LESSON 7: Ratios and Proportion

Weekly Focus: Ratio and Proportion
Weekly Skill: word problems

Lesson Summary: In the warm up, students will solve a work-related word problem with fractions. In Activity 1, they will fill in the blanks of sentences to practice vocabulary. In Activity 2, they will practice using proportions to solve word problems. In Activity 3, they will do problems in the workbook. In Activity 4, they compare the costs of 3 common consumer products. There are an exit ticket and an extra word problem at the end. Estimated time for the lesson is two hours.

Materials Needed for Lesson 7:

- Video (length 10:23) on using proportions to solve word problems. The video is required for teachers and recommended for students.
- *Mathematical Reasoning Test Preparation for the 2014 GED Test* Student Book pages 10 and 11
- *Mathematical Reasoning Test Preparation for the 2014 GED Test* Workbook pages 18 to 21
- Worksheet and answers for the application activity (https://www.yummymath.com/2014/an-ounce-of-cola/). Please download the activity directly from the website.
- Exit ticket (attached)

- Teacher Note: If students complete the word problems in the book quickly, have them solve them on the board while other students are still working.

Objectives: Students will be able to:

- Review vocabulary related to ratios and proportions
- Practice proportion and ratio word problems in the book
- Use real-life information to compare the costs of products

ACES Skills Addressed: N, CT, LS, SM
CCRS Mathematical Practices Addressed: Model with Math, Look for and make use of structure
Levels of Knowing Math Addressed: Intuitive, Pictorial, and Abstract

Notes:
You can add more examples if you feel students need them before they work. Any ideas that concretely relates to their lives make good examples.

For more practice as a class, feel free to choose some of the easier problems from the worksheets to do together. The "easier" problems are not necessarily at the beginning of each worksheet. Also, you may decide to have students complete only part of the worksheets in class and assign the rest as homework or extra practice.

The GED Math test is 115 minutes long and includes approximately 46 questions. The questions have a focus on quantitative problem solving (45%) and algebraic problem solving (55%).

Students must be able to understand math concepts and apply them to new situations, use logical reasoning to explain their answers, evaluate and further the reasoning of others, represent real world

problems algebraically and visually, and manipulate and solve algebraic expressions.

This computer-based test includes questions that may be multiple-choice, fill-in-the-blank, choose from a drop-down menu, or drag-and-drop the response from one place to another.

The purpose of the GED test is to provide students with the skills necessary to either further their education or be ready for the demands of today's careers.

Lesson 7 Warm-up: Solve the work problem	**Time: 10-15 Minutes**

Write/Project on the board: You just got a new job in sales. When you were hired, your boss asked you to divide your time the following ways: ½ of your work day on the sales floor, ¼ doing paperwork, 1/10 making sales calls, and the rest is up to you.

Basic Questions:

- If you work 8 hours, how much time is spent on the sales floor? (1/2 x 8 = 4 hours)
- How much time doing paperwork? (1/4 x 8 = 2 hours)
- How much time is left to sales calls and other tasks? (2 hours)

Extension Questions:

- How many minutes is 1/10 of the 8-hour day? (1/10 x 480 minutes =48 minutes. Students may solve this out different ways. Did anyone use decimals?)
- How much time is left in your day to do other tasks? (8 hours – 6:48 = 1:12)
- What fraction of the day is it? (Since ½ + ¼ + 1/10 = 17/20, then 3/20 is left)
- Can you check your fraction is correct by solving for minutes? (yes, 3/20 x 480/1 minutes in a day = 72 minutes = 1:12)

Lesson 7 Activity 1: Vocabulary in Sentences	**Time: 5 Minutes**

This activity can be projected on the board and done as a whole class. Have students volunteer to write answers.

Answers:
1. ratio
2. numerator, denominator
3. proportion
4. unit rate

Lesson 7: Activity 1

Use the correct term to fill in the blanks of the sentences below:

Numerator Unit Rate Proportion Ratio Denominator

1. A _____ compares two numbers. The second or bottom number does not necessarily represent a whole.
2. The _____ of a fraction represents the part while the _____ represents the whole.
3. A _____ is used to compare two ratios that are written as equals.
4. A _____ is a ratio with a denominator of 1.

