

## Lesson Plan

### The Cafeteria Grade 7 Proportional Reasoning

**CCSCM: Grade 7**

**DOMAIN: Ratios and Proportional Relationships**

**Cluster:** Analyze proportional relationships and use them to solve real-world and mathematical problems.

**Standard: 7.RP.2:** Recognize and represent **proportional relationships** between quantities.

**2a.** Decide whether two quantities are in a **proportional relationship**.

**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*

**Relevant Vocabulary:** proportion, equivalent ratios, ratio

**Note to Teacher** – Students should have attempted Levels 1 and 2 of the Cafeteria puzzle 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.

**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)

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2. Distribute **Interactive Resource 1** and explain that the trays will be referred to as 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>.

- Ask students which tray on screen 1 they could use to write a **ratio** (4<sup>th</sup>) Why? (*Discuss why this is the only tray that can be used to write a ratio.*)
- Have students write the word **ratio** for the 4<sup>th</sup> tray. ( $\frac{sushi}{slop}$ )
- Using screen 2 have the students write the word **ratio** for the 5<sup>th</sup> tray. ( $\frac{slop}{drumstick}$ )
- Have students write the number form of the **ratio** for both word ratios. ( $\frac{4}{7}$ ;  $\frac{21}{30}$ )
- Write **proportions** using 4<sup>th</sup> and 5<sup>th</sup> trays. (*Use words to initiate the setup of the ratio.*)

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

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

- Ask students if any other trays can be used to set up a **proportion**? (3<sup>rd</sup> tray with the 5<sup>th</sup> 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 the following **proportions** using the line segments from the two triangles (triangle ANR is similar to triangle CPL):

$$\frac{AN}{AR} = \frac{CP}{AR} \quad (CL) \qquad \frac{LC}{LP} = \frac{RN}{RN} \quad (RA) \qquad \frac{NA}{NA} = \frac{PL}{PC} \quad (NR)$$

- Have the students continue in pairs to rewrite the first **proportion** using the actual side lengths and then solve.

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$$\left(\frac{15}{9} = \frac{5}{n}, n = 3\right)$$

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, distribute *Differentiated Interactive Resource 4* and work through it with them. ( $\frac{8}{6} = \frac{XY}{3}$ ,  $XY = 4$ ,  $\frac{6}{3} = \frac{10}{YZ}$ ,  $YZ = 5$ )
- As a challenge for students, have them solve the following:  $\frac{x}{.36} = \frac{6}{1.8}$ ,  $\frac{4.2}{1.4} = \frac{7.5}{x}$ ,  
 $\frac{9.6}{1.6} = \frac{x}{5.2}$  (1.2, 2.5, 31.2)

#### Assessment

- Distribute the **Assessment** resource sheet.

Answers:

1. Answers may vary, for example,  $\frac{3}{5}, \frac{9}{15}, \frac{12}{20}, \dots$
2. 35, 13.75
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 teacher stats in the game 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

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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:**

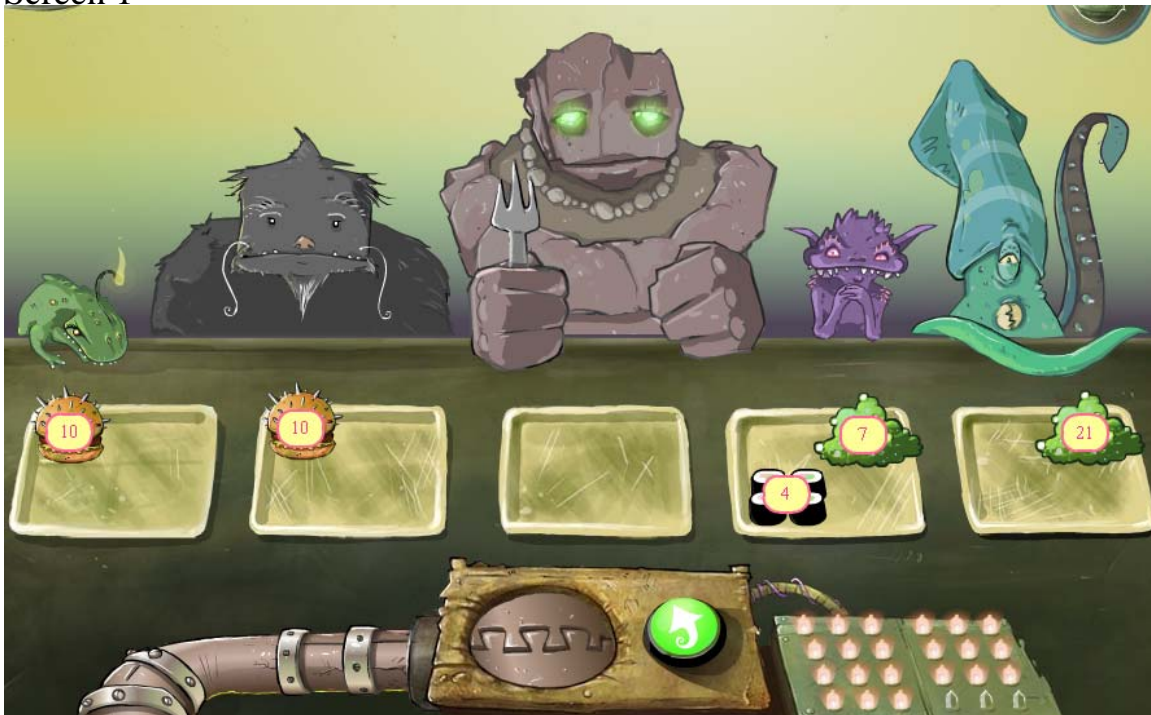
- Provide students with the following scenario:

