Logarithms Questions for CAT

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Questions

Instructions
For the following questions answer them individually

Question 1

If $log_3 2, log_3(2^x - 5), log_3(2^x - 7/2)$ are in arithmetic progression, then the value of x is equal to

A 5

B 4

C 2

D 3

Answer: D

Explanation:
$2log(2^x - 5) = log2 + log(2^x - 7/2)$
Let $2^x = t$
=> $(t-5)^2 = 2(t - 7/2)$
=> $t^2 + 25 - 10t = 2t - 7$
=> $t^2 - 12t + 32 = 0$
=> t = 8, 4
Therefore, x = 2 or 3, but 2^x > 5, so x = 3

Question 2

Let $u = (\log_2 x)^2 - 6\log_2 x + 12$ where x is a real number. Then the equation $x^u = 256$, has

A no solution for x

B exactly one solution for x

C exactly two distinct solutions for x

D exactly three distinct solutions for x

Answer: B

Explanation:
$x^u = 256$

Taking log to the base 2 on both the sides,

$u * \log_2 x = \log_2 256$

=>$[(\log_2 x)^2 - 6\log_2 x + 12] * \log_2 x = 8$

$(log_2 x)^3 - 6(log_2 x)^2 + 12log_2 x = 8$

Let $log_2 x = t$

$t^3 - 6t^2 + 12t - 8 = 0$

$(t-2)^3 = 0$

Therefore, $log_2 x = 2$

=> $x = 4$ is the only solution

Hence, option B is the correct answer.

Question 3

If $log_y x = (a * log_z y) = (b * log_x z) = ab$, then which of the following pairs of values for (a, b) is not possible?

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A (-2, 1/2)

B (1,1)

C (0.4, 2.5)

D (π, 1/ π)

E (2,2)

Answer: E

Explanation:

$log_y x = ab$

$a * log_z y = ab$ => $log_z y = b$

$b * log_x z = ab$ => $log_x z = a$

$log_y x$ = $log_z y * log_x z$ => $logx/logy = logy/logz * logz/logx$

=> $\frac{logx}{logy} = \frac{logy}{logx}$

=> $(logx)^2 = (logy)^2$

=> $logx = logy$ or $logx = -logy$

So, x = y or x = 1/y

So, ab = 1 or -1

Option 5) is not possible

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Question 4

If x >= y and y > 1, then the value of the expression $log_x(x/y) + log_y(y/x)$ **can never be**

A -1

B -0.5

C 0

D 1

Answer: D

Explanation:

$log_x(x/y) + log_y(y/x)$ = $1 - log_x(y) + 1 - log_y(x)$

= $2 - (log_x y + 1/log_x y)$ <= 0 (Since $log_x y + 1/log_x y$ >= 2)

So, the value of the expression cannot be 1.

Question 5

If $\log_2 \log_7 (x^2 - x + 37)$ **= 1, then what could be the value of 'x'?**

A 3

B 5

C 4

D None of these

Answer: C

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Explanation:

$\log_2 \log_7 (x^2 - x + 37) = 1$

$\log_7 (x^2 - x + 37) = 2$

$(x^2 - x + 37) = 7^2$

Given eq. can be reduced to $x^2 - x + 37 = 49$

So x can be either -3 or 4.

Question 6

Suppose, $\log_3 x = \log_{12} y = a$, where x, y are positive numbers. If G is the geometric mean of x and y, and $\log_6 G$ is equal to

A $\sqrt{a}$

B 2a

C a/2

D a

Answer: D

Explanation:

We know that $\log_3 x = a$ and $\log_{12} y = a$

Hence, $x = 3^a$ and $y = 12^a$

Therefore, the geometric mean of x and y equals $\sqrt{x \times y}$

This equals $\sqrt{3^a \times 12^a} = 6^a$

Hence, $G = 6^a$ Or, $\log_6 G = a$

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Question 7

The value of $\log_{0.008} \sqrt{5} + \log_{\sqrt{3}} 81 - 7$ is equal to

A 1/3

B 2/3

C 5/6

D 7/6

Answer: C

Explanation:

$\log_{0.008} \sqrt{5} + \log_{\sqrt{3}} 81 - 7$

$81 = 3^4$ and $0.008 = \frac{8}{1000} = \frac{2^3}{10^3} = \frac{1}{5^3} = 5^{-3}$

Hence,

$\log_{0.008} \sqrt{5} + 8 - 7$

$\log_{5^{-3}} 5^{\frac{1}{2}} + 8 - 7$

$\frac{log 5^{0.5}}{log 5^{-3}} + 1$

$-\frac{1}{6} + 1$

$= \frac{5}{6}$

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Question 8

If x is a real number such that $\log_3 5 = \log_5(2+x)$, then which of the following is true?

A 0 < x < 3

B 23 < x < 30

C x > 30

D 3 < x < 23

Answer: D

Explanation:

$1 < \log_3 5 < 2$

=> $1 < \log_5(2+x) < 2$

=> $5 < 2 + x < 25$

=> $3 < x < 23$

Question 9

If $log(2^a \times 3^b \times 5^c)$is the arithmetic mean of $log(2^2 \times 3^3 \times 5)$, $log(2^6 \times 3 \times 5^7)$, and $log(2 \times 3^2 \times 5^4)$, then a equals

Answer:3

Explanation:

$log(2^a \times 3^b \times 5^c) = \frac{log(2^2 \times 3^3 \times 5) + log(2^6 \times 3 \times 5^7) + log(2 \times 3^2 \times 5^4)}{3}$

$log(2^a \times 3^b \times 5^c) = \frac{log(2^{2+6+1} \times 3^{3+1+2} \times 5^{1+7+4})}{3}$

$log(2^a \times 3^b \times 5^c) = \frac{log(2^9 \times 3^6 \times 5^{12})}{3}$

$3log(2^a \times 3^b \times 5^c) = log(2^9 \times 3^6 \times 5^{12})$

Hence, 3a = 9 or a = 3

Question 10

If x is a positive quantity such that $2^x = 3^{\log_5 2}$. then x is equal to

A $\log_5 8$

B $1 + \log_3(\frac{5}{3})$

C $\log_5 9$

D $1 + \log_5(\frac{3}{5})$

Answer: D

Explanation:

Givne that: $2^x = 3^{\log_5 2}$

$\Rightarrow 2^x = 2^{\log_5 3}$

$\Rightarrow x = \log_5 3$

$\Rightarrow x = \log_5 \frac{3*5}{5}$

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$\Rightarrow x = \log_5 5 + \log_5 5^{\frac{3}{3}}$

$\Rightarrow x = 1 + \log_5 5^{\frac{3}{3}}$. Hence, option D is the correct answer.

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