

JAN 1997

- Change $r^s = t$ to logarithmic form.
A. $r = \log_s t$ B. $s = \log_t r$ C. $t = \log_r s$ D. $s = \log_r t$
- Evaluate: $\log_4 135$ (Accurate to 2 decimal places)
A. 0.53 B. 1.53 C. 2.13 D. 3.54
- Determine the range of the function $y = 3^x + 2$.
A. $y > -2$ B. $y > 2$ C. $y > 0$ D. all real numbers
- Which expression is equivalent to $3 \log a + \log b - \frac{1}{2} \log c$?
A. $\log\left(\frac{6ab}{c}\right)$ B. $\log\left(\frac{a^3b}{\sqrt{c}}\right)$ C. $\log\left(3a + b - \frac{1}{2}c\right)$ D. $\log\left(\frac{a^3 + b}{\sqrt{c}}\right)$
- Solve: $\log_2 x - \log_2 4 = 3$
A. 2 B. 12 C. 32 D. 36
- If $\log_9 5 = x$ and $\log_{27} 2 = y$, express $\log_3 100$ in terms of x and y .
A. $2(9^x + 27^y)$ B. $9x + 27y$ C. $24xy$ D. $4x + 6y$
- Given the function $f(x) = 7^{\frac{x}{2}} - 3$, determine its inverse, $f^{-1}(x)$.
A. $f^{-1}(x) = 2 \log_7 x - 6$ B. $f^{-1}(x) = 2 \log_7(x - 6)$
C. $f^{-1}(x) = 2 \log_7(x + 3)$ D. $f^{-1}(x) = 2 \log_7 x + 3$
- The population of a city is increasing at a rate of 6.5% each year. If the present population is 12 000, how long will it take for the population to reach 32 000?

16. Solve for x : $2 \log(4 - x) - \log 3 = \log(10 - x)$

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17. Evaluate: $\log_3 3^{-15}$

A. -15

B. -5

C. $\frac{1}{15}$

D. $\frac{1}{5}$

18. Which expression is equivalent to $2 \log \frac{3}{x}$?

A. $\log 9 - 2 \log x$

B. $\log 9 - \log x$

C. $\log 6 - \log 2x$

D. $(\log 3 - \log x)^2$

19. Determine the domain of the function $y = \log_2(x - 4)$.

A. $x > -4$

B. $x > 0$

C. $x > 2$

D. $x > 4$

20. Solve: $\log_6 x + \log_6(x - 5) = 2$

A. 3.5

B. 8.5

C. 9

D. 20.5

21. Given $f(x) = \log_3 x$, determine its inverse, $f^{-1}(x)$.

A. $f^{-1}(x) = x^3$

B. $f^{-1}(x) = 3^x$

C. $f^{-1}(x) = \log_x 3$

D. $f^{-1}(x) = \log_3 \frac{1}{x}$

22. Solve for x : $(\log_2 3)(\log_x 5)(\log_5 2) = 9$

A. $3^{\frac{1}{9}}$

B. $9^{\frac{1}{3}}$

C. 2

D. 3

23. Consider the graph of $y = -\log_2 x$. Which value for x in the interval $a \leq x \leq b$, $a > 0$, will give the largest value for y ?
- A. a B. b C. $\frac{(a+b)}{2}$ D. \sqrt{ab}
24. A river system has a current population of 4 000 000 fish. In each year, an enhancement program produces a 7% growth in population followed by a 200 000 fish harvest (i.e. 200 000 fish are taken from the population). Determine the number of fish after the second harvest.

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25. Evaluate: $\log_2 8$
- A. 2 B. 3 C. 4 D. 16
26. Which of the following is equivalent to $\log\left(\frac{a^3}{\sqrt{b}}\right)$
- A. $3 \log a - \frac{1}{2} \log b$ B. $\frac{3 \log a}{\frac{1}{2} \log b}$ C. $\log 3a - \log \frac{1}{2}b$ D. $\frac{\log 3a}{\log \frac{1}{2}b}$
27. Which of the following equations can be used to determine the number of years, t , that are needed for a \$300 deposit to increase to \$1500 if it is invested at 9% compounded annually?
- A. $1500 = 300(1.09)^t$ B. $300 = 1500(1.09)^t$ C. $1500 = 300(1.9)^t$ D. $300 = 1500(1.9)^t$
28. Determine the domain of the function $y = \log_3(x+1) - 2$.
- A. $x > -1$ B. $x > 1$ C. $y > -2$ D. $y > 2$
29. Solve: $\frac{1}{\log_2 x} + \frac{1}{\log_8 x} = 2$
- A. 2 B. 4 C. 8 D. 16

