Grade Level/Course: Grades 6-7

Lesson/Unit Plan Name: Part 1 - Multiple Representations of Ratios: from concrete to operational. Lesson 4 of 4 Modeling Ratios with Double Number Lines.

Rationale/Lesson Abstract: How comparing and contrasting multiple representations shift student's thinking from concrete to operational. Using hands on activities to create and understand the relationship of ratios to be multiplicative rather than additive. Written as four individual lessons or as stations for review.

Timeframe: multiple days.

Common Core Standard(s):

6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship 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."

6.RP.2 Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. 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."

6.RP.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.

6.RP.3a 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.

6.RP.3b Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

6.RP.3c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

6.RP.3d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

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 ½/¼ miles per hour, equivalently 2 miles per hour

Part 1, Lesson 4 – Modeling Ratios with Double Number Lines

Note to teacher: *Students should already have had short lessons on ratio language, how to write ratios, and how to convert ratios to unit ratios and percent so they can apply that knowledge to these lessons.*

Teacher Materials

- your favorite way to impart group lessons (white board, document camera)
- chart paper
- markers

Student Materials

- strip of double number lines
- a ratio word problem or situation
- glue
- scissors
- rulers
- student worksheets (one per student)

Part 1, Lessons 1-4

- Use and manipulate concrete objects and visual tools that are instructional in formulating and testing their thinking and understanding of ratio and proportion as multiplicative rather than additive.
- Increase their ability to think logically about the abstract concepts of ratio, rate and proportion.

Part 2, Lesson 1

- Recognize that using a proportion in isolation to solve a rate problem limits their knowledge to the answer of that specific problem. (This experience can be expanded by solving the proportion in 2 or 3 different ways.)
- Use a table to reveal the answers of the unit rate, and realize that those rates that are usually whole number multiple terms in between the proportion given and the proportion sought.
- (Ex. The ratio 3 to 5. Thinking: The second term is 2 times 3 which equals 6 and the second term for 5 is 10 therefore the next equivalent ratio is 6 to 10.)
- Use a graph to visually understand ratio as a linear model with answers as numerous as the points on a line.
- Use an algebraic equation to express the generalization of the pattern and to solve for any value.

Part 1, Lesson 4 – Modeling Ratios with Double Number Lines

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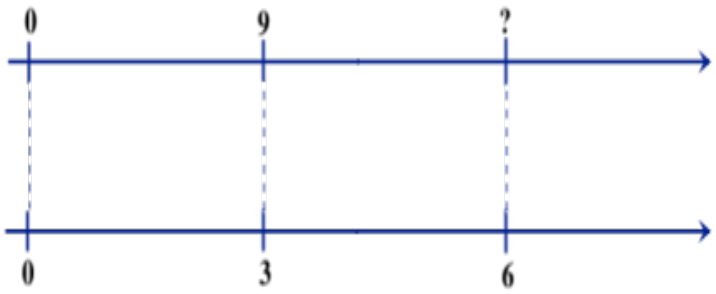
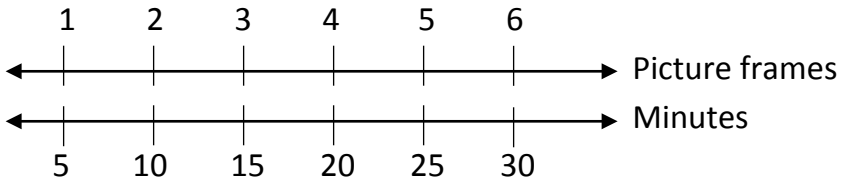


Lesson 4 – Modeling Ratios with Double Number Lines

Have students model solving ratios using double number lines. Each baggie should have an open double number line, a strip of paper with a ratio situation or word problem, and a student activity sheet with instructions. Students will represent the situation or solve the problem by placing the proper ratio numbers in the appropriate places on the number lines and labeling the number lines (see example). Repeat this station two or three times using different ratio situations and word problems, until students are confident in creating and presenting their double number lines of the activity. After your last time give them the exit ticket to answer on page 7.

Ex.) Rita makes on picture frame every 5 minutes, how many picture frames can she make in 30 min.?



Rita can make 6 picture frames in 30 minutes.

While they are doing these activities circulate and decide who you will have share their answers. Don't forget there is learning in misconceptions as well as correct answers.

