

Algebra 2 · Logarithms and Logarithmic Functions · Worksheet

Common Core F-LE.A.4, F-BF.B.4a, F-IF.C.7e · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

These 23 problems practice the definition of a logarithm, common and natural logs, and graphs of logarithmic functions. Later problems use the product, quotient and power properties, change of base, and inverse functions.

Problems run from easy to hard and finish with six applications such as earthquakes, pH and sound levels. They cover Common Core standards F-LE.A.4, F-BF.B.4a and F-IF.C.7e.

Algebra 2 Common Core: F-LE.A.4 · F-BF.B.4a · F-IF.C.7e

Problem 1: Exponential to log form

Write each exponential equation in logarithmic form.

- a. $2^5 = 32$
- b. $10^3 = 1000$
- c. $3^{-2} = \frac{1}{9}$
- d. $7^0 = 1$

Problem 2: Log to exponential form

Write each logarithmic equation in exponential form.

- a. $\log_4 64 = 3$
- b. $\log_5 \frac{1}{25} = -2$
- c. $\log_9 3 = \frac{1}{2}$
- d. $\log 0.01 = -2$

Problem 3: Evaluate simple logs

Evaluate each logarithm.

- a. $\log_2 16$
- b. $\log_3 81$
- c. $\log_5 125$

d. $\log_{10} 100000$

Problem 4: Evaluate fractions and roots

Evaluate each logarithm.

- a. $\log_2 \frac{1}{8}$
- b. $\log_4 2$
- c. $\log_8 4$
- d. $\log_{1/2} 8$

Problem 5: Special values

Evaluate each expression.

- a. $\log_9 1$
- b. $\log_{12} 12$
- c. $\log_7 7^5$
- d. $3^{\log_3 11}$

Problem 6: Find the base or the value

Find the unknown in each equation.

- a. $\log_b 49 = 2$
- b. $\log_b 64 = 3$
- c. $\log_3 x = 4$
- d. $\log_2 x = -5$

Problem 7: Common logarithms

Evaluate without a calculator. Then state which two consecutive integers $\log 450$ lies between.

- a. $\log 1000$
- b. $\log 0.001$
- c. $\log \sqrt{10}$
- d. $\log 450$

Problem 8: Natural logarithms

Evaluate each expression.

- a. $\ln e^4$
- b. $\ln 1$

- c. $\ln e$
- d. $\ln \frac{1}{e^3}$
- e. $e^{\ln 9}$

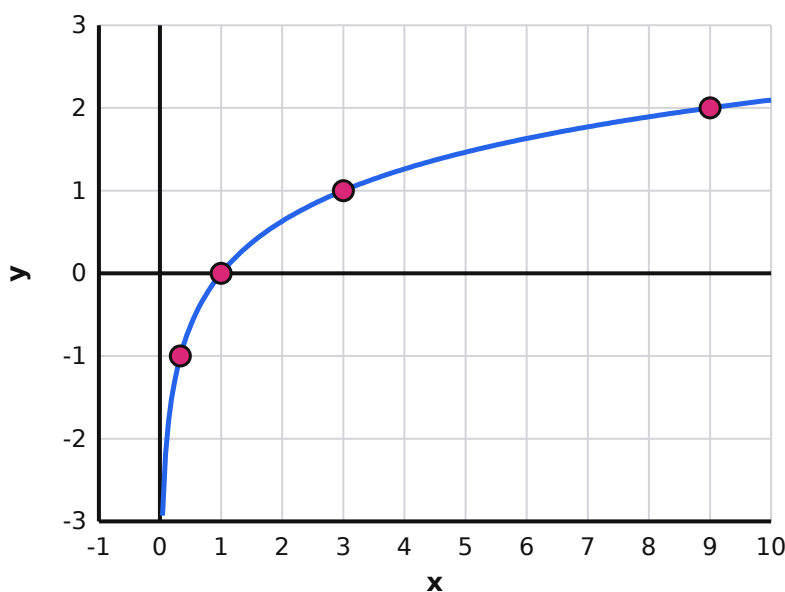
Problem 9: Use a calculator

Round each value to four decimal places.

- a. $\ln 7$
- b. $\log 56$
- c. $\ln 0.5$

Problem 10: Read a log graph

The graph shows $y = \log_3 x$. Use it to answer each part.



Graph of $y = \log_3 x$

- a. State the x-intercept.
- b. State the domain and the range.
- c. Write the equation of the vertical asymptote.
- d. Find $\log_3 9$ and $\log_3 \frac{1}{3}$.