   An example is $50\ \frac{miles}{hour}$.

Lesson 7 Activity 2: Ratios and Proportions Practice	**Time: 20-25 Minutes**

1) Example A: Write the ratio of men to women in class today. (First, write it as $\frac{x}{y}$.) Point out that although this is written in the same format as a fraction, it isn't a true fraction. Why not? Because the denominator isn't the total number of students. Explain that a ratio can also be written as x:y or as x to y.

2) Example B: Chang wants to buy 4 T-shirts. They are priced at 3 T-shirts for $18. How much will he pay for 4 shirts? Ask the students if they can do it first. This can be solved two ways. One way is with unit rate. If it costs $18 for 3, then $\frac{\$18}{3} = \frac{\$6}{1}$ so 4 shirts cost $24. The other way is to set up a proportion. $\frac{\$18}{3} = \frac{\$x}{4}$. When setting up proportions, it is important to use the same terms as the numerators ($ in this example) and the same as the denominators (shirts). The proportion can be solved with cross multiplication 18 times 4 = 3x, so x = $24.

3) Do problems in **student book** pages 10-11. Circulate to help. Review any questions that students found challenging. Choose a few problems to have students volunteer to do on the board and explain if they want.

Lesson 7 Activity 3: Workbook Problems	Time: 20-25 Minutes

Do the problems in the **workbook pages 18-21**. Have students volunteer to do some of the challenging problems on the board. If you prefer, you can do the next activity first as it will generate more conversation and then start on the workbook problems with the rest as homework.

Lesson 7 Activity 4 Application: Cola v. Milk v. Gas	Time: 20-25 Minutes

Work with students to do the **attached activity** that compares the cost of cola, gas, and milk. Please download the activity directly from the website. The activity has been attached for your reference.

Lesson 7 Exit Ticket (attached below)	Time: 5 Minutes

Write a proportion and solve: At a rate of $15 per dozen, how much will 30 roses cost?

Students may use a unit rate $15/12 roses = $1.25 each x 30 roses =$37.50.
They may set up a proportion of $15/12 = $x/30 and cross-multiply. If there is time, have them solve it both ways.

Lesson 7 Extra Problem	Time: 5-10 Minutes

Write on the board: Josh picked 8 quarts of strawberries and paid $10.00 for them.

Basic Question:

- How much did he pay per quart? *($1.25) Students may use decimals, unit rates, or proportions to solve the problem. Ask them and discuss all the valid ways they came up with the answer.*

Extension Questions:

- How many ounces did he pick? *(1 quart is 32 oz. so 8 x 32 =256 ounces)*
- If he had bought them at the store, they would have cost 2 ¼ times more. How much would they have cost? *($22.50) Discuss the various ways to solve the problem. Did they use whole numbers (double the $10.00 and then add a quarter of it $2.50)? Did they use decimals (10 x 2.25)? Did they use fractions (2 ½ x 10)?*

Cola by the Ounce

The other day I stopped for gas and I saw the sign below, attached to the soda cooler.

1. I wondered which size soda was the best deal? Make a guess and explain your thoughts.

2. Use the information from the picture to fill in the first two columns of the table then find the price per ounce for each bottle. Consider any rounding of ounces or price that you might do to make "nicer" numbers.

Ounces of Soda (oz.)	Price ($)	$ per oz.

3. Which size of soda do you think is the best deal? How do you know?

4. Right after I left the gas station, my wife called and asked me to stop and get some milk. In the grocery store I noticed that I could get a 2-liter bottle of soda for $2.04. How much would that amount of soda cost per ounce? (Use 2 liters = 68 ounces for this calculation)

5. Earlier today I paid $3.59 for a gallon of gas. I wondered what costs more? Gasoline or soda? If I used the price per ounce from the 3 situations in problem number two, how much would a gallon of soda cost (there are 128 ounces in a gallon)?

