

Logarithmic Functions: math practice, Grade 11 – download the PDF

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

1 Logarithmic form



Rewrite each exponential equation in logarithmic form.

a. $2^6 = 64$

b. $10^{-2} = 0.01$

c. $7^2 = 49$

d. $5^0 = 1$

e. $9^{1/2} = 3$

2**Exponential form**

Rewrite each logarithmic equation in exponential form.

a. $\log_3 81 = 4$

b. $\log_5 125 = 3$

c. $\log_2 \frac{1}{8} = -3$

d. $\log_{16} 4 = \frac{1}{2}$

e. $\log 1000 = 3$

3**Evaluating logarithms**

Evaluate without a calculator.

a. $\log_2 16$

b. $\log_5 \frac{1}{25}$

c. $\log_7 7$

d. $\log_9 1$

e. $\log_4 2$

f. $\log_{1/2} 8$

4 True or false?



Decide whether each statement is true or false and justify your answer.

a. $\log_2 0 = 0$

b. $\log_3(-9)$ is undefined.

c. $\log_4 4^7 = 7$

d. $\log 100 = 2$

e. $\log_2 8 + \log_2 4 = \log_2 12$

5 Domain of a logarithm



Find the domain of each function.

a. $f(x) = \log(x - 4)$

b. $g(x) = \log_3(2x + 10)$

c. $h(x) = \log_5(8 - x)$

6 Splitting products



Use the properties of logarithms to expand.

a. $\log_2(8x)$

b. $\log(1000y^2)$

c. $\log_5 \frac{x^3}{25}$

7 Natural logarithm values



Evaluate without a calculator.

a. $\ln e^4$

b. $e^{\ln 9}$

c. $\ln 1$

d. $\ln \frac{1}{e}$

e. $\ln \sqrt{e}$

8 Condensing logarithms



Write each expression as a single logarithm, then simplify when possible.

a. $\log_3 4 + \log_3 5$

b. $\log_2 48 - \log_2 3$

c. $2 \log 5 + \log 4$

d. $\frac{1}{2} \ln 81 - \ln 3$

9 Change of base



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

a. $\log_3 20$

b. $\log_7 50$

c. $\log_{0.5} 10$

10 Same base



Solve each equation by writing both sides as powers of the same base.

a. $5^x = 125$

b. $4^{x+1} = 64$

c. $2^{3x-1} = \frac{1}{32}$

d. $9^x = 27$

11 Simple logarithmic equations



Solve each equation.

a. $\log_2(x + 3) = 5$

b. $\log_5(2x - 1) = 2$

c. $\log x = -2$

d. $\ln x = 3$ (give the exact value and a decimal approximation)

12 Reading a logarithmic graph



Consider $f(x) = \log_2(x + 5) - 3$.

a. Give its domain and the equation of its vertical asymptote.

b. Find the x-intercept.

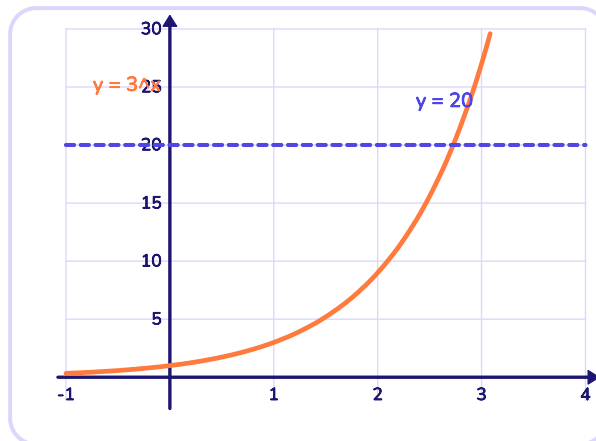
c. Find the y-intercept to three decimal places.

d. Sketch the graph using three points.

13 Using a graph and logs



The graph below shows $y = 3^x$ and the line $y = 20$.



- Estimate from the graph the value of x for which $3^x = 20$.
- Find that value exactly with a logarithm, and then to three decimals.

14 Growing bacteria



A culture starts with 500 bacteria and doubles every 3 hours, so $N(t) = 500 \cdot 2^{t/3}$ where t is in hours.

- When will the culture reach 8,000 bacteria?
- When will it reach 10,000 bacteria? Round to the nearest tenth of an hour.

15 A product of logs



Solve $\log_2 x + \log_2(x - 6) = 4$. Explain why one candidate must be rejected.

16 A quotient of logs



Solve $\log(x + 3) - \log(x - 1) = 1$.

17 Saving for a goal



You deposit \$4,000 in an account. How long will it take to reach \$6,000 if the account pays

a. 3.6% interest compounded annually, using $A = 4000(1.036)^t$?

b. 3.6% interest compounded continuously, using $A = 4000e^{0.036t}$?

Give both answers in years to the nearest hundredth and compare them.

18 Radioactive decay



An 80 mg sample of a substance has a half-life of 12 days: the amount left after t days is

$$A(t) = 80\left(\frac{1}{2}\right)^{t/12}.$$

a. When will 5 mg remain?

b. When will 20 mg remain?

c. When will 30 mg remain? Round to the nearest tenth of a day.

19 A hidden quadratic



Solve $e^{2x} - 5e^x + 6 = 0$. Give exact values and approximations to three decimal places.

20 Finding an inverse



Let $f(x) = 2 \cdot 3^x + 1$.

a. Find a formula for $f^{-1}(x)$.

b. State the domain of f^{-1} .

c. Verify that $f^{-1}(55) = 3$.

21 Reciprocal logarithms



- a. Show that $\log_a b \cdot \log_b a = 1$ for $a, b > 0, a, b \neq 1$.
- b. Use the change-of-base formula to compute $\log_2 9 \cdot \log_3 8$.



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