Lesson 12: From Ratio Tables to Double Number Line Diagrams

Student Outcomes

- Students create equivalent ratios using a ratio table and represent these ratios on a double number line diagram.
- Students extend and use a double number line diagram to solve ratio problems related to the real world.

Classwork

Exercise 1 (5 minutes)

Recall of prior knowledge—Ratio Tables (See attached ratio cards.)

MP.2 Each student is given a card with a ratio on it. The students move around the room in search of other students who have ratios that are equivalent to theirs. Students with equivalent ratios will form a group and create a ratio table, which will contain all of the equivalent ratios. As students present their ratio tables, the student audience will determine the accuracy of the groups' formations, as well as the accuracy of their tables. Circulate the room as a facilitator, guiding students who are having trouble. Collect cards and direct students back to their seats once the groups are completed.

Scaffolding:

Differentiate the exercise by choosing certain cards for each student. For example, a ratio of $2:1$ may be easier for a struggling learner to conceptualize, while a ratio of $3\frac{1}{2}:2$ may be more challenging.

Exercise 2 (7 minutes)

A guided whole-group discussion occurs as outlined below. Students are given time to think about and discuss the following questions independently or with their peers and then contribute to the whole-group discussion.

For more support:

To provide more information on this topic to support all learners' needs, refer to Teacher Notes – More Information on Soda and Sugar for video and news-related links.

Exercise 2

The amount of sugary beverages Americans consume is a leading health concern. For a given brand of cola, a 12-ounce serving of cola contains about 40 grams of sugar. Complete the ratio table, using the given ratio to find equivalent ratios.

Cola (ounces)	6	12	18
Sugar (grams)	20	40	60

Answers may vary but are found by either multiplying or dividing both 12 and 40 by the same number.

Exercise 3 (7 minutes)

Exercise 3

A 1-liter bottle of cola contains approximately 34 fluid ounces. How many grams of sugar would be in a 1-liter bottle of the cola? Explain and show how to arrive at the solution.

Cola (ounces)	6	12	18	24	30	36
Sugar (grams)	20	40	60	80	100	120

MP.3 Students may use different approaches. Some students may decide to extend their tables but may realize that they do not "easily" arrive at 34 for the ounces of cola when finding equivalent ratios. After adequate time, have students/groups present their predictions and methods to the class.

MP.1 When eliciting students' responses, ask probing questions as the opportunity arises, (e.g., "So are you telling me that since 34 ounces is between 30 and 36 ounces, the answer will be between 100 and 120 grams of sugar?", "Is it closer to 100 or 120? How do you know?", "Will the answer be a whole number? Why or why not?", "Can you express your answer as a mixed number?")

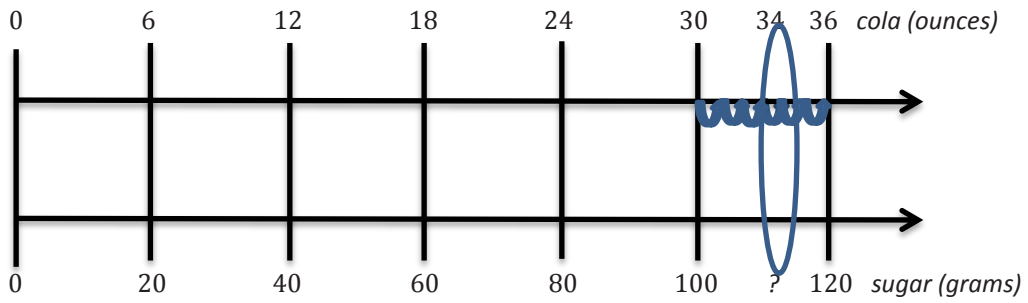
- What are some of the challenges we face when using a table for this type of problem?
  - *34 is not a multiple of 6, and we are counting by 6s for the ounces of cola and by 20s for grams of sugar.*

Example 1 (9 minutes)

MP.5 Whole group instruction continues with a teacher-led discussion (with an illustration) on using a double number line diagram to arrive at the answer for Example 1. This problem requires two different number lines since we are comparing ounces and grams, which are not the same units (1 gram is not equivalent to 1 ounce). Students record the following illustration on the double number line reproducible.

