Grade Level/Course: Grades 6-7

Lesson/Unit Plan Name: Part 1 - Multiple Representations of Ratios: from concrete to operational. Lesson 2 of 4 Representing Ratios with Objects and Area Models.

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 2 - Representing Ratios with Objects and Area Models

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

Baggie should include:

- 2 or 3 sets of objects that differ in color or shape
- a ratio card paired with an appropriate strip of area models
- student worksheets

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

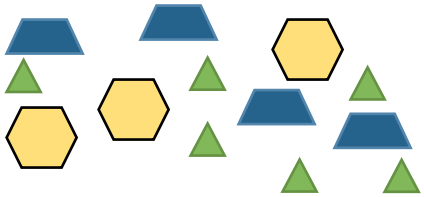
- Recognize that using a proportion in isolation to solve a rate problem limits their knowledge to the answer of that specific problem. (This experience can be expanded by solving the proportion in 2 or 3 different ways.)
- Use a table to reveal the answers of the unit rate, and realize that those rates 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.

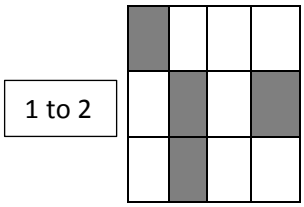
Part 1, Lesson 2 - Representing Ratios with Objects and Area Models

Student Materials

Baggie should include:

- 2 or 3 sets of objects that differ in color or shape
- a ratio card paired with an appropriate area model
- student worksheets





Lesson 2 – Representing Ratios with Objects and Area Models

Pre-set up 2 ratios models with the objects on a table at the side of the room.

> Model 1 - Put like objects next to like objects as in 9 red tiles next to 6 blue tiles. Model 2 mix differing amounts of three objects all together.

Student groups should alternate between the two models on the table and the area model and ratio card at their desks until everyone is finished. Have extra cards with ratios written on them for students, who finish early, to build using their objects. Students can also create, other area models cut from graph paper for their ratio. Students should shade in an appropriate area and leave the rest unshaded so it represents the ratio card. Repeat this station two or three times using different ratios and area models, until students are confident in creating and presenting their ratios and area models for the activity. After your last time give them the exit tickets to answer on page 7.

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 2 - Representing Ratios with Objects and Area Models

STUDENT WORKSHEET

Each group should receive a baggie with:

- 2 or 3 sets of objects that differ in color or shape,
- A ratio card paired with an appropriate area model
- student worksheet
- graph paper

1. In model 1 identify the ratio of the set of objects already laid out (like to like). _____

2. In model 2 identify the ratio of the set of objects already laid out (mixed objects). _____

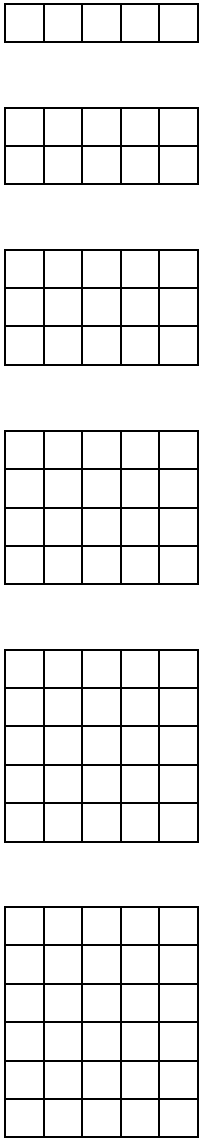
3. Build with your objects and draw below the ratio on your ratio card. The ratio is _____

4. Using the ratio on your ratio card, shade the area model (rectangle of graph paper) appropriately so that the shaded and un-shaded parts match the ratio and glue the area model and your ratio card below.