6. Which costs more, a gallon of Coke or a gallon of gas? Show or explain your reasoning.

7. Why do you think that soda companies sell so many sizes of their product?

8. In most of the world gasoline, soda and milk are packaged and measured in liters, a metric system unit of volume. I looked up some costs of these liquids when they are sold in liter measurements. In Canada four liters of milk sells for about $6.48. A two-liter bottle of Coke sells for about $2. A liter of gas sells for about $1.30. Compare the cost of Coke, milk and gasoline in liters.

9. Reflect on the process of comparing the costs of Coke, milk and gasoline using metric versus using U.S. units.

Lesson 14 Cola Activity Answers

2. Use the information from the picture to fill in the first two columns of the table then find the price per ounce for each bottle. Consider any rounding of ounces or price that you might do to make "nicer" numbers.

Ounces of Soda (oz.)	Price ($)	$ per oz.
20	$1.80	$0.09 ($0.0895)
16	$1.30	$0.06 ($0.0625)
12.5 or 12	$1.00	$0.08 ($0.0792)

3. Which size of soda do you think is the best deal? How do you know?
The 16 oz. soda is the best deal. I divided cost by the number of ounces to find the cost per ounce. Students should have rounded the costs and perhaps the 12.5 ounce quantity to12 ounces.

4. Right after I left the gas station, my wife called and asked me to stop and get some milk. In the grocery store I noticed that I could get a 2-liter bottle of soda for $2.04. How much would that amount of soda cost per ounce? (Use 2 liters = 68 ounces for this calculation)

$$\frac{\$2.04}{68\ ounces} = \$0.03\ per\ ounce$$

5. Earlier today I paid $3.59 for a gallon of gas. I wondered what costs more? Gasoline or soda? If I used the price per ounce from the 3 situations in problem number two, how much would a gallon of soda cost (there are 128 ounces in a gallon)?

Ounces of Soda (oz.)	Price ($)	$ per oz.	$ per gallon
20	$1.80	$0.09 ($0.0895)	$(\$0.0895)\times 128\ ounces = \$11.45$
16	$1.30	$0.06 ($0.0625)	$(\$0.0625)\times 128 ounces = \$8.00$
12.5 or 12	$1.00	$0.08 ($0.0792)	$(\$0.0792\times 128\ ounces = \$10.14$

6. Which costs more, a gallon of Coke or a gallon of gas? Show or explain your reasoning.
Wow. A gallon of soda costs a lot more than a gallon of gas. My work is shown in the chart above.

7. Why do you think that soda companies sell so many sizes of their product?
I imagine that soda companies feel that they can appeal to all of their consumers by offering;
   - Small sizes for people who just want what they need at the moment.
   - Larger sizes for people who feel that they need more for a single serving.
   - Big sizes for people who want to economize by buying in quantity and doling out servings from a large container.

   Enjoy the discussion and appreciate what students have to say.

8. In most of the world gasoline, soda and milk are packaged and measured in liters, a metric system unit of volume. I looked up some costs of these liquids when they are sold in liter measurements. In Canada, four liters of milk sells for about $6.48. A two-liter bottle of Coke sells for about $2. A liter of gas sells for about $1.30. Compare the cost of Coke, milk and gasoline in liters.
The milk is $1.62 per liter. $(6.48/4 = 1.62)$ The Coke is $1 per liter (2 / 2 = 1) and we already know that gasoline is about $1.30 per liter in Canada.

9. Reflect on the process of comparing the costs of Coke, milk and gasoline using metric versus using U.S. units.
It is way easier to convert and compare using metric! With U.S. units I have to convert ounces to gallons or vice versa.

Exit Ticket

Write a proportion and solve: At a rate of $15 per dozen, how much will 30 roses cost?

How did you solve the problem?

Exit Ticket

Write a proportion and solve: At a rate of $15 per dozen, how much will 30 roses cost?

How did you solve the problem?