Logarithms Questions from CAT Exams

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Link: Video explanations

1. The number of distinct integers n for which $\log_{\left(\frac{1}{4}\right)}\left(n^2-7n+11\right)>0$ is **(CAT 2025 Slot 1)**

   (A) 2

   (B) infinite

   (C) 1

   (D) 0

2. If $\log_{64} x^2+\log_8 \sqrt{y}+3\log_{512}(\sqrt{y}\,z)=4$, where x, y, and z are positive real numbers, then the minimum possible value of $(x+y+z)$ is **(CAT 2025 Slot 2)**

   (A) 48

   (B) 36

   (C) 24

   (D) 96

3. The sum of all possible real values of x for which $\log_{x-3}(x^2-9)=\log_{x-3}(x+1)+2$ is **(CAT 2025 Slot 3)**

   (A) -3

   (B) $\sqrt{33}$

   (C) 3

   (D) $\dfrac{3+\sqrt{33}}{2}$

4. If x is a positive real number such that $4\log_{10} x+4\log_{100} x+8\log_{1000} x=13$, then the greatest integer not exceeding x, is **(CAT 2024 Slot 1)**

5. If a, b and c are positive real numbers such that $a>10\geq b\geq c$ and $\dfrac{\log_8(a+b)}{\log_2 c}+\dfrac{\log_{27}(a-b)}{\log_3 c}=\dfrac{2}{3}$, then the greatest possible integer value of a is **(CAT 2024 Slot 2)**

6. If x and y are positive real numbers such that $\log_x(x^2+12)=4$ and $3\log_y x=1$, then $x+y$ equals **(CAT 2023 Slot 1)**

   (A) 10

   (B) 68

   (C) 20

   (D) 11

7. For some positive real number x, if $\log_{\sqrt{3}}(x) + \dfrac{\log_x(25)}{\log_x(0.008)} = \dfrac{16}{3}$, then the value of $\log_3(3x^2)$ is **(CAT 2023 Slot 2)**

8. For a real number x, if $\dfrac{1}{2}$, $\dfrac{\log_3(2^x - 9)}{\log_3 4}$, and $\dfrac{\log_5(2^x + \frac{17}{2})}{\log_5 4}$ are in an arithmetic progression, then the common difference is **(CAT 2023 Slot 3)**

   (A) $\log_4 7$

   (B) $\log_4\left(\dfrac{3}{2}\right)$

   (C) $\log_4\left(\dfrac{23}{2}\right)$

   (D) $\log_4\left(\dfrac{7}{2}\right)$

9. The number of distinct integer values of n satisfying $\dfrac{4 - \log_2 n}{3 - \log_4 n} < 0$, is **(CAT 2022 Slot 2)**

10. If $5 - \log_{10}\sqrt{1+x} + 4\log_{10}\sqrt{1-x} = \log_{10}\dfrac{1}{\sqrt{1-x^2}}$, then $100x$ equals **(CAT 2021 Slot 1)**

11. If $\log_2[3 + \log_3\{4 + \log_4(x-1)\}] - 2 = 0$ then $4x$ equals **(CAT 2021 Slot 2)**

12. For a real number a, if $\dfrac{\log_{15} a + \log_{32} a}{(\log_{15} a)(\log_{32} a)} = 4$, then a must lie in the range **(CAT 2021 Slot 3)**

   (A) $4 < a < 5$

   (B) $3 < a < 4$

   (C) $2 < a < 3$

   (D) $a > 3$

13. If $\log_4 5 = (\log_4 y)(\log_6 \sqrt{5})$, then y equals **(CAT 2020 Slot 1)**

14. If y is a negative number such that $2^{y^2 \log_3 5} = 5^{\log_2 3}$, then y equals **(CAT 2020 Slot 1)**

   (A) $-\log_2\left(\dfrac{1}{5}\right)$

   (B) $\log_2\left(\dfrac{1}{3}\right)$

   (C) $\log_2\left(\dfrac{1}{5}\right)$

   (D) $-\log_2\left(\dfrac{1}{3}\right)$

15. The value of $\log_a\left(\frac{a}{b}\right) + \log_b\left(\frac{b}{a}\right)$, for $1 < a \leq b$, cannot be equal to **(CAT 2020 Slot 2)**

