

DAY 19

MCA CET 2025

MATHS

LOGARITHM



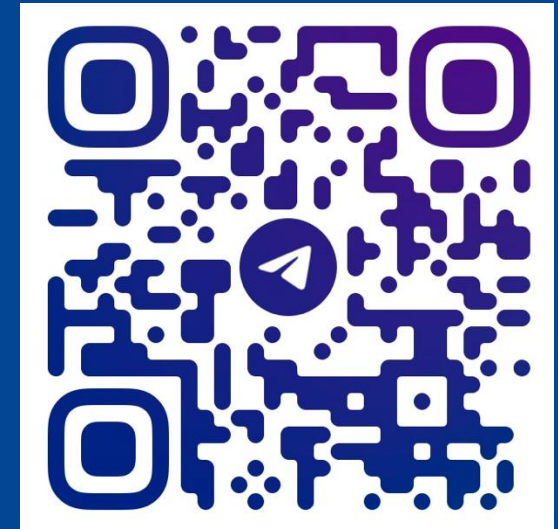
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Logarithm

$$a^b = c$$

$$\log_a c = b$$

↑
base

$$\text{true if } \begin{cases} c > 0 \\ a > 0 \\ a \neq 1 \end{cases}$$



Algebra of Logarithm

$$1. \log_a m + \log_a n = \log_a (m \times n)$$

$$2. \log_a m - \log_a n = \log_a \left(\frac{m}{n}\right)$$

$$3. \log_a (m^n) = n \log_a m$$



Algebra of Logarithm

$$4. \log_a m$$

$$= \frac{\log m}{\log a}$$

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

$$= \frac{1}{\frac{\log a}{\log m}}$$

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



Algebra of Logarithm

$$5. a^{\log_b c} = b^{\log_c a}$$

$$6. \log_{b^c} a = \frac{1}{c} \log_b a$$



Natural and Common Log

1. Common log (Brigg's log)

base = 10

e.g. $\log_{10} 100$



Natural and Common Log

2. Natural log (Napier's log)

base = 'e' = 2.71

e.g. $\log_e x = \ln x$

↑
representation for natural
log.



Antilog

$$\log a = b$$

↕

interchangeable.

$$\therefore a = \text{antilog } b$$



Characteristic & Mantissa

$\log 3.257$

↑
characteristic
Can be +ve, -ve or 0

← Mantissa
Can never be -ve
and always be
less than
'1'



How to find characteristic?

Case I :

The characteristic of the log of a number greater than 1

$$\log 3.257$$

$$n = 1$$

\Rightarrow

$$\text{characteristic} = n - 1$$

$$= 1 - 1$$

$$= 0$$



How to find characteristic?

Case II :

(-ve)

The characteristic of the log of a number smaller than 1

$$\log 0.0152$$

$$n=1$$

characteristic

$$= -(n+1)$$

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

$$= \bar{2}$$



Bar Notation in Log

$$\bar{2}.176$$

↓

$$-2 + 0.176$$

$$\bar{3}.0176$$
$$= -3 + 0.0176$$



What is the value of $\log_{10}(0.0001)$?

(a) $\frac{1}{4}$

(b) $-\frac{1}{4}$

~~(c) -4~~

(d) 4

NOTE: $\log_{10} 10 = 1$
 $\log_e e = 1$

$$\log_a m^n = n \log_a m$$

$$\log_{10} 0.0001 = \log_{10} \frac{1}{10000} = \log_{10} 10^{-4}$$

$$= \log_{10} \frac{1}{10^4} = \log_{10} 10^{-4}$$

$$= \log_{10} 10^{-4} = -4 \log_{10} 10 = -4$$



Find the logarithm of 1728 to the base $2\sqrt{3}$.

(a) 3.124

(b) 3.1732

~~(c) 6~~

(d) 5

$$\log_{2\sqrt{3}} 1728 = 6$$

$$2^6 \times 3^3$$
$$(\sqrt{3}^2)^3 = (\sqrt{3})^6$$

$$(2\sqrt{3})^6 = 1728$$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1



What is the value of

$$\frac{1}{2} \log_{10} 25 - 2 \log_{10} 3 + \log_{10} 18?$$

(a) 2

(b) 3

~~(c) 1~~

(d) 0

$$= \log \sqrt{25} - \log 3^2 + \log 18$$

$$= \log 5 - \log 9 + \log 18$$

$$= \log \frac{5}{9} \times 18 = \log \frac{10}{10} = 1$$



What is the value of $[\log_{10} (5 \log_{10} 100)]^2$?