Problem 11: Domain of a log function

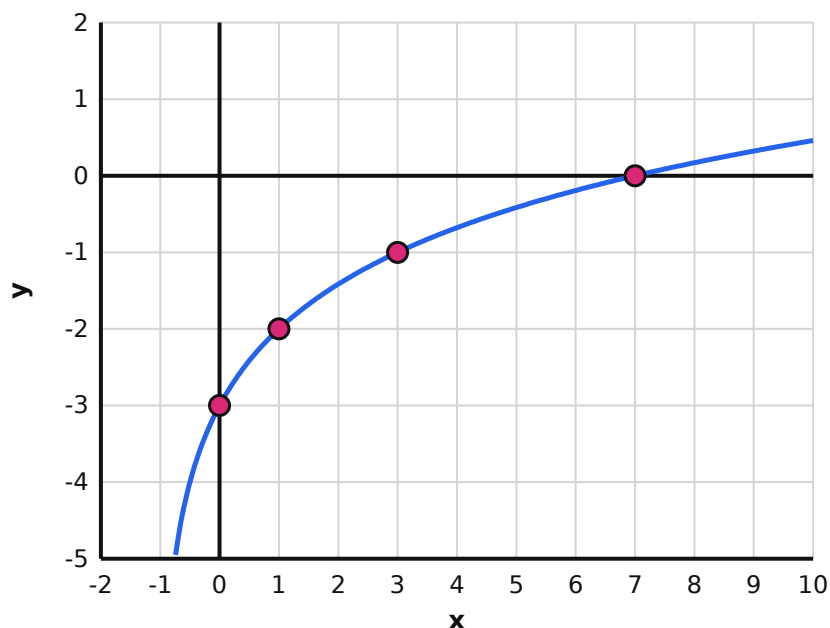
Find the domain of each function.

- a. $f(x) = \log_2(x-3)$
- b. $g(x) = \log(5-x)$
- c. $h(x) = \ln(2x+6)$

d. $k(x) = \log_4(x^2 - 9)$

Problem 12: Transformations of a log graph

The graph of $g(x) = \log_2(x+1) - 3$ is shown. State the asymptote, the domain, the y-intercept and the x-intercept.



Graph of $g(x) = \log_2(x + 1) - 3$

Problem 13: Expand a logarithm

Expand each expression using the properties of logarithms.

- $\log_3(9x)$
- $\log_2 \frac{x^3}{y}$
- $\log_5(25\sqrt{x})$
- $\ln \frac{e^2 x^4}{y^3}$

Problem 14: Condense a logarithm

Write each expression as a single logarithm.

- $\log_2 5 + \log_2 6$
- $3\log 2 + \log 5$
- $\ln 12 - \ln 4$
- $2\log_3 x + \log_3(x+1)$
- $\frac{1}{2}\log_7 x - 3\log_7 y$

Problem 15: Evaluate with properties

Use the properties of logarithms to find each value exactly.

- a. $\log_6 4 + \log_6 9$
- b. $\log_2 96 - \log_2 3$
- c. $3\log_8 2$
- d. $2\log_3 6 - \log_3 4$

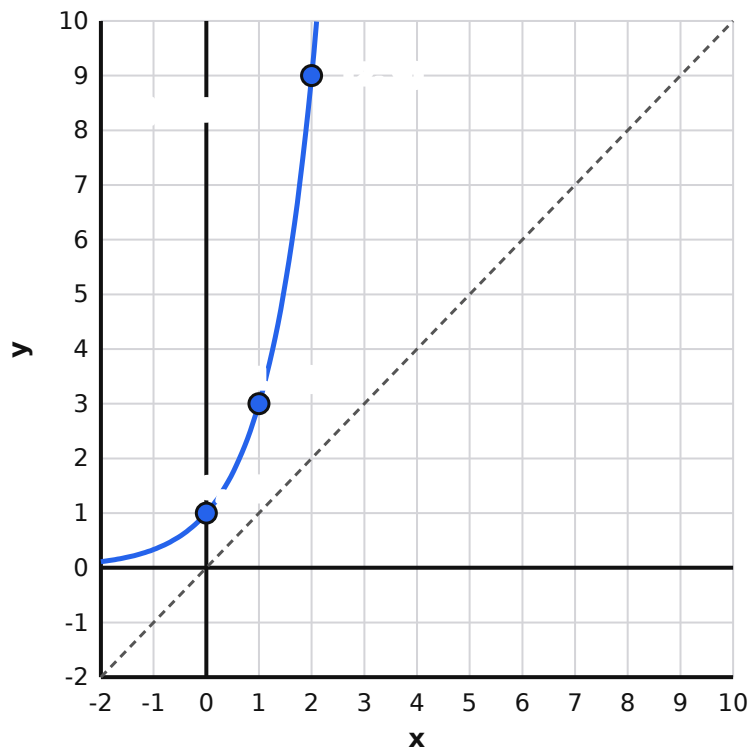
Problem 16: Change of base

Use the change of base formula to evaluate each logarithm. Round to four decimal places.

