

Section 3.3 - Properties of Logarithms

1. Rewrite the logarithm as a ratio of common logarithms.

$$\log_5 16$$

a. $\frac{\log 16}{\log 5}$

b. $\log \frac{16}{5}$

c. $\frac{\log 5}{\log 16}$

d. $\log \frac{5}{16}$

e. None of these

7. Rewrite the logarithm as a ratio of common logarithms.

$$\log_{2.7} x$$

a. $\frac{\log 2.7}{\log x}$

b. $\frac{\log x}{\log 2.7}$

c. $\log \frac{x}{2.7}$

d. $\log 2.7x$

e. None of these

9. Find the exact value of the logarithmic expression without using a calculator.

$$\log_6 216$$

a. 3

b. 6

c. 216

d. 35

e. None of these

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10. Find the exact value of the logarithmic expression without using a calculator.

$$\log_7 \sqrt[3]{7}$$

- a. 3
- b. $\frac{1}{3}$
- c. 7
- d. 21
- e. None of these

11. Find the exact value of the logarithmic expression without using a calculator.

$$5 \ln e^7$$

- a. 7
- b. 35
- c. 5
- d. e
- e. 1

12. Use the properties of logarithms to expand the expression as a sum, difference, and/or constant multiple of logarithms. (Assume all variables are positive.)

$$\ln 5x$$

- a. $\ln 5 - \ln x$
- b. $\frac{\ln 5}{\ln x}$
- c. $\ln 5 \times \ln x$
- d. $\ln 5 + \ln x$
- e. None of these

17. Condense the expression to the logarithm of a single quantity.

$$\ln 8 + \ln x$$

- a. $\ln x^8$
- b. $\ln 8x$
- c. $\ln \frac{8}{x}$

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d. $\ln 8^x$

e. $\ln 8 \times \ln x$

19. Condense the expression to the logarithm of a single quantity.

$$\log x - 3\log(x + 1)$$

a. $3\log(x(x + 1))$

b. $3\log \frac{x}{(x + 1)}$

c. $\log \frac{x}{(x + 1)^3}$

d. $\log(x(x + 1)^3)$

e. $\frac{1}{3} \log \frac{x}{(x + 1)}$

22. Condense the expression to the logarithm of a single quantity.

$$2[3\ln x - \ln(x + 2) - \ln(x - 2)]$$

a. $\ln \left(\frac{x^3}{(x - 2)(x + 2)} \right)^2$

b. $\ln \left(\frac{x^3(x + 2)}{(x - 2)} \right)^2$

c. $\ln \left(\frac{x^3(x - 2)}{(x + 2)} \right)^2$

d. $\ln \left(\frac{(x - 2)}{x^3(x + 2)} \right)^2$

e. $\ln \left(\frac{(x + 2)}{x^3(x - 2)} \right)^2$

24. Determine whether the statement is true or false given that $f(x) = \ln x$.

$$f(8x) = f(8) + f(x), x > 0$$

a. True

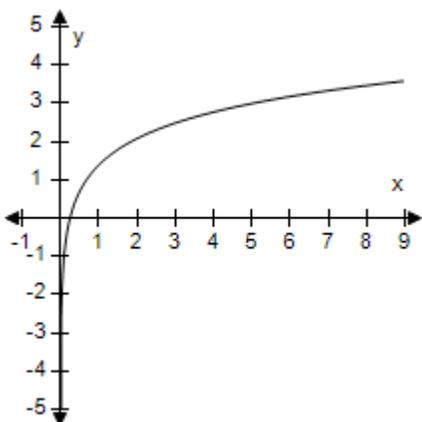
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b. False

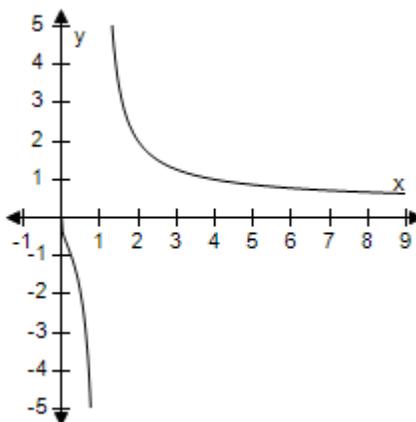
26. Use the change-of-base formula to rewrite the logarithm as a ratio of logarithms. Then use a graphing utility to graph the ratio.

$$f(x) = \log_4 x$$

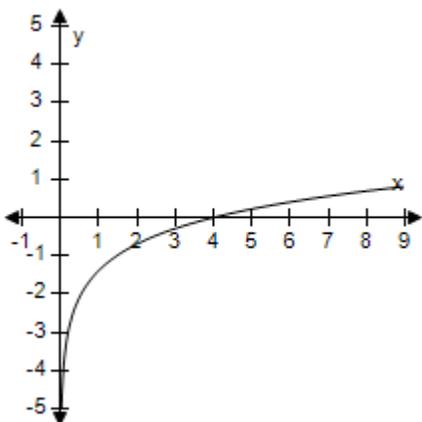
a. $f(x) = \log x + \log 4 = \ln x + \ln 4$



