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LOGARITHMS

INTRODUCTION

- In mathematics the logarithms is the inverse function to the exponentiation.
- The logarithm of a given number *x* is the exponent to which another fixed number, the *base b*, must be raised, to produce that number *x*
- since $1000 = 10 \times 10 \times 10 = 10^3$, the "logarithm to base 10" of 1000 is 3.
- For example: The logarithm of *x* to *base b* is denoted as $\log_b x$
- More explicitly the relation between logarithm and exponentiation is $\log_b x = y$ exactly if $b^y = x$
- The logarithm is denoted "$\log_b x$" (pronounced as "the logarithm of *x* to base *b*" or "the base-*b* logarithm of *x*" or (most commonly) "the log, base *b*, of *x*").

IMPORTANT TERMS

Property	Definition	Example
Product	$\log_b mn = \log_b m + \log_b n$	$\log_3 9x = \log_3 9 + \log_3 x$
Quotient	$\log_b \frac{m}{n} = \log_b m - \log_b n$	$\log_{\frac{1}{4}} \frac{4}{5} = \log_{\frac{1}{4}} 4 - \log_{\frac{1}{4}} 5$
Power	$\log_b m^p = p \cdot \log_b m$	$\log_2 8^x = x \cdot \log_2 8$
Equality	If $\log_b m = \log_b n$,, then $m = n$.	$\log_8(3x-4) = \log_8(5x+2)$ so, 3x – 4 = 5x+2

Question: 01

If log 27 = 1.431, then the value of log 9 is _____.

A. 0.934

B. 0.945

C. 0.954

D. 0.958

Answer: C

Explanation: 01

Log 27=1.431

log (3^3) = 1.431

3 log 3 = 1.431

log 3 = 0.477

log 9 = log(3^2) = 2 log 3 = (2 x 0.477) = 0.954.

Question: 02

$\log_6(216) + [\log(42) - \log(6)] / \log(49)$

A. 7/2

B. 1/2

C. 4/3

D. 2/3

Answer: A

Explanation: 02

$\log_6(216) + [\log(42) - \log(6)] / \log(49)$

$= \log_6(6^3) + \log(42/6) / \log(7^2)$

$= 3 + \log(7) / 2\log(7) = 3 + ½$

$= 7/2$

Question: 03

Find the value of $\log_2 2 + \log_2 2^2 + \log_2 2^3 + ... + \log_2 2^n$.

A. n(n+1)/2

B. n+1

C. n

D. 2n

Answer: A

Explanation: 03

$\log_2 2 + \log_2 2^2 + \log_2 2^3 + ... + \log_2 2^n$
$= \log_2 2 + 2\log_2 2 + 3\log_2 2 + ... + n\log_2 2$
$= 1+2+3+.....+n$
$= n(n+1)/2$

Question: 04

If log 2 = 0.301 and log 3 = 0.4771, find the number of digits in 48^{12}?

A. 19

B. 20

C. 21

D. 24

Answer: C

Explanation: 04

We have $\log 48^{12} = 12 \times \log 48 = 12 \times \log (2^4 \times 3)$
$= 12 \times (4 \log 2 + \log 3)$
$= 12 \times (4 \times 0.301 + 0.4771)$
$= 12 \times (1.204 + 0.4771)$
$= 12 \times 1.6811 = 20.1732$
Now the characteristic is 20, so the number of digits = 20 + 1 = 21.

Question: 05

Solve for ‘x:’ the equation is $2\log_2 x - \log_2 (x - 2) = 3$

A. 6

B. 4

C. 1

D. 2

Answer: B

Explanation: 05

We have $2\log_2 x - \log_2 (x - 2) = 3$

$\Rightarrow \log_2 x^2 - \log_2 (x - 2) = 3$

$\Rightarrow \log_2 (x^2/x-2) = 3$

$\Rightarrow (x^2/x-2) = 2^3 = 8$

$\Rightarrow x^2 = 8(x-2)$

$\Rightarrow x^2 - 8x + 16 = 0$

$\Rightarrow (x-4)^2 = 0$

$\Rightarrow x=4$

Hence answer is option B

Question: 06

$\text{Log}_{10}\ 3+\log_{10}(4x+1)=\log_{10}(x+1)+1$

A. 2/7

B. 7/2

C. 3/7

D. 7/3

Answer: B

Explanation: 06

$\log_{10} 3+\log_{10} (4x+1)=\log_{10} (x+1)+1$

$\text{Log}_{10} 3+\log_{10} (4x+1)=\log_{10} (x+1)+\log_{10} 10$

$\text{Log}_{10} (3(4x+1))=\log_{10} (10(x+1))$

➔ $3(4x+1)=10(x+1)$

➔ $12x+3 = 10x+10$

➔ $2x=7$

$\mathbf{x}=7/2$

Question: 07

If $\log_{10} 2 = 0.3010$, the value of $\log_{10} 80$ is _____.

