1.

RATIO AND PROPORTION, INDICES, LOGARITHMS

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unit I : Ratio :

* **Ratio :**

Ratio is comparison of two or more quantities.

3 : 4

antecedent | consequent

Ex :

Q. which ratio is greater ?

① $2\left[\frac{1}{5}\right] : 3\left[\frac{1}{5}\right]$ OR $3.6 : 4.0$

$\frac{5\times2+1}{5} : \frac{5\times3+1}{5}$ $\quad$ $\frac{36}{10} \quad \frac{40}{10}$

$\frac{11}{5} : \frac{16}{15}$ $\quad$ $36 : 40$

$11 : 16$ $\quad$ $\frac{36}{4} \quad \frac{40}{4} = 9 : 10$

$\frac{11}{16} \times \frac{9}{10} \Rightarrow \frac{110}{160} \leftarrow \boxed{\frac{144}{160}}$

- **Inverse Ratio :**

Eg. → 12 : 7

7 : 12 ← Inverse Ratio

- Greater inequality → $a : b$ when $a > b$. Eg- 7 : 5
- less inequality → $a : b$ when $a < b$ Eg- 5 : 7
- compounded Ratio

Eg → 5 : 6 , 7 : 8 , 9 : 10

compounded ratio will be :- 21 : 32

$\frac{5\times7\times9^{3}}{6\times8\times10} = \frac{21}{32}$

- **Duplicate Ratio (square) :**

Eg → 2 : 3 ⟶ $\boxed{4 : 9}$

- **Triplicate Ratio (cube) :**

Eg → 2 : 3 ⟶ $\boxed{8 : 27}$

- **Sub duplicate Ratio : (squareroot)**

Eg → 4 : 9 $\sqrt{4} : \sqrt{9} \Rightarrow \boxed{2 : 3}$

- **Sub Triplicate Ratio : (cuberoot)**

Eg → 27 : 64 $\Rightarrow (3^3)^{\frac{1}{3}} : (4^3)^{\frac{1}{3}} \Rightarrow \boxed{3 : 4}$

- **commensurable or Incommensurable :**

Eg → i) 2.2 : 2.4 $\Rightarrow \frac{22}{10} \quad \frac{24}{10} \Rightarrow \boxed{11 : 12}$ ← commensurable

ii) $\sqrt{7} : 8 \Rightarrow \sqrt{7} \times 8 \quad 8 \times \sqrt{7} \Rightarrow 7 : 8\sqrt{7}$ ← Incommensurable

- **continued ratio :**

Eg → 2 : 3 : 9 : 4

Unit II : Prepositions.

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- properties of proportion :

① Invertendo → If $a:b = c:d$, then $b:a = d:c$. $(\frac{a}{b} \frac{c}{d})\rightarrow$

② Alternendo → If $a:b = c:d$, then $a:c = b:d$ $\frac{a}{b}, \frac{c}{d}$

③ componendo →

$$a:b = c:d \text{ then}$$
$$(a+b):b = (c+d):d$$

④ Dividendo → $a:b = c:d$

$$(a-b):b = (c-d):d$$

⑤ componendo & Dividendo →

$$a:b = c:d$$
$$(a+b):(a-b) = (c+d):(c-d)$$

⑥ Addendo → $a:b = c:d = e:f \ldots$ then,

$$(a+c+e+\ldots):(b+d+f+\ldots)$$

⑦ subtrahendo → $(a-c-e-\ldots):(b-d-f-\ldots)$

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Unit - III : Indices

* **Indices** : The power, also known as the index, tells you how many times you have to multiply the number by itself and number will be called as base.

E.g :→ 2^4 , 3^3 , 18^2, etc.

- Cube Root : $\sqrt[3]{8} = (8)^{\frac{1}{3}} = (2 \times 2 \times 2)^{\frac{1}{3}}$ $(2^3)^{\frac{1}{3}} = 2$
- Square Root : $\sqrt[2]{4} = (4)^{\frac{1}{2}} = (2 \times 2)^{\frac{1}{2}}$ $(2^2)^{\frac{1}{2}} = 2$
- Negative powers : $2^{-3} = \frac{1}{2^3} = \frac{1}{2 \times 2 \times 2} = \frac{1}{8}$

Law 1 :

$$a^m \times a^n = a^{m+n}$$ (base must be same)

E.g :→ $2^3 \times 2^2 = 2^{3+2} = 2^5$

Law 2 :

$$\frac{a^m}{a^n} = a^{m-n}$$ (base must be same)

E.g :→

$$\frac{2^3}{2^2} = 2^{3-2} = 2^1$$

Law 3 :

$$[a^m]^n = a^{m \times n}$$

E.g :→ $[2^3]^2 = 2^{3 \times 2} = 2^6$

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Law 4 :

$$[ab]^n = a^n \times b^n$$

E.g :→ $(2 \times 3)^8 = 2^8\, 3^8$

Note :

① $a^0 = 1$

② $a^{-m} = \frac{1}{a^m}$ & $\frac{1}{a^{-m}} = a^m$

③ $a^x = a^y$, then $x = y$

④ $x^a = y^a$, then $x = y$

⑤ $\sqrt[m]{a} = a^{\frac{1}{m}}$

Unit IV : LOGARITHM

Define :

For all real numbers n and all positive numbers a and x, where $a \neq 1$.

* calculator trick to find out Logarithm *

↓

step 1 : type number & press root for 15 times

↓

step 2 : substract 1 after step 1

↓

step 3 : Divide number by 0.000070274 OR multiply by 14230

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★ **Law 1** :

$$\log mn = \log m + \log n$$

E.g: (i) $\log_{(8\times7)} = \log 8 + \log 7$

(ii) $\log_{(1\times2\times3)} = \log 1 + \log 2 + \log 3$

★ **Law 2** : $\log\left(\frac{m}{n}\right) = \log m - \log n$

E.g: (i) $\log \frac{27}{5} = \log 27 - \log 5$

(ii) $\log\left(\frac{5}{10}\right) = \log 5 - \log 10$

★ **Law 3** :

$$\log m^n = n.\log m$$

E.g: (i) $\log_3 81^3 = 3.\log 81$

(ii) $\log 2^2 = 2.\log 2$

★ change of base :

$$\log_b m = \log_a m \,/\, \log_a b$$

E.g:→ $\log_2 8 = \frac{\log_{10} 8}{\log_{10} 2}$

★ Antilogarithm Table : $\log_a n = x$

E.g:→ $\log_{10} x = 2.428$

⇒ $x = \text{antilog}(2.428)$

$\log_{10} x = 2.428$

$\text{antilog } 2.428 = x = 267.80$

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* calculator trick to find Anti-logarithm.

1. multiply number by 0.0000702 74 / divide by 14230
↓
2. Add 1 after step 1).
↓
3. press ` x = ' button for 15 times.