Logarithms

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Placement for All. All for Placement

This Video Completely covers the problems on"Logarithms" which is more than sufficient for all kind of placement Exams eg: TCS/WIPRO/AMCAT/ELITMUS/CoCubes and all other placement Exams.

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Logarithms

$\log_{10} a$

exponential exp. function

$a^x = b$

$\log a^x = \log b$

$x \log a = \log b$

$x = \frac{\log b}{\log a} = \log_a b$

$\log_a b$ → argument, b → base

$\log_n m^n = n \log_n m$

$\log_a^b = x$, $b = a^x$

$\log_{10} 100$ → argument, 10 → base

$x = \log_a b$

argument = base^x

Logarithms

Properties of Logarithms

never, 2-3 times

(1) $\log_a 1 = 0$ ✓ $\log_{10} 1 = 0$

(2) $\log_a a = 1$ ✓ $\log_{10} 10 = 1$, $\log_{16} 16 = 1$

(3) $\log_a (xy) = \log_a x + \log_a y$ $\log 6 = \log(2 \times 3)$, $\log_{10} 2 + \log_{10} 3$

(4) $\log_a (x/y) = \log_a x - \log_a y$ $\log 7/4$, $\log 7 - \log 4$

(5) $\log_a x^n = n \log_a x$ $\log 8 = \log 2^3$, $3 \log 2$

(6) $\log_a x = \frac{\log_b x}{\log_b a}$ $\frac{\log_{10} x}{\log_{10} a}$ → change of base formula

(7) $\log_a x = \frac{1}{\log_x a}$, $\log_7 2 = \frac{1}{\log_2 7}$

(8) $\log_a x = b$ ⇒ then $x = a^b$

$\log_a b = x$, $a = b^x$

Logarithms

$\log_b a = x \Rightarrow a = b^x$ ✓

① $\log_2 32 = x$, $x = ?$ ✓ ⇒ 5 ✓

2^5

$2 \times 2 \times 2 \times 2 \times 2 = 32$

$\log_2 32 = x$

$\log_a a = 1$ $\quad \log_a x^n = n \log_a x$

$\log_2 2^5 = x \Rightarrow 5 \log_2 2 = x$

$5 \times 1 = x$ $\quad x = 5$

② $\log_5 1 = y$, $y = ?$

$1 = 5^y$ $\quad 5^0$

$5^0 = 5^y$

$y = 0$ ✓

2nd

$\log_2 32 = x$ ✓

$32 = 2^x$

$2^5 = 2^x$

$x = 5$

Logarithms

Simplification

Q3. $\log 2^{14} = \log (8)^{3+x}$, $x = ?$ → 5/3 ✓

$(a^m)^n = a^{mn}$ ✓

$a^m = a^n$

$2^{14} = 8^{(3+x)} \Rightarrow 2^{14} = 2^{3(3+x)} \Rightarrow 2^{14} = 2^{9+3x}$

$\Rightarrow 14 = 9 + 3x$

$3x = 5$

$x = 5/3$

Q4. $\log 15^{33} = \log (225)^{18+x}$, $x = ?$ $3\frac{1}{2} = 1.5$ ✓

$\Rightarrow 15^{33} = (225)^{18+x} \Rightarrow 15^{33} = 15^{2(18+x)}$

$\Rightarrow 15^{33} = (15^2)^{18+x}$

$33 = 36 + 2x$

$2x = 3 \Rightarrow x = 3/2 \Rightarrow 1.5$

Logarithms

Q5 $\log_{10} 80 = ?$ $\quad \log 2 = 0.3010$ $\quad \log_{10} 2 = 0.3010$ ✓✓

$\log_{10} 10 \times 8 \Rightarrow \log_{10} 10 + \log_{10} 8 \Rightarrow 1 + \log_{10} 2^3 \Rightarrow 1 + 3 \log_{10} 2$

$1 + 3 \times 0.3010$

$1 + .9030$

1.9030

Q6. $\log_9 27 - \log_{27} 9 = ?$ 5/6 ✓

$\log_{3^2} 3^3 - \log_{3^3} 3^1 \Rightarrow \frac{3}{2} \log_3 3 - \frac{2}{3} \log_3 3$

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

$\frac{9-4}{6} = 5/6$

$\log_{x^3} x^2 = \frac{2}{3} \log x$

Logarithms

Q7. $\log_{125} 625 = ?$

$\log_{5^3} 5^4 \Rightarrow \frac{4}{3}\log_5 5 \to 1$ $\quad \log_a a = 1$

$= 4/3$

$625 = 25 \times 25$
$= 5\times5\times5\times5$
$= 5^4$

$\log_{10} xy = \log_{10} x - \log_{10} y$

Q8. $\log \frac{a^2}{b} + \log \frac{b}{a^2} = \log(a-b)$

a. $a=b$ b. $a-b=1$ c. $a+b=1$ d. $a^2+b^2=1$

$\log a^2 - \log b + \log b - \log a^2 = \log(a-b)$

$\log(a-b) = 0 \Rightarrow \log(a-b) = \log 1$

$a-b=1$

Logarithms

Q9. $\frac{1}{\log_a b} \times \frac{1}{\log_b c} \times \frac{1}{\log_c a} = ?$ $\log_b a = \frac{\log a}{\log b}$ $\quad \log_y x = \frac{1}{\log_x y}$

a. $a+b+c$ b. abc c. 0 d. 1

$\log_b a \times \log_c b \times \log_a c \Rightarrow \frac{\log a}{\log b} \times \frac{\log b}{\log c} \times \frac{\log c}{\log a} \Rightarrow 1$

