

Grade 8 Proportional Applications Lesson and Resources

VSC Standard 6.0 Knowledge of Number Relationships and Computation/Arithmetic: Students will describe, represent, or apply numbers or their relationships or will estimate or compute using mental strategies, paper/pencil or technology.

VSC Topic C. Number Computation

VSC Indicator 3. Analyze ratios, proportions, and percents

VSC Objective c. Solve problems using proportional reasoning

Clarification: The clarification is an explanation of the indicator and objective and how these math concepts appear in the puzzle.

Materials and/or Set Up: *Interactive Resource 1, Interactive Resource 2, Interactive Resource 3, Differentiated Interactive Resource 4, Assessment*

Math Discussion Terms: proportion, equivalent ratios, ratio

Note to Teacher – Students should have attempted Levels 1 and 2 of the Cafeteria puzzles (Employee’s Cafeteria and Manager’s Cafeteria) before this lesson is implemented. This lesson includes operations with decimals, as well as geometric applications for finding proportional segments of similar triangles and a follow-up scale drawing activity.

In the implementation of this lesson, it is recommended that the Interactive Resources be projected to encourage a rich and active discussion of math strategies and concepts.

Activities:

1. Review **proportions**, emphasizing that **equivalent ratios** simplify to the same fraction. Also, review the cross-product method of solving **proportions**. Ask students to

- Circle each **ratio** in the list that is equivalent to the given fraction:

$$\frac{12}{15} = \frac{2}{3}; \frac{4}{5}; \frac{8}{10}; \frac{24}{30}; \frac{30}{50}; \frac{48}{65}; \frac{60}{75} \quad (\text{Answers: } \frac{4}{5}; \frac{8}{10}; \frac{24}{30}; \frac{60}{75})$$

- Write 3 ratios that are **equivalent** to $\frac{4}{6}$. (Answers will vary such as $\frac{2}{3}; \frac{8}{12};$

$$\frac{12}{18}; \frac{40}{60}.$$

- Review the cross-product method of solving proportions: (If $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$). Have the students use the cross-product method to solve the following **proportions**: $\frac{13}{5} = \frac{n}{2.5}$, $\frac{.6}{n} = \frac{24}{8}$, $\frac{n}{.7} = \frac{10}{14}$ (6.5, .2, .5)

2. Use **Interactive Resource 1** to discuss ratios (Explain that the trays will be referred to as 1st, 2nd, 3rd, 4th, 5th.)

- Ask students which tray on screen 1 they could use to write a **ratio** (4th) Why? (*Discuss why this is the only tray that can be used to write a ratio.*)
- Have students determine a word **ratio** for the 4th and 5th trays. ($\frac{sushi}{slop}$
 $\frac{slop}{drumstick}$)
- Have students discuss and determine number ratios for both word ratios. ($\frac{4}{7}$;
 $\frac{21}{30}$)
- Have students discuss and determine **proportions** using the 4th and 5th trays. (*Use words to initiate the setup of the ratio.*)

$$\left(\frac{sushi}{slop} = \frac{sushi}{slop}; \frac{4}{7} = \frac{s}{21} \right) - 4^{\text{th}} \text{ tray to } 5^{\text{th}} \text{ tray}$$

$$\left(\frac{slop}{drumstick} = \frac{slop}{drumstick}; \frac{21}{30} = \frac{7}{d} \right) - 5^{\text{th}} \text{ tray to } 4^{\text{th}} \text{ tray}$$

- Ask students if any other trays can be used to set up a **proportion**. (3rd tray with the 5th tray)
- Ask the students to make predictions about the sushi on tray five and the drumstick on tray four, using the **proportions** written above. (*The sushi on tray 5 must be 12 and the drumstick on tray 4 will be 10.*)

3. Distribute **Interactive Resource 2**. Have the students work in pairs to complete Part

I ($\frac{AN}{AR} = \frac{CP}{CL}$, $\frac{LC}{LP} = \frac{RA}{RN}$, $\frac{NR}{NA} = \frac{PL}{PC}$) and Part II ($\frac{15}{9} = \frac{5}{n}$, $n = 3$).

4. Have students work individually to complete *Interactive Resource 3*. (ZF,

$$XQ, \frac{20}{14} = \frac{12}{x}, x = 8.4, \frac{20}{14} = \frac{x}{16.1}, x = 23)$$

Differentiation Suggestions:

- For students who are having difficulty, use *Differentiated Interactive Resource 4* to provide small group instruction. ($\frac{8}{6} = \frac{XY}{3}$, $XY = 4$, $\frac{6}{3} = \frac{10}{YZ}$, $YZ = 5$)

- As a challenge for students, have them solve the following: $\frac{x}{36} = \frac{6}{18}$, $\frac{4.2}{1.4} = \frac{7.5}{x}$,

$$\frac{9.6}{1.6} = \frac{x}{5.2} \quad (1.2, 2.5, 31.2)$$

Assessment

- Distribute the **Assessment** resource sheet.