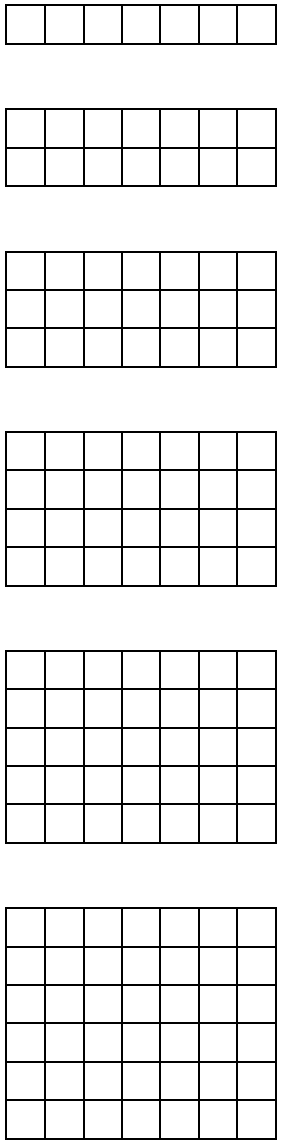
Part 1 Lesson 2 Representing Ratios with Objects and Area Models

AREA MODELS

2:3

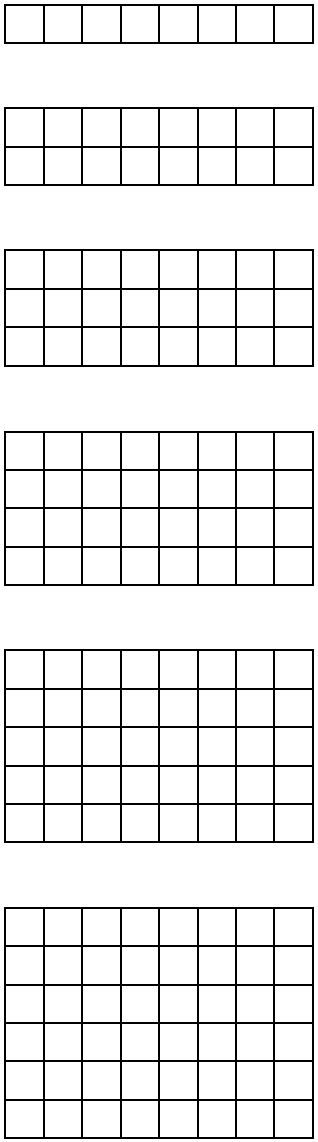


3:4

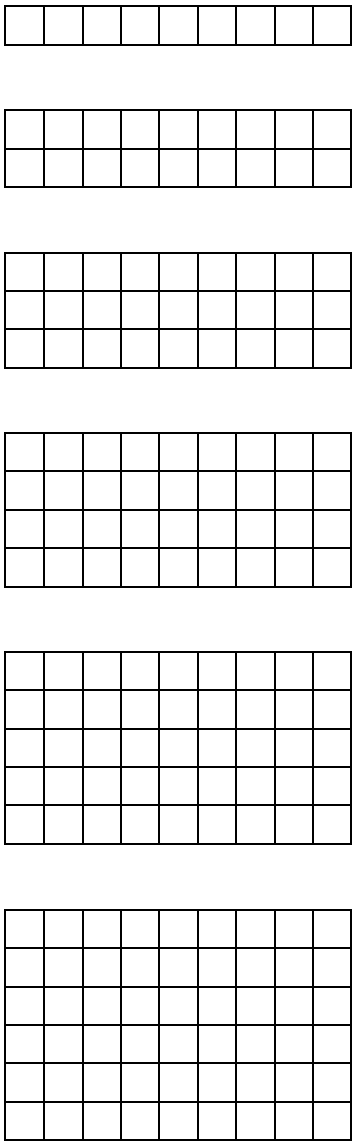


Cut in strips and paper clip to a ratio card.

3:5



2:7 or 4:5



Part 1, Lesson 2 - Representing Ratios with Objects and Area Models

RATIO CARDS- Cut apart and clip with an appropriate area model strip.

