* Conversion – a change of a number or quantity into another denomination

**Differentiation Considerations:**

* Consider using strategic grouping during this lesson. Heterogenous pairs can be used to help engage and benefit all learners during this activity.
* Consider allowing students to use the Blank Ratio Tables worksheet for support as they work through their partner and independent assignment.
* Consider allowing students access to the Which Measure? Conversion Chart as they work. This can be used during the Direction Instruction, Application Activity, or Independent Application portions of this lesson plan.
* Consider pulling a small group to provide support for using a ratio table to stay organized when working with conversions during both the Application Activity and the Independent Application portions of this lesson plan.

**Lesson and Instruction:**

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| **Lesson Components and Time Guidelines** | **Teacher Actions** |
| **Introduction/Hook**  Approximately 5-10 minutes | Hook students into the lesson by posing the following question: A lizard measures 30 inches in length. How many feet long is the lizard? Have students discuss the problem and their solution strategy with the peers around them.  Share out answers and solution strategies with the class. Explain to students that they were able to convert from one unit of measurement, inches, to another, feet.  If needed, show the following ratio table, and ask students how it helps them think about and solve this problem.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 1 ft | 2ft | 3ft | ½ ft | 2 ½ ft | | 12 in | 24 in | 36 in | 6 in | 30 in |   One way to think about this problem is by skip counting on the ratio table. Once we reached 3 feet (or 36 inches), we knew we had gone too far. We know that 24 is 6 less than 30, and that 6 is half of 12, so we added 6 inches (or ½ foot) to our table. Finally, we were able to combine our knowledge to show that 30 inches is equivalent to 2 ½ feet. |
| **Direct Instruction and Modeling**  Approximately 15-20 minutes | Pass out personal white boards, markers, and erasers, or use scratch paper. Model how to use a ratio table to solve conversion problems by using the Conversions and Ratios Model questions.  The first question involves simple conversions and addition. The second question extends students’ proportional reasoning skills and asks them to break apart numbers into their place values to support the use of a ratio table. The third question requires students to apply what they know about multiplying by powers of ten and decimal notation. The last question requires students to complete two conversions: first they must convert from gallons to quarts, and then from quarts to pints.  As you work through the four problems, consider gradually releasing the responsibility of thinking and solving the problems to students. After the first problem, solicit student strategies before solving. After the second problem, solicit student strategies and allow them time to work through the problem briefly before modeling how to finish solving it. After the third and fourth questions, if your students are ready for the rigor, allow students to work through the majority of the problem independently before modeling all the steps for solving it.  Note: there are multiply ways to use a ratio table to solve conversion problems. Although we provided one example, you and/or your students may come up with other strategies. We encourage you to share these with your class and make connections between them to deepen students understanding of and flexibility with math. |
| **Application Activity**  Approximately 10-15 minutes | Transition to the next phase of the lesson, partnering students and providing them a copy of the Workout Calculations assignment sheet. Instruct partners to complete the first half of the assignment collaboratively.  While students work, pull a small group to provide support for accurately using ratio tables to convert between units of measurement. |
| **Independent Application and Demonstration of Learning**  Approximately 10-15 minutes | After students have completed the first half of the assignment with their partner, they should transition to complete the second half independently. Encourage students to use ratio tables and proportional thinking to solve these problems just as they did with their partner.  Again, consider pulling a small group to provide support for accurately using ratio tables to convert between units of measurement. |
| **Closure**  Approximately 5-10 minutes | Return to the whole group setting to reflect on the objectives. Today, students were able to apply what they knew about ratios and proportional reasoning in order to solve problems involving conversation of measurements. Explain that although we often study topics in math separately, all areas of math are interconnected. It is useful to be able to think about math in different contexts. |

**Next Steps and Reflection:**

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| What went well? |  |
| What changes might be beneficial? |  |
| Reteaching needs |  |
| Extension needs |  |