- a. $\log_3 20$
- b. $\log_5 8$
- c. $\log_{12} 500$

Problem 17: Find an inverse function

The graph of $f(x) = 3^x$ is shown with the line $y = x$.



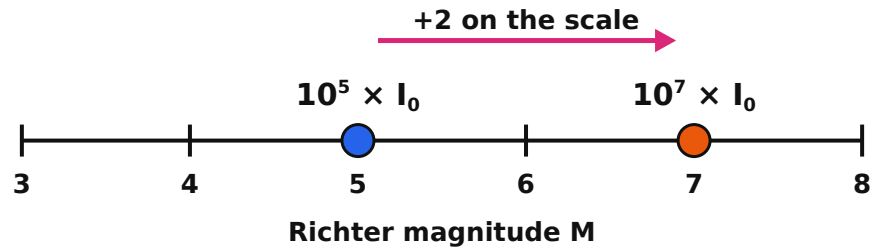
Graph of $f(x) = 3^x$

- a. Write the inverse function $f^{-1}(x)$.
- b. Give the points on the graph of f^{-1} that match (0,1), (1,3) and (2,9).
- c. Find the inverse of $g(x) = 2 \cdot 4^x$.

d. Find the inverse of $h(x) = \log_2 x + 3$.

Problem 18: Earthquake magnitudes

The Richter magnitude of an earthquake is $M = \log \frac{I}{I_0}$, where I is its intensity. Maya reads about a magnitude 5 quake and a magnitude 7 quake.

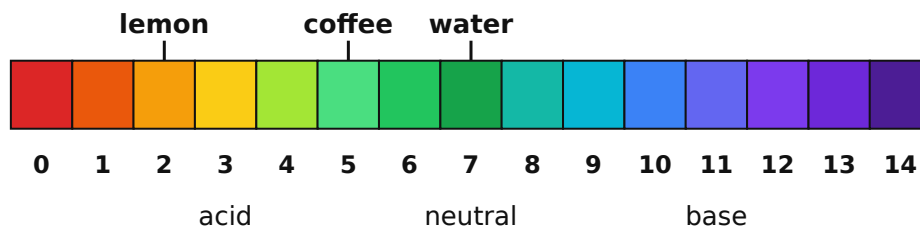


Magnitudes 5 and 7 on the Richter scale

- How many times as intense is the magnitude 7 quake?
- A quake has magnitude 6.4. Find $\frac{I}{I_0}$ to three significant digits.

Problem 19: Acidity and pH

The pH of a liquid is $\text{pH} = -\log[H^+]$, where $[H^+]$ is in moles per liter. Jamal tests lemon juice, coffee and water.

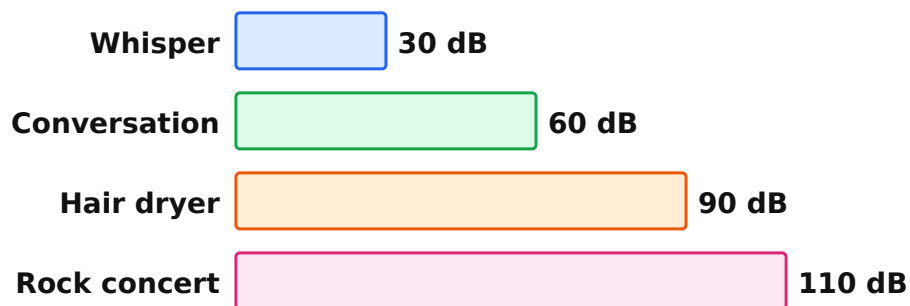


pH scale marking lemon juice 2, coffee 5, water 7

- Lemon juice has $[H^+] = 0.01$. Find its pH.
- Coffee has pH 5. Find $[H^+]$.
- How many times as large is $[H^+]$ in lemon juice as in coffee?
- Tomato juice has $[H^+] = 3.2 \times 10^{-5}$. Find its pH to the nearest hundredth.

Problem 20: Sound levels

Sound level in decibels is $L = 10 \log \frac{I}{I_0}$. Mei compares everyday sounds.



Bar chart of four sound levels

- Find $\frac{I}{I_0}$ for a conversation at 60 dB.
- Find $\frac{I}{I_0}$ for a hair dryer at 90 dB.
- How many times as intense is the hair dryer as the conversation?
- Two identical hair dryers run together, so the intensity doubles. Find the new level to the nearest hundredth of a decibel.

Problem 21: Digits of a large number

Diego wants to know how many digits 2^{50} has without writing it out. Use $\log 2 \approx 0.30103$ to find the number of digits.

Problem 22: Invert a growth model

A bacteria population is $P(t) = 500 \cdot 2^{t/3}$, where t is in hours. Write t as a function of P , then find t when $P = 4000$.

Problem 23: Find the error

Ethan writes $\log_2(x+3) = \log_2 x + \log_2 3$. Explain his error and use $x = 5$ to show that the statement is false.