

RATIO & PROPORTION

Def Ratio

→ 2 ya 2 se Jada num ke bich
Comparison establish karina hoto

	Apple	Banana
Cost	2	5
	$\times 2$	$\times 10$
	$\boxed{2:5}$	
Cost	20	50
Cost	4	10

Comparison must be between the same item

like kg with kg
length
breadth

Example

Popat had purchased dozen of lemon every
Rs 20 and dozen of apple 100

Compare

$$\frac{\text{Cost of Apple}}{\text{Cost of Lemons}} = \frac{100}{20} = 5$$

Hence apple are 5 times more expensive than lemon.

Ratio 5:1

properties of RaPO

$\star \frac{a}{b} = \frac{a}{b}$

a	(first term, Numerator)
b	(consequent, Second term)

$$\frac{3}{4} = 0.75$$

#1 $\frac{3 \times 9 \text{ (same num)}}{4 \times 2 \text{ (same num)}}$ \rightarrow Ratios don't get changed

$$\frac{3 \times 2}{4 \times 2} = \frac{6}{8} = 0.75$$

$$\frac{10}{20} = 0.5$$

$$\textcircled{B} \frac{10 \div 5}{20 \div 5} = \frac{2}{4} = \underline{0.5}$$

Q $p:q = 4:8 = 1:2$ find $\frac{(p+q+t)}{q+s+u}$

$$\frac{p}{q} = \frac{1}{3} - \frac{1}{4} = \frac{2}{12}$$

$$\frac{P}{V} = \frac{2m}{3n}$$

$$\begin{array}{r} 2m + 2m + 2m \\ 3n + 3n + 3n \end{array}$$

$$= \frac{6m}{9n}$$

$$\begin{array}{c|c|c} \textcircled{1} & \frac{p}{q} = \frac{2}{3} & \delta = \frac{2}{3} \\ & p = \frac{2q}{3} & \delta = \frac{2s}{3} \\ & & \frac{t}{u} = \frac{2}{3} \\ & & t = \frac{2u}{3} \end{array}$$

$$= \frac{p + \delta + t}{q + s + u}$$

$$= \frac{\frac{2q}{3} + \frac{2s}{3} + \frac{2u}{3}}{q + s + u} = \frac{\frac{2q + 2s + 2u}{3}}{q + s + u}$$

$$= \frac{2(q + s + u)}{3(q + s + u)} = \frac{2}{3} \text{ dm}$$

Back

$$\textcircled{2} \quad \frac{k_1}{k_2} = \frac{k_3}{k_4} = \frac{k_5}{k_6} = \frac{k_7}{k_8}$$

$$\frac{k_1 + k_3 + k_5}{k_2 + k_4 + k_6} = \frac{k_7}{k_8}$$

$$\frac{k_1 + k_3 + k_7}{k_2 + k_4 + k_8} = \frac{k_5}{k_6}$$

$$\frac{K_1}{K_2} = \frac{K_3}{K_4} = \frac{K_5}{K_6} = \boxed{\frac{K_7}{K_8}}$$

now remove this only for 3

Then also it is applicable

means it is valid on all the conditions

$$\frac{K_1}{K_2} = \frac{K_3}{K_4} = \frac{K_5}{K_6}$$

$$\begin{aligned} \frac{K_1 + K_3}{K_2 + K_4} &= \frac{K_5}{K_6} \\ \frac{K_3 + K_5}{K_4 + K_6} &= \frac{K_1}{K_2} \end{aligned}$$

$$\frac{K_1 + K_5}{K_2 + K_6} = \frac{K_3}{K_4}$$

Q If $a:b = c:d = 2:3$ then what is the value of $(ab+cd)/(b^2+d^2)$?

