

Precalculus · Exponential and Logarithmic Functions and Models · Worksheet

Common Core F-LE.A.4, F-BF.B.5, F-IF.C.8b · mathovore.fr

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

This precalculus exponential log worksheet gives 24 problems on exponential and logarithmic functions and models, ordered from easy to hard, with a separate answer key.

These 24 problems practice the Precalculus standards F-LE.A.4, F-BF.B.5 and F-IF.C.8b: converting between exponents and logarithms, finding inverse functions, using the laws of logarithms, and solving exponential and logarithmic equations.

The last six problems model money, decay, populations and logarithmic scales. Show every step and check logarithm solutions in the original equation.

Precalculus Common Core: F-LE.A.4 · F-BF.B.5 · F-IF.C.8b

Precalculus Exponential Log Worksheet: problems 1-5

Problem 1: Exponential to logarithmic form

Write each exponential equation in logarithmic form.

- a. $2^7 = 128$
- b. $10^{-3} = 0.001$
- c. $9^{1/2} = 3$
- d. $e^0 = 1$

Problem 2: Logarithmic to exponential form

Write each logarithmic equation in exponential form.

- a. $\log_5 125 = 3$
- b. $\log_4 \frac{1}{64} = -3$
- c. $\log_{36} 6 = \frac{1}{2}$
- d. $\ln 20 = t$

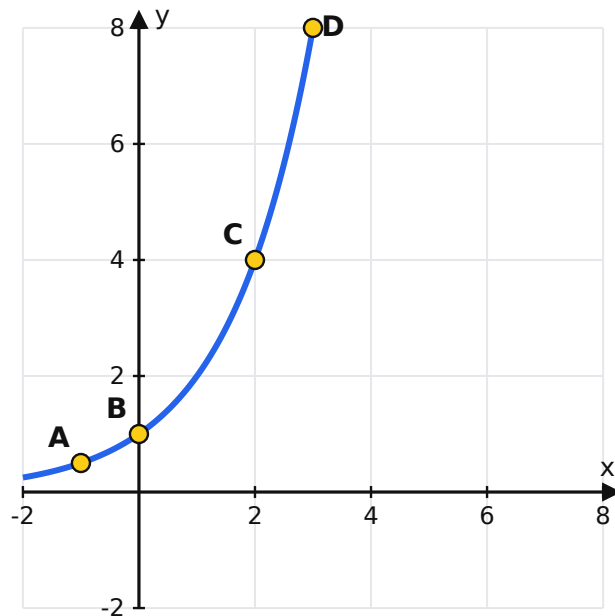
Problem 3: Evaluate logarithms

Evaluate each logarithm without a calculator.

- $\log_3 81$
- $\log_2 \frac{1}{32}$
- $\log_{25} 5$
- $\log_{1/4} 16$
- $\ln \sqrt{e}$

Problem 4: Points on an inverse graph

The graph shows $f(x) = 2^x$ and the labeled points A, B, C and D.



Graph of $f(x) = 2^x$ with four labeled points.

- Write the coordinates of the matching points A', B', C' and D' on the graph of f^{-1} .
- Write an equation for $f^{-1}(x)$.
- State the domain of f^{-1} .

Problem 5: Finding inverse functions

Find the inverse function of each function.

- $f(x) = 4^x$
- $f(x) = 2 \cdot 3^x$
- $f(x) = \ln(x+3)$
- $f(x) = 1 + \log_2 x$

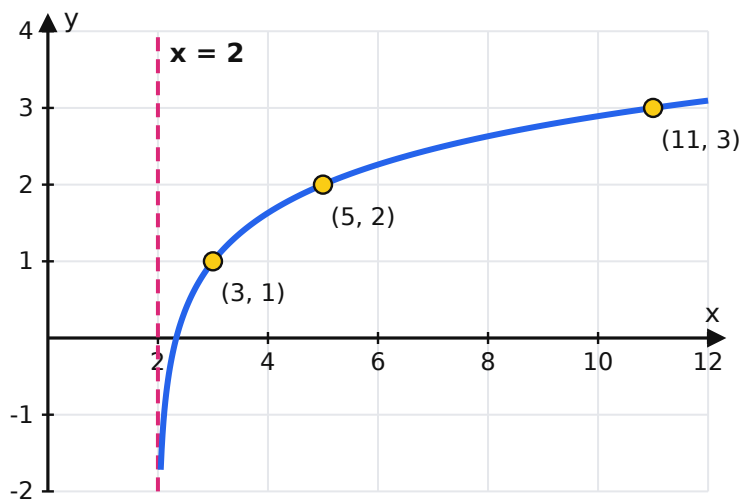
Precalculus Exponential Log Worksheet: problems 6-10

Problem 6: Verify inverses by composition

Show that $f(x) = e^{2x}$ and $g(x) = \frac{1}{2}\ln x$ are inverse functions.

