

## Uses of Ratio and Proportion in Quantitative Aptitude



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**Dear Gradians,**

Today we will discuss the **Ratio and Proportion** (one of the crucial topic of **Quantitative Aptitude** Section) useful for **Banking Exams** like **SBI PO**, **IBPS** etc. making calculation easier in **Mixture and Allegation**; **Simple Interest and Compound Interest**; **Profit, Loss and Discount**; **Problems on Ages**; **Partnerships**; **Percentages**; **Time and Work**; **Data Interpretation** etc. topics. You must learn this topic very precisely. **Meritshine** has already conducted two **Video Sessions** for the same topic. You can see these video from the link given below.

We will understand this topic with the help of examples which are discussed in Video Session.

**Example 1:** If  $A : B = 2 : 5$  and  $B : C = 7 : 3$  then find  $A : B : C$

**Solution:**

$$A : B = 2 : 5$$

$$B : C = 7 : 3$$

In this, value of B has to be same so to equate the value of B, we can take LCM of both the values of B i.e.  $(5 \times 7) = 35$

So multiply  $(A : B)$  by 7 and  $(B : C)$  by 5

$$\text{Hence, } A : B : C = 14 : 35 : 15$$

**Example 2:** If ratio of  $A : B : C$  is given in reciprocals, then convert it.

**Solution:** Suppose, if  $A : B : C = (1/2) : (1/3) : (1/5)$

take any number which is multiple of the product  $(2 \times 3 \times 5) = 30$

Now multiply it in the numerator part

$$A : B : C = (30/2) : (30/3) : (30/5) = 15 : 10 : 6$$

**Example 3:** The sum of the ages of Akhil and Binay is 48 years. Akhil is 4 years older than Chetan. The ratio of the ages of Binay and Chetan is 4 : 7. What was the age of Akhil 5 years back?

**Solution:**

Given Age of Akhil + Binay = 48 and Akhil is 4 yrs older than Chetan

$$\text{So, Binay} + \text{Chetan} = 44$$

$$\text{and Binay} : \text{Chetan} = 4 : 7$$

$$\text{Comparing } B + C = 11$$

$$\text{So, } 11 = 44$$

$$1 = 4$$

$$\text{Binay} = 4 \times 4 = 16 \text{ yrs}$$

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Chetan =  $7 \times 4 = 28$  yrs

Akhil = 32 yrs

Age of Akhil 5yrs back =  $32 - 5 = 27$  yrs

**Example 4:** The ratio of the ages of A and B is 6 : 5. The difference between the ages of C and A is more than 3 years. The age of D is a prime number between the ages of A and B. The ratio of the ages of B and C is 2 : 3. If the ages of all four are integers, what is the difference between the ages of C and D?

**Solution:** Given ratio of A : B = 6 : 5 and B : C = 2 : 3

So, A : B : C = 12 : 10 : 15

Now let's use conditions given i.e.

(i) All ages of A, B, C and D should be integers.

(ii) difference of age between A and C should be more than 3 yrs but from the above ratio difference is only 3 yrs.

So, we have to take A : B : C = 24 : 20 : 30

(iii) age of D lies between A and B and it should be prime number

Numbers between 24 and 20 are = 23, 22, 21 and 23 is the prime number. So, the age of D is 23

Difference of C and D =  $30 - 23 = 7$  yrs

**Example 5:** Ten years ago, the ages of Adam and Parker were in the ratio 6 : 7. After six years, Adam's age would be 9.09% less than Parker's age. What would be age of Parker after 9 years?

**Solution:** In percentage topic we have learnt that  $9.09\% = \frac{1}{11}$ , if age of Parker after 6 yrs is X then age of Adam will be  $X - (\frac{1}{11})X = (\frac{10}{11})X$  hence ratio of Adam and Parker =  $(\frac{10}{11})X : X = 10 : 11$

adam : parker

10yrs ago      6 : 7

after 6yrs      10 : 11

Difference between both these are 16 yrs

So,  $4 = 16$

$1 = 4$

hence, age of parker after 6 yrs =  $11 \times 4 = 44$

age of parker after 9 yrs =  $44 + 3 = 47$  yrs

**Example 6:** Five years ago, the ages of a father and son were in the ratio 7 : 2. After three years, their ages would be in the ratio 5 : 2. What was father's age 7 years back?

**Solution:** Father : Son

5yrs ago      7 : 2

3yrs after    5 : 2

The difference between age of father at 5yrs ago and 3 yrs after should be equal to the difference between age of son at 5yrs ago and 3 yrs. To achieve this condition, we manipulate the ratio.

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Father : Son

5yrs ago 21 : 6

3yrs after 25 : 10

now, we can see that  $25 - 21 = 4$  and  $10 - 6 = 4$

difference between 3yrs after and 5 yrs ago = 8yrs

So,  $4 = 8$  yrs

$1 = 2$  yrs

hence age of father's 5 yrs ago is 42 yrs and 7yrs ago = 40 yrs.

**Example 7:** A stick is broken up into two parts. The ratio of the lengths of the bigger part and the smaller part is equal to the ratio of the lengths of the full stick and the bigger part. What is this ratio?