Part 1, Lesson 4 – Modeling Ratios with Double Number Lines

STUDENT WORKSHEET

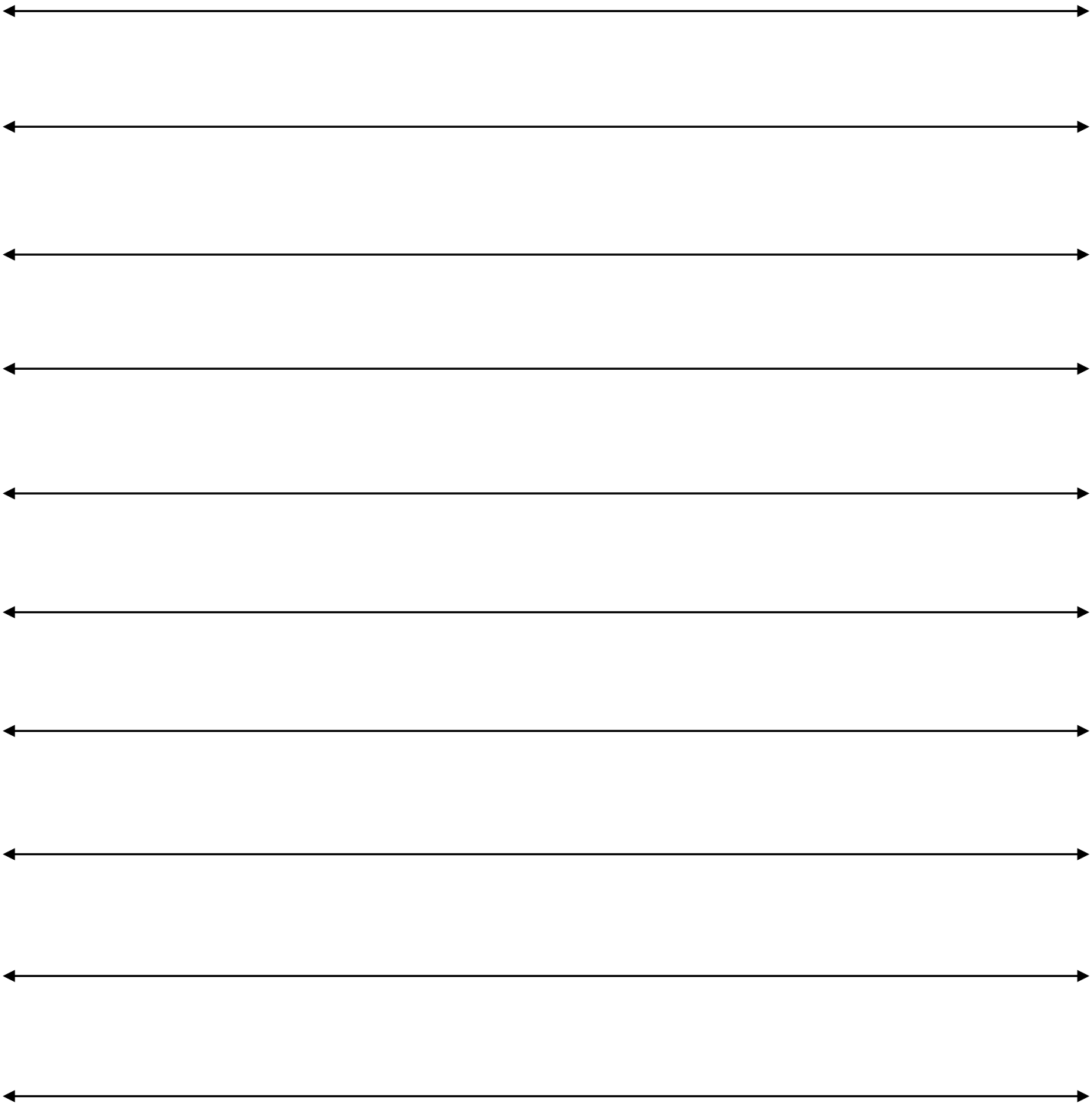
Each group should receive a baggie with:

strip of double number lines
glue
a ratio word problem
scissors
rules
student worksheet (one per student)

1. Glue your problem to your worksheet below.
2. Label what each of your number lines are representing. Then distribute the proper numbers on each of the lines and use a ruler to mark off the appropriate space to fit the numbers you have used. Glue the number line under the word problem or situation you have solved.
3. Then justify your model in words and/or diagrams or pictures.

Part 1, Lesson 4 – Modeling Ratios with Double Number Lines

DOUBLE NUMBER LINES



Part 1, Lesson 4 – Modeling Ratios with Double Number Lines

RATIO WORD PROBLEMS AND SITUATIONS

Shaded to unshaded is a 1:3 ratio of 64 objects

Shaded to unshaded is a $\frac{3}{5}$ ratio with 80 objects

Shaded to unshaded is a three to four ratio with 35 objects

Shaded to unshaded is a 1:2 ratio with 30 objects

Shaded to unshaded is a $\frac{1}{4}$ ratio with 60 objects

Shaded to unshaded is a one to five ratio with 24 objects

225 words in 5 minutes. What is my unit rate? At that speed how many words could I type in 15 minutes?

I charged $7.25 per hour cutting lawns. How much did I make working 3 hours? What did I make after 12 hours?

A 32 ounce bottle of flavored water costs $2.56. What is it's unit cost? If an 8 ounce bottle and a 12 ounce bottle have the same unit rate as the 32 ounce bottle how much are they?

If 5 cans of dog food are $7.75, what is the cost of a case of 20 cans? What is the cost for two cans?

If it takes 7 leaves to feed two caterpillars, How many leaves does it take to feed 12?

If the ratio of red cars to blue cars is three to five and there are 75 blue cars, how many red cars are there?

Exit Ticket

Lesson 4 ANSWER

LaShaundra hiked 108 minutes up a mountain. She jogged 27 minutes and walked the rest.

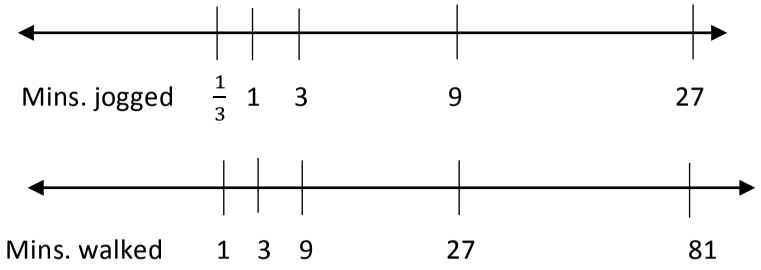
What is the ratio of time she jogged to the time she walked? Find the unit ratio of jogging to walking. Use a double number line to solve the problem. Show your work.

$$27 = 3\times3\times3$$

$$81 = 3\times3\times3\times3$$

Equivalent ratios are 9:27 or 3:9 and 1:3 ∴ the unit ratio is

$$\frac{1}{3} \; to \; 1$$



Exit Ticket

Lesson 4

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