Fluency Exercise to Reinforce Understanding:

Students can practice skip-counting aloud for each number line to understand the concept of scale.



- What is the scale we are using on each number line?
  - *6 for cola and 20 for sugar*

Show on the cola number line that 34 ounces is $\frac{4}{6}$, or $\frac{2}{3}$, of the way between 30 and 36. The answer for grams of sugar will be $\frac{4}{6}$, or $\frac{2}{3}$, of the way between 100 and 120. Since the intervals are by 20, to determine the answer, find $\frac{2}{3}$ of 20 and add it to 100. Students may choose to use $\frac{4}{6}$ instead of $\frac{2}{3}$.

Elicit student volunteers to show the math process and work using each of the two fractions. Students should see that the answers will be the same regardless of which fraction was used.

$\frac{2}{3} \times \frac{20}{1} = \frac{40}{3} = 13\frac{2}{6} = 13\frac{1}{3}$

$100 + 13\frac{1}{3} = 113\frac{1}{3}$

$113\frac{1}{3}$ grams of sugar

OR

$\frac{4}{6} \times \frac{20}{1} = \frac{80}{6} = 13\frac{2}{6} = 13\frac{1}{3}$

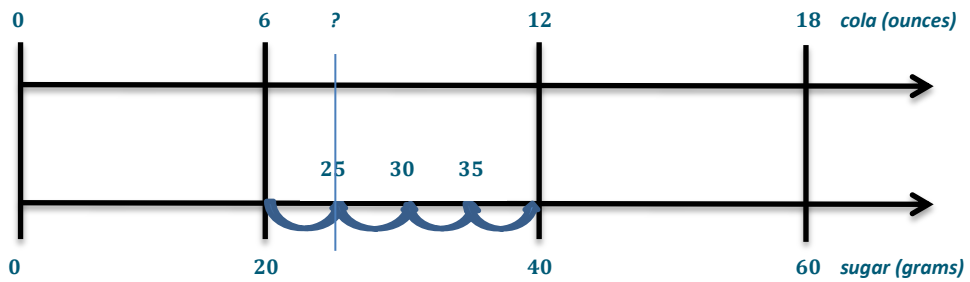
$100 + 13\frac{1}{3} = 113\frac{1}{3}$

$113\frac{1}{3}$ grams of sugar

Exercise 4 (7 minutes)

Exercise 4

A school cafeteria has a restriction on the amount of sugary drinks available to students. Drinks may not have more than 25 grams of sugar. Based on this restriction, what is the largest size cola (in ounces) the cafeteria can offer to students?



My estimate is between 6 and 12 ounces but closer to 6 ounces. I need to find $\frac{1}{4}$ of 6 and add it to 6.

$\frac{1}{4} \times \frac{6}{1} = \frac{6}{4} = 1\frac{1}{2}$

$6 + 1\frac{1}{2} = 7\frac{1}{2}$

A $7\frac{1}{2}$ ounce cola is the largest size that the school cafeteria can offer to students.

After students have ample time to create their double number line diagram and answer the question, encourage students to present their thought process to the class.

Exercise 5 (time permitting)

Exercise 5

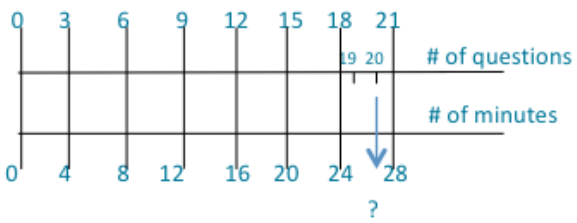
Shontelle solves three math problems in four minutes.

a. Use this information to complete the table below.