Q10. $\log \frac{1000}{(0.01)} = ?$ $\quad 0.01 = \frac{1}{100} = \frac{1}{10^2} = 10^{-2}$

$\log_{10^{-2}} 10^3 \Rightarrow \frac{3}{-2}\log_{10} 10 \to 1$

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

a. $\frac{1}{3}$ b. $-\frac{1}{3}$ c. $\frac{3}{2}$ d. $-\frac{3}{2}$

Logarithms

Q11. $\log_2[\log_2(\log_4 256)] = ?$ $\quad 256 = 16\times16 = 4\times4\times4\times4 = 4^4$

$\log_2[\log_2(\log_4 4^4)] \Rightarrow \log_2[\log_2 \log_4 4^4] \Rightarrow \log_2[\log_2^4 \log_4 4] \to 1$

$\log_2[\log_2 \log_2^2]$

$= \log_2 2 \times \log_2 2$

$= 1\times1 = 1$

a. 0 b. 1 c. 2 d. 5

$\log_b a = x \quad a = b^x$

Q12. $\log_2[\log_3(\log_2 x)] = 1, \; x = ?$

$\log_{2b}^{a}[\log_3(\log_2^b x)] = 1$

$\log_{3a}(\log_2^b x) = 2^1 = 2$

$\Rightarrow \log_2^b 2 = 3^2 = 9$

a. 2^7 b. 2^9 c. 2^{12} d. 2^{16}

$\log_2 x = 9$

$x = 2^9$

Logarithms

Q13. $\log_{10}(x+1) + \log_{10} 5 = 3$]

a. 199 b. 200 C. 299 d. 300

$\Rightarrow \log_{10} 5(x+1) = 3$

$\Rightarrow 5(x+1) = 10^3$

$5(x+1) = 1000$

$(x+1) = 200$

$x = 200 - 1 = 199$

log log

① $\log_{10} x + \log_{10} y = \log_{10} xy$

② $\log_b a = x$

$a = b^x$]

Logarithms

Q14. $\log 125 + \log 8 = x \Rightarrow x = ?$

a. 1 b. 3 C. 4 d. 6

$\log\left(\frac{1000}{8}\right) + \log 8 = x$

$\log 1000 - \log 8 + \log 8 = x$

$\log_{10} 10^3 = x$

$3 \log_{10} 10 = x$

$x = 3$

$\frac{1000}{8} = 125$

Extra Careful

✓ $5 \Rightarrow \frac{10}{2}$

✓ $50 = \frac{100}{2}$

✓ $150 = \frac{300}{2}$

✓ $\frac{1000}{8} = 125$

$\log xy$

$\log x - \log y$

Logarithms

Q15. $\log_7 2 = m$

$\log_{49} 28 = ?$

a. $2(1+2m)$ b. $\frac{1+2m}{2}$ C. $\frac{2}{1+2m}$ d. $(1+m)$

$\log_7^2$

$\Rightarrow \frac{\log 4 + \log 7}{2 \log 7} \Rightarrow \frac{\log 2^2 + \log 7}{2 \log 7}$

$\frac{2\log 2}{2\log 7} + \frac{\log 7}{2\log 7} \Rightarrow \frac{2\log 2 + \log 7}{2 \log 7}$

$\log_7 2 + \frac{1}{2} \Rightarrow m + \frac{1}{2}$

$\left[\frac{(2m+1)}{2}\right]$ ✓

$\log_{49} 28 \Rightarrow \frac{\log 28}{\log 49}$

$\frac{\log 4 \times 7}{\log 7 \times 7}$

$\frac{\log 4 + \log 7}{\log 7^2}$

$\log \frac{x}{y}$

$\frac{\log x}{\log y}$

$\log xy$

$\log x + \log y$

Logarithms

Q16. $2\log(a+b) = \log 9 + \log a + \log b$ then $a^2+b^2 = ?$

a. 0 b. 11ab c. 7ab d. None

$\log x + \log y = \log xy$

$2\log(a+b) = \log 9 + \log a + \log b$

$\log(a+b)^2 = \log 9ab$

$a^2+b^2+2ab = 9ab$

$a^2+b^2 = 9ab - 2ab = 7ab$

Logarithms

Vgood

Q17. $\log 2 = 0.3010$ and $\log 3 = 0.4771$, then value of $\log_5 512$ is.

(a) 2.870 (b) 2.467 (c) 3.876 (d) 3.912

Square - 1-35
Cube - 1-15
table 1-20

$\log_5 512$

$\log_{10/2} 512$

$\frac{\log 512}{\log 10/2}$

$5 = \frac{10}{2}$

$\log_{10} 2^9$

$\log 10 - \log 2$

$\frac{9\log 2}{1 - 0.3010}$

$\frac{9 \times 0.3010}{0.6990}$

$\frac{\log x}{\log y}$

1.0000
0.30 10
.6990

[3.876]

27090
6990

$512 = 8^3 \Rightarrow 512$
$(2^3)^3$
$= 2^9$

Logarithms

Q18.

n	f(n)
8	3
32	5
128	7
512	9

f(n) logarithm

From the above table, the function f(n) is

(a) $n\log_2 n$ (b) $\log_2 n$ (c) exp(n) (d) 2^n

TCS 2020

$f(n) = \log_2 n$

$f(n) = \log_2 8$

$= \log_2 2^3$

$= 3\log_2 2$

$\Rightarrow 3 \times 1 = 3$