

Ratios and Proportions

Chapter-XII

Introduction

- We normally compare two quantities by taking the difference between them.
- But most often this does not work out well.
- For such cases we use what is called a **ratio**.

What is a Ratio ?

- A ratio is a **comparison** between similar quantities using **division**.
- Note that for using ratio, the quantities **need to be similar**.
- We represent a ratio of two quantities say '**a**' and '**b**' by **$a : b = a / b$** .

Example

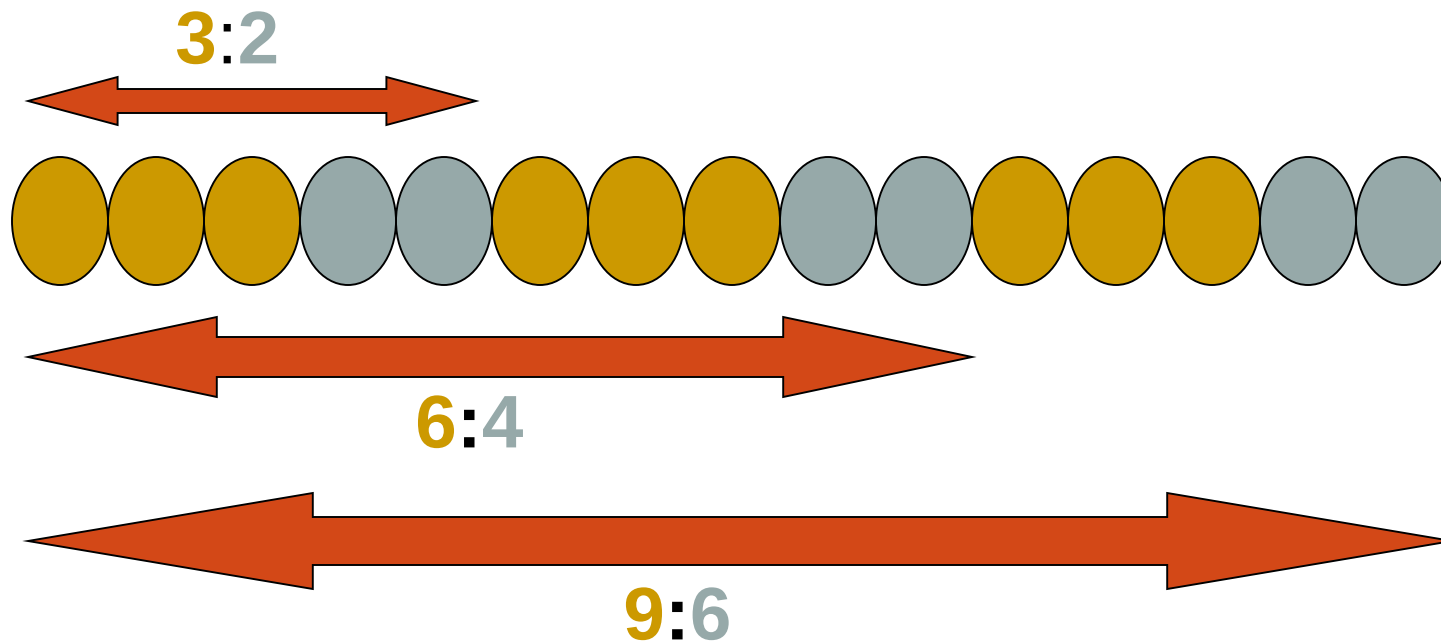
- For example, if Ramesh scores 80 marks in an exam and Suresh scores 60 marks, then the ratio of their marks is $80:60=80/60=4/3=4:3$.
- Thus we see that two different ratios can be equal, for example in the above $80:60=4:3$. Hence they can be taken as a sort of equal measures .
- In a ratio, the ordering is important. Thus $3:4$ is different from $4:3$. Compare these to division. Is $\frac{3}{4} = \frac{4}{3}$? No. And hence the same in case of ratios.

Proportions

- We can also compare two ratios. We do so by using **proportions**.
- If two **ratios** are the **same** then we say that they are in **proportion**.
- We denote a proportion by $::$. Thus if ' $\mathbf{a : b = c : d}$ ', then ' $\mathbf{a : b :: c : d}$ '.
- As in a ratio, so also in a proportion the **ordering** of the numbers is important.

Proportions

- For example, see the following example :



- We can say that **$3:2 :: 6:4 :: 9:6$** .