(A) 0

(B) 1

(C) -1

(D) -0.5

16. If $\log_a 30 = A$, $\log_a\left(\frac{5}{3}\right) = -B$ and $\log_2 a = \frac{1}{3}$, then $\log_3 a$ equals **(CAT 2020 Slot 3)**

(A) $\frac{A+B-3}{2}$

(B) $\frac{A+B}{2} - 3$

(C) $\frac{2}{A+B-3}$

(D) $\frac{2}{A+B} - 3$

17. $\frac{2 \times 4 \times 8 \times 16}{(\log_2 4)^2(\log_4 8)^3(\log_8 16)^4}$ equals **(CAT 2020 Slot 3)**

18. Let x and y be positive real numbers such that $\log_5(x+y) + \log_5(x-y) = 3$, and $\log_2 y - \log_2 x = 1 - \log_2 3$. Then xy equals **(CAT 2019 Slot 1)**

(A) 25

(B) 150

(C) 250

(D) 100

19. If x is a real number, then $\sqrt{\log_e \frac{4x - x^2}{3}}$ is a real number if and only if **(CAT 2019 Slot 2)**

(A) $-3 \leq x \leq 3$

(B) $1 \leq x \leq 2$

(C) $1 \leq x \leq 3$

(D) $-1 \leq x \leq 3$

20. If x is a positive quantity such that $2^x = 3^{\log_5 2}$, then x is equal to **(CAT 2018 Slot 1)**

(A) $\log_5 9$

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

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

(D) $\log_5 8$

21. If $\log_{12} 81 = p$, then $3\left(\frac{4-p}{4+p}\right)$ is equal to **(CAT 2018 Slot 1)**

(A) $\log_2 8$

(B) $\log_6 8$

(C) $\log_4 16$

(D) $\log_6 16$

22. If $\log_2(5 + \log_3 a) = 3$ and $\log_5(4a + 12 + \log_2 b) = 3$, then $a + b$ is equal to **(CAT 2018 Slot 1)**

(A) 32

(B) 59

(C) 67

(D) 40

23. If $p^3 = q^4 = r^5 = s^6$, then the value of $\log_s(pqr)$ is equal to **(CAT 2018 Slot 2)**

(A) $\frac{24}{5}$

(B) 1

(C) $\frac{47}{10}$

(D) $\frac{16}{5}$

24. $\frac{1}{\log_2 100} - \frac{1}{\log_4 100} + \frac{1}{\log_5 100} - \frac{1}{\log_{10} 100} + \frac{1}{\log_{20} 100} - \frac{1}{\log_{25} 100} + \frac{1}{\log_{50} 100} =?$ **(CAT 2018 Slot 2)**

(A) 0

(B) $\frac{1}{2}$

(C) -4

(D) 10

25. Suppose, $\log_3 x = \log_{12} y = a$, where x, y are positive numbers. If G is the geometric mean of x and y, then $\log_6 G$ is equal to: **(CAT 2017 Slot 1)**

(A) $\sqrt{a}$

(B) $2a$

(C) $\frac{a}{2}$

(D) a

26. The value of $\log_{0.008}\sqrt{5}+\log_{\sqrt{3}}81-7$ is equal to: **(CAT 2017 Slot 1)**

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

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

(C) $\frac{5}{6}$

(D) $\frac{7}{6}$

27. If x is a real number such that $\log_3 5=\log_5(2+x)$, then which of the following is true? **(CAT 2017 Slot 2)**

(A) $0<x<3$

(B) $23<x<30$

(C) $x>30$

(D) $3<x<23$

28. If $\log\left(2^a\cdot 3^b\cdot 5^c\right)$ is the arithmetic mean of $\log\left(2^2\cdot 3^3\cdot 5\right)$, $\log\left(2^6\cdot 3\cdot 5^7\right)$, and $\log\left(2\cdot 3^2\cdot 5^4\right)$, then a equals: **(CAT 2017 Slot 2)**

