Standards Plus® – Mathematics – Grade 7		
Domain: Ratios & Proportional Relationships	Focus: Unit Rate	Lesson: #1
Standard: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.		

Lesson Objective: Students will learn how to compare two ratios and calculate unit rate using fractional amounts.

Introduction: "Today we will find unit rate using complex fractions."

Instruction: "The unit rate is the rate for one item. A complex fraction is a fraction that has one or more fractions in the numerator and / or denominator. Ratios can compare fractional quantities to other fractional quantities. Look at Example A. I am going to represent this ratio as: $\frac{\frac{1}{2}}{\frac{2}{3}}$ yards per hour. This ratio is an example of a *complex fraction* because it has a fraction in the *numerator* and another fraction in the *denominator*. I know that $\frac{\frac{1}{2}}{\frac{2}{3}}$ mathematically means $\frac{1}{2}$ divided by $\frac{2}{3}$. Following the rule for division of fractions, first write $\frac{1}{2} \div \frac{2}{3}$. Next I rewrite the division sign as a multiplication sign and invert the fraction to the right of the sign and write $\frac{1}{2} \times \frac{3}{2}$. Then I multiply the numerators, and I multiply the denominators $\frac{1}{2} \times \frac{3}{2} = \frac{3}{4}$ $\frac{3}{4} \frac{\text{square yards}}{1 \text{ hour}}$. Therefore, Jose can sweep $\frac{3}{4}$ of a square yard in one hour (square yards per hour). The label of *square yards per hour* is a combination of the two labels *square yards* and *one hour* from the initial problem.

Guided Practice: "Let's look at Example B. Write the complex fraction on your worksheet. (Select a student volunteer to write that fraction on the board.) Rewrite your complex fraction as a fractional division problem. (Select another student to share their written response.) Perform the indicated division and compute the resulting answer." Ask another student to identify the unit label that should be on this problem.

Independent Practice: Follow the same process to complete the problems on your worksheet. As students work, continue to monitor their progress and answer questions.

Review: When students are finished, go over the answers.

Closure: "Today we found unit rates using complex fractions."

Answers:

1. White rabbit: $\frac{7}{10}$; Brown rabbit: $\frac{1}{2}$; White rabbit travels faster because he/she covered more distance.
2. Kristi runs a lap in 6 minutes; Marie runs a lap in 7 minutes. Kristi is the faster runner because it took her less time to run 1 lap.

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Directions: Fill in the boxes with the correct number.

Example A: Jose can sweep $\frac{1}{2}$ of a square yard in $\frac{2}{3}$ of an hour. What is his speed in terms of square yards per hour?

$$\frac{\frac{\square}{\square}}{\frac{\square}{\square}} = \frac{\square}{\square} \div \frac{\square}{\square} = \frac{\square}{\square} \bullet \frac{\square}{\square} = \frac{\square}{\square} \quad \frac{\text{square yards}}{1 \text{ hour}}$$

Example B: A garden hose fills $\frac{4}{9}$ of a gallon bucket in $\frac{2}{3}$ minutes. What is the flow rate in gallons per minute?

$$\frac{\frac{\square}{\square}}{\frac{\square}{\square}} = \frac{\square}{\square} \div \frac{\square}{\square} = \frac{\square}{\square} \bullet \frac{\square}{\square} = \frac{\square}{\square} \quad \frac{\text{gallons}}{\text{minute}}$$

Directions: Find the correct answer to each question and explain your answer.

1. The white rabbit travels $\frac{2}{5}$ miles in $\frac{4}{7}$ days. The brown rabbit travels 3 miles in 6 days. Which rabbit travels at the faster pace? Explain how you know.

2. It takes Kristi 15 minutes to run $2\frac{1}{2}$ laps. It takes Marie, her friend, $3\frac{1}{2}$ minutes to run $\frac{1}{2}$ of a lap. Explain which girl runs the fastest lap and how you can tell.

Standards Plus® – Mathematics – Grade 7		
Domain: Ratios & Proportional Relationships	Focus: Unit Rate	Lesson: #2
Standard: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.		

Lesson Objective: Students will learn how to find unit price.

Introduction: "Today we will find unit price."