Proportions

- We can notice that, the ratios we used are in fact equal because, they occur as outputs, when we multiply the both numbers in the ratio by same integer.
- For Instance, **$3:2 = 6:4$** because, **$3:2 = (3 \times 2) : (2 \times 2) = 6:4$** .
- **$3:2 = 9:6$** because , we get **$9:6$** , by multiplying each number by '3'. (i.e. **$(3 \times 3) : (2 \times 3) = 9:6$**)

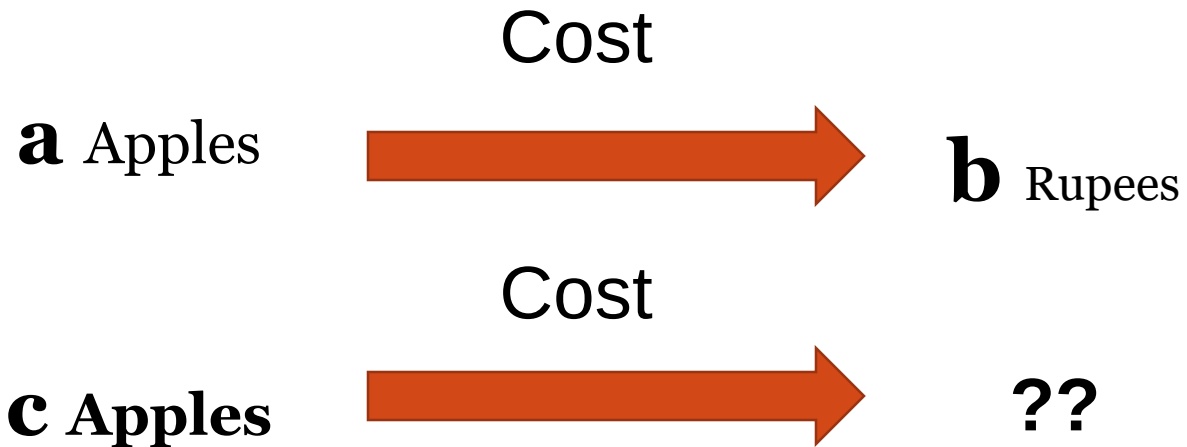
Unitary Method

- The method in which we find the **value** of a given **unit** and then use it to determine the **value** of a **certain number** of **units** is called **unitary method**.
- For example, if 16 bottles of water costs Rs. 160, then we must use the unitary method to determine the cost of 21 bottles of water.
- In this case we first find the cost of one bottle of water, which will be $\text{Rs. } 160/16 = \text{Rs. } 10$.
- Then we use this value to determine the cost of 21 bottles of water, which is $\text{Rs. } 10 \times 21 = \text{Rs. } 210$.

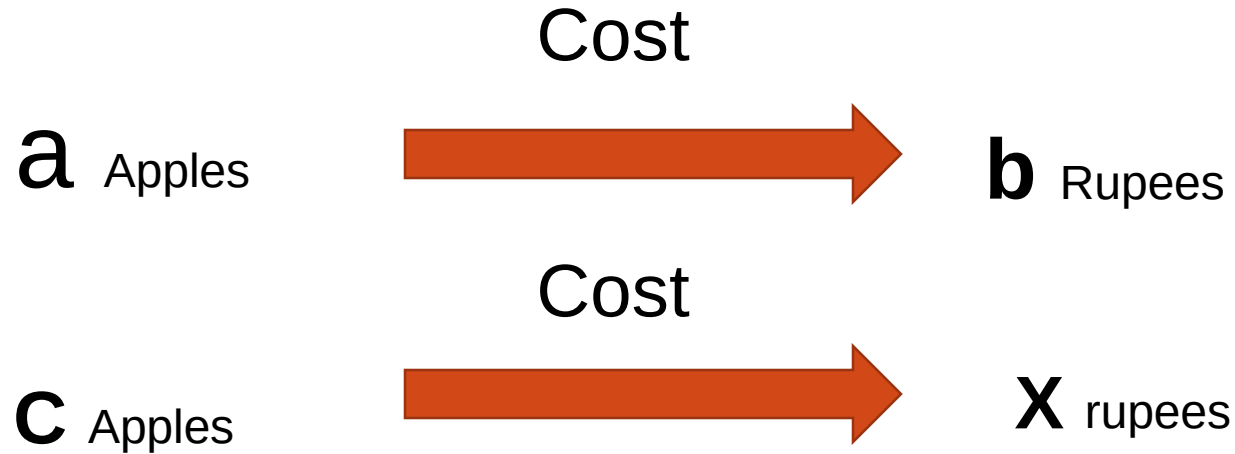
Unitary Method (Generalized method)

- The main technique in unitary method is to write the known things and the things to be found, one below the another . For example, If '**a**' number of apples cost '**b**' rupees , what is the cost of '**c**' number of apples ?
- Recall (From Chapter XI : Algebra) that '**a**', '**b**' and '**c**' used here are variables, and we use them here because we don't know the values of each of the entity used.