29. If $\lfloor\log_{10}1\rfloor+\lfloor\log_{10}2\rfloor+\lfloor\log_{10}4\rfloor+\cdots+\lfloor\log_{10}n\rfloor=n$, where $\lfloor x\rfloor$ denotes the greatest integer less than or equal to x, then: **(CAT 2016)**

(A) $96\le n<104$

(B) $104\le n<107$

(C) $107\le n<111$

(D) $111\le n<116$

30. Find x, if $\log_2 x+\log_x 2^x=0$. **(CAT 2015)**

31. If $x\ge y$ and $y>1$, then the value of the expression $\log_x y+\log_y x$ can never be **(CAT 2014)**

(A) -1

(B) -0.5

(C) 0

(D) 1

32. What is the sum of n terms in the series $\log m+\log\frac{m}{2}+\log\frac{m}{3}+\log\frac{m}{4}+\cdots+\log\frac{m}{n}$? **(CAT 2014)**

(A) $\log\left(\frac{m}{n}\right)^{\frac{n}{n-1}}$

(B) $\log\left(\frac{m}{n}\right)$

(C) $\log\left(\frac{m^n}{n!}\right)$

(D) $\log\left(\frac{m^n}{n}\right)$

33. Find the values of x and y for the given equations:
(I) $xy^2 = 4$ (II) $\log_3(\log_2 x) + \log_{1/3}(\log_{1/2} y) = 1$. **(CAT 2013)**

(A) $x = \frac{1}{8}$, $y = 64$

(B) $x = 64$, $y = \frac{1}{4}$

(C) $x = 4$, $y = \frac{1}{2}$

(D) $x = \frac{1}{4}$, $y = 4$

34. If $\log(x^a - x^b) - \log(x^a - b) + \log\left(\frac{x}{b}\right) = 0$, find $\frac{a^2}{b^2} + \frac{b^2}{a^2}$. **(CAT 2012)**

(A) 4

(B) 2

(C) 3

(D) 6

35. Which of the following statements is *not* correct? **(CAT 2010)**

(A) $\log_{10} 10 = 1$

(B) $\log 2 + \log 3 = 2 \times 3$

(C) $\log_{10} 1 = 0$

(D) $\log(1 \cdot 2 \cdot 3) = \log 1 + \log 2 + \log 3$

36. Let $u = \log_2 x - \log_2(x^2 + 6x + 12)$, where x is real. Then the equation $x^u = 256$ has **(CAT 2010)**

(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

37. If $\log_y z = a$, $\log_z x = b$, and $\log_x y = ab$, then which of the following pairs (a, b) is *not* possible? **(CAT 2006)**

(A) $\left(-\frac{1}{2}, \frac{1}{2}\right)$

(B) $(1, 1)$

(C) $(0.4, 2.5)$

(D) $\left(\pi, \frac{1}{\pi}\right)$

(E) $(2, 2)$

38. If $x \geq y$ and $y > 1$, then the value of the expression $\log_x\left(\frac{x}{y}\right) + \log_y\left(\frac{y}{x}\right)$ can never be: **(CAT 2005)**

(A) -1

(B) -0.5

(C) 0

(D) 1

39. Let $u = (\log_2 x)^2 - 6(\log_2 x) + 12$, where x is a real number. Then the equation $x^u = 256$ has: **(CAT 2004)**

(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

40. If $\log_3 2$, $\log_3(2^x - 5)$, $\log_3\left(2^x - \frac{7}{2}\right)$ are in arithmetic progression, then the value of x is: **(CAT 2003)**

(A) 5

(B) 4

(C) 2

(D) 3

41. What is the sum of n terms in the series:

$$\log m + \log\left(\frac{m^2}{n}\right) + \log\left(\frac{m^3}{n^2}\right) + \log\left(\frac{m^4}{n^3}\right) + \ldots$$

(CAT 2003)