Instruction: "Last year you learned that a *ratio* is a relationship between two quantities. The most common way to write a ratio is in fraction form. An example of unit price would be $2 per ounce or $10 per pint or $5 for each. The unit price is the price for one item. Let's look at Example A together. The problem provides the cost of $\frac{1}{2}$ gallon of paint, but I need to find the cost of 1 gallon (the unit rate). To find the cost of 1-gallon, my first step is to divide $\left(\frac{\$6.50}{\frac{1}{2}}\right)$. This fraction is called a complex fraction because it represents a fraction divided by a fraction. $\left(\frac{\$6.50}{\frac{1}{\frac{1}{2}}}\right)$. I know it is easier to perform the operation if $6.50 is converted to the fractional form of $6\frac{1}{2}$. This complex fraction is read $6\frac{1}{2}$ divided by $\frac{1}{2}$. The second step is to write $6\frac{1}{2} \div \frac{1}{2}$. To divide fractions, I need to change all mixed numbers to fractions so $6\frac{1}{2}$ is $\frac{13}{2}$. I'll write $\frac{13}{2} \div \frac{1}{2}$. Now I change the division sign to a multiplication sign and invert the fraction to the right of the sign $\frac{13}{2} \times \frac{2}{1}$. Next I multiply the numerators 13 times 2 equals 26. And multiply the denominators 2 times 1 equals 2. So I have $\frac{26}{2}$ which is 13. Therefore, 1 gallon of paint will cost $13."

Guided Practice: "Let's look at Example B. This example is asking which of the two options is the better buy. The better buy will be the amount that costs the least amount of money. We will need to find the unit price of both the $2\frac{1}{2}$ cookies and the 18 cookies, and then compare the two answers. First let's write the complex fraction representing the $2\frac{1}{2}$ cookies for 33¢ on your worksheet $\left(\frac{.33}{2\frac{1}{2}} \text{ or } \frac{\frac{.33}{1}}{2\frac{1}{2}}\right)$. (Select a student volunteer to explain the next step in the solution process. Convert the mixed number of $2\frac{1}{2}$ to the improper fraction $\frac{5}{2}$. Select another student to explain the next step in the process. Multiply $\frac{.33}{1}$ times $\frac{2}{5}$. (Direct students to perform the calculations on their own and check their answers as you walk around the room.) ($0.13) Only half of the problem is now completed. Let's find the unit rate of the second item working as a pair with the student sitting next to you. As students work, monitor student progress and answer questions. When students have completed finding the unit cost, select a student to share their answer. (18 cookies cost $0.29 each.) The better buy is the $2\frac{1}{2}$ cookies because the cost for one item is less."

Independent Practice: Instruct students to work independently on the problems from the worksheet. As students work, continue to monitor their progress and answer questions.

Review: When students have finished, go over the correct answers.

Closure: "Today you used complex fractions to find unit prices and were able to determine which of two prices is the better buy."

Answers:

1. Item 1 costs $0.15. Item 2 costs $0.21. Item 1 is the better buy.
2. 5 lbs costs $1.70 per lb. $3\frac{1}{3}$ pounds costs $2.03 per lb. The 5-lb price is the better buy.

Standards Plus® – Mathematics – Grade 7		
Domain: Ratios & Proportional Relationships	Focus: Unit Rate	Lesson: #2
Standard: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.		

Directions: Find the unit rate. Round answers to the nearest tenth.

Example A: A $\frac{1}{2}$ gallon of paint costs $6.50. How much will one gallon of paint cost?

Example B: Which is the better buy, $2\frac{1}{2}$ cookies for $0.33 or 18 cookies for $5.16?

1. Which is the better buy? Item 1, which costs $0.95 for $6\frac{2}{5}$ ounces or Item 2, which costs $3.25 for $15\frac{1}{8}$ ounces?

2. Which is the better buy? 5 pounds of popcorn for $8.50 or $3\frac{1}{3}$ pounds of popcorn for $6.75?

Standards Plus® – Mathematics – Grade 7		
Domain: Ratios & Proportional Relationships	Focus: Unit Rate	Lesson: #3
Standard: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.		

Lesson Objective: Students will use their knowledge of unit rates and unit price to find the total number of items or the total cost.

Introduction: "Today we will use your knowledge of unit rate and unit price information to find out the total amount for more than 1 item."

Instruction: "Let's look at Example A. Write the solution process on your paper as I write it on the board. The first thing I need to calculate is the unit rate. I calculate unite rate by setting up the ratio for the relationship between seconds and yards by writing the complex fraction $\frac{2\frac{1}{6} \text{ seconds}}{7\frac{1}{2} \text{ yards}}$. After writing the complex fraction, I will rewrite the mixed numbers as fractions $\frac{\frac{13}{6}}{\frac{15}{2}}$. Next I will change the division sign to a multiplication sign $\frac{13}{6} \cdot \frac{2}{15}$. I will multiply the numerators and then multiply the denominators $\frac{26}{90}$. I can simplify $\frac{26}{90}$ to $\frac{13}{45}$. I divide 13 ÷ 45 and get $0.2\overline{8}$ and round to 0.3. 0.3 is the unit rate, the number of seconds it takes Alexis to run 1 yard. This is not the final answer. I'll reread the question which asks me to find how long it will take for Alexis to run 50 yards. If it takes Alexis 0.3 seconds to cover 1 yard and she has to travel for 50 yards, then it will take her $0.3 \cdot 50$ seconds to travel the 50 yards. It will take Alexis 15 seconds to travel 50 yards."