30. If $\log_3 7 = x$ and $\log_2 9 = y$, determine an expression for $\log_9 7 + \log_2 3$ in terms of x and y .

- A. $\frac{1}{2}x + \frac{1}{2}y$ B. $2x + \frac{1}{2}y$ C. $\frac{1}{2}x + \sqrt{y}$ D. $2x + \sqrt{y}$

31. Solve: $\log(3x - 5) + \log(2x - 1) = 1$

JAN 1999

32. Evaluate: $\log_{12} 8000$

- A. 0.33 B. 2.82 C. 3.62 D. 3.90

33. Express $3 \log a + \log b - \log c$ as a single logarithm.

- A. $\log\left(\frac{a^3 b}{c}\right)$ B. $\log(a^3 + b - c)$ C. $3 \log\left(\frac{ab}{c}\right)$ D. $\log\left(\frac{3ab}{c}\right)$

34. Determine the range of the function $y = 7^{x+2} - 4$.

- A. $y > -4$ B. $y > -2$ C. $y > 2$ D. $y > 4$

35. Solve: $\log_3(2x + 3) - \log_3(x + 1) = 2$

- A. $-\frac{6}{7}$ B. $-\frac{3}{4}$ C. 0 D. no real roots

36. Simplify: $8^{\log_2 6x}$

- A. $18x$ B. $6x^3$ C. $216x^3$ D. $1296x^4$

37. Solve for x : $(\log_x 7)(\log_7 5) = 2$

A. $\frac{5}{2}$

B. $\sqrt{5}$

C. $\frac{2\sqrt{3}}{7}$

D. $\frac{\sqrt{35}}{7}$

38. A population of frogs doubles every 20 weeks. If the present population is 400 frogs, how long will it take for the population to reach 10 000?

JUN 199939. Change $y = \log_5 x$ to exponential form.

A. $x = 5y$

B. $x = 5^y$

C. $x = y^5$

D. $x = \left(\frac{1}{5}\right)^y$

40. Express $\log a - \log b + 2 \log c$ as a single logarithm.

A. $\log \frac{ac^2}{b}$

B. $\log \frac{a}{bc^2}$

C. $\log \frac{ab}{2c}$

D. $\log \frac{a}{2bc}$

41. Solve for x : $3^x = 18$

A. $x = \log 6$

B. $x = 3 \log 18$

C. $x = \frac{\log 18}{\log 3}$

D. $x = \log 18 - \log 3$

42. Determine an equation of the asymptote of the graph of $y = 4 \log_5(x - 4) + 5$

A. $x = 4$

B. $x = 5$

C. $y = 4$

D. $y = 5$

43. Solve: $\log_2(4 - x) - \log_2 x = 1$

A. 1

B. $\frac{4}{3}$

C. $\frac{3}{2}$

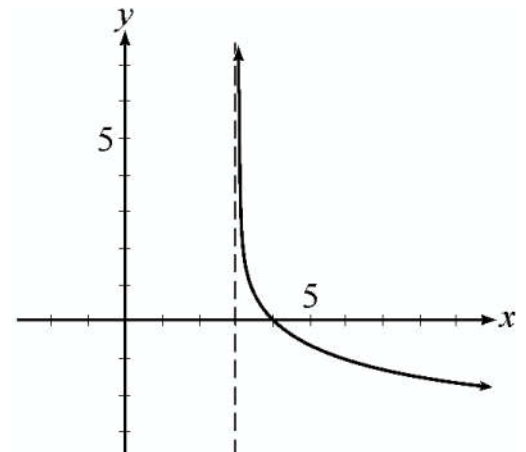
D. 2

44. Determine an expression equivalent to $\frac{1}{\log_a x} - \frac{1}{\log_b x}$.
- A. $\log_a x - \log_b x$ B. $\log_x a - \log_x b$ C. $\log_b x - \log_a x$ D. $\log_x b - \log_x a$
45. The point (m, n) is on the graph of $f(x) = a^x$. Which of the following must be a point on the graph of $g(x) = \log_a x$, ($a > 0$)?
- A. $(-m, -n)$ B. $(-n, -m)$ C. (m, n) D. (n, m)

JAN 2000

46. Change $a = b^c$ to logarithmic form.
- A. $\log_a b = c$ B. $\log_b c = a$ C. $\log_c a = b$ D. $\log_b a = c$
47. Solve for y : $x = \log c^y$
- A. $\frac{x}{\log c}$ B. $\log c^x$ C. $\frac{x}{c}$ D. $x - \log c$
48. A population of insects doubles every 5 days. If there are currently 1 200 insects, determine an equation for the population P , of insects, t days from now.
- A. $P = 1\,200\left(\frac{1}{2}\right)^{\frac{t}{5}}$ B. $P = 1\,200\left(\frac{1}{2}\right)^{5t}$ C. $P = 1\,200(2)^{5t}$ D. $P = 1\,200(2)^{\frac{t}{5}}$
49. Determine the equation of the logarithmic function shown:

