Ratios vs. Rates

Adapted Lesson Plan

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Lesson Plan: Ratios vs. Rates

Goal
The students will be able to discriminate between ratios and rates.

Objective
Given either a number that is either a ratio, rate, or neither, written on an index card, or on the board, and the directions "Tell me if this is a ratio, rate, or neither," the student will verbally respond with the correct answer, without prompts, for 5 consecutive trials.

Learning Standards
Standards of the National Council of Teachers of Mathematics:

Content Strand *Algebra*: Instructional programs from prekindergarten through grade 12 should enable all students to understand numbers, ways of representing numbers, relationships among numbers, and number systems.

- Students work flexibly with fractions, decimals, and percents to solve problems.

Process Strand *Connection Strand:* Instructional programs from prekindergarten through grade 12 should enable all students to understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

New York State Learning Standard MST 3:

Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world setting, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability and trigonometry.

Content Strand: *Number Sense and Operations Strand*: Students will understand numbers, multiple ways of representing numbers, relationships among number, and number systems.

6.N.8 Distinguish the difference between rate and ratio

Process Strand: *Problem Solving Strand:* Students will monitor and reflect on the process of mathematical problem solving.

6.PS.20 Understand valid counterexamples
Connections Strand: students will understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

6.CN.4 Understand multiple representations and how they are related

Prerequisites
1. 1. Given an algebraic equation, on a sheet of paper, and the directions, "Solve for x," students will be able to correctly manipulate the equation to get x by itself.

Example:

$$5x - 2 = 23$$

$$3 + x = 10$$

2. Given a fraction, on a sheet of paper or projected on the SMARTboard, and the directions, "Point to the numerator/denominator (chosen at random for different fractions), the student will correctly point to the correct number that represents the numerator/denominator.

3. Given a sentence with a unit of measurement in it, and the directions, "Underline the unit of measurement," students will underline the unit of measurement in the sentence.

Example:

The girl ran five miles.

Measure 6 cups of milk.

Introduction

Tell the students that today they will be learning the difference between ratios and rates. By the end of the lesson they will be able to tell whether a number is a ratio, a rate, or neither. They need to know this because ratios and rates are used in their everyday lives. From driving a car, to baking a cake, rates and ratios are everywhere.

Day 1 Review: (Prerequisite #2) I will show the students a flashcard with a fraction on it, and I will ask the students to point to the numerator/denominator. This is giving the students a review of the parts of a fraction, and ensures they grasp it in case I refer to them throughout the lesson.

Day 2 Review: Chorally read the poster aloud with the students. I will then remind them to remember that a rate includes two different units. They need to use this in many situations, for example finding the probability of winning a game, or measuring ingredients for cooking.

Development

Visual Aids (see attached poster pg 7)

Explanation

I will explain to the students the difference between ratios and rates while referring to the poster. Fist I will go over what a ratio is. A ratio is a comparison of two numbers by division. There are multiple ways ratios can be represented. They can be written using words, such as an out of b or a to b. Then they can be written mathematically using a colon, or as a fraction. Next I will read the examples and non-examples to the class, and reiterate why the examples are ratios.

Next I will move onto rates and explain to the students the definition of rates as well as the different ways they can be represented. I will say a rate is a type of ratio that has two different units of measurement. They too can be written using words such as "a number of cups to b number of teaspoons" or "a number of feet per b minutes." In addition they can be written mathematically using a colon, like "a grams: b feet" and "$\frac{\text{a miles}}{\text{b hours}}$".

Finally I will have the students chorally read the poster aloud with me.

Comparison with a Known

I will say deciding whether or not a number is a ratio or a rate is like deciding whether a vehicle is a car or a truck. There are a lot of similarities between cars and trucks however you can tell the difference if you know the specific characteristics of each. When given two numbers, one of which is a ratio, and one that is a rate, you can see many similarities in the ways they are written, however when you look at the units that are given, you can tell them apart.

Examples and Materials

Examples:

I will use ratios, rates, and non-examples of both, one at a time on a flashcard, or projected on the SMARTboard. I'll be sure to vary the ways in which both the ratios and rates are written.

