**Learning Task: What is Unit Rate?

Students will develop an understanding of the unit rates associated with a proportional relationship. Students will also develop the ability to determine the appropriate rate to use in solving a problem and to use the corresponding unit rate to solve missing-value problems.

STANDARD ADDRESSED IN THIS TASK

MCC7.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.*

STANDARDS FOR MATHEMATICAL PRACTICE

1. Model with mathematics.
2. Attend to precision.
3. Look for and make use of structure.
4. Look for and express regularity in repeated reasoning

COMMON MISCONCEPTIONS

A common error in setting up proportions is placing numbers in incorrect locations. This is especially easy to do when the order in which quantities are stated in the problem is switched within the problem statement.

ESSENTIAL QUESTIONS:

- How are unit rates represented?
- How does a unit rate represent a real-world situation?
- How do I interpret a unit rate (using words and mathematically)?

MATERIALS:

- Activity sheets 1-4 for each student
- active-board or transparencies of these sheets for class discussion

GROUPING

Individual / Partner

TASK DESCRIPTION:

Begin the lesson with a Number Talk. Number talks are a great way for students to use mental math to solve and explain a variety of math problems. A Number Talk is a short, ongoing daily routine that provides students with meaningful ongoing practice with computation. Number Talks should be structured as short sessions alongside (but not necessarily directly related to) the ongoing math curriculum. It is important to keep Number Talks short, as they **are not intended to replace current curriculum or take up the majority of the time spent on mathematics**.

In fact, teachers need to spend only 5 to 15 minutes on Number Talks. Number Talks are most effective when done every day. As previously stated, the primary goal of Number Talks is computational fluency. Students develop computational fluency while thinking and reasoning like mathematicians. When they share their strategies with others, they learn to clarify and express their thinking, thereby developing mathematical language. This in turn serves them well when they are asked to express their mathematical processes in writing. In order for students to become computationally fluent, they need to know particular mathematical concepts that go beyond what is required to memorize basic facts or procedures.

All Number Talks follow a basic six-step format. The format is always the same, but the problems and models used will differ for each number talk.

1. **Teacher presents the problem.** Problems are presented in a word problem or a written algorithm.

2. **Students figure out the answer.** Students are given time to figure out the answer. To make sure students have the time they need, the teacher asks them to give a “thumbs-up” when they have determined their answer. The thumbs up signal, given at chest level, is unobtrusive- a message to the teacher, not the other students.

3. **Students share their answers**. Four or five students volunteer to share their answers and the teacher records them on the board.

4. **Students share their thinking.** Three or four students volunteer to share how they got their answers. (Occasionally, students are asked to share with the person(s) sitting next to them.) The teacher records the student's thinking.

5. **The class agrees on the "real" answer for the problem.** The answer that together the class determines is the right answer is presented as one would the results of an experiment. The answer a student comes up with initially is considered a conjecture. Models and/or the logic of the explanation may help a student see where their thinking went wrong, may help them identify a step they left out, or clarify a point of confusion. There should be a sense of confirmation or clarity rather than a feeling that each problem is a test to see who is right and who is wrong. A student who is still unconvinced of an answer should be encouraged to keep thinking and to keep trying to understand. For some students, it may take one more experience for them to understand what is happening with the numbers and for others it may be out of reach for some time. The mantra should be, "If you are not sure or it doesn't make sense yet, keep thinking."

6. **The steps are repeated for additional problems**.

Similar to other procedures in your classroom, there are several elements that must be in place to ensure students get the most from their Number Talk experiences. These elements are:

1. A safe environment
2. Problems of various levels of difficulty that can be solved in a variety of way
3. Concrete models
4. Opportunities to think first and then check
5. Interaction
6. Self-correction

For this Number Talk, begin with the following problem, "6 melons cost $12. How much does one melon cost?" Record the problem on the far left side of the board. Provide students with wait time as they work to mentally solve this problem. When majority of the students have given the "thumbs up" signal, call on several students (3-4) to share their answer and the strategy they used to solve. Record the information provided by the students exactly how it is told to you. It is important to allow students ownership of their thinking.

Record, "3 watermelons cost $15. How much does one watermelon cost?" on the board next to the previous problem. Provide students with wait time as they work to mentally solve this problem. When majority of the students have given the "thumbs up" signal, call on several students (3-4) to share their answer and the strategy they used to solve. Record the information provided by the students exactly how it is told to you.

Record, "3 apples cost $.99. How much does 1 apple cost?" on the board towards the far right. Provide students with wait time as they work to mentally solve this problem. When majority of the students have given the "thumbs up" signal, call on several students (3-4) to share their answer and the strategy they used to solve. Record the information provided by the students exactly how it is told to you.

At the end of the Number Talk, discuss the strategies used to find the answers. Some of the strategies students may use are relationship between multiplication and division, division, guess and check and skip counting. Talk with the students about which strategy was most efficient (quick, easy and accurate).

Allow for a maximum of 15 minutes to conduct the Number Talk before moving into the lesson.

Explain to students, in the Number Talks, strategies were used to identify a **unit rate**.
Revisit the first problem from the Number Talk. Have students identify the rate (6/12), then identify the unit rate (1/2). Have students define a unit rate.

On the recording sheet, students analyze a real life situation to create two versions of a unit rate. Then, students need to analyze the two possible rates and determine which is the most appropriate to the given problem and use this rate to find possible cost for other values within the given problem.

Resource used for this task:

Cramer, K.., Behr, M., & Bezuk, N. (1989). Proportional relationships and unit rates. *Mathematics Teacher, 82* (7), 537-544.
http://www.cehd.umn.edu/ci/rationalnumberproject/89_4.html

**TE: What is Unit Rate?

Selecting the Appropriate Unit Rate

At Ralph's fruit stand 3 apples cost 90 cents. You want to buy 7 apples. How much will they cost?

1. What are the two possible rates for this problem?

   Solution: 3 apples/90 cents 90 cents/3 apples

2. Show each rate as a unit rate.

   Solution: $\frac{1}{30}$ apple per 1 cent 30 cents per 1 apple

3. What does each unit rate tell you?
   Solution: The portion of an apple for 1 cent
   The number of cents for one apple

4. Which unit rate will help you solve the problem?
   Solution: 30 cents per apple

5. If it costs 30 cents to buy 1 apple, how much will 2 apples cost? 4 apples? Complete the table below.

APPLES	COST IN CENTS
1	**30**
2	**60**
3	**90**
4	**120**
5	**150**

What pattern do you see? **The cost in cents increases by 30 cents each time.**

Multiply the number of apples by 30 cents to get the total cost

6. Since you know the unit price, write a number sentence for the cost of seven apples. Write an equation for the cost of any number of apples.
   (30 cents per apple)(7 apples) = $2.10
   (Unit rate)(number of apples) = total cost
   30x = y where x is the cost per apple and y is the number of apples

**SE What is the Unit Rate?

Selecting the Appropriate Unit Rate

Based on your understanding of the models given from sheet 1, how would you explain or define a unit rate?

At Ralph's fruit stand 3 apples cost 90 cents. You want to buy 7 apples. How much will they cost?

1. What are the two possible rates for this problem?

2. Show each rate as a unit rate.

3. What does each unit rate tell you?

4. Which unit rate will help you solve the problem?

5. If it costs 30 cents to buy 1 apple, how much will 2 apples cost? 4 apples? Complete the table below. Then, describe the pattern you see in the chart.

APPLES	COST IN CENTS
1	30
2	
3	
4	
5	

6. Since you know the unit price, write a number sentence for the cost of seven apples. Write an equation for the cost of any number of apples.