

Exponential and Logarithmic Functions: math practice, Grade 12 – download the PDF

24 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Evaluating an exponential function

★★★

Let $f(x) = 3 \cdot 2^x$. Compute $f(0)$, $f(4)$ and $f(-1)$.

2 Growth or decay?

★★★

For each function, say whether it models growth or decay and give the percent change per step: (a) $y = 5(1.08)^x$ (b) $y = 200(0.9)^x$ (c) $y = 7\left(\frac{3}{2}\right)^x$ (d) $y = 4\left(\frac{1}{3}\right)^x$.

3 From exponential to logarithmic form

★★★

Rewrite each equation in logarithmic form: (a) $2^7 = 128$ (b) $10^{-2} = 0.01$ (c) $9^{1/2} = 3$.

4 Logarithms without a calculator

★★★

Evaluate: (a) $\log_3 81$ (b) $\log_5 \frac{1}{25}$ (c) $\log_4 2$ (d) $\ln e^5$ (e) $\log 1000$.

5 Condensing logarithms



Write each as a single number: (a) $\log_6 4 + \log_6 9$ (b) $\log_2 40 - \log_2 5$ (c) $2\log_3 6 - \log_3 4$

6 Matching bases



Solve: (a) $2^x = 64$ (b) $5^{x+1} = 125$ (c) $10^x = 0.001$ (d) $\left(\frac{1}{2}\right)^x = 8$.

7 Town population



A town of 12,000 people grows 3% per year. (a) Write a formula for the population $P(t)$ after t years. (b) Find the population after 2 years, rounded to a whole person.

8 Simple logarithmic equations



Solve: (a) $\log_3 x = 4$ (b) $\log_2(x - 1) = 3$ (c) $\ln x = 0$ (d) $\log_x 49 = 2$ with $x > 0$.

9 Using the change of base formula



Use a calculator and the change of base formula to approximate to four decimal places: (a) $\log_5 40$ (b) $\log_2 10$.

10 An exponential equation with a calculator



Solve $7^x = 30$. Give the exact answer and a four-decimal approximation.

11 Equation with base e



Solve $4e^{2x} = 36$.

12 A logarithmic equation



Solve $\log_4(3x + 1) = 2$ and verify your answer.

13 Monthly compounding



You deposit \$2,500 at 4.8% annual interest compounded monthly. How much will you have after 5 years?

14 When does the car lose enough value?

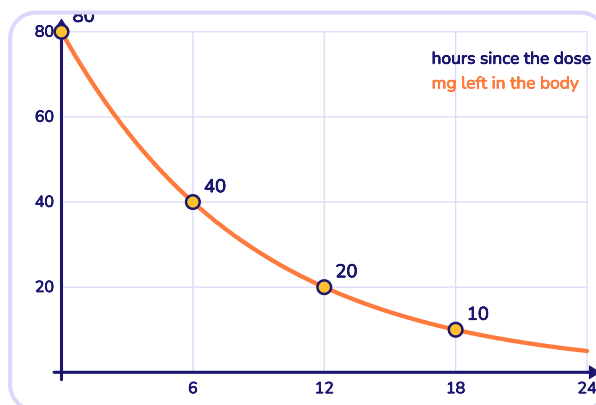


A car bought for \$24,000 loses 15% of its value each year, so $V(t) = 24000(0.85)^t$. After how many *whole* years is it worth less than \$10,000?

15 Medicine in the body



A patient takes 80 mg of a medicine whose half-life is 6 hours, so $N(t) = 80\left(\frac{1}{2}\right)^{t/6}$ (see the graph).



(a) How many mg remain after 10 hours? (b) After how many hours are 10 mg left?

16 Expanding a logarithm



Expand $\ln \frac{x^3 \sqrt{y}}{e^2}$ using the laws of logarithms, for $x, y > 0$.

17 Equation in quadratic form

★★★

Solve $9^x - 4 \cdot 3^x - 45 = 0$.

18 Two logs, one extraneous root

★★★

Solve $\log x + \log(x - 21) = 2$.

19 Equating arguments

★★★

Solve $\ln(x + 2) + \ln(x - 2) = \ln 5$.

20 Doubling and tripling time

★★★

An account earns interest compounded continuously. (a) At 4.5%, how long to double? (b) At 6%, how long to triple? Round to two decimals.

21 Chemistry: pH

★★★

The pH of a solution is $\text{pH} = -\log[\text{H}^+]$, where $[\text{H}^+]$ is the hydrogen ion concentration in moles per liter. (a) Find the pH when $[\text{H}^+] = 3.2 \times 10^{-5}$. (b) Blood has pH 7.4: find its concentration.

22 Fitting a model to two data points

★★★

A culture has 800 cells at $t = 0$ hours and 5,000 cells at $t = 4$ hours. Assume $N(t) = 800e^{kt}$. (a) Find k . (b) Predict the number of cells at $t = 6$.

23 True or false?



Decide whether each statement is true or false, and justify with a counterexample or a law.

- (a) $\log(a + b) = \log a + \log b$ for all $a, b > 0$. (b) $\ln(x^2) = 2 \ln x$ for every real $x \neq 0$. (c) $\log_b x \cdot \log_x b = 1$ for $b, x > 0, b, x \neq 1$.

24 Annual versus continuous



You invest \$800 at 7%. (a) If interest is compounded annually, what is the first whole year in which the balance reaches \$5,000? (b) How long does it take with continuous compounding?



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