Logarithms- Keynotes

1.If x,a and m are any three numbers connected by the relation:

$m=a^x$ $(a>0, a\neq1)$, then,

"x" is defined as the logarithm of "m" to the base "a" and is written as:

$x=\log_a m$

2.Some important results:

(a) $m = a^{\log am}$

(b) $x = \log_a (a^x)$

(c) $\log_a 1 = 0$

3.Some important theorems:

(a) $\log_a (mn) = \log_a m + \log_a n$

(b) $\log_a (m/n) = \log_a m - \log_a n$

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

(d) $\log_a m = (\log_b m) / (\log_b a)$ ……. Change of base theorem

(e) $\log_a a = 1$

(f) $\log_a b * \log_b a = 1$

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Exercise Questions

1.If $a^x = b^y$, then

a.log a/b= x/y   b.log a/ log b = x/y   c.log a/ log b = y/x   d.log b/a = x/y

2.2 $\log_{10} 5 + \log_{10} 8 - \frac{1}{2} \log_{10} 4$ = ?

a.2   b.4   c.2 + 2 $\log_{10} 2$ d.4 - 4 $\log_{10} 2$

3.$\log_a (ab) = x$, then $\log_b (ab)$ is :

a.1/x   b.x/ (x+1)   c.x/(1-x)   d.x/(x-1)

4.If $\log_8 x + \log_8 1/6 = 1/3$, then the value of x is:

a.12   b.16   c.18   d.24

5.The value of ($\log_9 27 + \log_8 32$) is:

a.7/2   b.19/6   c.5/3   d.7

6.If $\log_{12} 27 = a$, then $\log_6 16$ is:

a.(3-a)/4(3+a)   b.(3+a)/4(3-a)   c.4(3+a)/(3-a)   d.4(3-a)/(3+a)

7.The value of ($1/\log_3 60 + 1/\log_4 60 + 1/\log_5 60$) is:

a.0   b.1   c.5   d.60

8.If log x + log y = log (x+y), then,

a.x=y b.xy=1 c.y= (x-1)/x d.y=x/(x-1)

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

a.0.934 b.0.945 c.0.954 d.0.958

10.If log 2= 0.030103, the number of digits in 2^{64} is :

a.18 b.19 c.20 d.21

Answer & Explanations

1.(c). $a^x = b^y \Rightarrow \log a^x = \log b^y \Rightarrow x \log a = y \log b$

$\Rightarrow \log a / \log b = y/x$

2.(a). $2 \log_{10} 5 + \log_{10} 8 – ½ \log_{10} 4$

$= \log_{10} (5^2) + \log_{10} 8 - \log_{10} (4^{1/2})$

$= \log_{10} 25 + \log_{10} 8 - \log_{10} 2 = \log_{10} (25*8)/2$

$= \log_{10} 100 = 2$

3.(d). $\log_a (ab) = x \Rightarrow \log b / \log a = x \Rightarrow (\log a + \log b)/ \log a = x$

$1+ (\log b/ \log a) = x \Rightarrow \log b/ \log a = x-1$

$\log a/ \log b = 1/ (x-1) \Rightarrow 1+ (\log a/ \log b) = 1 + 1/ (x-1)$

$(\log b/ \log b) + (\log a/ \log b) = x/ (x-1) \Rightarrow (\log b + \log a)/ \log b = x/ (x-1)$

$\Rightarrow \log (ab)/ \log b = x/(x-1) \Rightarrow \log_b (ab) = x/(x-1)$

4.(a). $\log_8 x + \log_8 (1/6) = 1/3$

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=> (log x/ log 8) + (log $^{1}/_{6}$ / log 8) = log ($8^{1/3}$) = log 2

=> log x = log 2 – log 1/6 = log (2*6/1)= log 12

5.(c). Let $\log_9$ 27 = x. Then, 9^x = 27

=> $(3^2)^x = 3^3$ => 2x = 3 => x= 3/2

Let $\log_8$ 32 = y. Then

8^y = 32 => $(2^3)^y = 2^5$ => 3y = 5 => y=5/3

6.(d). $\log_{12}$ 27 = a => log 27/ log 12 = a

=> log 3^3 / log (3 * 2^2) =a

=> 3 log 3 / log 3 + 2 log 2 = a => (log 3 + 2 log 2)/ 3 log 3 = 1/a

=> (log 3/ 3 log 3) + (2 log 2/ 3 log 3) = 1/3

=> (2 log 2)/ (3 log 3) = 1/a – 1/3 = (3-a)/ 3a

=> log 2/ log 3= (3-a)/3a => log 3 = (2a/3-a)log2

$\log_{16}$ 16 = log 16/ log 6 = log 2^4/ log (2*3) = 4 log 2/ (log 2 + log 3)

= 4(3-a)/ (3+a)

7.(b). $\log_{60}$ 3 + $\log_{60}$ 4 + $\log_{60}$ 5 + $\log_{60}$ (3*4*5)

= $\log_{60}$ 60 = 1

8.(d). log x + log y = log (x+y)

=> log (x+y) = log (xy)

=> x+y = xy => y(x-1) = x

=> y= x/(x-1)

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9.(c). log 27 = 1.431 => log 3^3 = 1.431

=> 3 log 3= 1.431 => log 3 = 0.477

Therefore, log 9 = log 3^2 = 2 log 3 = (2*0.477) = 0.954

10.(c). log 2^{64} = 64 log 2 = (64*0.30103) = 1926592

Its characteristics is 19.

Hence, the number of digits in 2^{64} is 20.

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