Examples of Ratios:	**Examples of Rates:**
3:4	12 meters per feet
15 to 6	$\frac{4 \text{ quarts}}{3 \text{ gallons}}$
1 out of 5	5 teaspoons to 1 cup
$\frac{2}{7}$	

Non-examples:

I will periodically show non-examples such as the ones listed below. I will be sure to include both gross and fine discriminators.

- -8
- 8.4
- 15=9x
- π

I Do/Think Aloud/We Do

I will do at least two examples of a ratio and a rate, and at least two non-examples in random order.

For each example I will begin by reading the number to the class. For example, I will say "This reads seven to two. Hmmm is this a ratio, rate, or neither. Let me look at the poster to see. It says ratios can be written a to b, and this is written in the same form. Great! So this could be a ratio, but first let me check if it could be a rate. Rates can also be written a to b, but the definition says 'rates are a type of ratio with two measurements having different units.' I better look and see if this has two different units. Hmmm 'a to b.' That doesn't have any units, therefore it has to be a ratio. Wonderful!"

I will do at least one more example of a ratio, being sure to think aloud, give self-praise, make planned mistakes, and make corrections.

Next I will do an example using a rate. I will say "This says 'two teaspoons of salt per 1 cup of water.' Now I have to decide whether or not this is a ratio, rate, or neither. First let me look and see if it's a ratio. Well I don't see 'a per b' as a way to write ratios, so it's not a ratio. A rate is a ratio with two different units. Does this example have two different units? Oh yes it does! It has teaspoons and cups. Now let me look at rates. Nope, not a rate either. Oh wait! I didn't look at the poster thoroughly enough. The third way we can write a rate says the number unit of one per number of unit 2. That is the same way this is written therefore it must be a rate. Am I done? Yep! Even though I made a mistake at first, I slowed down and fixed my mistake so I can give myself a pat on the back!"

I will do at least one more example of a rate, being sure to think aloud, give self-praise, make planned mistakes, and make corrections.

Finally I will do a non-example of both. I will say "Four feet is the example. How will I decide if this is a ratio, a rate, or neither? First I will look and see if it's a ratio. 'A ratio is a comparison of two numbers by division.' Well I only have one number here so it can't be a ratio. I'm doing well so far, but I have to keep working until I find out what it is. So is it a rate? I think it is because there is a unit and I remember rates have units. Oh whoops! It says on the poster that rates have two different units and this only has one. So it can't be a rate! Also rates are types of ratios, and I already said it's not a ratio, so I defiantly know it's not a rate! So I know it's not a ratio, and it's not a rate, therefore my answer has to be neither. It's not a ratio or a rate. I've done wonderfully!"

I will do at least one more example of a non-example, being sure to think aloud, give self-praise, make planned mistakes, and make corrections.

Guided Practice

Corrective Feedback: if a student is hesitating or is giving a wrong answer, I will offer a hint. If the student continues to struggle after the hint is provided, I will offer a model like shown below.

Hint: Say the definition of either a ratio or a rate, depending on what they are stuck on.

Model: I will say "(number) is a (ratio/rate/neither) because (read definition of ratio/rate, or if it's neither then say the aspect that makes it neither).

Motivating Activity: We will use the computer to play Ratio Martian. In this game the student will have to classify ratios. (Reference: http://www.arcademicskillbuilders.com/games/ratio-martian/ratio-martian.html)

Closure

To end the lesson, I will re-read the poster to the class (only definitions of rates and ratios, and the way they can be written, not the examples and non-examples). I will remind them that they need to tell the difference whenever they see a ratio. They will have to decide is this just a

comparison of two numbers or is this representing a rate with different units of measurement. This is just like seeing a vehicle on the road and figuring out if it's a car or truck.

Independent Practice (see page 9)

I will give the students a worksheet on solving algebraic equations (Prerequisite #1).

