Ratios, Unit Rates, and Proportions

Summary

Compare quantities using ratios, rates, and proportions

Main Core Tie

Mathematics Grade 6

Strand: RATIOS AND PROPORTIONAL RELATIONSHIPS (6.RP) Standard 6.RP.1

Additional Core Ties

Mathematics Grade 6

Strand: RATIOS AND PROPORTIONAL RELATIONSHIPS (6.RP) Standard 6.RP.2

Mathematics Grade 6

Strand: RATIOS AND PROPORTIONAL RELATIONSHIPS (6.RP) Standard 6.RP.3

Materials

Clock with seconds hand or timer
1 piece of bubble gum for each team
2 2-liter bottles of soda per class
1 tennis or racquet ball for each team
1 deck of cards per student pair
2 meter sticks and tape for each team
Worksheets: Rate Contests, Comparing Numbers, Equivalent Ratios-Proportions
Linker Cubes
Journal pages: Defining Rate, Defining Proportion

Background for Teachers

Enduring Understanding (Big Ideas):
Rates and Ratios are comparisons using division
Essential Questions:
How is a ratio or rate used to compare two quantities or values? Where can examples of ratios and rates be found?
How can I model and represent rates, ratios, and proportions?
What is a proportion?
How are cross products and unit rates helpful in determining whether two ratios are equivalent?
Skill Focus:
Write ratios, rates and proportions. Compare quantities using these.
Vocabulary Focus:
Ratio, unit rate, words that suggest rate: per, each, and at (@), numerator, denominator, proportion
Ways to Gain/Maintain Attention (Primacy):
Manipulative, conjecture, calculators, games and contests, writing, cooperative activity literature

Instructional Procedures

Starter:
Find the decimal for each
3/5
1/8
10/4

Write each percent a fraction and a decimal.

    40%

    120%

    2.5%

Launch-Mobilizing Background Knowledge:

In our language, we use words to show a comparison such as larger, faster, and darker. Write three other words that indicate a comparison.

In math, we can use two operations to show a comparison. We can use subtraction, or finding the difference as in 12 - 3 = 9 (twelve is nine greater than three), or we can use division, or finding a quotient, as in 12 ÷ 3 = 4 (twelve is four times greater than three). For each of the following tell whether the comparison is being made with subtraction or with division:

    8 -- 2 = 6

    10 is twice as great as 5

    4 is three less than 7

    6/2 = 3

Lesson Segment 1: How can a ratio be used to compare two quantities or values? Where can examples of ratios be found?

Smart Pal communicators: Have student pairs work together to show both ways to compare the following pairs of numbers (subtraction, finding a difference and, division, finding a quotient), showing their reasoning on a Smart Pal or team board. Have them write the comparisons for each as shown:

10 -- 4 = 6

10/4 = 2. 5

And then write words for their comparison as shown:

Ten is six more than four

10 is 2.5 times greater than 4.

    6 and 3

    20 and 5

    18 and 2

    15 and 10

Work together as a class using Linking Cubes and the "Comparing Numbers" worksheet to compare quantities. Tell students they will be using ratios for making comparisons in this unit.

Lesson Segment 3: What is a rate? Where can examples of rates be found?

A rate is a special kind of ratio. When we need to use a rate, we use words like: per, each, or at (@). Explain that rates are used when the two items being compared in a ratio are different measures or units. For example, comparing the number of green apples to red apples, boys to girls, or trucks to cars on the road does not require us to use different measures just different numbers. However, comparing the number of CD's to the cost of CD's is comparing number measures to money measures. Comparing miles to gallons also require different unit measures. Have students use the Agree, Disagree or Unsure response cards attached to tell whether or not each of the following situations involves two different units of measure. As they hold up their responses, remind them that different units of measure are written using a special ratio called a rate.

    The number of miles you travel in an hour

    The number of white pairs of shoes you own compared to the number of black.

    The length of a rectangle compared to the width

    The amount of money you make in an 8 hour day.

When we are comparing different measures or units, we use words like per and symbols like /. Show the examples m/g or price per CD, points per quarter, m/h, and beats per measure (music) We find unit rates by setting up a ratio and dividing it.

Do Math Talk to practice the following. In Math Talk, a student and partner go to the board. They work

on the board as the others in the room are working at their desks. When they finish, <u>teacher</u> selects one of them to explain what they wrote as the class listens. As they listen to the explanation, the class members each write one good question they could ask. A good question is a question that begins with "why" or "how". One or two of the class member are called on to ask their good question to the partners at the board. This is an excellent way to get kids listening to each others explanations.

Practice these examples:

125 miles on 8 gallons of gas. Write as a ratio and find the rate of miles <u>per</u> gallon.

90 points in a basketball game. This is an average of how many points in each quarter? Write ratio and find the rate of points <u>in each</u> quarter.

5 CD's for $$60. This is buying CD's @ how many dollars each?

Your heart beats 80 times in a minute. How many beats per second is this?

Practice Activities: Discuss and complete the following activities together

Rate Contests

Help students do the rate activities described on the Rate Contests worksheet. Use words like per, each and at (@) in the discussion that ensues.

Journal: Work with students to complete the "Defining Rate" (Frayer Model) vocabulary page for their journals.

Lesson segment 3: What is a proportion? How are cross products and unit rates helpful in determining whether two ratios are equivalent?

Give student pairs one card (attached). Any left over cards should be place where students can have access to look at them. Have students mix around the room looking for another pair whose ratio is equivalent to theirs. If they don't find other students, they should check the extra cards that were laid out. When they find the card they are looking for, they discuss with the other pair how they determine equivalency. All four will need to be able to explain how they decided their ratios were equivalent. Give them five minutes to find their match. Have a couple of students explain how they knew their ratios were equivalent. Model and have students use calculators to divide several equivalent ratios to determine if they are a proportion. Also, model checking for proportionality using cross products.

Find student pairs from the matching activity that had an inverse. (3/4 and 4/3, 2/5 and 5/2, 4/5 and 5/4, 1/6 and 6/1). Q. These have the same numbers, so are they equivalent ratios? How can you use equivalent quotients or cross products to check?

Work through the Equivalent Ratios- Proportions worksheet using the Reporting Reporter cooperative structure. Student teams work together to answer all the parts of problem 1. Teacher selects a student from each team to be the reporter. This person travels to another team to describe how their team answered the question. The neighboring team listens and adds any ideas they may have had, or makes any suggestions or corrections needed. The reporter then returns to their home team and the teams repeat this with the remaining problems on the worksheet.

Journal: Have students complete the "Defining Proportion" Frayer Model for their journal. Help them read their proportions "____ compares to ____ the same way that ____ compares to ____". Or, ____ divides into ____ the same number of times that ____ divides into ____. They should write the words for their proportion examples in the column 3 of the journal.

Assign text practice for finding unit rates or determining equivalent ratios as needed.

<u>Assessment Plan</u>

Performance tasks, journal

<u>Bibliography</u>

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