YAKEEN NEET 2.0

2026

Microlecture

Basic Maths and Calculus (Mathematical Tools)

PHYSICS

Lecture 03

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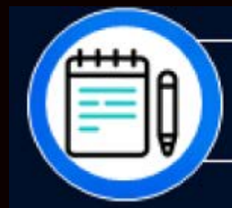

Topics to be covered

- A.P (Arthemadic Progression)
- Logarithm

A.P. (Arthemahic Progression)

General form $a,\ a+d,\ a+2d,\ \ldots\ a+(n-1)d$ (n^{th} term)

here $a \rightarrow 1^{st}$ term

$d \rightarrow$ common Difference.

n^{th} term $a_n = a+(n-1)d$.

Sum of n^{th} term $= S_n = \frac{n}{2}\left[2a+(n-1)d\right] = \frac{n}{2}\left(\text{First No} + \text{Last No.}\right)$

Q Find the 10^{th} term of given series, also find sum of first 10 numer.

1, 5, 9, 13, ...

Soln

$a = 1$

$d = 4$

$$a_{10} = a + (n-1)d = 1 + (10-1) \times 4 = 1 + 36 = 37$$

$$S_{10} = \frac{n}{2}\left(2a + (n-1)d\right)$$

$$= \frac{10}{2}\left(2 \times 1 + (10-1)4\right)$$

$$= 5\left(2 + 36\right) = \underline{190}$$

$$S_{10} = \frac{n}{2}\left(1^{st} \text{ term} + \text{Last term}\right)$$

$$= \frac{10}{2}\left(1 + 37\right) = 190$$

Q 30^{th} term of an AP 10, 7, 4. . . .

also find sum of first 30 term of this A.P.

Soln 10, 7, 4, 1, ...

$a = 10$

$d = -3$

$$a_{30} = a + (n-1)d$$

$$= 10 + (30-1)(-3)$$

$$= 10 - 29 \times 3$$

$$= -77$$

$$S_{30} = \frac{30}{2}\left(2 \times 10 + (30-1)(-3)\right)$$

Q Sum of the give A.P

$$3 + 7 + 11 + 15 + \cdots + 103$$

Sol^n

$a = 3$

$d = 4$

$$a_n = a + (n-1)d$$

$$103 = 3 + (n-1)4$$

$$\boxed{n = 26}$$

$$S_n = \frac{n}{2}\left[\text{1}^{st}\text{ term} + \text{Last term}\right] = \frac{26}{2}(3+103) = \checkmark$$

Q Find the sum of first 10 natural numer.

Sol $1+2+3+\cdots\cdots+10$

$$S_n = \frac{n}{2}\left(1^{st}\text{ no.} + \text{Last No.}\right) = \frac{10}{2}(1+10) = 55$$

$$\sum_{n=1}^{n} n = 1+2+3+4+\cdots$$

$$= \frac{n(n+1)}{2}$$

Q Find the sum of first n natural numer.

$$1, 2, 3, 4, \_\ \_\ \_\ \_\ \ n$$

$$S_n = \frac{n}{2}\left(1^{st}\text{ No.} + \text{Last No.}\right) = \frac{n}{2}(1+n)$$

Log → It is the power to which base must be raised to yield the given no.

$\log_b a$ → log a with base b

$\log_2 10$ → log 10 with base 2

2 → base

$\log_b^a = c$ (Let) here $a, b > 0$, $b \neq 1$

$a = b^c$

$\log_{10}^a = 3$

$\Rightarrow \quad a = 10^3$

$\log_b a$ = b की power क्या होनी चाहिए कि a आ जाए

b Ki power Kya honi chahiye Ki a Aaa jaye .