Number of Questions	3	6	9	12	15	18	21	24	27	30
Number of Minutes	4	8	12	16	20	24	28	32	36	40

b. **Shontelle has soccer practice on Thursday evening. She has a half hour before practice to work on her math homework and to talk to her friends. She has 20 math skill-work questions for homework, and she wants to complete them before talking with her friends. How many minutes will Shontelle have left after completing her math homework to talk to her friends?**

Use a double number line diagram to support your answer, and show all work.



Step 1: $\frac{2}{3} \times 4 = \frac{8}{3} = 2\frac{2}{3}$

Step 2: $24 + 2\frac{2}{3} = 26\frac{2}{3}$

Step 3: $30 - 26\frac{2}{3} = 3\frac{1}{3}$

Shontelle can talk to her friends for $3\frac{1}{3}$ *minutes.*

Closing (5 minutes)

Have students complete the 3-2-1 Activity.

- Name three different ways you can represent a group of equivalent ratios.
  - *Ratio Table, Tape Diagram, Double Number Line Diagrams*
- Share two things you learned about Double Number Line Diagrams.
- Tell one thing you want to know more about from today's lesson.

Lesson Summary

Double Number Line Diagram: a tool used for understanding the equivalence of two related numbers. It is called *double* because each mark on the line has two numbers matched to it. The top row of numbers describes the whole represented by the line in one way, and the bottom row describes the whole represented by the line in another way. Because the whole line is the same, it is possible to see the equivalences between the rows of numbers at any point on the line.

Exit Ticket (5 minutes)

Additional Teacher Notes

More Information on Soda and Sugar:

Video: http://www.cnn.com/2013/01/14/health/coke-obesity

Video: http://www.teachertube.com/viewVideo.php?video_id=13788

http://www.sugarstacks.com/beverages.htm

http://www.cdc.gov/features/healthybeverages/

Name _____ Date_____

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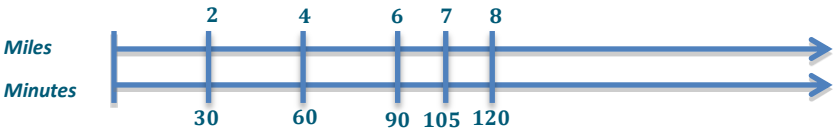
Exit Ticket

Kyra is participating in a fundraiser walk-a-thon. She walks 2 miles in 30 minutes. If she continues to walk at the same rate, determine how many minutes it will take her to walk 7 miles. Use a double number line diagram to support your answer.

Exit Ticket Sample Solution

Kyra is participating in a fundraiser walk-a-thon. She walks 2 miles in 30 minutes. If she continues to walk at the same rate, determine how many minutes it will take her to walk 7 miles. Use a double number line diagram to support your answer.



It will take Kyra 105 minutes to walk 7 miles.

Problem Set Sample Solutions

1. **While shopping, Kyla found a dress that she would like to purchase, but it costs $\$52.25$ more than she has. Kyla charges $\$5.50$ an hour for babysitting. She wants to figure out how many hours she must babysit to earn $\$52.25$ to buy the dress. Use a double number line to support your answer.**

   9.5 hours

2. **Frank has been driving at a constant speed for 3 hours, during which time he traveled 195 miles. Frank would like to know how long it will take him to complete the remaining 455 miles, assuming he maintains the same constant speed. Help Frank determine how long the remainder of the trip will take. Include a table or diagram to support your answer.**

   7 hours

7 to 4	28: 16	$3\frac{1}{2}$ to 2	35: 20
3 to 8	30: 80	6 to 16	12: 32
5 to 1	45: 9	15 to 3	$2\frac{1}{2}$ to $\frac{1}{2}$

3 to 4	$9:16$	$1\frac{1}{2}$ to 2	$15:20$
3 to 6	$30:60$	1 to 2	$4:8$
2 to 1	$44:22$	$18:9$	1 to $\frac{1}{2}$

1 to 6	8: 48	6 to 36	5: 30
9 to 4	36: 16	3 to $\frac{4}{3}$	18: 8
7 to 6	42: 36	21 to 8	$3\frac{1}{2}$ to 3

Double Number Line Reproducible