Problem 7: Features of a log graph

The graph shows $g(x) = \log_3(x-2)+1$.



Graph of g with a dashed vertical asymptote at $x = 2$.

- Give the equation of the vertical asymptote.
- State the domain and the range.
- Find the exact x-intercept.
- Find $g(29)$.

Problem 8: Expand logarithms

Use the laws of logarithms to expand each expression.

- $\log_b(x^3y^2)$
- $\ln \frac{5x}{y^4}$
- $\log_2 \sqrt{\frac{8x}{z}}$

Problem 9: Condense logarithms

Write each expression as a single logarithm.

- $2\log 3 + \log 5$
- $\ln 12 - \ln 4 + 2\ln x$
- $\frac{1}{2}\log_2 x + 2\log_2 y - 3\log_2 z$

Problem 10: Using given logarithm values

Given $\log 2 \approx 0.3010$ and $\log 3 \approx 0.4771$, approximate each value without a calculator key for logarithms.

- a. $\log 6$
- b. $\log 18$
- c. $\log 1.5$
- d. $\log 8$
- e. $\log \frac{2}{9}$

Precalculus Exponential Log Worksheet: problems 11-15

Problem 11: Change of base

Use the change-of-base formula to approximate each value to three decimal places.

- a. $\log_5 40$
- b. $\log_7 3$
- c. $\log_2 100$

Problem 12: Same-base exponential equations

Solve each equation by writing both sides with the same base.

- a. $4^{x+1} = 32$
- b. $9^x = 27^{x-2}$
- c. $\left(\frac{1}{2}\right)^x = 16$
- d. $25^{x-1} = 125^x$

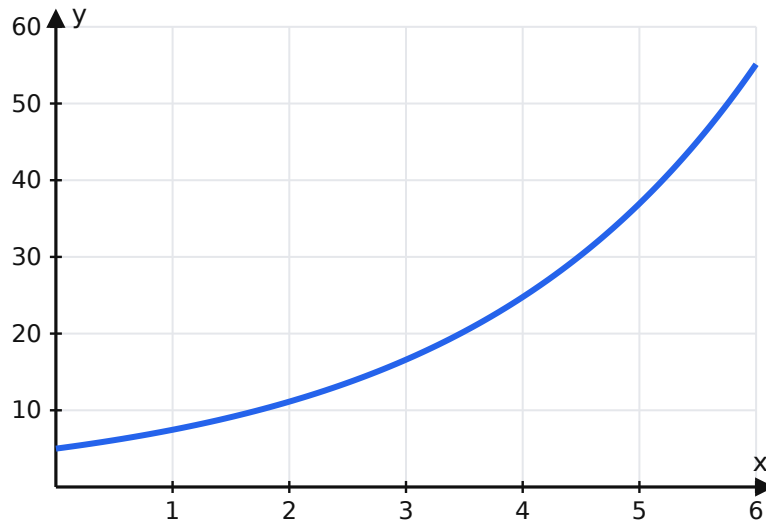
Problem 13: Solve using logarithms

Solve each equation. Give an exact answer, then round to three decimal places.

- a. $3 \cdot 2^x = 60$
- b. $7^{x-1} = 50$
- c. $5e^{2x} = 45$
- d. $12(0.9)^x = 3$

Problem 14: Estimate, then solve

The graph shows $y = 5e^{0.4x}$.



Graph of $y = 5e^{(0.4x)}$ for x from 0 to 6.

- Use the graph to estimate the solution of $5e^{0.4x} = 40$.
- Solve the equation exactly and round to three decimal places.

Problem 15: Logarithmic equations

Solve each equation and reject any extraneous solution.

- $\log_2(x+3) + \log_2(x-3) = 4$
- $\ln x + \ln(x-2) = \ln 8$
- $\log_3(2x-1) = 2$
- $\log(x+6) = 2\log x$

Precalculus Exponential Log Worksheet: problems 16-20

Problem 16: Quadratic form

Solve each equation.

- $e^{2x} - 5e^x + 6 = 0$
- $4^x - 6 \cdot 2^x + 8 = 0$

Problem 17: Transformations of an exponential

Let $h(x) = -2^{x-1} + 3$. Describe how its graph is related to the graph of $y = 2^x$, then answer the questions.

- Describe the transformations.
- Give the equation of the horizontal asymptote.
- Find the y-intercept.

- d. Find the exact x-intercept.
- e. State the range.

Problem 18: Rewrite growth and decay models

Answer each question about exponential models.

- a. Write $A = 200(0.8)^t$ in the form $A = Ce^{kt}$ and give k to four decimal places.
- b. The model $A = 50e^{0.07t}$ is continuous. By what percent does A grow in each full time unit, to two decimal places?
- c. Write $P = 300 \cdot 2^{t/3}$ in the form $P = 300e^{kt}$ and give k to four decimal places.

