

# RATIOS

## A DEFINITION

### Definition Ratio

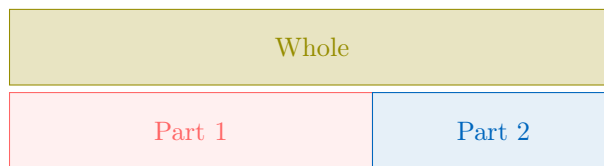
A **ratio** is a comparison of two quantities. The ratio 3 to 2 can be expressed as  $3 : 2$  or  $\frac{3}{2}$ .

## B PART-PART AND PART-WHOLE RATIOS

### Definition Part-part Ratio

A **part-part ratio** compares two distinct parts of a whole.

Part 1 : Part 2



**Ex:** For one bowl of fruit juice, there are 3 cherries and 2 apples.

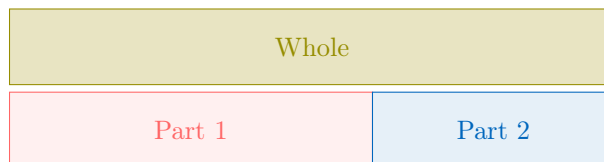


The ratio of cherries to apples is  $3 : 2$ .

### Definition Part-whole Ratio

A **Part-whole ratio** compares one part of a whole to the whole.

Part 1 : Whole or Part 2 : Whole



**Ex:** If a juice is made with 1 lemon and 2 oranges, find the ratio of oranges to the total number of fruits.



*Solution:*

- The total number of fruits is  $1 + 2 = 3$ .
- The ratio of oranges to the total number of fruits is  $\frac{2}{3}$ .

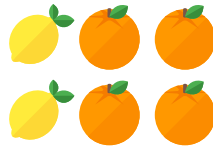
## C EQUAL RATIOS

### Discover: Making Juice

- Let's make some fresh juice! For one glass of juice, we need 1 lemon and 2 oranges. The ratio of lemons to oranges is  $1 : 2$ .



- Now, if we want to make two glasses of juice, we need to double the ingredients.



- The ratio remains the same. The ratios are equal:  $1 : 2 = 2 : 4$ .

### Definition Equal Ratios

Two ratios are **equal** if one can be expressed as a multiple of the other.

### Method Using Fractions

To show that two ratios are equal, we can compare their related fractions. If the fractions are equal, then the ratios are equal.

**Ex:**

$$\text{As } \frac{1}{2} = \frac{2}{4}, 1 : 2 = 2 : 4$$

## D PROPORTION

**Discover:** Imagine you're making a fruit juice mix. The recipe calls for 3 cups of orange juice and 2 cups of apple juice. This ratio of 3 : 2 ensures the juice has the right flavor balance. But what if you want to make a larger batch? If you double the amount of orange juice to 6 cups, you need to double the amount of apple juice to 4 cups to keep the same taste. The ratio 3 : 2 is the same as 6 : 4, meaning the two mixtures will taste the same. This equality of ratios is called a proportion.

### Definition Proportion

A **proportion** states that two ratios are equal.

**Ex:** To make 1 chocolate cake, 4 eggs are needed. How many eggs are needed to make 2 cakes?

*Solution:* For 1 cake, it takes 4 eggs. Therefore, to maintain this proportion for 2 cakes, multiply both the number of cakes and the number of eggs by 2:

$$\frac{4}{1} = \frac{8}{2}$$

Thus, to make 2 chocolate cakes, you need 8 eggs.

## E UNITARY METHOD

**Discover:** The unitary method is an approach used to solve problems involving proportions. The essence of this method is to determine the value of one unit of a quantity and then use that value to find the unknown quantity.

### Method Unitary Method

5 apples cost \$10. To calculate the cost of 8 apples, follow these steps:

- **To the unit:** Find the cost of 1 apple by dividing the total cost by the initial number of apples 5:

$$\frac{10}{5} = \frac{2}{1}$$

So, 1 apple costs 2 dollars.

- **From the unit:** Find the cost of 8 apples by multiplying the unit ratio by the final number of apples 8:

$$\frac{2}{1} = \frac{16}{8}$$

$\xrightarrow{\times 8}$  (top arrow from 1 to 8)  
 $\xrightarrow{\times 8}$  (bottom arrow from 1 to 8)

So, 8 apples cost 16 dollars.

- $\frac{10}{5} = \frac{2}{1} = \frac{16}{8}$

$\xrightarrow{\div 5}$  (top arrow from 10 to 2)  
 $\xrightarrow{\div 5}$  (bottom arrow from 5 to 1)  
 $\xrightarrow{\times 8}$  (top arrow from 1 to 8)  
 $\xrightarrow{\times 8}$  (bottom arrow from 1 to 8)

## F CROSS-MULTIPLICATION METHOD

**Discover:** Cross-multiplication is a method used to solve problems involving proportions. This method involves cross-multiplying across the quantities of a proportion to find the unknown quantity.

### Method Cross-Multiplication Method

5 apples cost \$10. To calculate the cost of 8 apples, follow these steps:

- **Set up the proportion:** Write the proportion where the cost of 5 apples is to 10 dollars as the cost of 8 apples is to  $x$  dollars:

$$\frac{10}{5} = \frac{x}{8}$$

- **Solve for  $x$ :**

$$\frac{10}{5} = \frac{x}{8}$$

$\swarrow \searrow$  (cross-multiplication arrows)

$$5 \times x = 10 \times 8 \text{ (cross multiplication)}$$

$$x = \frac{10 \times 8}{5} \text{ (dividing both sides by 5)}$$

$$x = 16$$

- So, 8 apples would cost 16 dollars.