

Ratios

is to

$$\underset{\text{antecedent}}{a} : \underset{\text{consequent}}{b} = \frac{a}{b}$$

• Increase in a ratio

- Original value $\boxed{500}$
 - Increase in the ratio $5:9$

$$\left. \begin{array}{l} \text{old} \quad \text{New} \\ 5:9 \end{array} \right\} \frac{500}{\text{old}} \times \text{new} = \frac{500}{5} \times 9 = 900$$

• Decrease in a ratio

- Original value $\boxed{500}$
 - Decrease in the ratio $8:3$

$$\left. \begin{array}{l} \text{old} \quad \text{new} \\ 8:3 \end{array} \right\} \frac{500}{8} \times 3 = 187.5$$

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• Inverse ratio $b:a$

• Compounded ratio - Product of multiple ratios

$$a:b \ \& \ c:d \Rightarrow \frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$

• Duplicate ratio $\rightarrow a^2:b^2$

• Triplicate ratio $\rightarrow a^3:b^3$

• Sub-duplicate ratio $\rightarrow \sqrt{a}:\sqrt{b}$

• Sub-triplicate ratio $\rightarrow \sqrt[3]{a}:\sqrt[3]{b}$

• Commensurable ratio \rightarrow (Int): (Int) $-\infty, -2, -1, 0, 1, 2, 3, \dots, \infty$

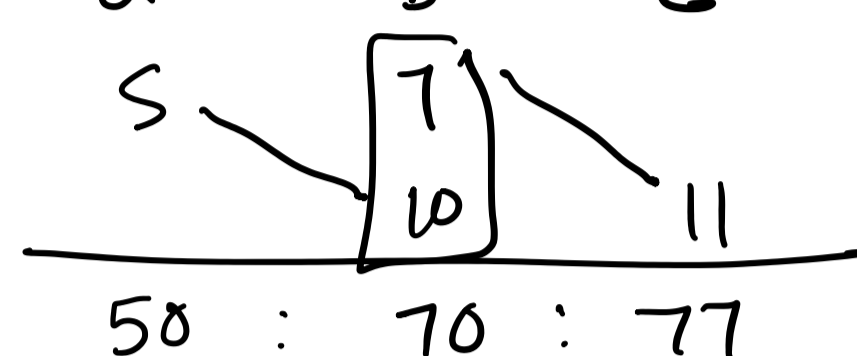
Incommensurable $\rightarrow \sqrt{2}:5$

$$\left. \begin{array}{l} \text{Int} \\ 5:3 \end{array} \right\} \begin{array}{l} \text{Int} \\ 2.5:3.5 \\ 25:35 \end{array}$$

• Continued ratio

$$\left. \begin{array}{l} a:b = 5:7 \\ b:c = 10:11 \end{array} \right\} a:b:c$$

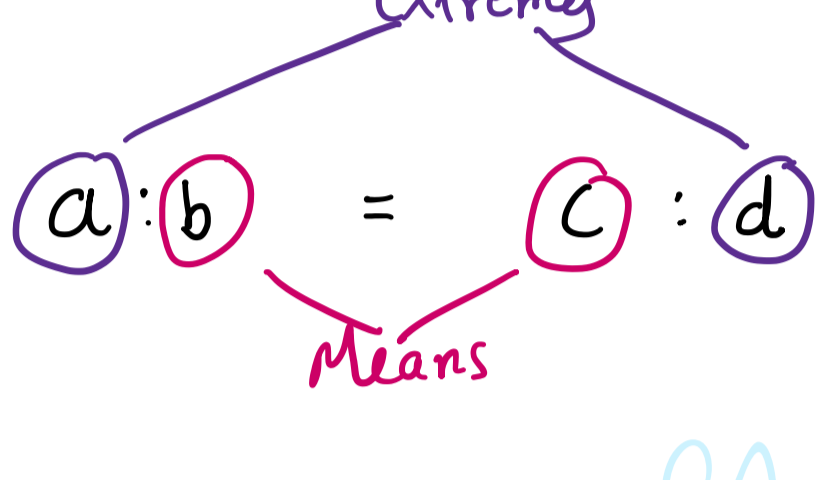
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Proportions

