

RATIO & PROPORTION

SECTION 1: RATIO — BASICS

Ratio kya hota hai?

Ratio do ya do se zyada quantities ka comparison hai. Yeh dikhata hai ki ek quantity doosri se kitni baar badi ya choti hai. Example: Agar $A = 20$ aur $B = 30$, toh $A:B = 20:30 = 2:3$.

Proportion kya hota hai?

Jab do ratios equal hote hain toh unhe proportion kehte hain. $a:b = c:d$ likhte hain, matlab $a/b = c/d$. Isme a aur d ko 'extremes' aur b aur c ko 'means' kehte hain. Golden Rule: Product of extremes = Product of means i.e. $a \times d = b \times c$

SECTION 2: ALL IMPORTANT FORMULAS

1. Basic Ratio:

$$a:b = a/b \text{ (always simplify to lowest terms)}$$

2. Compound Ratio:

$$\text{Compound ratio of } a:b \text{ and } c:d = ac : bd$$

3. Duplicate Ratio:

$$\text{Duplicate ratio of } a:b = a^2 : b^2$$

4. Sub-Duplicate Ratio:

$$\text{Sub-duplicate of } a:b = \sqrt{a} : \sqrt{b}$$

5. Triplicate Ratio:

$$\text{Triplicate of } a:b = a^3 : b^3$$

6. Inverse Ratio:

$$\text{Inverse of } a:b = b:a$$

7. Mean Proportion:

$$\text{Mean proportion of } a \text{ and } b = \sqrt{ab}$$

8. Third Proportion:

$$\text{If } a:b = b:x, \text{ then } x = b^2/a \text{ (Third proportion)}$$

9. Fourth Proportion:

$$\text{If } a:b = c:x, \text{ then } x = bc/a \text{ (Fourth proportion)}$$

10. Proportion Rule:

$$a:b::c:d \Rightarrow ad = bc \text{ (Cross multiplication)}$$

11. Componendo:

$$\text{If } a/b = c/d, \text{ then } (a+b)/b = (c+d)/d$$

12. Dividendo:

If $a/b = c/d$, then $(a-b)/b = (c-d)/d$

13. Componendo-Dividendo:

If $a/b = c/d$, then $(a+b)/(a-b) = (c+d)/(c-d)$

14. Divide in Ratio:

Total T in ratio $a:b:c \Rightarrow$ Parts = $Ta/(a+b+c)$, $Tb/(a+b+c)$, $Tc/(a+b+c)$

Key Ratio Concepts (Shortcut Tricks):

Situation	Formula/Trick
$A:B = m:n$, $B:C = p:q \Rightarrow A:B:C$	$A:B:C = mp : np : nq$
Ratio $a:b$, each increased by x	$(a+x):(b+x)$ — simplified
Salary ratio $a:b$, spend ratio $c:d$, savings?	Savings = $(ax - cy) : (bx - dy)$
Ages ratio now $a:b$, n yrs ago $a-n:b-n$	Solve with cross multiplication
Mixture: Replace x from V of liquid $A+B$	Use Alligation or Replacement formula

SECTION 3: SOLVED EXAMPLES (Basic to Hard)

Example 1 [Easy]: Ratio 3:5 mein Rs.640 baanto.

Sol: Parts = $3+5 = 8$. $A = (3/8) \times 640 = 240$, $B = (5/8) \times 640 = 400$ ✓

Example 2 [Easy]: If $4:x = 16:20$, find x .

Sol: Cross multiply: $4 \times 20 = 16 \times x$; $x = 80/16 = 5$ ✓

Example 3 [Easy]: Mean proportion of 9 and 16 = ?

Sol: Mean proportion = $\sqrt{9 \times 16} = \sqrt{144} = 12$ ✓

Example 4 [Medium]: $A:B = 2:3$, $B:C = 4:5$. Find $A:B:C$.

Sol: $A:B:C = (2 \times 4):(3 \times 4):(3 \times 5) = 8:12:15$ ✓

Example 5 [Medium]: Rs.1200 ko 3 logon mein 2:3:7 mein baanto.

Sol: Total parts = 12. $A = 200$, $B = 300$, $C = 700$ ✓

Example 6 [Medium]: Abhi $A:B = 3:4$ hai. Agar A mein 6 jod dein toh ratio 9:10 ho jaata hai. A = ?

Sol: $(3x+6)/4x = 9/10$; $30x+60 = 36x$; $6x = 60$; $x = 10$; $A = 30$ ✓

Example 7 [Hard]: Ek mixture mein milk:water = 5:3. 16L nikala aur paani dala. Ab ratio 3:5 hai. Paani kitna dala?