2019 TCS NQT

$$\frac{a}{b} = \frac{c}{d} = \frac{2}{3}$$

$$a = \frac{2}{3}b \quad | \quad c = \frac{2}{3}d$$

$$= \frac{ab+cd}{b^2+d^2}$$

$$= \frac{\frac{2}{3}b^2 + \frac{2}{3}d^2}{b^2+d^2}$$

$$= \frac{\frac{2}{3}(b^2+d^2)}{(b^2+d^2)} = \frac{2}{3}$$

$$\frac{a}{b} - \frac{c}{d} = \frac{2}{3}$$

$$\hookrightarrow \frac{a+c}{b+d} = \frac{2}{3}$$

$$\frac{ax+R}{bx+R} = \frac{cy}{dy} = \frac{2}{3}$$

$$ax = P$$

$$bx = Q$$

$$cy = R$$

$$dy = S$$

$$\frac{P}{Q} = \frac{R}{S} = \frac{2}{3}$$

$$\frac{P+R}{Q+S} = \frac{2}{3}$$

$$\frac{ax+cy}{bx+dy} = \frac{2}{3}$$

$$\frac{ax}{bx} = \frac{cy}{dy} = \frac{2}{3}$$

$$\frac{a}{b} = \frac{c}{d} = \frac{2}{3}$$

$$\text{let } P = ab \quad Q = b^2$$

$$R = cd \quad S = d^2$$

$$\frac{ab+cd}{b^2+d^2} = \frac{2}{3}$$

New property

$$\frac{k_2 + k_3 + k_5}{k_2 + k_4 + k_6} = \frac{k_7}{k_8}$$

$$\frac{a k_2}{a k_2} = \frac{b k_3}{b k_4} = \frac{c k_5}{c k_6} = \frac{d k_7}{d k_8}$$

$$\Rightarrow \frac{a k_2 + b k_3 + c k_5}{a k_2 + b k_4 + c k_6} = \frac{k_7}{k_8}$$

Example

$$1. \frac{a}{b} = \frac{c}{d} \Rightarrow \frac{a}{b} = \frac{c}{d} = \frac{2a+3c}{2b+3d} = \frac{ab+cd}{b^2+d^2}$$

$$2. \frac{a}{b} = \frac{c}{d} = \frac{e}{f} \Rightarrow \frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \frac{a+2c+3e}{b+2d+3f} = \frac{4a-3c+9e}{4b+3d+9f}$$

Q If $P:Q = 9:8 = 7:4 = 2:3$ then
what is the value of $\frac{(mp+nr+ot)}{mq+ms+ok}$

$$\text{Sol} = \underline{\text{Ratio}}$$

$$\frac{p}{q} = \frac{21}{5} = \frac{1}{4} = \frac{2}{3}$$

$$\frac{m \cdot p}{n \cdot q} = \frac{12 \cdot 21}{17 \cdot 5} = \frac{61}{84}$$

$$\frac{m \cdot p + n \cdot 06}{n \cdot q + n \cdot 5 + 04} = \frac{2}{3} \text{ Ans}$$

Types of Ratio

Type 1: Duplicate Ratio $a^2 : b^2$ ($8^2 : 1^2 = 64 : 1$)

Type 2: Sub-Duplicate Ratio $\sqrt{a} : \sqrt{b}$ ($\sqrt{8} : \sqrt{1} = 2\sqrt{2} : 1$)

Type 3: Triplicate Ratio $a^3 : b^3$ ($8^3 : 1^3 = 512 : 1$)

Type 4: Sub-Triplicate Ratio $\sqrt[3]{a} : \sqrt[3]{b}$ ($\sqrt[3]{8} : \sqrt[3]{1} = 2 : 1$)

Type 5: Invert/Reciprocal Ratio

$$\frac{1}{a} : \frac{1}{b} = \frac{b}{a} \quad \left(\frac{1}{8} : \frac{1}{1} \right) = \frac{1}{8}$$

Q find duplicate ratio $a:b$

$$a:b \rightarrow a^2:b^2$$

$$a^2:b^2 = 8^2:1^2$$

~~Q~~ ~~Q~~

4:1

Q

$$\text{duplicate} = 2^2:1^2 \quad | \quad 4^2:1^2 \quad (16:1)$$

$$\text{Sub triplicate} = 2:1 \quad | \quad \sqrt{4}:1 \quad (2:1)$$

$$\text{Triplicate} = \sqrt[3]{4}:1 \quad | \quad \sqrt[3]{4}:1$$

$$\text{Invert} = 1:4 \quad | \quad \frac{1}{1}:\frac{4}{4}$$

$$a:b \rightarrow \frac{1}{a}:\frac{1}{b}$$

$$= \frac{b}{ab}:\frac{a}{ab} = b:a \text{ inv}$$

$$\frac{bc}{ab}$$

$$\frac{bc}{ab}$$

$$a:b:c \xrightarrow{\text{Invert}} \frac{1}{a}:\frac{1}{b}:\frac{1}{c}$$

$$\frac{\frac{1}{a}}{\frac{1}{b}} = \frac{b}{a}$$

$$\frac{c}{ab}$$

$$\frac{bc}{ac}$$

$$\frac{bc}{abc}:\frac{ac}{abc}:\frac{ab}{abc}$$

$$= bc:ac:ab$$

Inverse ratio = reciprocal ratio

$$Q) 3:4:6 \xrightarrow{\text{inv}} \frac{1}{3} : \frac{1}{4} : \frac{1}{6}$$

$$= \frac{4}{12} : \frac{3}{12} : \frac{2}{12}$$

$$\frac{8}{3} \quad \frac{4}{3} \quad \frac{2}{3}$$

$$= 4:3:2 \text{ ans}$$

$\times 8_3$

Compound ratio / mixed ratio / Compound:

