Lesson Plan

The Cafeteria Grade 7 Equivalent Ratios

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: Colored Chips or other manipulatives, ***Ratio Cards, Interactive Resource 1***, ***Interactive Resource 2, Interactive Resource 2 Answer Key, Assessment***

Relevant Vocabulary: equivalent, ratio, greatest common divisor, numerator, denominator, greatest common factor

Note to Teacher – Students should have attempted levels 1 and 2 of the Cafeteria puzzle before this lesson is implemented.

Activities:

1. Use colored chips (or other manipulatives) on the overhead to illustrate an example of patterns. Discuss the relationship among those examples to the food patterns on the trays in the Cafeteria puzzle.

R	G	R	G	__	G
B	Y	__	Y	B	__

2. Place ***Ratio Cards*** randomly on the white/chalkboard. Review the definition of **equivalent ratios**. Model how to match two Ratio Cards to identify equivalent ratios.

   Sample explanation for $\frac{1}{3}=\frac{9}{27}$

   *When simplifying $\frac{9}{27}$, the **greatest common divisor** must be identified, and in this fraction, that greatest common divisor is nine. Nine is the greatest number, other than 1, that can divide into both 9 and 27. When reducing or simplifying the fraction, divide nine into the **numerator**, 9, and **denominator**, 27. Nine divides into 9 one time. Nine divides into 27 three times. This simplifies, or reduces the fraction $\frac{9}{27}$ to $\frac{1}{3}$. So, $\frac{9}{27}=\frac{1}{3}$ is a statement of **equivalent ratios**. The idea of multiplying or dividing by the number one, written as a fraction, can be used to verify that two fractions are equivalent. Multiplying any number by* *one gives the identical number with which you started*. For *example, 1 times 10 is 10, 1 times 4,973 is 4,973, and 1 times any number, n, gives n as the product. And the number one can be written as a fraction with the same* ***numerator*** *and* ***denominator****, such as* $\frac{3}{3}$*, or* $\frac{9}{9}$*, or* $\frac{10{,}000}{10{,}000}$*, or* $\frac{a}{a}$ *, or* $\frac{wxyz}{wxyz}$ *. So we can show that* $\frac{1}{3}$ *and* $\frac{9}{27}$ *are* ***equivalent fractions*** *by multiplying the fraction with the smaller numbers by the* ***greatest common factor*** *of the* ***numerator*** *and* ***denominator*** *of the other fraction. Therefore* $\frac{1}{3} \bullet \frac{9}{9} = \frac{9}{27}$*, so* $\frac{1}{3}$ *and* $\frac{9}{27}$ *are* ***equivalent fractions.***

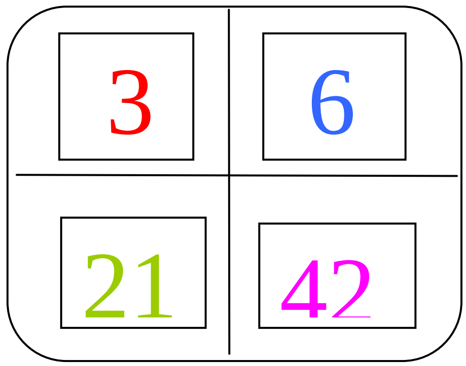
Cross products can also serve as a check to verify that two fractions are equivalent. For example, if $\frac{a}{b} = \frac{c}{d}$*, then a times d equals b times c, which can be written:*

$a \times d = b \times c$. Using numbers, if $\frac{1}{3} = \frac{9}{27}$*, then* $1 \times 27 = 3 \times 9$*.*

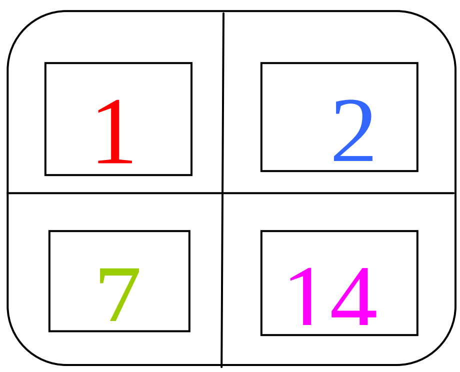
3. Place the equal sign, from the ***Ratio Cards***, between the ratios. Ask students to explain why the two **ratios** are **equivalent**. Ask students to demonstrate how to check their work using multiplication by one or cross products.
4. Call on five students at a time to come up to the board and match the **equivalent ratios**.
5. After each **equivalent ratio** is created, have the class check the work and discuss why the **ratios** are **equivalent**, using the ideas of **greatest common divisors**, multiplying by one, and cross products. ($\frac{2}{3} \bullet \left(\frac{7}{7}\right) = \frac{14}{21}$, $\frac{5}{8} \bullet \left(\frac{3}{3}\right) = \frac{15}{24}$, $\frac{1}{4} \bullet \left(\frac{3}{3}\right) = \frac{3}{12}$, $\frac{2}{5} \bullet \left(\frac{10}{10}\right) = \frac{20}{50}$, $\frac{8}{7} \bullet \left(\frac{2}{2}\right) = \frac{16}{14}$, $\frac{12}{15} \bullet \left(\frac{2}{2}\right) = \frac{24}{30}$, $\frac{3}{8} \bullet \left(\frac{10}{10}\right) = \frac{30}{80}$, $\frac{3}{4} \bullet \left(\frac{3}{3}\right) = \frac{9}{12}$, $\frac{1}{2} \bullet \left(\frac{25}{25}\right) = \frac{25}{50}$, $\frac{6}{1} \bullet \left(\frac{3}{3}\right) = \frac{18}{3}$)
6. Pair students and distribute ***Interactive Resource 1.*** Have students identify and write the **equivalent ratios** in simplified form across the trays. Ask them to predict what number on the middle tray will complete the puzzle. (*70*). Have student pairs share their answers.
7. Distribute ***Interactive Resource 2***, and have students work with the given ratios to find the numbers that will solve the puzzle. *(See Interactive Resource 2 Answer Key for answers.)*