Guided Practice: "Look at Example B, what information do we need to find first? (The unit rate.) Write the unit rate ratio in fraction form $\left(\frac{110 \text{ miles}}{4\frac{2}{3} \text{ gallons}}\right)$. How do we simplify the resulting complex fraction? (Multiply the numerator by the reciprocal of the denominator.) Find the unit rate. $(\frac{\frac{110}{1}}{\frac{14}{3}} = \frac{110}{1} \cdot \frac{3}{14} = \frac{330}{14} = 23.6 \text{ mpg})$. Nathan can drive 23.6 miles per gallon of gas. (Select another student to explain the next step in the solution process: multiply the 23.6 miles per 1 gallon of gas times 12 gallons of gas). Perform the operation on your worksheet. (Choose a student to share their answer: 283.2 miles. Examples A and B were solved by using the following process: *Total Cost* = *Unit Price* • *Number of Items*.) Write the total cost formula on your worksheet in the bottom margin."

Independent Practice: "Follow the same process to complete the problems on your worksheet."

Review: When students are finished, go over the correct answers.

Closure: "Today you used your knowledge of unit rate and unit price to find the total number of items or the total cost. One way to find the total amount of an item is to first find the unit rate and multiply that answer by how many items there are in the problem."

Answers:

1. 125 pgs/hr; 300 pgs
2. Store A: $1.50/lb.; Store B: $1.64/lb; $45.75 (from Store A)

Standards Plus® – Mathematics – Grade 7		
Domain: Ratios & Proportional Relationships	Focus: Unit Rate	Lesson: #3
Standard: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.		

Directions: Use unit rate to find the answers to the following problems. (Round all calculations to the nearest tenth.)

Example A: Alexis runs $7\frac{1}{2}$ yards every $2\frac{1}{6}$ seconds. How long will it take her to run 50 yards?

Example B: Nathan can drive 110 miles with $4\frac{2}{3}$ gallons of gas. How many miles can he drive with 12 gallons of gas?

1. It takes Lily $\frac{4}{5}$ of an hour to read 100 pages of her book. How many pages can she read in $2\frac{2}{5}$ hours?

2. Logan wants to buy $30\frac{1}{2}$ pounds of grapes. Store A has them priced at \$4.00 for $2\frac{2}{3}$ pounds. Store B has them priced at \$3.00 for $1\frac{5}{6}$ pounds. What is the least he will have to pay for his grapes?

Standards Plus® – Mathematics – Grade 7		
Domain: Ratios & Proportional Relationships	Focus: Unit Rate	Lesson: #4
Standard: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.		

Lesson Objective: Students will transform and convert unit rates.

Introduction: "Today we will transform unit rates to complete measurement conversions. In order to perform the conversions in this lesson, we will be required to use multiple unit rates within each problem."

Instruction: "Let's look at Example A together. I am going to convert 6 km. / hour to meters / second using three steps.

- Step 1: I'll write the initial problem in fraction form $\left(\frac{6\text{ km}}{1\text{hr}}\right)$.
- Step 2: I will use the measurement conversion table to select the appropriate measurement unit. In this case, I need to select a conversion rate that will involve kilometers, so the kilometer in the problem can be mathematically eliminated. $\left(\frac{6\ \cancel{\text{km}}}{1\text{hr}} \bullet \frac{1000\text{ m}}{1\ \cancel{\text{km}}}\right)$. Since $\frac{\text{km}}{\text{km}}$ is equal to 1, the km can be eliminated without changing the value of the equation, resulting in: $\frac{6000\text{ m}}{1\text{ hr}}$. $\frac{1000\text{ m}}{1\text{ km}}$ needs to be written in this manner so the km label in the denominator can cancel out the km label in the numerator. Since the final answer needs to be in the form $\frac{\text{meters}}{\text{second}}$, the numerator portion of the conversion has been completed.
- Step 3: Now the term of $\frac{6000\text{ m}}{1\text{ hr}}$ needs the denominator to be converted to seconds. By checking the measurement conversion table there is no conversion indicated between hours and seconds; however, I know that 60 minutes equals 1 hour $\left(\frac{6000\text{ m}}{1\ \cancel{\text{hr}}} \bullet \frac{1\ \cancel{\text{hr}}}{60\text{ min}} = \frac{6000\text{ m}}{60\text{ min}} = \frac{100\text{ m}}{1\text{ min}}\right)$. The last step in the process is to convert the minutes located in the denominator to seconds by multiplying by $\frac{1\text{ min}}{60\text{ sec}}$. Simplifying, $\frac{100\text{ m}}{1\ \cancel{\text{min}}} \bullet \frac{1\ \cancel{\text{min}}}{60\text{ sec}} = \frac{100\text{ m}}{60\,\text{sec}}$. Performing the indicated calculation $\frac{100\text{ m}}{60\text{ sec}}$ = 1.7 meters/sec."