b ⟶ base

$\log_2 8$ = 2 ki kitni power kar du ki 8 Aa jaye = 3

Since $2^3 = 8$

$\log_2 8 = 3$

* $\log_2 16$ = 2 ki kitni power kar du ki 16 Aaa jaye = 4

$\log_2 16 = 4$ Since $2^4 = 16$

* $\log_3 9 = 2$

* $\log_4 64 = 3$

* $\log_{10} 100 = 2$

* $\log_3 27 = 3$

* $\log_{10} 1000 = 3$

$\log_2^8 = 3 \implies 8 = 2^3$

$\log_4^{64} = 3 \implies 64 = 4^3$

$\log_3^9 = 2 \implies 9 = 3^2$

$\log_{10}^{100} = 2 \implies 100 = 10^2$

$b^c = a$

$\log_b^a = c$

$\Rightarrow a = b^c$

Q $\log_{x-2}^{16} = 2$ find the value of x

Soln $16 = (x-2)^2$

$x-2 = +4$

$x = 6$ ✓

$x-2 = -4$

$x = -2$ Reject ✗

Natural log. (ln) ≡ Iska Matlab base e Hai where $e = 2.71$

$\ln 5 = \log_e 5$

$\ln 50 = \log_e 50$

$\ln 100 = \log_e 100$

$$\ln x = y$$

$$\log_e x = y$$

$$\boxed{x = e^y}$$

Q Find the value of x in following case.

① $\ln x = 2$

Sol^n $\log_e x = 2 \Rightarrow x = e^2$

② $\ln x = 3$

Sol^n $\Rightarrow x = e^3$

③ $\ln x = 5$

$\Rightarrow x = e^5$

$$(\text{कदद्व}) = 10^{5}$$

$$25 = e^{x}$$

Find the value of x in following case

① $\log_2 x = 3 \Rightarrow x = 2^3 = 8$

② $\log_4 x = 2 \Rightarrow x = 4^2 = 16$

③ $\log_5 x = 2 \quad x = 5^2 = 25$

④ $\log_{10} x = 3 \quad x = 10^3 = 1000$

⑤ $\log_2 x = 1$

$x = 2^1 = 2$

⑥ $\log_{10} x = 1$

$x = 10^1 = 10$

⑦ $\log_{21.5} x = 1$

$\boxed{x = 21.5}$

⑧ $\ln x = 1$

$x = e$

⑨ $\log_{10} x = 5 \quad x = 10^5$

⑩ $\log_{10} x = -1$

$x = 10^{-1} = \frac{1}{10} = .1$

⑪ $\log_{10} x = -2$

$x = 10^{-2}$

⑫ $\ln x = -3$

$x = e^{-3}$

⑬ $\log_{10} 1 = x$

$$\log_b^a = c$$

$a > 0$
$b > 0$
$b \neq 1$

$$10^{-1} = .1$$

(13) * $\log_{10} 1 = 0$

$1 = 10^0$

* $\log_b 1 = 0$

$1 = b^0$

* $\log_a^a = 1$

* $\log_x^x = 1$

* $\log_{10}^{10} = 1$

$\log_{50}^{50} = 1$

$\log_e^e = 1$

$\ln e = 1$

$\log_{10}^{10} = 1$

* $\log_{10}^{10} = 1$

* $\log_{2}^{2} = 1$

$$\log_{a}^{a} = 1$$

$$\log 1 = 0$$

$$\log_{10}(m \times n) = \log_{10} m + \log_{10} n$$

$$\log\left(\frac{m}{n}\right) = \log m - \log n$$

$$\log\left(\frac{V_f}{V_i}\right) = \log V_f - \log V_i$$

(base same)

$$\ln \frac{V_f}{V_i} = \ln V_f - \ln V_i$$

$$\log(m \cdot n) = \log m + \log n$$

* or $\log m + \log n = \log m.n$

Q find value of

$\log 2 + \log 3 = \log 6$

Q $\log 2 + \log 5 = \log 2 \times 5$

$= \log 10$

Q $\log 2 + \log 3 + \log 5 = \log (2 \times 3 \times 5)$

$= \log 30$

Q $\log 4 + \log 10 + \log\left(\frac{1}{8}\right)$

$= \log\left(4 \times 10 \times \frac{1}{8}\right) = \log 5$

Similarly

$$\log\left(\frac{m}{n}\right) = \log m - \log n$$

Q $\log 6 - \log 2 = \log \frac{6}{2} = \log 3$

Q $\log 8 - \log 4 + \log 2$

$= \log\left(\frac{8}{4} \times 2\right) = \log 4$

Q $\log 10 + \log 100 - \log 50$

$= \log\left(\frac{10 \times 100}{50}\right) = \log 20$

Q $\log 2 + \log 4 + \log 8 + \log \frac{1}{4} - \log 16$

$= \log\left(\frac{2 \times 4 \times 8 \times \frac{1}{4}}{16}\right) = \log 1 = 0$