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.*)

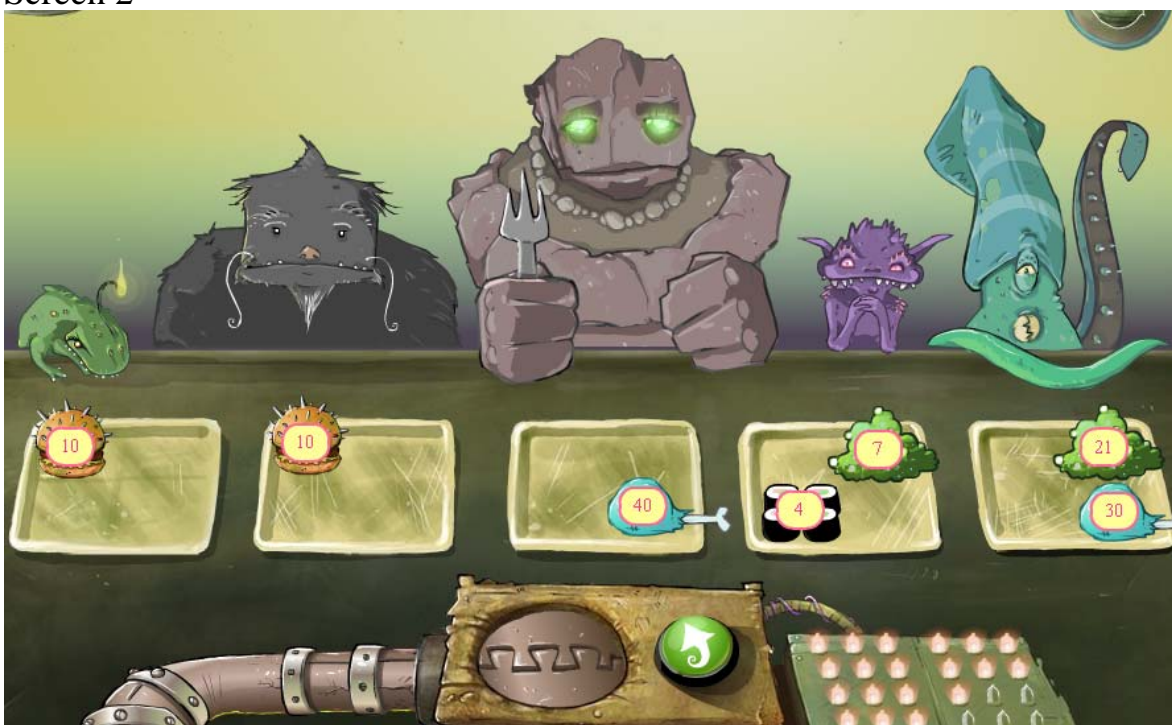
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# Interactive Resource 1

Screen 1

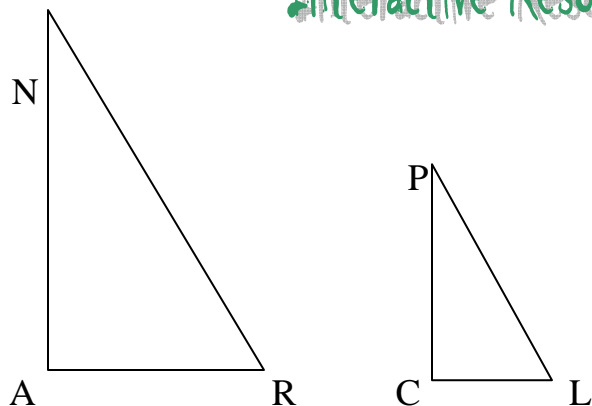


Screen 2



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*Interactive Resource 2*



(triangle ANR is similar to triangle CPL)

