

Cafeteria Grade 7 Proportional Reasoning Clarification

CCSSM: 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 of Math Discussion Terms

RATIO is a comparison of two numbers or quantities written as, for example 7 to 9, 7:9, or $\frac{7}{9}$. A **PROPORTION** is an equation indicating that two ratios are **EQUIVALENT**, or equal.

The word **EQUAL** is used when numbers are used to show amounts of the same magnitude, such as $4 = 3 + 1$ and the word **EQUIVALENT** indicates generic amounts of the same magnitude without specific numbers, such as $a=b$.

In a true proportion, $\frac{a}{b} = \frac{c}{d}$, the product of a & d (called the extremes) is equal to the product of b & c (called the means). In other words, the cross products are equal:
 $a \times d = b \times c$.

To solve a proportion with a missing element, for example, $\frac{3}{8} = \frac{x}{96}$, multiply the extremes (3×96) and the means ($8 \times x$) and set them equal to each other in an equation:
 $8 \times x = 3 \times 96$

Simplify the equation:

$$8x = 288$$

Solve the equation by dividing both sides of the equation by 8:

$$\frac{8x}{8} = \frac{288}{8}$$

Simplify to get $x = 36$.

Classroom Example 1

$$\frac{6}{9} = \frac{x}{12}$$

Multiply the extremes, 6×12 and multiply the means, $9 \times x$; then set them equal to each other in an equation: $9x = 6 \times 12$.

Simplify the equation: $9x = 72$

Solve the equation by dividing both sides by 9: $\frac{9x}{9} = \frac{72}{9}$ Therefore, $x = 8$.

Some students might prefer to find the missing number by using the idea of equivalent fractions:

Classroom Example 2

$$\frac{3}{n} = \frac{21}{35}$$

Since 3 times 7 equals 21, then the question is what number, n , times 7 is 35? The answer is that 5 times 7 equals 35, so $n = 5$. Solving this problem using cross products, as in Example 1 above, would yield the same answer. (Set 3 times 35 equal to 21 times n : $3 \times 35 = 21 \times n$ and solve the equation for n . Note that the Example 2, using equivalent fractions is a convenient method when one of the numerators (or denominators) is a multiple of the other, such as 3 and 21.

The Math in the Puzzle

In the Cafeteria puzzle, players must place foods with the correct amounts on the appropriate trays by observing ratios among the foods that are already on the trays. Proportions must be maintained between the food values on each tray and between trays.



In the screen shot above, a player could use the first monster's tray on the left to write a ratio relating the burger to the drumstick: $\frac{\text{burger}}{\text{drumstick}} = \frac{15}{20}$, or $\frac{3}{4}$. This means that the

$\frac{15}{20}$ or $\frac{3}{4}$ ratio of burger to drumstick must be maintained for all of the trays. Likewise, the ratio of drumstick on the first tray to drumstick on the last tray is $\frac{20}{40}$, or $\frac{1}{2}$ so all items on the last tray must be twice the corresponding item on the first tray.