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

$$ad = bc$$

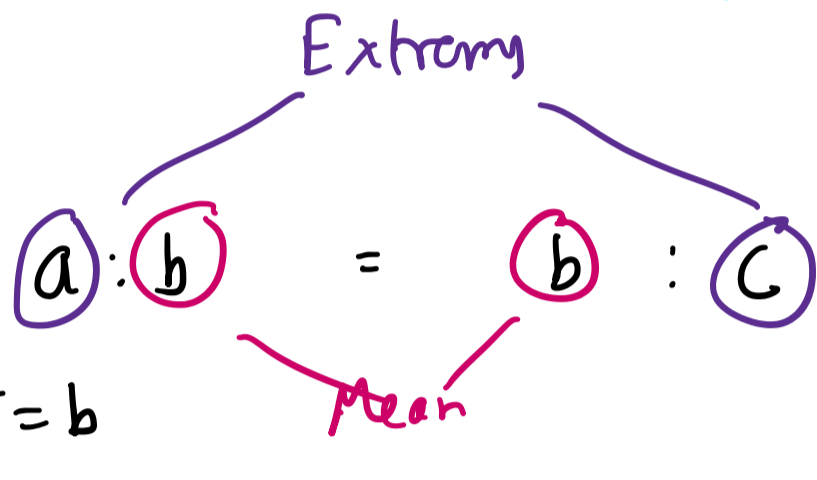


a, b, c, d in prop

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

$$ac = b^2 \Rightarrow \sqrt{ac} = b$$



a, b, c in prop

• Properties - $a:b = c:d \rightarrow \frac{a}{b} = \frac{c}{d}$

• Cross product

$$ad = bc$$

• Invertendo

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

• Alternendo

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

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• Componendo

$$\frac{a+b}{b} = \frac{c+d}{d}$$

• Dividendo

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

• Componendo & Dividendo

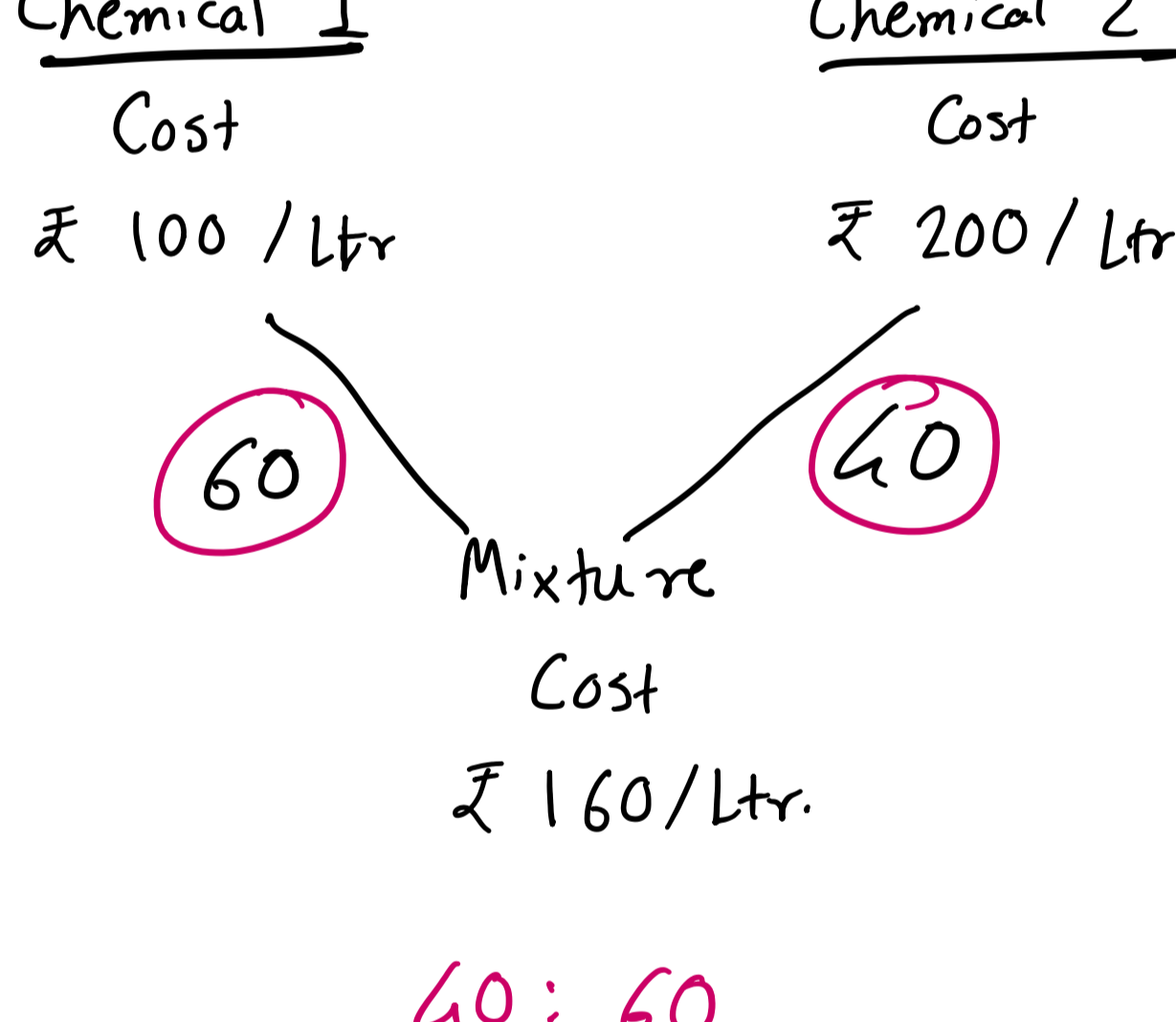
$$\frac{a+b}{a-b} = \frac{c+d}{c-d}$$

• Addendo & subtrahendo

$$\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots = \frac{a+c+e+\dots}{b+d+f+\dots} = \frac{a-c-e-\dots}{b-d-f-\dots}$$

* Mixture Questions

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Indices

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$$a^m \cdot a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$a^0 = 1$$

$0^0 = \text{ND}$

$$(ab)^m = a^m \cdot b^m$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

$$1^a = 1$$

$$a^1 = a$$