(A) $\log\left[\frac{n^{(n-1)}}{m^{(n+1)}}\right]^{\frac{n}{2}}$

(B) $\log\left[\frac{m^m}{n^n}\right]^{\frac{n}{2}}$

(C) $\log\left[\frac{m^{(1-n)}}{n^{(1-m)}}\right]^{\frac{n}{2}}$

(D) $\log\left[\frac{m^{(1+n)}}{n^{(n-1)}}\right]^{\frac{n}{2}}$

42. If $\log_{10} x - \log_{10} \sqrt{x} = 2 \log_x 10$, then a possible value of x is: **(CAT 2003)**

(A) 10

(B) $\frac{1}{100}$

(C) $\frac{1}{1000}$

(D) None of these

43. If $\frac{1}{3} \log_3 M + 3 \log_3 N = 1 + \log_{0.008} 5$, then: **(CAT 2003)**

(A) $M^9 = \frac{9}{N}$

(B) $N^9 = \frac{9}{M}$

(C) $M^3 = \frac{3}{N}$

(D) $N^9 = \frac{3}{N}$

44. If $\log_2[\log_7(x^2 - x + 37)] = 1$, then what could be the value of x? **(CAT 1997)**

(A) 3

(B) 5

(C) 4

(D) None of these

45. If $\log_7 \log_5(\sqrt{x} + 5 + \sqrt{x}) = 0$, find the value of x. **(CAT 1994)**

(A) 1

(B) 0

(C) 2

(D) None of these

46. $\log_6 216\sqrt{6}$ is: **(CAT 1994)**

(A) 3

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

(C) $\frac{7}{2}$

(D) None of these

Additional Practice Questions for CAT Exam

The following practice questions are taken from various math competitions and other sources. I have only selected those questions that are as close to the style and format of the CAT exam. These questions are of extremely high quality and I recommend them to be the best source after the official questions from the previous CAT exams.

47. Of the following:

(1) $a(x-y) = ax - ay$
(2) $a^{x-y} = a^x - a^y$
(3) $\log(x-y) = \log x - \log y$
(4) $\dfrac{\log x}{\log y} = \log x - \log y$
(5) $a(xy) = (ax)\cdot(ay)$

(AHSME 1950)

(A) only 1 and 4 are true
(B) only 1 and 5 are true
(C) only 1 and 3 are true
(D) only 1 and 2 are true
(E) only 1 is true

48. The value of

$$\log_5\left(\frac{(125)(625)}{25}\right)$$

is equal to: **(AHSME 1950)**

(A) 725
(B) 6
(C) 3125
(D) 5
(E) none of these

49. If $\log_{10} m = b - \log_{10} n$, then $m =$ **(AHSME 1950)**

(A) $\dfrac{b}{n}$
(B) bn
(C) $10^b n$
(D) $b - 10^n$
(E) $\dfrac{10^b}{n}$

50. The values of a in the equation

$$\log_{10}(a^2 - 15a) = 2$$

are: **(AHSME 1951)**

(A) $\dfrac{15 \pm \sqrt{233}}{2}$
(B) $20, -5$
(C) $\dfrac{15 \pm \sqrt{305}}{2}$
(D) ± 20
(E) none of these