Differentiation Suggestions:

- Group students who are having trouble grasping **equivalent ratios.** Draw a box with four sections to resemble the cafeteria trays. In each section, write a number in a different color. Pull 2 numbers to form a ratio and ask students to simplify the ratio. Have students then choose 2 numbers to form a ratio and simplify it. Review answers.



- Draw another box with equal ratios with colors corresponding to the first box. Instruct the students to create ratios and simplify those ratios. Lead students to discover that the ratios are equivalent from one tray to another**.**



Assessment:

- Distribute the **Assessment** resource sheet.

Answers:

1. $\frac{6}{10} = \frac{3}{5}$

2. $\frac{24}{36} = \frac{2}{3}$

3. Responses will vary. John needs $\frac{6}{8}$ *cups of sugar to equal* $\frac{3}{4}$

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.

- Remove the face cards from standard decks of playing cards, or make cards with numbers of your choice. With students playing in pairs, shuffle and deal the cards between the two students, each of whom will stack their cards face-down. Each student will turn over their top card, and will take turns forming a fraction with the smaller number card as the numerator, and the larger as the denominator. The student whose turn it is has an agreed upon amount of time (a sand timer is helpful) to either simplify the fraction or declare that is already in simplest form. If the player whose turn it is cannot answer within the allotted time, or if the answer is not in simplest form, the other player gets a chance to answer. The player who wins each round collects the cards, and the winner is the one holding the most cards at the end of play.

Real World Connection:

- Provide students with this scenario:

  You have a chance to reach into two jars of quarters and to keep as many as you can get in one handful. You reach with your right hand in the first jar and get 19 out of the 57 coins in that jar. Then, with your left hand, you reach into another jar that has 51 quarters, and you are able to hold 17. Which hand got a greater fractional part, or ratio, of the coins it could have gotten? (*They both got the same ratio, because* $\frac{19}{57} = \frac{1}{3}$ *and* $\frac{17}{51} = \frac{1}{3}$ *)*

Ratio Cards

$\dfrac{2}{3}$	$\dfrac{14}{21}$

$\frac{5}{8}$	$\frac{15}{24}$
$\frac{1}{4}$	$\frac{3}{12}$

$\frac{20}{50}$	$\frac{2}{5}$
$\frac{8}{7}$	$\frac{16}{14}$

$\frac{12}{15}$	$\frac{24}{30}$
$\frac{3}{8}$	$\frac{30}{80}$

$\frac{9}{12}$	$\frac{3}{4}$
$\frac{1}{2}$	$\frac{25}{50}$

$\dfrac{18}{3}$	$\dfrac{6}{1}$

Interactive Resource 1

Interactive Resource 2

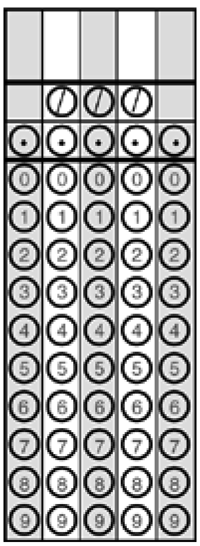
Interactive Resource 2
Answer Key

Assessment

1. Circle a ratio equivalent to $\frac{3}{5}$.

A. $\frac{5}{3}$ **B.** $\frac{11}{13}$ **C.** $\frac{6}{10}$ **D.** $\frac{9}{12}$

2. What is the lowest ratio equivalent to $\frac{24}{36}$?



3. Jenn and John are baking cupcakes for their math class. They are each making an equal batch to split the work. They each need $\frac{3}{4}$ cups of sugar. However, John's measuring cup is divided into sections that are each $\frac{1}{8}$ cup. How many $\frac{1}{8}$ cups of sugar does he need to measure in his cup to equal $\frac{3}{4}$ of a cup? Use numbers, symbols, and/or words to explain your answer.

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