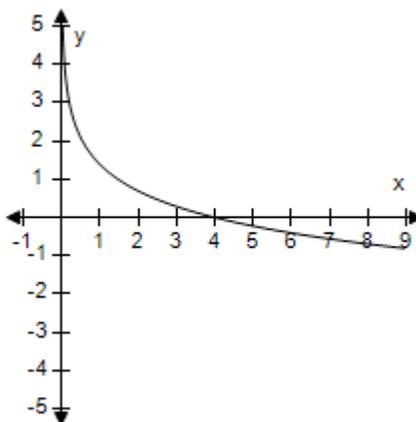
b. $f(x) = \frac{\log 4}{\log x} = \frac{\ln 4}{\ln x}$



c. $f(x) = \log \frac{x}{4} = \ln \frac{x}{4}$

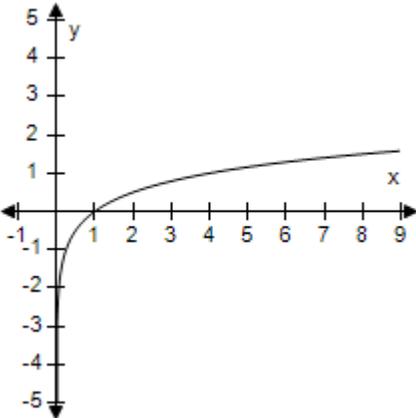


d. $f(x) = \log \frac{4}{x} = \ln \frac{4}{x}$



e. $f(x) = \frac{\log x}{\log 4} = \frac{\ln x}{\ln 4}$

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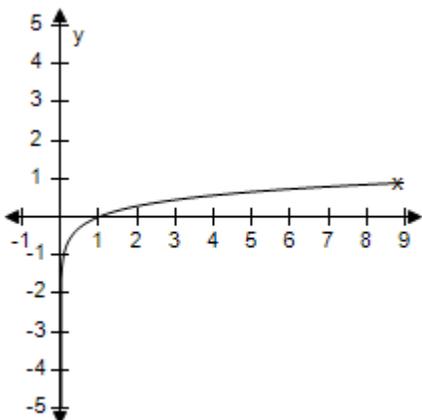


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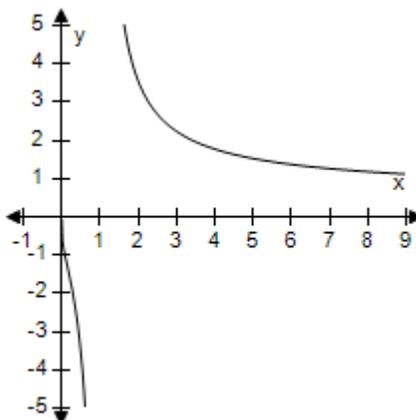
28. Use the change-of-base formula to rewrite the logarithm as a ratio of logarithms. Then use a graphing utility to graph the ratio.

$$f(x) = \log_{11.7} x$$

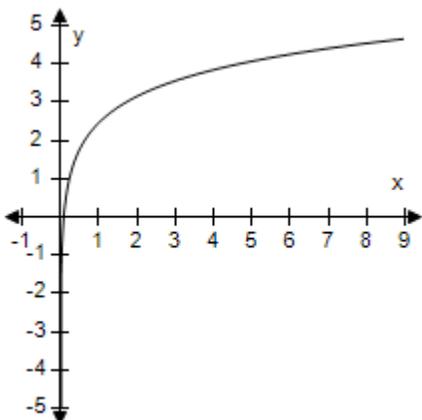
a. $f(x) = \frac{\log x}{\log 11.7} = \frac{\ln x}{\ln 11.7}$



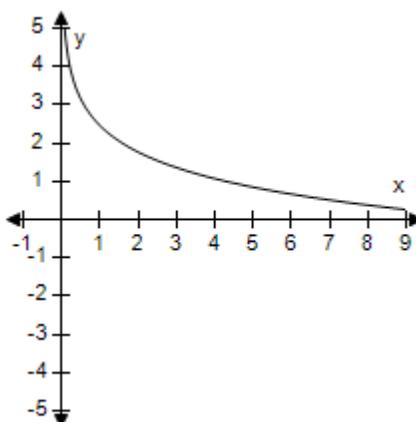
b. $f(x) = \frac{\log 11.7}{\log x} = \frac{\ln 11.7}{\ln x}$