power-power

* $\log_b x^3 = 3 \log_b x$

* $\log x^5 = 5 \log x$

* $\log x^6 = 6 \log x$

**

$$\log_b a^n = n \log_b a$$

Q $\log_2^8 = \log_2^{2^3} = 3 \log_2^2 = 3$

Q $\log_5^{125} = \log_5^{5^3} = 3 \log_5^5 = 3$

Q $\log 64 = \log 2^6 = 6 \log 2$

$\log 8 = \log 2^3 = 3\log 2$

$\log 81 = \log 3^4 = 4\log 3$

Q $\log 2 + \log 8 + \log 16 - \log 64 \Rightarrow \log\left(\frac{2\times 8\times 16}{64}\right) = \log 4$

$= \log 2^2 = 2\log 2$

M2

$\log 2 + 3\log 2 + 4\log 2 - 6\log 2$

$= 2\log 2$

Q If $\log 2 = x$

find the value of

(a) $\log 64 = \log 2^6 = 6 \log 2 = 6x$

(b) $\log 4 + \log 64 - \log 32$

$= \log\left(\frac{4 \times 64}{32}\right) = \log 8 = \log 2^3 = 3 \log 2$

$= 3x$

Q $\log_{10} x + \log_{10} y = 2$

Find the value of $x \cdot y$

Sol^n $\log_{10} xy = 2$

$xy = 10^2 = 100$

For the curve.

Q $\log_{10} x^2 + \log_{10} y = 2$

Find the value of y at $x = 2$

Sol^n $\log_{10}(x^2 \cdot y) = 2$

$x^2 y = 10^2$

$x^2 y = 100$

put $x = 2$

$2^2 y = 100$

$\boxed{y = 25}$

Q $\log 64$ will be

① $2\log 2$

② $6\log 2$

③ $5\log 2$

④ $4\log 2$

$$\log 64 = \log 2^6 = 6\log 2$$

$\log x^3 = 3\log x$

$\log x^{10} = 10\log x$

$\log x^{-2} = -2\log x$

$\log x^{-6} = -6\log x$

$\log\left(\frac{1}{8}\right) = \log(8^{-1}) = -1\log 8$

$= -1\log 2^3$

$= -3\log 2$

$\log\left(\frac{1}{2}\right)^3 = 3\log\left(\frac{1}{2}\right) = 3\log 2^{-1}$

$= -3\log 2$

$\log\frac{1}{8} = \log 1 - \log 8$

$= 0 - \log 2^3 = -3\log 2$

Q Find $(WD)_{by\ gas}$ in isothermal process at $T = 100K$, $(n = 2\ mole)$ if Volume of gas rises from $V_i = 2m^3$ to $V_f = 64\ m^3$

$$(WD)_{gas} = nRT \ln \frac{V_f}{V_i}, \quad (\text{Use } \ln 2 = .69)$$

Soln

$$(WD)_{gas} = nRT \ln\left(\frac{64\,m^3}{2\,m^3}\right)$$

$$= nRT \ln 32$$

$$= nRT \ln 2^5$$

$$= nRT \times 5 \ln 2$$

$$= 2 \times R \times 100 \times 5 \times .69$$

$$= \checkmark$$

Rules

* $\log_b^a = c \Rightarrow a = b^c$

$a>0, b>0, b\neq 1$

* $\log 1 = 0$
* $\log_a^a = 1$
* $\log_{10}^{10} = 1$
* $\log_e^{50} = \ln 50$
* $\ln e = 1$

Base Same.

* $\log(m.n) = \log m + \log n$
* $\log(x.y.z) = \log x + \log y + \log z$
* $\log\left(\frac{m}{n}\right) = \log m - \log n$

* $\log_b^{a^n} = n \log_b^a$

$\log_{10}^{2^5} = 5 \log_{10}^2$

* $\log 3^4 = 4 \log 3$
* $\ln 3^5 = 5 \ln 3$

THANK YOU