BC Pre-Calculus 12 Logarithms

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- Logarithms: operations, functions, and equations
- Applying laws of logarithms
- Evaluating with different bases
- Using common and natural logarithms
- Exploring inverse of exponential
- Graphing, including transformations
- Solving equations with same base and with different bases
- Solving problems in situational contexts

1. $y = 2\log(x + 4)$. What is the value of the x-intercept?

2. $y = 3\log(x - 2)$. Equation of the vertical asymptote?

3. $y = \log(x + 1)^2$. What is the domain of this graph?

4. Solve $3^{4x} = 5$

5. True or False: $2^3 = 8$ is equivalent to $\log_8 2 = 3$

6. $y = -\log_2\left(\frac{x}{2} - 4\right)$. What is the value of the x-intercept?

7. $y = -\log_2\left(\frac{x}{2} - 4\right)$. What is the value of the y-intercept?

8. $y = -\log_2\left(\frac{x}{2} - 4\right)$. What is the domain of this function?

9. $y = -\log_2\left(\frac{x}{2} - 4\right)$. What is the range of this function?

10. Evaluate $\log 1000$

11. Evaluate $\log_4 x = \frac{1}{2}$

12. Evaluate $\log 0.01$

13. Find the missing denominator: $\log_5 7 = \frac{\ln 7}{?}$

14. Find the missing denominator: $\log_5 7 = \frac{\log_3 7}{?}$

15. $f(x) = \log_{\sqrt{2}}(x+1) = k \log_2(x+1)$. Find k.

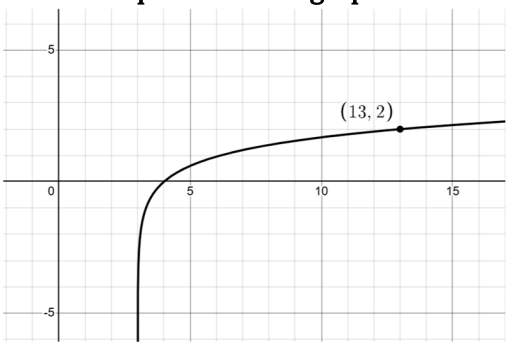
16. $g(x) = \log\left(\frac{5}{2}x\right)$. Describe as a horizontal transformation of $f(x) = \log x$.

A. Horizontal stretch by a factor of 2.5
B. Horizontal compression by a factor of 0.4.
C. Vertical shift down by $\log 2.5$ units
D. Horizontal shift left by 2.5 units

17. $g(x) = \log\left(\frac{5}{2}x\right)$. Describe as a vertical transformation of $f(x) = \log x$.

A. Vertical stretch by 2.5
B. Vertical shift up by $\log 2.5$
C. Vertical shift down by 2.5
D. No vertical transformation possible

18. Find the equation of the graph below:



A. $y = \log_2(x-3) - 2$
B. $y = \log_{10}(x-3)$
C. $y = \log_3(x-4)$
D. $y = \log(x-3) + 1$

19. Evaluate $\ln e^3$

20. Evaluate $\log_3 1$

21. Evaluate $\log_1 5$

A. 0
B. 5
C. 1
D. Undefined

22. $y = \log_b x$. What are the restrictions on the variables b and x?
Choose MORE than one correct answer.

A. $b > 0$
B. $x > 0$
C. $b \neq 1$
D. $b > 1$

23. Can $\log_2 x$ be negative?

A. Yes
B. No

24. Is $y = \log(-x)$ defined or undefined?

A. Defined
B. Undefined

25. True or False: $\log ab^3 = 3 \log ab$

A. True
B. False

26. Solve $(\log x)^2 = 100$

A. $x = 10$
B. $x = 10$ or $x = -10$
C. $x = 10^{10}$ or $x = 10^{-10}$
D. $x = 2$
E. $x = \pm 10$
F. $x = \pm 2$

27. Simplify $3^{\log_3 5}$

28. Simplify $e^{\ln 3}$

29. Solve $9^{2x+1} = 27^{3-x}$

30. $3^{2x} = 5^{x+2}$. Solve x using log rules.

A. $x = \frac{\log 5}{2 \log 3}$

B. $x = \frac{2 \log 5}{2 \log 3 - \log 5}$

C. $x = \frac{2 \log 5}{2 \log 3 + \log 5}$

D. $x = \log\left(\frac{25}{9}\right)$

31. Solve the inequality $2x < 10 + \ln e$

A. $x < 5$

B. $x < 5.5$

C. $x < 11$

D. $x < 6$

32. Solve $\log\left(\frac{1}{100}\right) x \geq \ln\left(\frac{1}{e^2}\right)$

A. $x \geq 1$

B. $x \leq \frac{1}{100}$

C. $x \leq 1$

D. $x \geq e^2$

33. $f(x) = \ln x$. Find the x-intercept given $g(x) = -3f\left(\frac{1}{4}x - 1\right)$

34. Evaluate $\log\left(\log_2\left(\log_9 81\right)\right)$

35. Solve $\log 4x = \log(x + 15)$

36. Find the smallest solution to:
$\log_8(-10x + 9) = \log_8(x^2 + 25)$

37. $\log_4(x^2 - 6) = \log_4(x)$.
How many solutions exist?