Accommodations

- **For students with reading problems:** I will provide the students with text-to-speech software. (Reference: http://www.naturalreaders.com/index.htm)
- **For students with writing problems:** I will provide speech-to-text software. (References: http://www.nuance.com/)
- **For students with behavior problems:** I will use a structured classroom routines and schedules, proximity control, specific praise, reminders, and reprimands as needed for behavior in relation to classroom rule. For students who need more support, I will design a token system.
- **For students with high ability:** I will allow them to use the computer to play the online game "Ratio Stadium" (Reference: http://www.arcademicskillbuilders.com/games/ratio-stadium/ratio-stadium.html).
- **For students who are English language learners:** I will provide icons on the posters and worksheets and allow them to use these students to use the same accommodations as those with reading and writing problems (Reference: http://www.enchantedlearning.com/dictionary.html)
- **For students with oral communication problems:** I will provide a communication board containing icons and words including ratio, rate, neither, yes, no, job well done, my turn, etc.

Evaluation

During each trial of Guided Practice, I will collect data on each student and record their progress in the table below. Then I will make a graph for each student, plotting the trial number versus the percent of correct factors. This data will give the students and I a visual representation of their level of progress. If no or very little progress is being made, then I will reevaluate my teaching style and make changes where it's necessary.

Students ►	A.S	W.C	R.G	T.H	G.J	V.B	C.R	O.L	D.F
Trials ▼									
1									
2									
3									
4									

Key:

✓ - Independently Correct

P - Verbal prompt was necessary

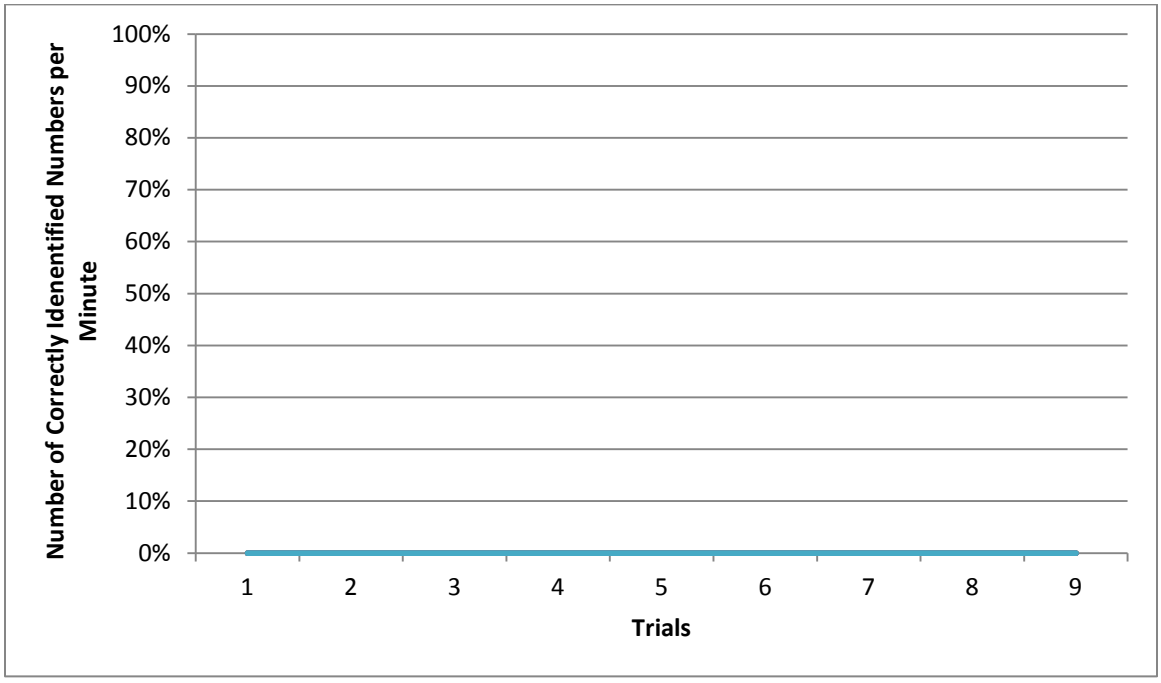
✗ - Full model and verbal prompt was necessary

Progress Monitoring

I will give a one minute probe to the students at least three times a week on discriminating between ratios and rates. I will administer these probes and record the data until the students reach criterion.