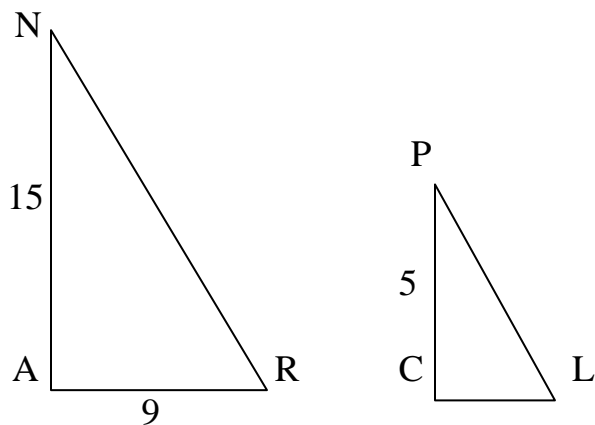
Complete the proportions using the figures above.

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

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

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

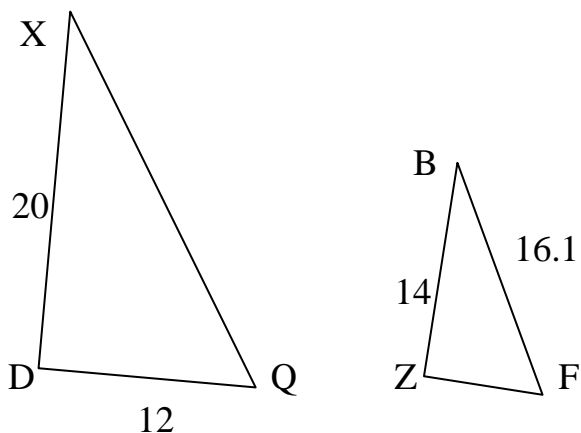
Rewrite and solve the first proportion from part one using the actual side lengths.



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

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Interactive Resource 3



(triangle XDQ is similar to triangle BZF)

1. Complete the following proportions:

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

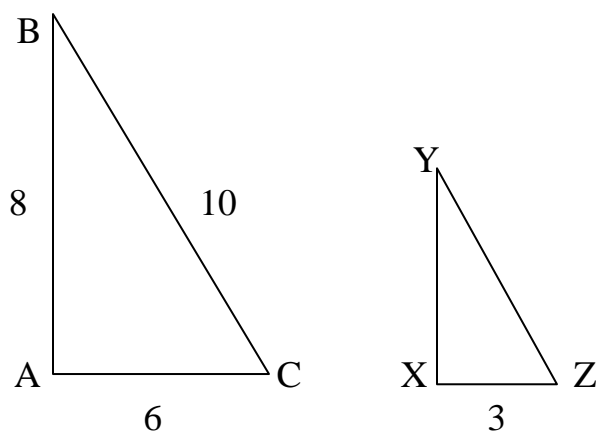
2. Rewrite and solve the proportions above using the actual side lengths.

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*Differentiated Interactive Resource 4*

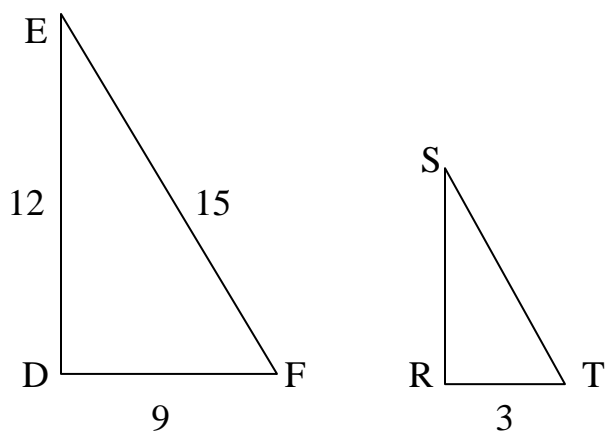
Write and solve proportions to find the missing sides of the triangles below.

1.)



(triangle ABC is similar to triangle XYZ)

2.)



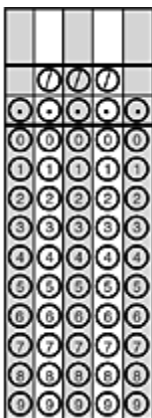
(triangle DEF is similar to triangle RST)



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# 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?