c. $f(x) = \log x + \log 11.7 = \ln x + \ln 11.7$

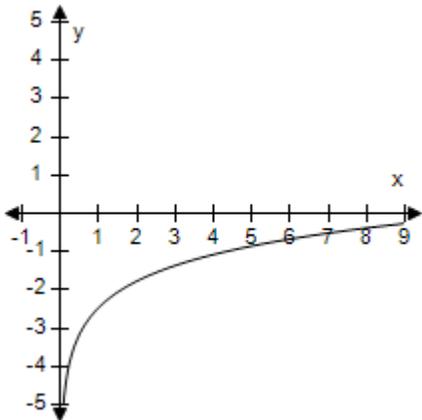


d. $f(x) = \log \frac{11.7}{x} = \ln \frac{11.7}{x}$



e. $f(x) = \log \frac{x}{11.7} = \ln \frac{x}{11.7}$

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30. Evaluate the logarithm using the change-of-base formula. Round your result to three decimal places.

$$\log_2 6$$

- a. 2.585
- b. 6.585
- c. 4.585
- d. 5.585
- e. 3.585

34. Use the properties of logarithms to rewrite and simplify the logarithmic expression.

$$\log_2 (4^2 \cdot 5^4)$$

- a. $4 + \log_5 4$
- b. $2 + \log_4 5$
- c. $2 + 2 \log_2 5$
- d. $4 + 4 \log_2 5$
- e. $2 + 4 \log_2 5$

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36. Use the properties of logarithms to rewrite and simplify the logarithmic expression.

$$\ln\left(\frac{7}{e^{11}}\right)$$

- a. $\ln 7$
- b. $\frac{\ln 7}{11}$
- c. $\ln 7 - 11$
- d. $\ln 11 - 7$
- e. $\ln 11$

37. Rewrite the logarithm $\log_6 412$ in terms of the common logarithm (base 10).

- a. $\log 6 \log 412$
- b. $\frac{\log 412}{\log 6}$
- c. $\frac{\log 6}{\log 412}$
- d. $\log 412$
- e. $\frac{\log 412}{\log_6 10}$

39. Evaluate the logarithm $\log_7 126$ using the change of base formula. Round to 3 decimal places.

- a. 4.836
- b. 2.485
- c. 0.402
- d. 9.411
- e. 2.1

41. Simplify the expression $\log_5 50$.

- a. $10\log_5 2$
- b. $2 \log_5 2$
- c. 2
- d. $2 + \log_5 2$
- e. The expression cannot be simplified.

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42. Find the exact value of $\log_7 \sqrt[3]{49}$ without using a calculator.

- a. $\frac{3}{49}$
- b. $\frac{14}{3}$
- c. $\frac{2}{3}$
- d. -1
- e. $\frac{49}{3}$

43. Simplify the expression $\log_3 \left(\frac{1}{27} \right)^3$.

- a. 3
- b. 0
- c. -9
- d. -81
- e. The expression cannot be simplified.

44. Find the exact value of $\ln e^{2.50} - \ln \sqrt{e}$ without using a calculator.

- a. 5
- b. 2.5
- c. 1.25
- d. 2
- e. 3

46. The pH of an acidic solution is a measure of the concentration of the acid particles in the solution, with smaller values of the pH indicating higher acid concentration. In a laboratory experiment, the pH of a certain acid solution is changed by dissolving over-the-counter antacid tablets into the solution. In this experiment, the pH changes according to the equation

$$\text{pH} = 5.14 + \log \left(\frac{x}{0.40 - x} \right)$$

where x is the number of grams of antacid added to the solution. What is the pH of the solution after the addition of 0.05 grams of antacid tablet?

- a. 5.99
- b. 4.02
- c. -0.85
- d. 4.29

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e. 5.14

52. Assume that x , y , and c are positive numbers. Use the properties of logarithms to write the expression $\log_c 5xy$ in terms of the logarithms of x and y . Simplify your answer completely.

- a. $\log_c 5 + \log_c xy$
- b. $\log_c 5 + \log_c x + \log_c y$
- c. $\log_c 5 + \log_c x$
- d. $\log_c 5 + \log_5 x + \log_5 y$
- e. $\log_c 5 + \log_c y$

57. Assume that x , y , and z are positive numbers. Use the properties of logarithms to write the expression $-2 \log_b x - 6 \log_b y + \frac{1}{7} \log_b z$ as the logarithm of one quantity.

- a. $\log_b \frac{z^{1/7}}{x^6 y^2}$
- b. $\log_b \frac{z^{1/6}}{x^2 y^7}$
- c. $\log_b \frac{z^{1/2}}{x^7 y^6}$
- d. $\log_b \frac{x^{1/7}}{y^2 z^6}$
- e. $\log_b \frac{z^{1/7}}{x^2 y^6}$