Unitary Method

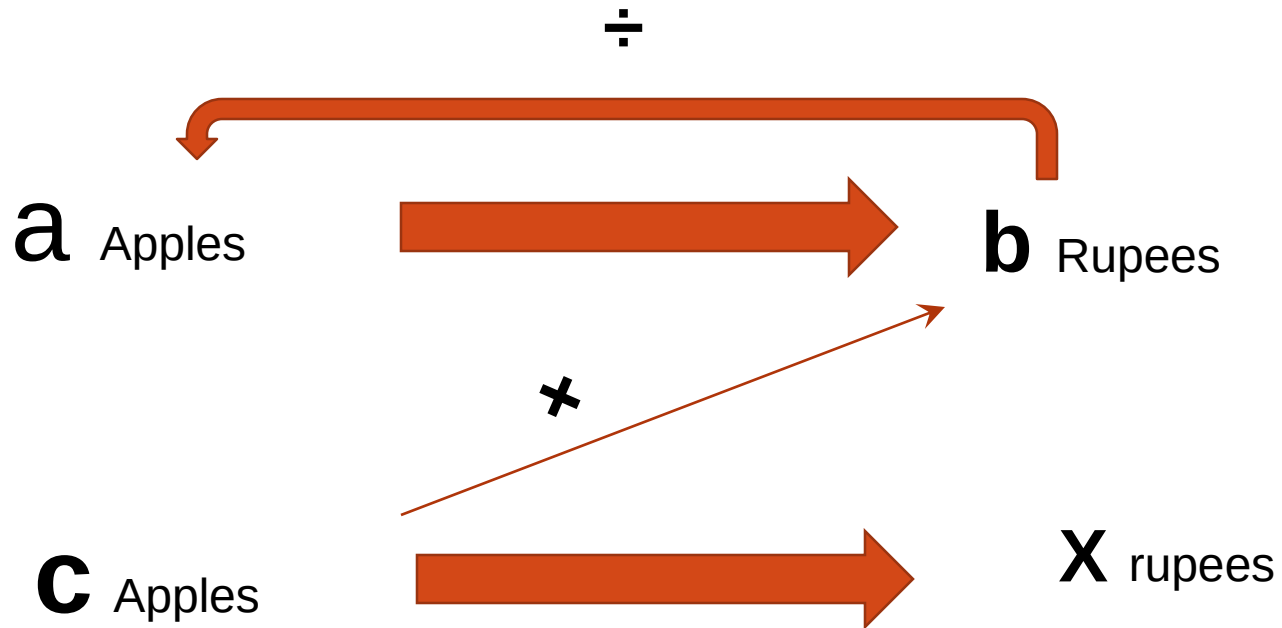


Unitary Method



- Let us assume they cost **X** Rupees .

Unitary Method

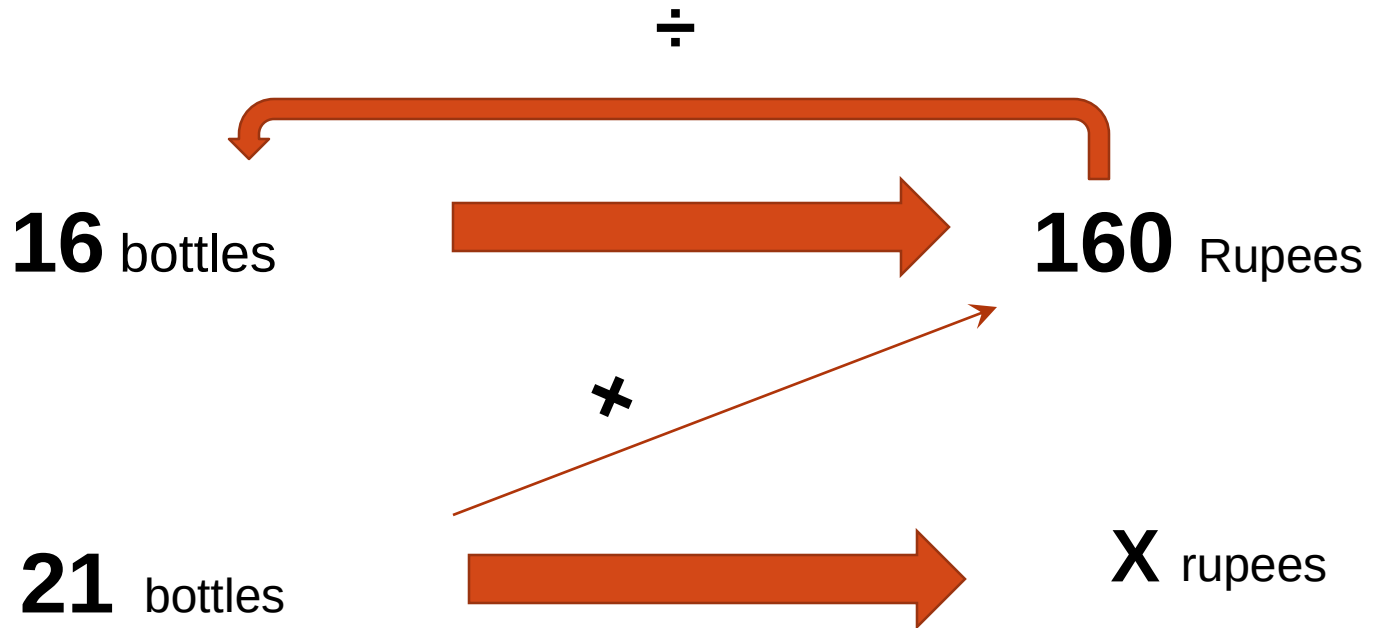


$$X = (c \times b) \div a$$

Unitary method (Question)

- For example, if 16 bottles of water costs Rs. 160, then we must use the **unitary method** to determine the cost of 21 bottles of water .

Unitary Method



$$X = (21 \times 160) \div 16 = 210 \text{ Rs}$$