51. The value of $10^{\log_{10} 7}$ is: **(AHSME 1951)**

(A) 7

(B) 1

(C) 10

(D) $\log_{10} 7$

(E) $\log_7 10$

52. $\log p + \log q = \log(p+q)$ only if: **(AHSME 1952)**

(A) $p = q = 0$

(B) $p = \dfrac{q^2}{1-q}$

(C) $p = q = 1$

(D) $p = \dfrac{q}{q-1}$

(E) $p = \dfrac{q}{q+1}$

53. If $\log_{10}(x^2 - 3x + 6) = 1$, the value of x is: **(AHSME 1953)**

(A) 10 or 2

(B) 4 or -2

(C) 3 or -1

(D) 4 or -1

(E) none of these

54. The logarithm of $27 \cdot \sqrt[4]{9} \cdot \sqrt[3]{9}$ to the base 3 is: **(AHSME 1953)**

(A) $8\frac{1}{2}$

(B) $4\frac{1}{2}$

(C) 5

(D) 3

(E) none of these

55. The product $\log_a b \cdot \log_b a$ is equal to: **(AHSME 1953)**

(A) 1

(B) a

(C) b

(D) ab

(E) none of these

56. $\log 125$ equals (Note: all log terms are in base 10): **(AHSME 1954)**

(A) $100 \log 1.25$

(B) $5 \log 3$

(C) $3 \log 25$

(D) $3 - 3 \log 2$

(E) $(\log 25)(\log 5)$

57. If $\log x - 5 \log 3 = -2$, then x equals: **(AHSME 1955)**

(A) 1.25

(B) 0.81

(C) 2.43

(D) 0.8

(E) either 0.8 or 1.25

58. Through the use of theorems on logarithms,

$$\log \frac{a}{b} + \log \frac{b}{c} + \log \frac{c}{d} - \log \frac{ay}{dx}$$

can be reduced to: **(AHSME 1957)**

(A) $\log \dfrac{y}{x}$

(B) $\log \dfrac{x}{y}$

(C) 1

(D) 0

(E) $\log \dfrac{a^2 y}{d^2 x}$

59. If

$$P = \frac{s}{(1+k)^n},$$

then n equals: **(AHSME 1958)**

(A) $\dfrac{\log(s/P)}{\log(1+k)}$

(B) $\log \dfrac{s}{P(1+k)}$

(C) $\log \dfrac{s-P}{1+k}$

(D) $\log \dfrac{s}{P} + \log(1+k)$

(E) $\dfrac{\log s}{\log P(1+k)}$

60. If $\log_k x \cdot \log_5 k = 3$, then x equals: **(AHSME 1958)**

(A) k^5

(B) $5k^3$

(C) k^3

(D) 243

(E) 125

61. The set of solutions for the equation

$$\log_{10}(a^2 - 15a) = 2$$

consists of: **(AHSME 1959)**

(A) two integers

(B) one integer and one fraction

(C) two irrational numbers

(D) two non-real numbers

(E) no numbers, that is, the set is empty

62. If

$$x = (\log_8 2)^{(\log_8 8)},$$

then $\log_8 x$ equals: **(1966 AHSME)**

(A) -3

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

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

(D) 3

(E) 9

63. If $\log_M N = \log_N M$, $M \neq N$, $MN > 0$, $M \neq 1$, and $N \neq 1$, then MN equals: **(1966 AHSME)**

(A) $\frac{1}{2}$

(B) 1

(C) 2

(D) 10

(E) a number greater than 2 and less than 10

64. Given $\frac{\log a}{p} = \frac{\log b}{q} = \frac{\log c}{r} = \log x$, all logarithms to the same base and $x \neq 1$. If $\frac{b^2}{ac} = x^y$, then y is: **(1967 AHSME)**

(A) $\frac{q^2}{p+r}$

(B) $\frac{p+r}{2q}$

(C) $2q - p - r$

(D) $2q - pr$

(E) $q^2 - pr$

65. If all the logarithms are real numbers, the equality

$$\log(x+3)+\log(x-1)=\log(x^2-2x-3)$$

is satisfied for: **(1968 AHSME)**

(A) all real values of x

(B) no real values of x

(C) all real values of x except $x=0$

(D) no real values of x except $x=0$

(E) all real values of x except $x=1$

66. If it is known that $\log_2 a+\log_2 b\geq 6$, then the least value that can be taken on by $a+b$ is: **(1969 AHSME)**

(A) $2\sqrt{6}$

(B) 6

(C) $8\sqrt{2}$

(D) 16

(E) none of these

67. If $a=\log_2 225$ and $b=\log_2 15$, then: **(1970 AHSME)**

(A) $a=\dfrac{b}{2}$

(B) $a=\dfrac{2b}{3}$

(C) $a=b$

(D) $b=\dfrac{a}{2}$

(E) $a=\dfrac{3b}{2}$

68. If $\log_2\big(\log_3(\log_4 x)\big)=\log_3\big(\log_4(\log_2 y)\big)=\log_4\big(\log_2(\log_3 z)\big)=0$, then the sum $x+y+z$ is equal to: **(1971 AHSME)**