$$a:b$$

$$c:d$$

Compound ratio

$$= a \times c : b \times d$$

$$= ac : bd$$

$$m:n \text{ and } p:q \rightarrow (m \times p) :$$

$$(m:n), (p:q) \text{ and } (r:s) \rightarrow (m \times p \times r) : (n \times q \times s)$$

Name	Email	Phone

Q find the compound ratio of
 $2/3$, $7/9$ and $12/35$

$$2 \times 7 \times 12 = 3 \times 9 \times 35$$

$$\begin{array}{r} 24 \\ \times 7 \\ \hline 168 \end{array}$$

$$24 \times 7 = 27 \times 35$$

$$168$$

$$\begin{array}{r} 25 \\ \times 27 \\ \hline 245 \\ 70 \times \\ \hline 840 \end{array}$$

$$\frac{24 \times 7}{27 \times 35} = \frac{24}{135} \text{ Ans}$$

$$= \frac{8}{45} \text{ Ans}$$

Q) find the compound ratio of
 $2/3$, $4/6$ and $7/9$

Cognizant 2020

$$\frac{2 \times 4 \times 7}{3 \times 6 \times 9} = \frac{28}{81} \text{ Ans}$$

Combining ratio

Q. If $\frac{a}{b} = \frac{2}{3}$ $\frac{b}{c} = \frac{5}{6}$

find a:b:c

$$ab : bc = \frac{2 \times 5}{3 \times 6} =$$

a:b:c

Q $a:b=2:3$
 $b:c=5:6$

$a:b:c?$

Ans $2:3:5$
 given $5:5:6$

$2 \times 5 : 5 \times 3 : 6 \times 3 \Rightarrow 10:15:18$ Ans

Q $a:b=3:4$
 $b:c=7:8$

$a:b:c$

$3:4:7$

$7:7:8$

$21:28:32$ Ans

Q Info 8/8 2018

If $a:b=3:4$

$b:c=5:6$

$c:d=2:3$

$$a:b:c:d$$

$$8:4:4:4$$

$$5:5:6:8$$

$$2:2:2:3$$

$$\frac{24}{72}$$

$$30:40:48:72$$

on solving

$$15:20:24:36 \text{ Ans}$$

My try

Q TCS / NQT (2018)

If the ratio of x to y is $6/5$ and the ratio of z to y is $3/4$ then the ratio of x to z is

$$\frac{x}{y} = \frac{6}{5}$$

$$\frac{z}{y} = \frac{3}{4}$$

My Sol.

$$x:y:z$$

$$6:5:5$$

$$24:20:15$$

$$24:20:15$$

$$= \frac{24}{15} = \frac{8}{5}$$

$$\frac{x}{z} = ?$$

$$\frac{x}{z} = \frac{6}{5} \times \frac{4}{3} = \frac{8}{5}$$

$$\frac{x}{z} = \frac{24}{15} = \frac{8}{5}$$

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

Q Accenture 2019, 2017

Three Cricket Players - Virat Kohli, Rohit Sharma and MS Dhoni play for three different cricket teams RCB, MI and CSK respectively in IPL 2020. Virat's runs to Rohit's runs and Rohit's runs to Dhoni's runs are in the ratio 5:7. If the total runs scored by all the three players in the tournament is 327 find the total runs scored by Rohit Sharma in IPL 2020?

~~V~~ V to R R to D = 5:7

$$V + R + D = 327$$

$$\frac{V}{R} = \frac{R}{D} = \frac{5}{7} \quad \text{And } R$$

$$R = 327 - V - D$$

~~V to R~~ $\frac{V}{R} = \frac{5}{7} \quad \frac{R}{D} = \frac{5}{7}$

$$\left(\frac{\frac{R}{D}}{\frac{V}{R}} \right) = \frac{R^2}{VD} = \frac{5}{1}$$
$$R^2 = VD$$