Problem 19: Compound interest time

Maya deposits \$2,000 in an account paying 4% annual interest compounded quarterly. Use $A = P\left(1 + \frac{r}{n}\right)^{nt}$ to find how many years it takes for the balance to reach \$3,000.

Problem 20: Continuous compounding

Jamal invests \$5,000 at 3.5% interest compounded continuously, $A = 5000e^{0.035t}$. Find the time for the money to double and the time to reach \$12,000. Round to two decimal places.

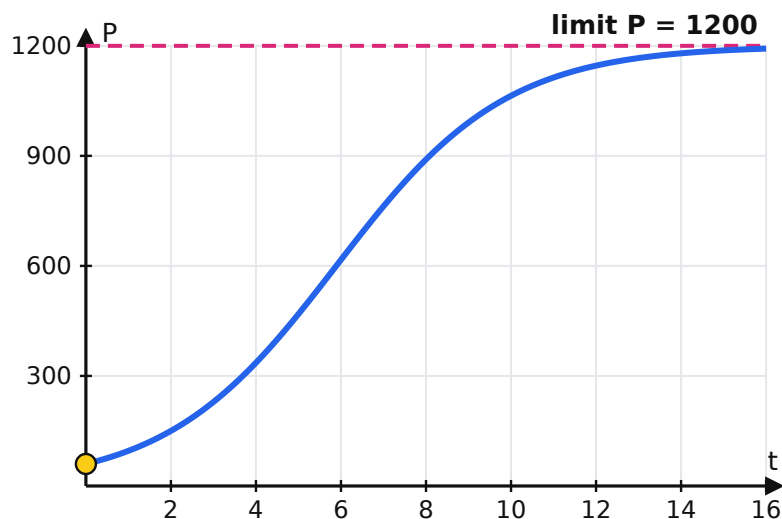
Precalculus Exponential Log Worksheet: problems 21-24

Problem 21: Radioactive decay dating

Carbon-14 has a half-life of 5,730 years, so the fraction left after t years is $\left(\frac{1}{2}\right)^{t/5730}$. A bone fragment has 30% of its original carbon-14. Find its age to the nearest year.

Problem 22: Logistic population model

The number of students who have heard a rumor at a school of 1,200 is modeled by $P(t) = \frac{1200}{1 + 19e^{-0.5t}}$, where t is in hours.



The rumor model levels off at 1,200 students.

- How many students knew the rumor at $t = 0$?
- What is the carrying capacity?
- When did exactly 600 students know the rumor?
- Find $P(8)$ to the nearest student.

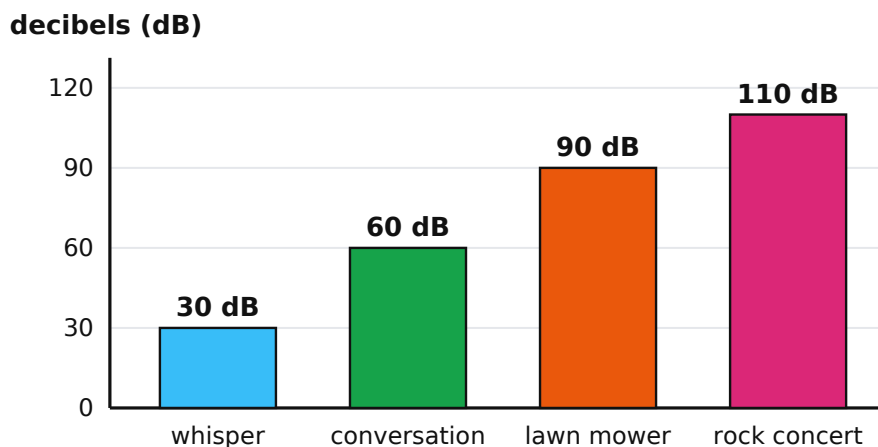
Problem 23: pH calculations

The pH of a solution is $\text{pH} = -\log[H^+]$. Round to two decimal places.

- A sample of rain has $[H^+] = 3.2 \times 10^{-5}$ mol/L. Find its pH.
- Seawater has pH 8.2. Find $[H^+]$ in scientific notation.
- How many times greater is the hydrogen ion concentration at pH 3 than at pH 6?

Problem 24: Decibels and earthquakes

Sound level is $L = 10 \log \frac{I}{I_0}$ decibels, where I_0 is the faintest audible intensity.



Sound levels of four common sources.

- How many times as intense as a conversation is a lawn mower?
- Find $\frac{I}{I_0}$ for a rock concert, in scientific notation.
- An earthquake of magnitude 7.1 is compared with one of magnitude 5.4. By what factor is its wave amplitude greater? Round to the nearest whole number.

How to use this precalculus exponential log worksheet

Print this precalculus exponential log worksheet as a PDF, solve every problem on paper, then compare with the answer key.