(A) 50

(B) 58

(C) 89

(D) 111

(E) 1296

69. If $f(x)=\log\left(\dfrac{1+x}{1-x}\right)$ for $-1<x<1$, then $f\left(\dfrac{3x+x^3}{1+3x^2}\right)$ in terms of $f(x)$ is: **(1972 AHSME)**

(A) $-f(x)$

(B) $2f(x)$

(C) $3f(x)$

(D) $[f(x)]^2$

(E) $[f(x)]^3-f(x)$

70. If $\log_8 3 = p$ and $\log_3 5 = q$, then, in terms of p and q, $\log_{10} 5$ equals **(1974 AHSME)**

(A) pq

(B) $\dfrac{3p+q}{5}$

(C) $\dfrac{1+3pq}{p+q}$

(D) $\dfrac{3pq}{1+3pq}$

(E) p^2+q^2

71. Which positive numbers x satisfy the equation $(\log_3 x)(\log_x 5) = \log_3 5$? **(1975 AHSME)**

(A) 3 and 5 only

(B) 3, 5 and 15 only

(C) only numbers of the form $5^n \cdot 3^m$, where n and m are positive integers

(D) all positive $x \neq 1$

(E) none of these

72. Let a, b and x be positive real numbers distinct from one. Then

$$4(\log_a x)^2 + 3(\log_b x)^2 = 8(\log_a x)(\log_b x)$$

(1976 AHSME)

(A) for all values of a, b and x

(B) if and only if $a = b^2$

(C) if and only if $b = a^2$

(D) if and only if $x = ab$

(E) none of these

73. If

$$y = (\log_2 3)(\log_3 4)\cdots(\log_n(n+1))\cdots(\log_{31} 32),$$

then: **(1977 AHSME)**

(A) $4 < y < 5$

(B) $y = 5$

(C) $5 < y < 6$

(D) $y = 6$

(E) $6 < y < 7$

74. For all positive numbers x distinct from 1,

$$\frac{1}{\log_3 x} + \frac{1}{\log_4 x} + \frac{1}{\log_5 x}$$

equals **(1978 AHSME)**

(A) $\dfrac{1}{\log_{60} x}$

(B) $\dfrac{1}{\log_x 60}$

(C) $\dfrac{1}{(\log_3 x)(\log_4 x)(\log_5 x)}$

(D) $\dfrac{12}{(\log_3 x) + (\log_4 x) + (\log_5 x)}$

(E) $\dfrac{\log_2 x}{(\log_3 x)(\log_5 x)} + \dfrac{\log_3 x}{(\log_2 x)(\log_5 x)} + \dfrac{\log_5 x}{(\log_2 x)(\log_3 x)}$

75. If $b > 1$, $x > 0$ and

$$(2x)^{\log_b 2} - (3x)^{\log_b 3} = 0,$$

then x is: **(1981 AHSME)**

(A) $\dfrac{1}{216}$

(B) $\dfrac{1}{6}$

(C) 1

(D) 6

(E) not uniquely determined

76. If $a > 1$, $b > 1$ and

$$p = \frac{\log_b(\log_b a)}{\log_b a},$$

then a^p equals: **(1982 AHSME)**

(A) 1

(B) b

(C) $\log_a b$

(D) $\log_b a$

(E) $a^{\log_b a}$

77. If $\log_7(\log_3(\log_2 x)) = 0$, then $x^{-1/2}$ equals **(1983 AHSME)**

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

(B) $\frac{1}{2\sqrt{3}}$

(C) $\frac{1}{3\sqrt{3}}$

(D) $\frac{1}{\sqrt{42}}$

(E) none of these

78. The product of all real roots of the equation $x^{\log_{10} x} = 10$ is **(1984 AHSME)**

(A) 1

(B) -1

(C) 10

(D) 10^{-1}

(E) none of these

79. If $\lfloor x \rfloor$ is the greatest integer less than or equal to x, then

$$\sum_{N=1}^{1024} \lfloor \log_2 N \rfloor =$$

(1986 AHSME)