**Solution:** Let the length of bigger part of the rod is 1 m and the length of smaller part of the rod is x m, then total length of the rod is  $(1+x)$  m

Given, ratio of bigger to smaller is equal to ratio of the length of full stick to bigger part

So,  $1/x = (1+x) / 1$

$$x^2 + x = 1$$

$$x^2 + x - 1 = 0$$

using quadratics  $x = (-1 \pm \sqrt{5})/2$

but  $x = (-1 + \sqrt{5})/2$  is the answer, because another will give the negative answer.

**Example 8:** The contents of two vessels containing wine and water in the ratio 2 : 3 and 5 : 6 are mixed in the ratio 10 : 7. What would be the ratio of wine and water in the final mixture?

**Solution:**

|  | Wine |  | Water |
|--|------|--|-------|
|--|------|--|-------|

|          |   |   |   |
|----------|---|---|---|
| vessel 1 | 2 | : | 3 |
|----------|---|---|---|

|          |   |   |   |
|----------|---|---|---|
| vessel 2 | 5 | : | 6 |
|----------|---|---|---|

to make the total quantity same in both vessel we have to multiply ratio of vessel 1 by  $(5+6= 11)$  and vessel 2 by  $(2+3 = 5)$

Now, Vessel 1 22 : 33

Vessel 2 25 : 30

But, vessel 1 and vessel 2 are mixed in the ratio of 10 : 7.

So, wine =  $22 \times 10 + 25 \times 7 = 395$

water =  $33 \times 10 + 30 \times 7 = 540$

It is given that two vessels containing wine and water in the ratio 2 : 3 and 5 : 6 but both vessels have same quantity of total mixture.

So, ratio of wine and water in final mixture =  $395 : 540 = 79 : 108$

How to express data in a smarter way.

Wine : water

vessel 1  $(2 : 3) \times 11 \times 10$

vessel2  $(5 : 6) \times 5 \times 7$

vessel 1  $(2 : 3) \times 110 = (2 : 3) \times 22 = 44 : 66$

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$$\text{vessel2} \quad (5 : 6) \times 35 = (5 : 6) \times 7 = 35 : 42$$

Hence, ratio will be  $(44+35) : (66+42) = 79 : 108$

**Example 9:** A mixture contains wine and water in the ratio 3 : 2 and another contains them in the ratio 4 : 5. How many litres of the former must be mixed with 15 litres of the latter so that the resultant mixture contains equal quantities of wine and water?

**Solution:** In this, after mixing of both different mixture, quantity of wine and water becomes equal.

Let X litre of mixture 1 is mixed with 15 litres of mixture 2, then

$$(3/5)X + (4/9)15 = (2/5)X + (5/9)15$$

$$X/5 = 15/9$$

$$X = 75/9 = 25/3$$

How to do it by using ratio concept and above discussed methodology?

Ultimately we have to equal the ratio of wine and water in the final mixture.

Wine : Water

Mix 1      3      :      2

Mix 2      4      :      5

We have to make the sum of quantity of wine in mix 1 and mix 2 equal to sum of quantity of water in mix 1 and mix2.

But in the above question it is already given so, we will mix it in the same quantity.

If we mix 5 litres of mixture1 and 9 litres of mixture2, then the ratio of quantity will be same.

So, if it is 15 litres of mixture2, then mixture1 =  $(15 \times 5)/9 = 25/3$  litres.

**Example 10:** A mixture contains wine and water in the ratio 3 : 2 and another contains them in the ratio 7 : 3. In what ratio should the two be mixed to get a resultant mixture with wine and water in the ratio 17 : 8?

**Solution:** Let these are mixed in ratio of 1:X, we will not assume a : b because there will be two variables and will make the calculation harder.

Now,      wine : water

mixture1      3 : 2

mixture2      7 : 3

First we will solve it as done in 8.

$$\text{So, } (3:2) \times (10) \times 1 = (3:2) \times 2$$

$$(7:3) \times (5) \times X = (7:3) \times X$$

ratio of wine and water in final mixture is  $(3 \times 5 + 7X) : (2 \times 5 + 3X)$

$$(6 + 7X) / (4 + 3X) = 17/8$$

solving it,  $X = 4$

So, it will be mixed in the ratio of 1:4

**Wrong Approach**

Some of you will mark answer (1:2), why?

$$3 : 2 \times 1 = 3 : 2$$

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$$7 : 3 \times 2 = 14 : 6$$

So,  $(3+14) : (2+6) = 17 : 8$

**Allegation Approach:** we will discuss it in detail in the next article.

In this approach, allegation will be applied only on one object throughout the solution.

So, let's apply it on wine

In mixture1, % of wine is 60% in solution

In mixture2, % of wine is 70% in solution

In final mixture, % of wine is 68%

So, 60-----68-----70

60    8    68    2    70, you can see difference of 68 and 60 is 8 and 70 and 68 is 2.

For calculating the ratio of mixing, answer will be the reciprocal of ratio of these differences.

ratio in which it is mixed =  $2 : 8 = 1 : 4$

You can watch video session on Ratio and Proportion conducted by Meritshine.

### Ratio and Proportion Part-1

### Ratio and Proportion Part-2

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