CBM Performance Objective

Given a one minute probe on discriminating between ratios and rates (see attached pg 9), and the directions on the probe read aloud by the teacher, the student will write the answers at the rate of the median of a class of typical peers, for three consecutive probes.



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Ratio

A comparison of two numbers by division

Can be written:

a out of b

a to b

a:b

$\frac{a}{b}$

Examples of ratios:	Non-examples of ratios:
4:1	12
5 to 6	$1.9x10^8$
9 out of 11	5x=8
$\frac{3}{7}$	π
	-3
	2 meters per second

Rates

A type of ratio with two measurements having different units

Can be written:

a number of cups to b teaspoons

a grams: b feet

a feet per minute

$\frac{a \text{ miles}}{b \text{ hours}}$

Examples of rates:	Non-examples of rates:
55 miles per hour	18
3.5 teaspoons of oil to 1 cup of flower	-1.5
7 ounces out of 5 pounds	π
9 feet: 1 hour	9 out of 11
$\frac{18 \text{ feet}}{5 \text{ seconds}}$	$4.3x10^9$
	9x+7=4

Name:_____ Date:_____

Directions: Tell me whether each number is a ratio, rate, or neither. Start at number one and work from left to right. If you are unsure of the answer skip it and go on to the next one.

1. $\frac{15}{4}$	2. -1	3. 7 feet:6 seconds	4. $\frac{2\ teaspoons}{5\ grams}$	5. 1 cup	6. 5 to 4	7. 9:3	8. 2 oz per gallon	9. 5x
10. 7 feet: 6inches	11. 8 grams per teaspoon	12.16 to 7	13. 7 cm to 5 feet	14. $9\ x\ 10^3$	15. cars and trucks	16.2 to 20	17. $\frac{1oz}{7\ cm}$	18. 7 to 8.5
19. 93.5	20. 5	21. $\frac{9\ inches}{8\ inches}$	22. 5 to 3	23. 7feet/2 feet	24. 2 tons per truck	25. $\frac{-2}{5}$	26. feet and gallons	27. 5 pounds
28. 1 gram and 4 oz	29. 9 out of 13	30. juice and cookies	31. 2-7x	32. 1.5 oz	33. 8+21=y	34. 8 jelly beans per 2 children	35. $\frac{2\ gal}{9\ ft}$	36. 4.3 grams per teaspoon
37. sugar and salt	38.6.7	39. 48	40. 90 feet to 3 inches	41. 15 out of 30	42.20:4	43. 4 inches to 5 yards	44. inches to feet	45. 7z=36
46.$\frac{6cm}{7\ cm}$	47. 1.4x+1=9	48.3 out of 7	49. 4 to 5	50. 6 cups per quart	51. $5k-6^x$	52. 5:9	53.y=5	54. 3:5
55. $7x10^4$	56. 15 holes per yard	57. $12x10^4$	58.4 miles per day	59. 34	60.v=7	61. $(\frac{3x}{7x})$	62. r^3	63.7 to 9
64. 18 to 5	65.7 years per 1 cycle	66.6 to 8	67. people per year	68. f^3	69. 81.5	70. 6 oz. per foot	71. 5x/7y	72. 50 per25

Kuta Software - Infinite Pre-Algebra

Name_____

Two-Step Equations With Integers

Date_____ Period____

Solve each equation.

1) $\frac{r}{10} + 4 = 5$

2) $\frac{n}{2} + 5 = 3$

3) $3p - 2 = -29$

4) $1 - r = -5$

5) $\frac{k - 10}{2} = -7$

6) $\frac{n - 5}{2} = 5$

7) $-9 + \frac{n}{4} = -7$

8) $\frac{9 + m}{3} = 2$

9) $\frac{-5 + x}{22} = -1$

10) $4n - 9 = -9$

11) $\frac{x + 9}{2} = 3$

12) $\frac{-12 + x}{11} = -3$

13) $\frac{-4 + x}{2} = 6$

14) $-5 + \frac{n}{3} = 0$