(A) 8192

(B) 8204

(C) 9218

(D) $\lfloor \log_2(1024!) \rfloor$

(E) none of these

80. Suppose that p and q are positive numbers for which

$$\log_9(p) = \log_{12}(q) = \log_{16}(p+q).$$

What is the value of q/p? **(1988 AHSME)**

(A) $\frac{4}{3}$

(B) $\frac{1}{2}\left(1+\sqrt{3}\right)$

(C) $\frac{8}{5}$

(D) $\frac{1}{2}\left(1+\sqrt{5}\right)$

(E) $\frac{16}{9}$

81. If $x, y > 0$, $\log_y x + \log_x y = \dfrac{10}{3}$ and $xy = 144$, then $\dfrac{x+y}{2} =$ **(1991 AHSME)**

(A) $12\sqrt{2}$
(B) $13\sqrt{3}$
(C) 24
(D) 30
(E) 36

82. If $\log_2\big(\log_2(\log_2(x))\big) = 2$, then how many digits are in the base-ten representation for x? **(1994 AHSME)**

(A) 5
(B) 7
(C) 9
(D) 11
(E) 13

83. If $\log_2\big(\log_2(\log_2(x))\big) = 2$, then how many digits are in the base-ten representation for x? **(1994 AHSME)**

(A) 5
(B) 7
(C) 9
(D) 11
(E) 13

84. There exist positive integers A, B, and C, with no common factor greater than 1, such that

$$A \log_{200} 5 + B \log_{200} 2 = C.$$

What is $A + B + C$? **(1995 AHSME)**

(A) 6
(B) 7
(C) 8
(D) 9
(E) 10

85. If $3 = k \cdot 2^r$ and $15 = k \cdot 4^r$, then $r =$ **(1996 AHSME)**

(A) $-\log_2 5$
(B) $\log_5 2$
(C) $\log_{10} 5$
(D) $\log_2 5$
(E) $\dfrac{5}{2}$

86. If $3 = k \cdot 2^r$ and $15 = k \cdot 4^r$, then $r =$ **(1996 AHSME)**

(A) $-\log_2 5$
(B) $\log_5 2$
(C) $\log_{10} 5$
(D) $\log_2 5$
(E) $\frac{5}{2}$

87. How many different prime numbers are factors of N if

$$\log_2\left(\log_3(\log_5(\log_7 N))\right) = 11?$$

(1998 AHSME)

(A) 1
(B) 2
(C) 3
(D) 4
(E) 7

88. What is the value of the expression

$$\frac{1}{\log_2 100!} + \frac{1}{\log_3 100!} + \frac{1}{\log_4 100!} + \cdots + \frac{1}{\log_{100} 100!}\,?$$

(1998 AHSME)

(A) 0.01
(B) 0.1
(C) 1
(D) 2
(E) 10

89. For all positive integers n, let $f(n) = \log_{2002} n^2$. Let

$$N = f(11) + f(13) + f(14).$$

Which of the following relations is true? **(2002 AMC 12A)**

(A) $N < 1$
(B) $N = 1$
(C) $1 < N < 2$
(D) $N = 2$
(E) $N > 2$

90. For all integers n greater than 1, define $a_n = (\log_n 2002)^{-1}$. Let

$$b = a_2 + a_3 + a_4 + a_5 \quad \text{and} \quad c = a_{10} + a_{11} + a_{12} + a_{13} + a_{14}.$$