38. Solve $\ln(x - 1) - \ln(x - 6) = \ln 4$.
Answer in the form a/b.

39. Solve $\ln(3x + 2) - \ln 5 = 4$
The answer is $x = \frac{ae^4 - 2}{b}$. Evaluate $a + b$.

40. Solve $\log_2(x^2 - 7) + \log_{\frac{1}{2}}(x - 1) = 3$
The answer is $4 \pm \sqrt{k}$. Find k only.

41. Find the inverse of the function $y = 3^{x-2}$.

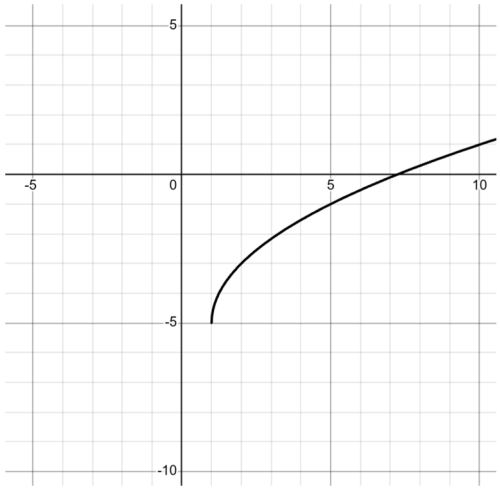
42. $\left(\frac{1}{8}, -3\right)$ is on $f(x) = \log_c x$.
$(4, k)$ is on the graph of the inverse function
$y = f^{-1}(x)$. Find k.

43. Solve $8^{1-2x} = 4^{x+2}$ using both exponents and log rules

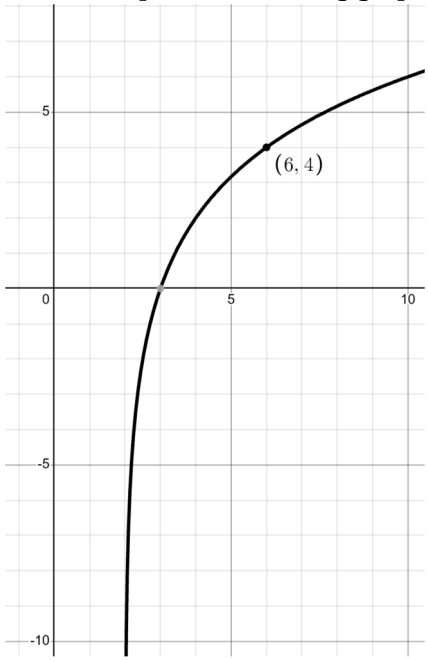
44. True or False: $\log(ab^3) = 3 \log (ab)$

45. Express $\log \left(\frac{z^2}{xy^3}\right)$ in terms of a, b, c given that

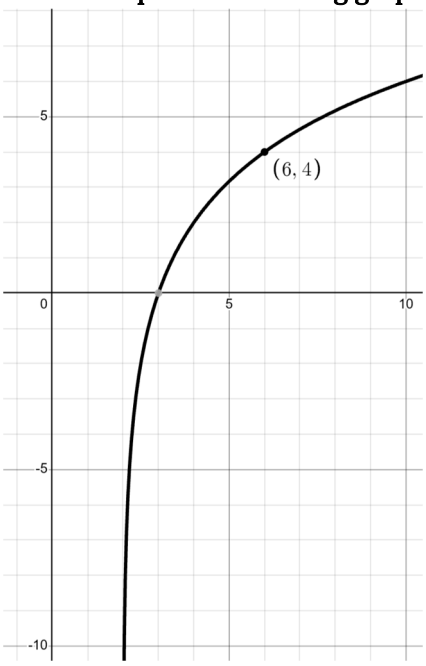
46. Find the equation of the following graph.



47. Find the equation of the log graph below in the form $y = a\log_2(x + b)$



48. Find the equation of the log graph below in the form $y = a \log (x + b)$



49. Find the domain of $y = \log x^2$

50. True of False $(\log x)^2 = \log x^2$

51. True or False $(\log x)^2 = \log(x)^2$

52. $g(x) = \log_3(x - 2)$. Find $g^{-1}(x)$.

53. Given $f(x) = \log_2 x$, evaluate $f^{-1}(-3)$

54. Evaluate $\log_2\left(\log_3(\log_4 64)\right)$

55. Solve $\log_2 x + \log_2(x+2) = \log_2(x+6)$

56. Solve $\log\left(\frac{1}{2}\right) x < 2$

57. Solve x given:

$\log_3 x + \log_5 y = 6$

$\log_3 x - \log_5 y = 2$

58. The Richter magnitude is defined as $M_A = \log\left(\frac{I_A}{I_0}\right)$
where I_A is the intensity of the ground motion of earthquake A, whereas I_0 is the intensity of a "standard" earthquake.
How many times stronger is an 8.1 magnitude earthquake vs. a 5.2 magnitude earthquake?

59. A cola drink has a pH of 2.5. Milk has a pH of 6.6.
How many times as acidic is cola than milk?
Formula: $\mathrm{pH} = -\log[H^+]$

60. The intensity level of sound is measured in decibels as: $\beta = 10\log\left(\frac{I}{I_0}\right)$, where I is the intensity level of the sound and I_0 is intensity of the faintest sound that a normal person can hear. The maximum headphone volume is 110 dB. How many times as intense is this sound as compared to the sound level of an 85 dB chainsaw?

61. Enrichment: Research the various laws of logarithms proofs.