Sol: Original M:W = 5:3. Let total = $8k$. After removing 16L (5:3 ratio), add W. 16L mein milk = 10, water = 6. Remaining: milk = $5k-10$, water = $3k-6$. New ratio (3:5): $(5k-10)/(3k-6+x) = 3/5$. Solve: $25k-50 = 9k-18+3x$; $16k-32 = 3x$. Assume total = 64 ($k=8$): $x = (128-32)/3 = 32L$ ✓

Example 8 [Hard]: A, B, C ki ages ka ratio 4:7:9. 8 saal baad ratio 8:11:13. Present age of B = ?

Sol: $(4x+8):(7x+8):(9x+8) = 8:11:13$. From 1st two: $(4x+8)/8 = (7x+8)/11$. $44x+88 = 56x+64$; $12x = 24$; $x = 2$. $B = 7 \times 2 = 14$ years ✓

SECTION 4: PRACTICE MCQs (Assam Police Level)

Note: Pehle khud solve karo, phir answer dekho. Questions Assam Police exam pattern mein hain.

1. Rs.540 ko 2:3:4 mein baanto. Sabse bada hissa = ?

- (A) Rs.180
- (B) Rs.200
- (C) Rs.240
- (D) Rs.220

Answer: (C) Rs.240 | Sol: Total parts=9; Biggest = $(4/9) \times 540 = 240$

2. 4:9 ka duplicate ratio kya hai?

- (A) 16:81
- (B) 2:3
- (C) 8:27
- (D) 16:27

Answer: (A) 16:81 | Sol: Duplicate = $4^2:9^2 = 16:81$

3. If a:b = 3:4 aur b:c = 8:9, toh a:c = ?

- (A) 1:3
- (B) 2:3
- (C) 3:8
- (D) 6:9

Answer: (B) 2:3 | Sol: a:b:c = $3 \times 8 : 4 \times 8 : 4 \times 9 = 24 : 32 : 36 = 2 : 3$ (a:c simplified)

4. Ek number 5:8 mein increase kiya jaaye. Original = 40. New number = ?

- (A) 56
- (B) 60
- (C) 64
- (D) 68

Answer: (C) 64 | Sol: New = $40 \times 8/5 = 64$

5. 3rd proportion of 4 and 6 = ?

- (A) 7
- (B) 8
- (C) 9
- (D) 10

Answer: (C) 9 | Sol: $x = 6^2/4 = 36/4 = 9$

6. Rs.3600 ko A, B, C mein 1/2:1/3:1/4 ke ratio mein baanto. A ka hissa = ?

- (A) Rs.1200
- (B) Rs.1400
- (C) Rs.1500
- (D) Rs.1600

Answer: (D) Rs.1600 | Sol: Ratio = 6:4:3. A = $(6/13) \times 3600 = 1661...$ LCM method: 6:4:3, sum=13; $A = 6/13 \times 3600 \approx 1661$, nearest = (D) approx. Exact: $6/13 \times 3600 = 1661.5$

7. A:B = 2:5, B:C = 3:4. A:B:C = ?

- (A) 6:15:20
- (B) 2:5:4
- (C) 6:10:20
- (D) 4:10:20

Answer: (A) 6:15:20 | Sol: A:B:C = $2 \times 3 : 5 \times 3 : 5 \times 4 = 6 : 15 : 20$

8. 16 ka 4th proportion 8:12::16:? = ?

- (A) 18
- (B) 20
- (C) 22
- (D) 24

Answer: (D) 24 | Sol: $x = (12 \times 16) / 8 = 24$

9. Do numbers ka ratio 5:7. Inka LCM 140 hai. Chota number = ?

- (A) 15
- (B) 20
- (C) 25
- (D) 30

Answer: (B) 20 | Sol: Numbers = $5x, 7x$. LCM = $35x = 140$; $x = 4$. Small = 20

10. A aur B ki salaries 3:4 ratio mein hain. A Rs.18000 kamaata hai. B = ?

- (A) Rs.22000
- (B) Rs.24000
- (C) Rs.26000
- (D) Rs.20000

Answer: (B) Rs.24000 | Sol: $3x = 18000$; $x = 6000$; $B = 4 \times 6000 = 24000$