Guided Practice: "Let's follow the same process to complete Example B. We will be converting yards per hour to feet per minute. Which unit measure will be converted first? (Students can convert either the yards to feet (numerator) or the hours to minutes (denominator). For ease of consistency, instruct students to always start the conversion with the numerator.) Review the measurement conversion table and select an applicable conversion factor. Remember our goal is to transition from yards to feet. You will use the steps I modeled." Guide students through each step.

Independent Practice: Use the steps to complete problems 1 – 2 from the worksheet. As students work, continue to monitor their progress and answer questions.

Review: When students have finished, go over the correct answers.

Closure: "Today we used the measurement conversion table to transform and convert unit rates.

Answers:

1. 0.3 centimeters per second
2. 6.8 inches per foot

Standards Plus® – Mathematics – Grade 7

Domain: Ratios & Proportional Relationships Focus: Unit Rate Lesson: #4

Standard: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

Directions: Perform the indicated conversion. (Round all computations to the nearest tenth.)

MEASUREMENT CONVERSIONS

LENGTH
1 foot (ft) = 12 inches (in.)
1 yard (yd) = 3 feet
1 yard = 36 inches
1 mile = 1,760 yards
1 mile = 5,280 feet
1 km = 1,000 m
1 m = 100 cm

CAPACITY
1 cup (c) = 8 fluid ounces
1 pint (pt) = 2 cups
1 quart (qt) = 2 pints
1 quart = 4 cups
1 gallon (gal) = 4 quarts

WEIGHT
1 pound (lb) = 16 ounces (oz)
1 ton (T) = 2,000 pounds

CONVERSION BETWEEN CUSTOMARY AND METRIC MEASUREMENT

1 yard = 0.914 m
1 foot = 0.305 m
1 inch = 2.54 cm
1 quart = 0.946 L
1 ounce = 28.35 g
1 pound = 0.45 kg

Example A: 6 kilometers per hour = _____ meters per second

Example B: 20 yards per hour = _____ feet per minute

1. 12 meters per hour = _____ centimeters per second

2. 1000 yards per mile = _____ inches per foot

Standards Plus® – Mathematics – Grade 7	
Domain: Ratios & Proportional Relationships	Focus: Unit Rate
Assessment: #1	

This assessment may be used in the following ways:

- As a formative assessment of the students' progress.
- As an additional opportunity to reinforce the vocabulary, concepts, and knowledge presented in the previous 4 lessons.

Standard: 7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

Procedure: Read the directions aloud and ensure that students understand how to respond to each item.

- If you are using this as a formative assessment, have the students complete the evaluation independently.
- If you are using this to reinforce instruction, determine the items that will be completed as guided practice, and those that will be completed as independent practice.

Additional Tips:

- All Standards Plus assessments are available in an **interactive digital format** in the Standards Plus Digital Platform.
- When the assessments are administered and scored digitally, the platform automatically creates intervention groups and recommends **additional printable intervention lessons**.
- You can also access the printable intervention lessons from the home screen in the digital platform.

Review: Review the correct answers with students as soon as they are finished.

Answers:

1. (7.RP.1) Item A: $1.68; Item B: $1.65. Item B is the better buy.
2. (7.RP.1) 62.1 pages
3. (7.RP.1) 3.6 hamburgers per minute
4. (7.RP.1) 451.5 miles
5. (7.RP.1) 8.3 meters per second

Standards Plus® – Mathematics – Grade 7	
Domain: Ratios & Proportional Relationships	Focus: Unit Rate
Assessment: #1	

Directions: Find the answer to each of the following problems while working independently. Circle your answer. (Round all calculations to the nearest tenth.)

1. Which is the better buy, Item A, selling at $5\frac{2}{3}$ pounds for $9.52 or Item B, selling at $1\frac{1}{5}$ pounds for $1.98?