(a) 4

(b) 3

(c) 2

~~(d) 1~~

②

$$[\log_{10} 5 \times 2]^2$$
$$= [\log_{10} 10]^2$$



The value of $\log_y x \cdot \log_z y \cdot \log_x z$ is

(a) $\log xyz$

(b) xyz

~~(c) 1~~

(d) 0

$$\frac{\cancel{\log x}}{\cancel{\log y}} \times \frac{\cancel{\log y}}{\cancel{\log z}} \times \frac{\cancel{\log z}}{\cancel{\log x}} = 1$$



The value of $\frac{1}{\log_{xy}(xyz)} + \frac{1}{\log_{yz}(xyz)} + \frac{1}{\log_{zx}(xyz)}$ is

- (a) xyz
- ~~(b) 2~~
- (c) 0
- (d) 1

$$\log_{xy^2} x^4 + \log_{x^2y} y^2 + \log_{x^2y^2} z^2$$
$$= \log_{x^2y^2} \frac{x^4 \times y^2 \times z^2}{x^2y^2} = \frac{2^2 \times 4^2 \times 2^2}{(2 \times 4)^2} = (2 \times 4)^2$$



The value of $\log_{(0.01)}(1000)$ is

(a) $\frac{1}{3}$

(b) $-\frac{1}{3}$

(c) $\frac{3}{2}$

~~(d) $-\frac{3}{2}$~~

$\log_{10} 10^3$
 $\log_{10} 10^{-2}$

$= \frac{3}{-2} \log_{10} 10$

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



The characteristic in $\log \underline{6.7482} \times 10^{\textcircled{-5}}$ is

(a) 6

(b) - 4

(c) 5

~~(d) - 5~~



The value of $10^{\log_{10} m + 2 \log_{10} n + 3 \log_{10} p}$ is

(a) $m^2 np^3$

(b) $mn^2 p^3$

(c) $m^3 np^2$

(d) None of these

$$10 [\log_{10} m + \log_{10} n^2 + \log_{10} p^3]$$

$$10 [\log_{10} mn^2 p^3]$$

$$= mn^2 p^3$$

~~\log_{10}~~ 1-

$$= m \log_n^a$$

$$a \log_n^m$$



The number of zeros that are between the decimal point and the first significant figure in $(0.5)^{100}$,

if $\log(0.5) = \bar{1}.6990$ is

- ~~(a) 30~~ (b) 20 (c) 10 (d) 40

$$\log n = \log 0.5^{100}$$

$$\log n = 100 \log 0.5$$

$$\begin{aligned} &= 100 \times (\bar{1}.6990) \\ &= 100 \times (-1 + 0.6990) \\ &= -100 + 69.90 \\ &= \underline{\underline{-100 + 69 + 0.90}} \end{aligned}$$

$$\begin{aligned} &= -31 + 0.90 \\ &= \bar{31}.90 \\ &= \bar{30} \end{aligned}$$

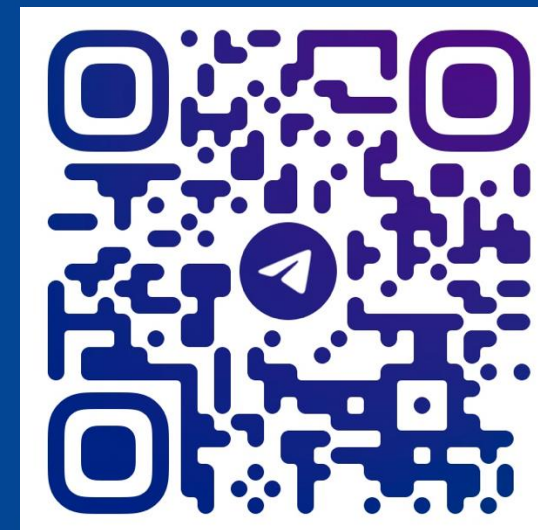
n+1



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