

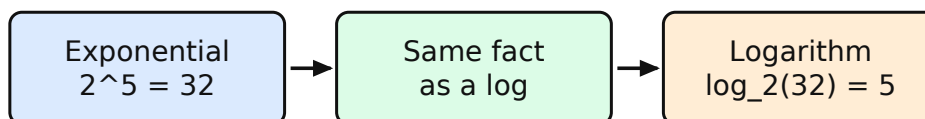
Algebra 2 - Logarithms - Answer Key

Common Core F-LE.A.4, F-BF.B.5, F-IF.C.7e · maths-pdf.fr/en/

Every worksheet problem on logarithms is solved here, one step at a time. Compare your method as well as your final answer, because the steps show where applying the product rule to a sum can go wrong. Final answers appear in bold so you can find them quickly when you only need a check.

Algebra 2 · Common Core State Standards: **F-LE.A.4, F-BF.B.5, F-IF.C.7e**

Exercise 1 - Exponential to log



A logarithm is an exponent: $\log_b(x) = y$ means $b^y = x$.

The base is 2 and the exponent is 5.

$$\log_2(32) = 5$$

Exercise 2 - Log to exponential

The base is 3, the answer 4 is the exponent.

$$3^4 = 81$$

Exercise 3 - Evaluate a log

Ask: $2^? = 64$. $2^6 = 64$.

6

Exercise 4 - Fractional argument

$$5^{-2} = \frac{1}{25}$$

-2

Exercise 5 - Common log

The base is 10: $10^3 = 1000$.

3

Exercise 6 - Root as an exponent

$9^{1/2} = 3$, so the exponent is $\frac{1}{2}$.

$\frac{1}{2}$

Exercise 7 - Natural log

$\ln e^4 = 4$ because the base is e . $\ln 1 = 0$ because $e^0 = 1$.

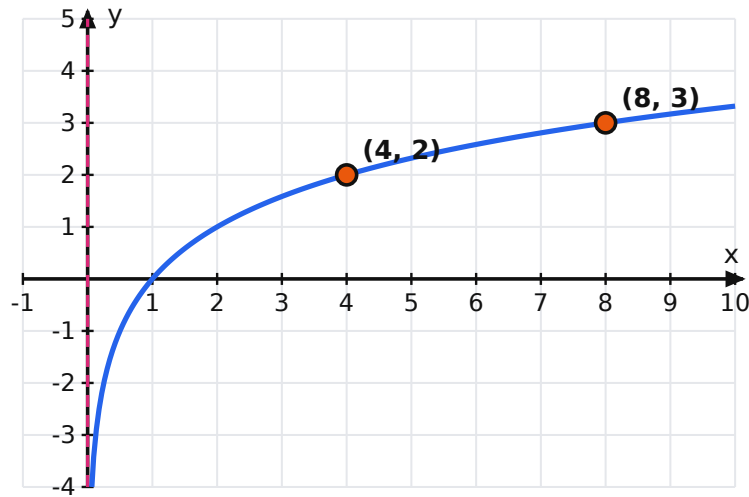
4 and 0

Exercise 8 - Solve a log equation

Rewrite: $x = 4^3$.

$x = 64$

Exercise 9 - Read the graph



Read the y-values at $x = 4$ and 8 .

$f(4) = 2$ and $f(8) = 3$, because $2^2 = 4$ and $2^3 = 8$.

The graph exists only for $x > 0$.

$f(4) = 2$, $f(8) = 3$; domain $x > 0$; asymptote $x = 0$

Exercise 10 - Expand

Product rule: $\log_3(9) + \log_3(x^2)$. $\log_3(9) = 2$. Power rule: $\log_3(x^2) = 2\log_3(x)$.

$$2 + 2\log_3(x)$$

Exercise 11 - Condense

$2\log 5 = \log 25$. Then $\log 25 + \log 4 = \log 100$.

$$\log 100 = 2$$

Exercise 12 - Condense a difference

Quotient rule: $\ln \frac{12}{3} = \ln 4$.

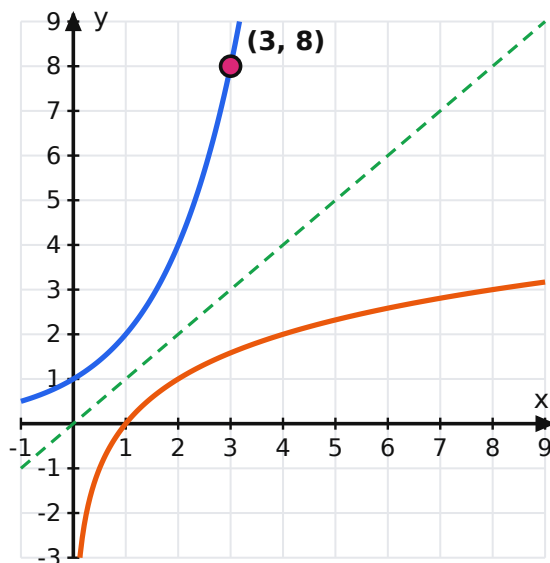
$$\ln 4$$

Exercise 13 - Change of base

$$\log_2(20) = \frac{\ln 20}{\ln 2} \approx \frac{2.9957}{0.6931} \approx 4.32.$$

About 4.32

Exercise 14 - Solve $2^x = 20$



2^x and its inverse; $2^{4.32}$ is about 20.

Take the log base 2 of both sides: $x = \log_2(20)$.

Change of base: $x = \frac{\ln 20}{\ln 2} \approx 4.32$.

Check: $2^{4.32} \approx 19.97$.

$$x = \log_2(20) \approx 4.32$$

Exercise 15 - Coefficient in the exponent

Take the natural log: $2x \ln 5 = \ln 100$.

$$x = \frac{\ln 100}{2 \ln 5} = \frac{4.6052}{3.2189} \approx 1.43.$$

x is about 1.43

Exercise 16 - Isolate first

Divide by 3: $2^x = 16$. Since $2^4 = 16$, $x = 4$.

$$x=4$$

Exercise 17 - Solve a log equation, shifted

$$x+3=2^5=32, \text{ so } x=29. \text{ Check: } \log_2(32)=5.$$

$$x=29$$

Exercise 18 - Extraneous solution

$$\text{Combine: } \log[x(x-3)]=1, \text{ so } x(x-3)=10.$$

$$x^2-3x-10=0 \text{ gives } (x-5)(x+2)=0.$$

$$x=-2 \text{ makes } \log x \text{ undefined. Check } x=5: \log 5 + \log 2 = \log 10 = 1.$$

$$x=5$$

Exercise 19 - Doubling time

$$\text{Solve } 5000(1.06)^t = 10000: 1.06^t = 2.$$

$$t = \frac{\ln 2}{\ln 1.06} \approx 11.90. \text{ The table agrees: between 11 and 12 years.}$$

About 11.9 years

Exercise 20 - pH scale

$$\text{First: } -\log 10^{-3} = 3.$$

$$\text{Second: } -\log(2.5 \times 10^{-5}) = -(\log 2.5 - 5) = 5 - 0.398 \approx 4.60.$$

pH 3 and about 4.60

Exercise 21 - Earthquakes

$$M_1 = \log 10^6 = 6 \text{ and } M_2 = \log 10^4 = 4.$$

$$\text{Intensity ratio: } \frac{10^6}{10^4} = 100.$$

Magnitudes 6 and 4; 100 times as intense

Exercise 22 - Find the error

$\log(20) \approx 1.301$ but $\log 10 + \log 10 = 2$. The claim is false.

The correct rule is $\log(xy) = \log x + \log y$.

The sum rule applies to the product xy