- A. $y = \log_3(x - 3)$
 B. $y = \log_3(x + 3)$
 C. $y = -\log_3(x + 3)$
 D. $y = -\log_3(x - 3)$



50. Solve for x : $(\log_2 8)^x - (\log_9 3)^{x+1} = 0$
- A. -0.50 B. -0.39 C. -0.33 D. 1.71
51. If $\log 5 = m$ and $\log 7 = n$, determine $\log \frac{35}{10}$ in terms of m and n .
- A. $\frac{mn}{10}$ B. $\frac{m+n}{10}$ C. $m+n-1$ D. $m+n-10$
52. A population of wolves decreases by 2% each year. At the present time, there are 8 000 wolves. How long will it take for the population to become 500 wolves? (Answer to the nearest year.)
53. Given $\frac{1}{\log_y 4} = \log_{\frac{1}{4}} \left(\frac{1}{8x} \right)$, express y as a polynomial function of x . State the restrictions on x and y .

JUN 2000

54. Change $\log_a b = c$ to exponential form.
- A. $b = a^c$ B. $b = c^a$ C. $a = b^c$ D. $a = c^b$
55. Evaluate: $\log 2^{2000}$
- A. 0 B. 10.97 C. 602.06 D. infinitely large

63. Determine the domain of the function $y = \log_4(x + 7) - 3$.

- A. $x > -7$ B. $x > -3$ C. $x > 3$ D. $x > 7$

64. If $f(x) = 3 \log x$, determine $f^{-1}(x)$, the inverse of $f(x)$.

- A. $f^{-1}(x) = \frac{1}{3 \log x}$ B. $f^{-1}(x) = \frac{1}{3} \log \frac{1}{x}$ C. $f^{-1}(x) = 10^{\frac{x}{3}}$ D. $f^{-1}(x) = 10^{x-3}$

65. A culture has 300 bacteria. The number of bacteria doubles every 4 hours. How long will it take for the number of bacteria to reach 72 000?

- A. 31.63 hours B. 33.27 hours C. 36.88 hours D. 60 hours

66. Determine the number of solutions for the following system:



$$y = -4 \log_{12} x$$

$$y = 4 \sin x$$

- A. 2 B. 3 C. 4 D. 5

67. Simplify: $2^{\log_8 x^{27}}$

- A. $3x$ B. $9x$ C. x^3 D. x^9

JUN 2001

68. Change $b^a = c$ to logarithmic form.

- A. $\log_b a = c$ B. $\log_c b = a$ C. $\log_b c = a$ D. $\log_c a = b$

69. Express $2 \log k + \log 5 - \log p$ as a single logarithm.

- A. $\log \frac{5k^2}{p}$ B. $\log \frac{10k}{p}$ C. $\log (k^2 + 5 - p)$ D. $\log (2k + 5 - p)$

70. Solve: $\log_2 x + \log_2(x - 2) = 3$

- A. 2.5 B. 3 C. 4 D. $1 + \sqrt{7}$

71. The population of a type of bacteria triples every 20 hours. In how many hours will a population of 30 become a population of 1000?

- A. 63.84 B. 101.18 C. 106.83 D. 169.32

72. Determine the domain of the function $y = \log_{(2x-3)}(x)$.

- A. $x > 0, x \neq 1$ B. $x > 0, x \neq 2$ C. $x > \frac{3}{2}, x \neq 1$ D. $x > \frac{3}{2}, x \neq 2$