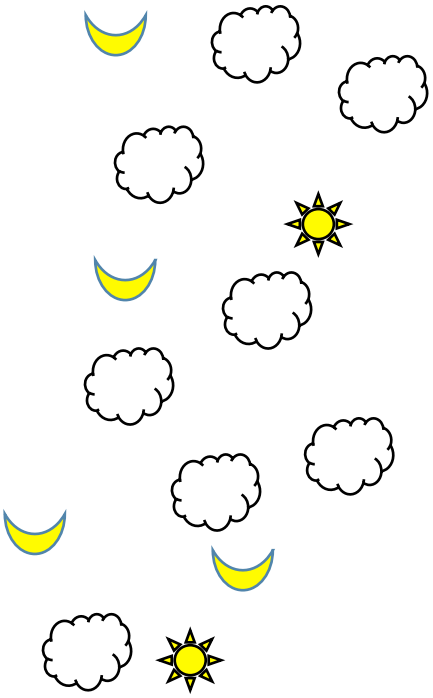
$\frac{2}{3}$	TWO TO THREE	2:3
$\frac{3}{5}$	THREE TO FIVE	3:5
$\frac{2}{7}$	TWO TO SEVEN	2:7
$\frac{4}{5}$	FOUR TO FIVE	4:5
$\frac{3}{4}$	THREE TO FOUR	3:4

EXIT TICKETS FOR STATION 2

Exit Ticket

Lesson 2a

What is the ratio of clouds to moons? Suns to clouds? Use complete sentences and show the ratio 2 different ways.

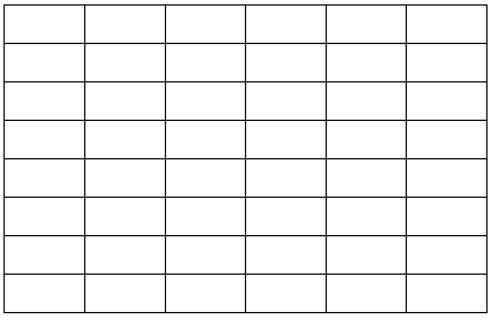


Exit Ticket

Lesson 2b

If the ratio of carrot plants to potato plants is $\frac{3}{5}$. Shade in the amount of carrot plants below.

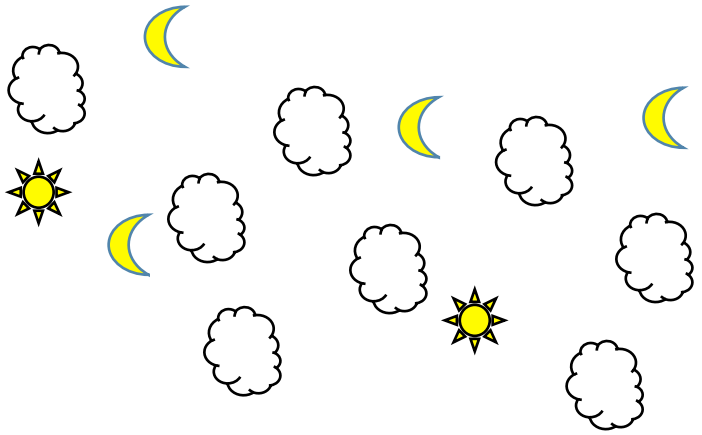
= 1 plant



Exit Ticket

Lesson 2a ANSWER

What is the ratio of clouds to moons? Suns to clouds? Use complete sentences and show the ratio 2 different ways.



There are 8 clouds to 4 moons. The ratio is 2:1 or two to one.

There are 2 suns to 8 clouds. The ratio is 1 to 4 or 1:4.

Exit Ticket

Lesson 2b ANSWER

If the ratio of carrot plants to potato plants-is $\frac{3}{5}$. Shade in the amount of carrot plants below.

= 1 plant