A. 1.6020

B. 1.9030

C. 9030

D. None of these

Answer: B

Explanation: 07

$\log_{10} 80 = \log_{10} (8 * 10)$

$= \log_{10} 8 + \log_{10} 10$

$= \log_{10} (2^3) + 1$

$= 3 \log_{10} 2 + 1$

$= (3 \times 0.3010) + 1$

$= 1.9030.$

Question: 08

If $\log_{10} 5 + \log_{10} (5x + 1) = \log_{10} (x + 5) + 1$, then x is equal to:

A. 1

B. 3

C. 5

D. 10

Answer: B

Explanation: 08

$\log_{10} 5 + \log_{10} (5x + 1) = \log_{10} (x + 5) + 1$
$\log_{10} 5 + \log_{10} (5x + 1) = \log_{10} (x + 5) + \log_{10} 10$
$\log_{10} [5 (5x + 1)] = \log_{10} [10(x + 5)]$
$5(5x + 1) = 10(x + 5)$
$5x + 1 = 2x + 10$
$3x = 9$
$x = 3.$

Question: 09

If log x + log (x + 3) = 1 then the value(s) of x will be, the solution of the equation

A. x + x + 3 = 1

B. x + x + 3 = 10

C. x (x + 3) = 10

D. x (x + 3) = 1

Answer : C

Explanation: 09

taking log x= log10x
using the law of logs
Log A+log B=log AB
we have
Log x+log (x+3)=1
Log x(x+3)=1−−(1)
definition of logs
Log ab=c⇒ac=b
(1)⟶101=x(x+3)
∴x2+3x=10
x2+3x−10=0
factorising and solving
(x+5)(x−2)=0
⇒x=−5, or x=2
When solving with x=2 the equation becomes as option c

Question: 10

Find x if log x = log 1.5 + log 12

A. 18

B. 8

C. 15

D. 12

Answer: A

THANK YOU

Question: 09

If $2^{2x+4} - 17 \times 2^{x+1} = -4$, then which of the following is true?

A. x is a positive value

B. x is a negative value

C. x can be either a positive value or a negative value

D. None of these

Answer: C

Explanation: 09

$2^{x+4} - 17 * 2^{x+1} = -4$
$2^{x+1} = y$
$2^{2x+2} = y^2$
$2^2(2^{2x+2}) - 17 * 2^{x+1} = -4$
$4y^2 - 17y + 4 = 0$
$4y^2 - 16y - y + y = 0$
$4y (y - 4) - 1 (y - 4) = 0$
$Y = 4$
2^{x+1}
$x + 1 = 2$ or -2
$x = 1$ or -3

the answer is "x can be either a positive value or a negative value".

Question: 10

$\log_3 x + \log_x 3 = 17/4$. Find X?

A. 3^4

B. $3^{1/8}$

C. $3^{1/4}$

D. $3^{1/3}$

Answer: C

Explanation: 10

$\log_3 x + \log_x 3 = 17/4$
Let $y = \log_3 x$
We know that $\log_x 3 = 1/\log 3(x)$
Thus the equation can be written as $y + 1/y = 174$
$4y^2 + 4 = 17y$
$4y^2 + 4 - 17y = 0$
$y = 4$ or $¼$
$\log_3 x = 4$
Then $x = 3^4$
If $y = 1/4$
$\log_3 x = 1/4$
$x = 3^{1/4}$

Explanation: 12

Question: 13

$\log_a 4 + \log_a 16 + \log_a 64 + \log_a 256 = 10$. Then a = _____.

A. 2

B. 4

C. 8

D. 5

Answer: B

Explanation: 13

$\log a^{(4+16+64+256)} = 10 \log a\ 4^{10} = 10$ then $a=4$

Question: 14

$\text{Log}_{15}\, 3375 \times \log_{4} 1024 =$ _____.

A. 1

B. 18

C. 4

D. 15

Answer: D

Explanation: 14

$\log_{15}3375 \times \log_{4}1024 = 3 \log 15\ 15 \times 5 \log 4\ 4 = 3 \times 5 = 15$

Question: 15

If log 3 = 0.4771, find log $(0.81)^2 \times \log (27/10)^{2/3}$ π log 9.

A. 2.689

B. -0.0552

C. 2.2402

D. 2.702

Answer: D