2. Riley reads $35\frac{2}{5}$ pages of her library book every $\frac{4}{7}$ of an hour. How many pages of her book does she read each hour?

3. During an eating contest, Claire can eat $2\frac{3}{7}$ of a hamburger in $\frac{2}{3}$ of a minute. How many hamburgers can she eat in 1 minute?

4. Dylan can drive $110\frac{1}{4}$ miles on $3\frac{2}{3}$ gallons of gas. How many miles can he travel with 15 gallons of gas?

Use the following table for question 5:

MEASUREMENT CONVERSIONS

LENGTH
1 foot (ft) = 12 inches (in.)
1 yard (yd) = 3 feet
1 yard = 36 inches
1 mile = 1,760 yards
1 mile = 5,280 feet
1 km = 1,000 m
1 m = 100 cm

CAPACITY
1 cup (c) = 8 fluid ounces
1 pint (pt) = 2 cups
1 quart (qt) = 2 pints
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WEIGHT
1 pound (lb) = 16 ounces (oz)
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CONVERSION BETWEEN CUSTOMARY AND METRIC MEASUREMENT

1 yard = 0.914 m
1 foot = 0.305 m
1 inch = 2.54 cm
1 quart = 0.946 L
1 ounce = 28.35 g
1 pound = 0.45 kg

5. 30 kilometers per hour = _____ meters per second

Standards Plus® High Impact Standards – Mathematics – Grade 7
Performance Lesson #1 – Domain: Ratios and Proportional Relationships

Standard Reference: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction (1/2)/(1/4) miles per hour, equivalently 2 miles per hour.*

Required Student Materials:

- **Student Pages: St. Pgs. 9-10** (Student Worksheet)

Lesson Objective: The students will write a variety of unit rate problems and create an answer key that shows the solutions and explanation of the answers. They will trade problems with a partner, solve, and discuss.

Overview: Students will use their knowledge of unit rates, ratios, fractions, and decimals to write, solve, and defend the answers to problems related to a scenario as addressed in the first week of the Standards Plus Ratios and Proportional Relationships Daily Lessons 1-4, E1.

Students will:

- Write six rate problems.
- Create an answer key for the rate problems.
- Trade and solve a partner's problems.
- Discuss the results in small groups.
- Critique each other's reasoning as part of a whole group discussion.

Guided Practice: *(Required Student Materials: St. Pg. 9)*

- Review vocabulary.
- Review measurement conversions.
- Review the following: complex fractions, fractions, decimals, and money.

Independent Practice: *(Required Student Materials: St. Pgs. 9-10)*

Have the students:

- Write six problems based on given criteria.
- Create an answer key for each problem including an explanation/defense of the reasoning.
- Trade problems with a partner and solve each other's problems. Debrief.
- Work in small groups to discuss the process.

Review & Evaluation:

- Hold a whole class discussion to share and critique each student's answers and their reasoning.

Standards Plus® High Impact Standards – Mathematics – Grade 7
Performance Lesson #1 – Domain: Ratios and Proportional Relationships

Vocabulary:

Unit rate: The value of one measurement relative to one unit.

Ratio: The comparison of two numbers or quantities using division.

Complex Fraction: A fraction that has one or more fractions in the numerator and/or the denominator.

Numerator: The top number in a fraction.

Denominator: The bottom number in a fraction.

Unit price: The price for one item.

Measurement conversion: Converting between larger or smaller units within the same scale or between customary and metric measurement scales.

MEASUREMENT CONVERSIONS

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1 mile = 5,280 feet
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CAPACITY
1 cup (c) = 8 fluid ounces
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WEIGHT
1 pound (lb) = 16 ounces (oz)
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CONVERSION BETWEEN CUSTOMARY AND METRIC MEASUREMENT

1 yard = 0.914 m
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Part I:

Directions: Write a problem for each of the scenarios listed below. Create an answer key that shows how to solve the problems and defend your answers.

1. A problem that involves a complex fraction.
2. A problem that involves a fraction and a decimal.
3. A problem that involves money.
4. A problem that involves a complex fraction and decimals.
5. A problem that uses customary to metric conversion.
6. A problem that uses metric to customary conversion.

Part II:

Directions: Trade your problems with another student. Each of you will solve each other's problems. Then you will work together to check your solutions against your answer keys.

Part III:

Directions: In groups of 4 or 6, discuss the process of writing problems and creating answer keys. Then discuss the process of solving and checking solutions. Finally, each of you will share how you defended your solution, and the whole class will discuss and critique the reasoning.