$$a^{-m} = \left(\frac{1}{a}\right)^m = \frac{1}{a^m}$$

$$\sqrt[m]{a} = a^{1/m}$$

$$a^m = a^n \Rightarrow m=n$$

$$a^m = b^m \Rightarrow a=b$$

except $(-2)^2 = (2)^2$

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Logarithm

$$\underline{a^b} = c \xrightarrow{\text{Rearrange}} b = \log_a c$$

$$\log_b a = c \xrightarrow{\hspace{2cm}} b^c = a$$

$$\log_a a = 1$$

$$\log_1 a = \text{ND}$$

$$\log_a a = \text{ND}$$

$$\log_a 0 = \text{ND}$$

$$\log_a 1 = 0$$

$$\log_a (\text{veno}) = \text{ND}$$

$$\log a + \log b = \log(ab)$$

$$\log a - \log b = \log(a/b)$$

$$\log(a+b) = \text{X}$$

$$\log(a-b) = \text{X}$$

$$\log a^m = m \cdot \log a$$

$$a^{\log a b} = b$$

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Change of Base \rightarrow

$$\log_b a = \frac{\log_a a}{\log_a b}$$

Common base = 10
 \downarrow
 Logtable
 Natural base = e

(Characteristic) & (Mantissa) - From Logtable

Nos. > 1

Nos. < 1

\downarrow
 (No. of digits - 1)

\downarrow
 - (zeros immediately after decimal point + 1)

$$\log 135.26$$

$$\downarrow$$

$$\boxed{1.2}$$

$$\log 0.06$$

$$\downarrow$$

$$-(1+1) = -2$$

$$\log 5000$$

$$\downarrow$$

$$\boxed{3.7}$$

$$\log 0.00705$$

$$-(2+1) = -3$$

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