Answers:

1. Answers may vary, for example, $\frac{3}{5}$, $\frac{9}{15}$, $\frac{12}{20}$

2. $\frac{2}{7} = \frac{10}{35}$, $\frac{5}{8} = \frac{13.75}{22}$

3. 15 girls

Follow Up:

- Have students return to the puzzle to apply what they learned in the lesson. Ask: Did the lesson help you to clarify the math in the puzzle? How so? What other strategies could you have used to help you solve the puzzle? Additionally, check

student game progress through the Administrator's Tool to determine students' level of understanding.

- Assign the following task to students:

Scale drawings are another application of ratios and proportions. Choose a picture, a map, or an object, and impose a grid on it. Enlarge or reduce it by drawing the corresponding part from each square of the original picture (with the grid superimposed on it) in the same square of a grid that is much larger or smaller than the original.

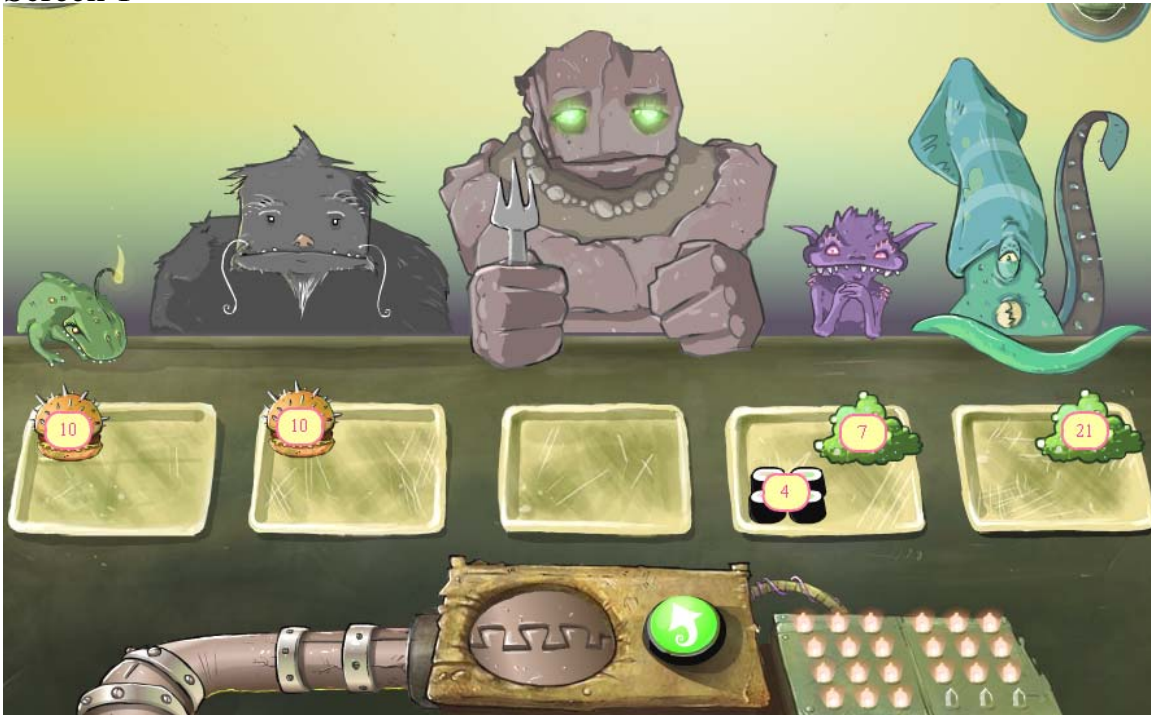
Real World Connection:

- Provide students with the following scenario:

A six-foot tall athlete is casting a shadow that is ten feet. If the building the person is standing next to is casting a shadow that is 210 feet, how tall is the building. Use a drawing to assist your calculations. (*The building is 126 feet tall.*)

Interactive Resource 1

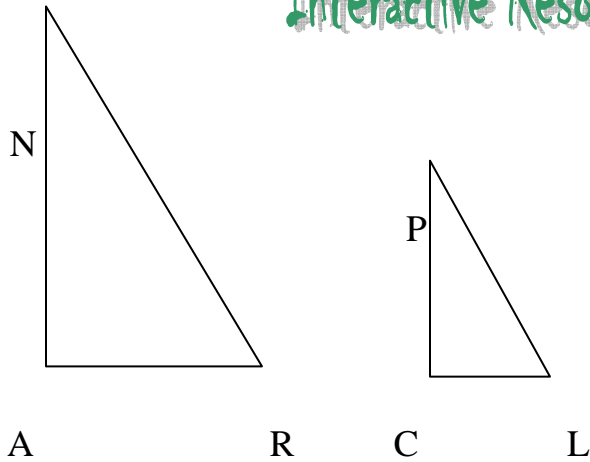
Screen 1



Screen 2



Interactive Resource 2



(triangle ANR is similar to triangle CPL)