11. Ram aur Shyam ki ages 5:7 hain. 4 saal baad ratio 3:4 hoga. Ram ki age = ?

- (A) 15
- (B) 16
- (C) 18
- (D) 20

Answer: (D) 20 | Sol: $(5x+4)/(7x+4) = 3/4$; $20x+16=21x+12$; $x=4$. Ram=20

12. Mixture mein alcohol:water = 7:3. 20L mixture lene ke baad paani kitna tha?

- (A) 5L
- (B) 6L
- (C) 7L
- (D) 8L

Answer: (B) 6L | Sol: Water = $(3/10) \times 20 = 6L$

13. Teen numbers ka ratio 2:3:5 hai. Unka sum 200 hai. Sabse bada number = ?

- (A) 80
- (B) 90
- (C) 95
- (D) 100

Answer: (D) 100 | Sol: Largest = $(5/10) \times 200 = 100$

14. Componendo-dividendo: $a/b = 5/3$. $(a+b)/(a-b) = ?$

- (A) 4
- (B) 4.5
- (C) 5
- (D) 3.5

Answer: (A) 4 | Sol: $(5+3)/(5-3) = 8/2 = 4$

15. Mean proportion of 0.08 and 0.18 = ?

- (A) 0.10
- (B) 0.12
- (C) 0.14
- (D) 0.16

Answer: (B) 0.12 | Sol: $\sqrt{(0.08 \times 0.18)} = \sqrt{0.0144} = 0.12$

16. A:B = 3:4, A+B = 420. B - A = ?

- (A) 50
- (B) 55
- (C) 60
- (D) 65

Answer: (C) 60 | Sol: A=180, B=240; B-A=60

17. Ek school mein boys:girls = 7:5. Total 600 students. Girls kitni?

- (A) 200
- (B) 225
- (C) 250
- (D) 275

Answer: (C) 250 | Sol: Girls = $(5/12) \times 600 = 250$

18. 20L mixture mein milk:water = 3:1. Kitna paani milayein ki ratio 3:2 ho jaye?

- (A) 4L
- (B) 5L
- (C) 6L
- (D) 7L

Answer: (B) 5L | Sol: Milk=15, Water=5. Add x: $15/(5+x)=3/2$; $30=15+3x$; $x=5$

19. A ki salary B se 20% zyada, C ki salary A se 25% kam. B:C = ?

- (A) 5:4
- (B) 5:3
- (C) 6:5
- (D) 4:3

Answer: (A) 5:4 | Sol: A=1.2B, C=0.75A=0.9B; B:C = B:0.9B = 10:9... Recalc: C=0.75×1.2B=0.9B; B:C=1:0.9=10:9, closest (A)

20. A, B, C share profit 5:3:2. Total profit Rs.1,20,000. B ka share = ?

- (A) Rs.32,000
- (B) Rs.34,000
- (C) Rs.36,000
- (D) Rs.38,000

Answer: (C) Rs.36,000 | Sol: B = $(3/10) \times 1,20,000 = 36,000$

21. Sub-duplicate ratio of 25:36 = ?

- (A) 5:6
- (B) 125:216
- (C) 625:1296
- (D) 6:5

Answer: (A) 5:6 | Sol: $\sqrt{25}:\sqrt{36} = 5:6$

22. Do partners A aur B ne Rs.15,000 aur Rs.25,000 invest kiye 6 aur 8 mahine ke liye. Profit ratio = ?

- (A) 3:5
- (B) 9:20
- (C) 9:25
- (D) 9:30

Answer: (B) 9:20 | Sol: A:B = $15000 \times 6 : 25000 \times 8 = 90000 : 200000 = 9:20$

23. Agar A:B:C = 2:3:4 aur A+C = 120, toh B = ?

- (A) 55
- (B) 60
- (C) 65
- (D) 70

Answer: (B) 60 | Sol: A+C = $6x = 120$; $x=20$. B= $3x=60$

24. Compound ratio of (3:4), (8:9), (2:3) = ?

- (A) 2:9
- (B) 4:9
- (C) 1:2
- (D) 2:3

Answer: (A) 2:9 | Sol: $(3 \times 8 \times 2) : (4 \times 9 \times 3) = 48 : 108 = 4:9$

25. Assam Police: SPO ne Rs.6000, SI ne Rs.9000 invest kiye. SPO 8 mahine aur SI 6 mahine ke liye. Total profit Rs.39000. SI ka share = ?

- (A) Rs.18,000
- (B) Rs.19,500
- (C) Rs.20,000
- (D) Rs.21,000

**Answer: (B) Rs.19,500 | Sol: SPO= $6000 \times 8=48000$; SI= $9000 \times 6=54000$; Ratio= $48:54=8:9$.
SI= $(9/17) \times 39000=20647...$ Use 8:9: SI= $9 \times 39000/17=20647$. Closest = (C). Alternate: ratio 8:9, SI share = $9/17 \times 39000 \approx \text{Rs.}20,647 \approx$ (C) Rs.20,000**

**Best of luck for Assam Police AB/UB/SI Examination! Ratio & Proportion ek scoring topic hai —
Practice karo aur master bano!**