

RATIO & PROPORTION

Complete SSC CGL Master Notes

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1. RATIO - BASIC CONCEPTS

Definition & Notation

Ratio is the comparison of two quantities of the same kind by division.
Ratio $a:b$ means "a to b" and can be written as a/b .

Properties of Ratio:

1. $a:b = a/b$
2. $a:b \neq b:a$ (unless $a = b$)
3. Ratio has no units
4. Both terms should be in same units
5. Ratio can be simplified like fractions

Types of Ratios

Type	Description	Example
Simple Ratio	Comparison of two quantities	3:4, 5:7
Compound Ratio	Product of corresponding terms	(3:4) and (5:6) → 15:24
Duplicate Ratio	Square of the ratio	Duplicate of 3:4 = 9:16
Triplicate Ratio	Cube of the ratio	Triplicate of 3:4 = 27:64
Sub-duplicate	Square root of ratio	Sub-duplicate of 9:16 = 3:4

2. PROPORTION - FUNDAMENTALS

Definition & Types

Proportion is the equality of two ratios.
If $a:b = c:d$, then a, b, c, d are in proportion.

Proportion Notation:

$a:b = c:d$ or $a:b :: c:d$

Here, a and d are **extremes**

b and c are **means**

Product of extremes = Product of means

Continued Proportion

Continued Proportion:

Three numbers a, b, c are in continued proportion if:

$a:b = b:c$ or $b^2 = ac$

Here, b is called the **mean proportional**

c is called the **third proportional**

Example: Find mean proportional between 4 and 9

Solution:

- Let mean proportional be x
- Then $4:x = x:9$
- $x^2 = 4 \times 9 = 36$
- $x = \sqrt{36} = 6$

3. PROPORTION THEOREMS

Important Theorems

If $a:b = c:d$, then:

1. **Invertendo:** $b:a = d:c$
2. **Alternendo:** $a:c = b:d$
3. **Componendo:** $(a+b)/b = (c+d)/d$
4. **Dividendo:** $(a-b)/b = (c-d)/d$
5. **Componendo-Dividendo:** $(a+b)/(a-b) = (c+d)/(c-d)$

Theorem Applications

Example: If $a:b = 3:4$, find $(5a+3b):(2a+b)$

Solution:

- Let $a = 3k$, $b = 4k$
- $5a+3b = 5(3k) + 3(4k) = 15k + 12k = 27k$
- $2a+b = 2(3k) + 4k = 6k + 4k = 10k$
- Ratio = $27k:10k = \mathbf{27:10}$

4. PARTNERSHIP PROBLEMS

Profit Sharing Ratio

Partnership Formula:

Profit Sharing Ratio = (Investment × Time)

For two partners A and B:

A's share : B's share = (A's investment × A's time) :
(B's investment × B's time)

Partnership Examples

Example: A invests ₹5000 for 6 months, B invests ₹3000 for 8 months. Find profit ratio.

Solution:

- A's share = $5000 \times 6 = 30000$
- B's share = $3000 \times 8 = 24000$
- Ratio = $30000:24000 = 5:4$

Example: Three partners invest ₹4000, ₹6000, ₹8000 for 1 year. Total profit ₹36000.

Solution:

- Ratio = $4000:6000:8000 = 4:6:8 = 2:3:4$
- Total parts = $2+3+4 = 9$
- A's share = $(2/9) \times 36000 = ₹8000$
- B's share = $(3/9) \times 36000 = ₹12000$
- C's share = $(4/9) \times 36000 = ₹16000$

5. MIXTURE PROBLEMS

Alligation Rule

Alligation Rule:

Quantity of Cheaper / Quantity of Dearer = (Price of Dearer - Mean Price) / (Mean Price - Price of Cheaper)

Graphical Method:

Dearer Price --- (Mean Price - Cheaper Price)

Mean Price

Cheaper Price --- (Dearer Price - Mean Price)

Mixture Examples

Example: Mix rice costing ₹20/kg and ₹30/kg to get mixture at ₹25/kg in ratio?

Solution:

- Using alligation:
- Cheaper (₹20) --- (30-25) = 5
- Mean Price (₹25)
- Dearer (₹30) --- (25-20) = 5
- Ratio = 5:5 = **1:1**

6. AGE PROBLEMS

Age Ratio Concepts

Key Points:

- Age difference remains constant over time
- Age ratio changes over time
- Present age = x years, then after n years = $(x+n)$
- Present age = x years, then n years ago = $(x-n)$

Age Problem Examples

Example: Present ages of A and B are in ratio 5:4. After 3 years, ratio becomes 11:9. Find present ages.

Solution:

- Let present ages: $5x$ and $4x$
- After 3 years: $(5x+3)/(4x+3) = 11/9$
- Cross multiply: $9(5x+3) = 11(4x+3)$
- $45x + 27 = 44x + 33$
- $x = 6$
- Present ages: A = 30 years, B = 24 years

7. COIN & MONEY PROBLEMS

Money Distribution

Example: ₹555 distributed among A, B, C in ratio $1/4:1/5:1/6$. Find each share.

Solution:

- Ratio = $1/4:1/5:1/6$
- LCM of 4,5,6 = 60
- Multiply by 60: 15:12:10
- Total parts = $15+12+10 = 37$
- A's share = $(15/37) \times 555 = ₹225$
- B's share = $(12/37) \times 555 = ₹180$
- C's share = $(10/37) \times 555 = ₹150$

8. SSC CGL PRACTICE PROBLEMS

Problem Set with Solutions

Problem 1: If $a:b = 3:4$ and $b:c = 5:6$, find $a:b:c$

Solution:

- Make b same in both ratios
- $a:b = 3:4 = 15:20$
- $b:c = 5:6 = 20:24$
- $a:b:c = \mathbf{15:20:24}$

Problem 2: Number divided in ratio 2:3:4. If largest share is 1000, find total amount.

Solution:

- Ratio = 2:3:4, largest share = 4 parts = 1000
- 1 part = $1000/4 = 250$
- Total parts = $2+3+4 = 9$
- Total amount = $9 \times 250 = \mathbf{2250}$

Problem 3: In mixture of 60L, milk:water = 2:1. Add water to make ratio 1:2. Find water added.

Solution:

- Current: Milk = 40L, Water = 20L
- Let x liters water added
- New ratio: $40/(20+x) = 1/2$
- $80 = 20 + x$
- $x = \mathbf{60 \text{ liters}}$

Shortcut Methods

Quick Ratio Tips:

1. To find $a:b:c$ from $a:b$ and $b:c$, take LCM of b's values

2. In partnership, time in months can be used directly
3. For mixture problems, use alligation rule
4. In age problems, age difference remains constant
5. For money distribution, find value of 1 part first

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