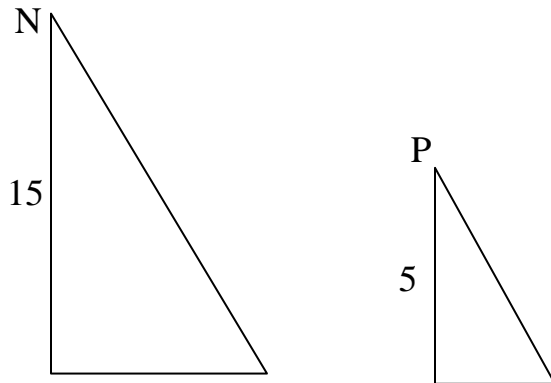
Part I: Complete the proportions using the figures above.

1. $\frac{AN}{AR} = \frac{CP}{\quad}$

2. $\frac{LC}{LP} = \frac{\quad}{RN}$

3. $\frac{\quad}{NA} = \frac{PL}{PC}$

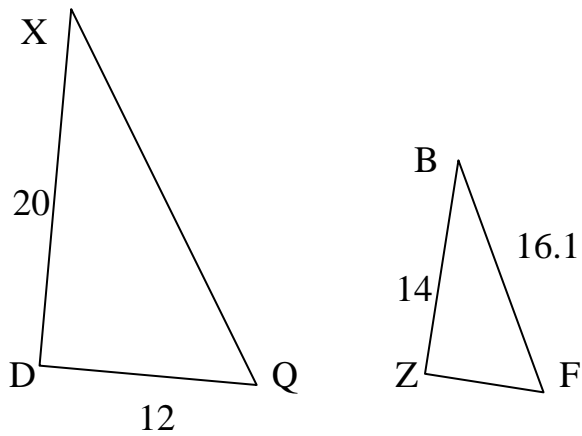
Part II: Rewrite and solve the first proportion from Part I, using the actual side lengths.



A R C L
9

$$\frac{AN}{AR} = \frac{CP}{AR} \rightarrow$$

Interactive Resource 3



(triangle XDQ is similar to triangle BZF)

1. Complete the following proportions:

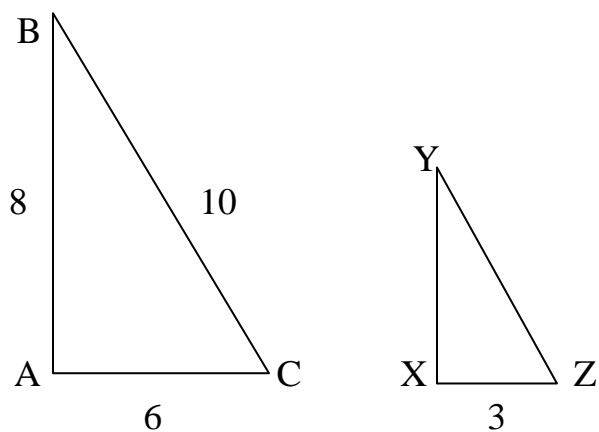
$$\frac{XD}{BZ} = \frac{DQ}{BF} \qquad \frac{XD}{BZ} = \frac{\quad}{BF}$$

2. Rewrite and solve the proportions above using the actual side lengths.

Differentiated Interactive Resource 4

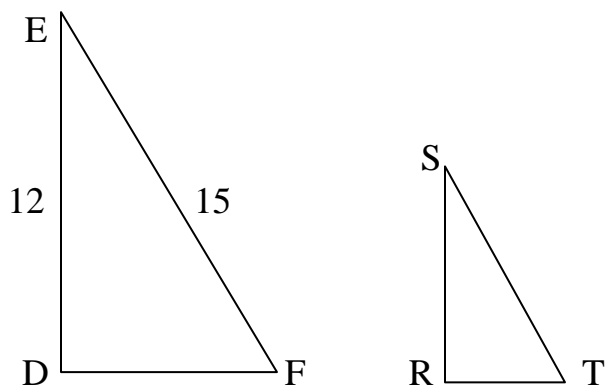
Write and solve proportions to find the missing sides of the triangles below.

1.)



(triangle ABC is similar to triangle XYZ)

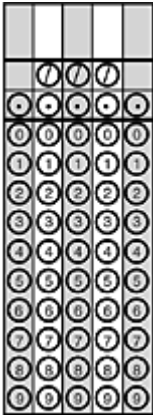
2.)



9 3
(triangle DEF is similar to triangle RST)

Assessment

1. Write an equivalent ratio for $\frac{6}{10}$.



2. Solve the proportions.

$$\frac{2}{7} = \frac{10}{x}$$

$$\frac{5}{8} = \frac{x}{22}$$

3. Mr. Murphy's class has a boy to girl ratio of 4 to 5. $\frac{\text{boy}}{\text{girl}}$ can be written $\frac{4}{5}$. How many girls are in the class if there are a total of 12 boys?