73. Solve for x : $\log_a a^{2x} = \log_{b^2} b^{3x-3}$

- A. -3 B. $-\frac{3}{2}$ C. $\frac{3}{2}$ D. 3

74. Simplify: $\log_{\frac{1}{x}} \frac{1}{y} - \log_{\frac{1}{x}} y - \log_x \frac{1}{y}$

- A. $\log_x y^3$ B. $\log_x y$ C. $-\log_x y$ D. $\log_x y - 2$

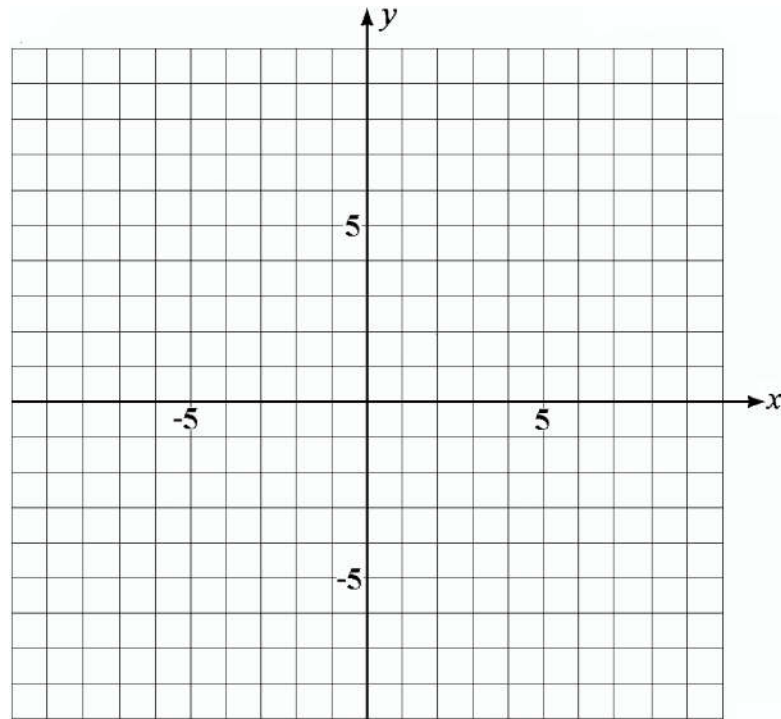
SPECS 200175. The population of ABC high school is currently 1 250 students and is decreasing at an annual rate of 3%. Which expression represents the population, P , of the school 5 years from now?

- A. $P = 1\,250(1.03)^5$ B. $P = 1\,250(1.03)^{-5}$ C. $P = 1\,250(0.97)^5$ D. $P = 1\,250(0.97)^{-5}$

76. The half-life of plutonium-239 is about 25 000 years. How many years does it take until only 36% of the plutonium still remains?

SAMPLE 2001

77. Graph $\log_5(y + 2) = x + 1$ on the grid below. State any asymptotes and give exact values for the x - and y -intercepts.



78. A recent earthquake in Washington measured 6.3 on the Richter scale. In 1964, the Alaskan earthquake measured 8.5. How many times as intense was the 1964 Alaskan earthquake compared to the recent Washington earthquake?
- A. 1.35 B. 2.2 C. $10^{1.35}$ D. $10^{2.2}$
79. Solve for x : $\log_3(x - 6) + \log_3 x = 3$
- A. 4.5 B. 9 C. 16.5 D. -3, 9
80. A bank account earns interest at a rate of 7% per year compounded continuously. Which equation will determine the effective annual growth rate, r ? (P_0 is the initial amount invested; t is time, in years, over which the amount is invested.)
- A. $P_0(1 + r)^t = P_0e^{0.07t}$ B. $P_0(1.07)^t = P_0e^{rt}$
 C. $P_0(1 + r)^t = P_0e^{1.07t}$ D. $P_0(1.07)^t = P_0e^{(1+r)t}$
81. If 3150 mg of a radioactive substance decays to 450 mg in 73 weeks, determine the half-life of the substance to the nearest week. (Solve algebraically using logarithms.)

JAN 2002

82. Change to logarithmic form: $p = q^r$
- A. $\log_p q = r$ B. $\log_q p = r$ C. $\log_r p = q$ D. $\log_q r = p$
83. Evaluate: $\log_2 7.5$
- A. 0.44 B. 0.57 C. 2.26 D. 2.91
84. Determine the range of the function $y = 2^{x-3} + 4$
- A. $y > 4$ B. $y > -4$ C. $x > 3$ D. $x > -3$
85. Solve: $16^{x+1} = 8^{1-x}$
- A. $-\frac{1}{3}$ B. $-\frac{1}{7}$ C. $\frac{2}{7}$ D. $\frac{2}{5}$
86. Which expression is equivalent to $\log\left(\frac{100x^3}{y}\right)$?
- A. $2 + \log(3x - y)$ B. $300 \log x - \log y$ C. $2 + 3 \log x - \log y$ D. $\log(100 + x^3 - y)$
87. Solve: $\log_3(x + 4) + \log_3(6 - x) = 2$
- A. 3 B. 5 C. 3, -5 D. 5, -3
88. Simplify: $a^{\log_a 8 + \log_a 2}$
- A. 10 B. 16 C. a^{10} D. a^{16}
89. The population of a city grows continuously according to the formula $P = P_0 e^{kt}$. Determine the value of the growth rate, k , if the population increases from 30 000 to 45 000 in 8 years.
- A. 0.02 B. 0.05 C. 0.41 D. 1.05