What is $b - c$? **(2002 AMC 12B)**

(A) -2
(B) -1
(C) $\frac{1}{2002}$
(D) $\frac{1}{1001}$
(E) $\frac{1}{2}$

91. If $\log(xy^3) = 1$ and $\log(x^2y) = 1$, what is $\log(xy)$? **(2003 AMC 12B)**

(A) $-\frac{1}{2}$
(B) 0
(C) $\frac{1}{2}$
(D) $\frac{3}{5}$
(E) 1

92. The set of all real numbers x for which

$$\log_{2004}\big(\log_{2003}(\log_{2002}(\log_{2001} x))\big)$$

is defined is $\{x \mid x > c\}$. What is the value of c? **(2004 AMC 12A)**

(A) 0
(B) 2001^{2002}
(C) 2002^{2003}
(D) 2003^{2004}
(E) $2001^{2002^{2003}}$

93. Determine the value of ab if $\log_8 a + \log_4 b^2 = 5$ and $\log_8 b + \log_4 a^2 = 7$. **(AIME 1984)**

94. Find $(\log_2 x)^2$ if $\log_2\big(\log_8 x\big) = \log_8\big(\log_2 x\big)$. **(AIME 1988)**

95. The number $\dfrac{2}{\log_4(2000^6)} + \dfrac{3}{\log_5(2000^6)}$ can be written as $\dfrac{m}{n}$, where m and n are relatively prime positive integers. Find $m + n$.

(AIME II 2000)

96. The solutions to the system of equations

$$\log_{225} x + \log_{64} y = 4, \qquad \log_x 225 - \log_y 64 = 1$$

are (x_1, y_1) and (x_2, y_2). Find $\log_{30}(x_1 y_1 x_2 y_2)$. **(AIME I 2002)**

97. Suppose $a, b, c > 0$ satisfy $a^{\log_3 7} = 27$, $b^{\log_7 11} = 49$, and $c^{\log_{11} 25} = \sqrt{11}$. Compute

$$a^{(\log_3 7)^2} + b^{(\log_7 11)^2} + c^{(\log_{11} 25)^2}.$$

(AIME II 2009)

98. Positive numbers x, y, and z satisfy $xyz = 10^{81}$ and

$$(\log_{10} x)(\log_{10} yz) + (\log_{10} y)(\log_{10} z) = 468.$$

Find $\sqrt{(\log_{10} x)^2 + (\log_{10} y)^2 + (\log_{10} z)^2}$. **(AIME II 2010)**

99. The value of x that satisfies $\log_{2^x}\left(3^{20}\right) = \log_{2^{x+3}}\left(3^{2020}\right)$ can be written as $\frac{m}{n}$, where m and n are relatively prime positive integers. Find $m + n$.

(AIME II 2020)

100. There is a unique positive real number x such that the three numbers $\log_8(2^x)$, $\log_4 x$, and $\log_2 x$, in that order, form a geometric progression with positive common ratio. The number x can be written as $\frac{m}{n}$, where m and n are relatively prime positive integers. Find $m + n$.

(AIME I 2020)

101. There exist real numbers x and y, both greater than 1, such that $x \log_x y = 4$ and $y \log_y x = 10$. Find xy.

(AIME I 2024)

Answer Key: Logarithms Questions from CAT Exams

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1. (D)
2. (A)
3. (D)
4. 31
5. 14
6. (A)
7. 7
8. (D)
9. 47
10. 99
11. 5
12. (A)
13. 36
14. (B)
15. (B)
16. (C)
17. 24
18. (B)
19. (C)
20. (B)
21. (B)
22. (B)
23. (C)
24. (B)
25. (D)
26. (C)
27. (D)
28. 3

29. (C)

30. $x = 1$ or $x = 2^{-6/5}$.

31. (D)

32. (D)

33. (B)

34. (C)

35. (B)

36. (B)

37. (E)

38. (D)

39. (B)

40. (D)

41. (D)

42. (B)

43. (B)

44. (C)

45. (B)

46. (C)

47. (E)

48. (D)

49. (E)

50. (B)

51. (A)

52. (D)

53. (B)

54. (B)

55. (E)

56. (C)

57. (C)

58. (B)

59. (A)

60. (E)
61. (A)
62. (A)
63. (B)
64. (C)
65. (B)
66. (D)
67. (B)
68. (C)
69. (C)
70. (D)
71. (D)
72. (E)
73. (B)
74. (A)
75. (B)
76. (D)
77. (E)
78. (A)
79. (B)
80. (D)
81. (B)
82. (A)
83. (A)
84. (A)
85. (D)
86. (D)
87. (A)
88. (C)
89. (D)
90. (B)

91. (D)
92. (B)
93. 512
94. 027
95. 007
96. 12
97. 469
98. 075
99. 103
100. 017
101. 025