

Logarithms: The Inverse of Exponents

Grade 11 – Algebra 2 math · Test Answer Key · Standards: F-LE.A.4, F-BF.B.4a, F-IF.C.7e

Each answer shows the work worth points and a short scoring guide. Award partial credit when the method is correct but an arithmetic slip occurs, and use the total out of 20 to judge mastery.

Standards: F-LE.A.4, F-BF.B.4a, F-IF.C.7e · **Level:** Grade 11 Algebra 2

Question 1 Convert between forms (2 points)

- a. $\log_7 49 = 2$.
- b. $10^{-2} = 0.01$.

Scoring: 1 point for each correct form.

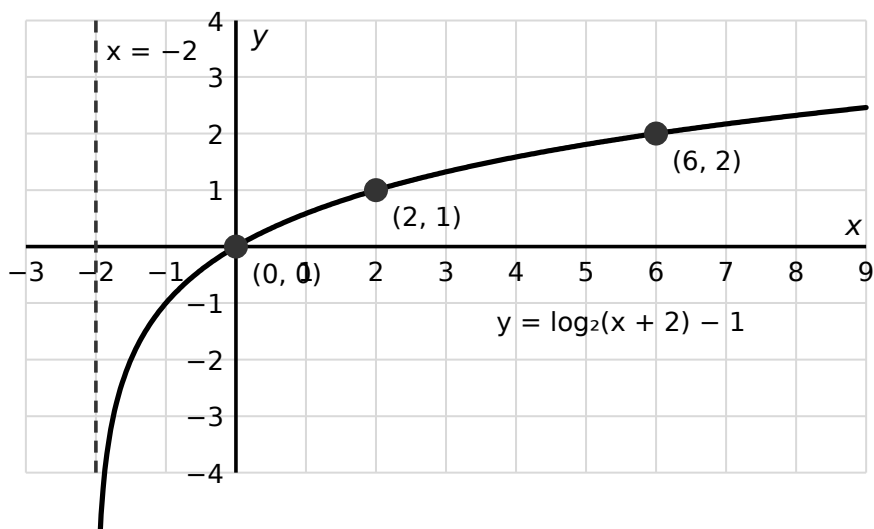
Question 2 Evaluate logarithms (3 points)

- a. $4^3 = 64$, so **3**.
- b. $9^{1/2} = 3$, so **1/2**.
- c. $7 + 3 = \mathbf{10}$.

Scoring: 1 point for each correct value.

Question 3 Read a logarithmic graph (3 points)

- a. $x = -2$, where $x + 2 = 0$.
- b. $x > -2$.
- c. $\log_2(6 + 2) - 1 = \log_2 8 - 1 = 3 - 1 = 2$. **Verified.**



The function is $y = \log_2(x + 2) - 1$.

Scoring: 1 point for each part.

Question 4 Expand a logarithm (2 points)

$$\log_2 8 + 2 \log_2 p - \log_2 q = 3 + 2 \log_2 p - \log_2 q.$$

Scoring: 1 point for the product and quotient rules, 1 point for the power rule and the value 3.

Question 5 Condense and simplify (2 points)

$$\log_6(12 \cdot 3) = \log_6 36 = 2, \text{ since } 6^2 = 36.$$

Scoring: 1 point for combining, 1 point for the value.

Question 6 Change of base (2 points)

$$\log_7 90 = \ln 90 \div \ln 7 \approx 4.4998 \div 1.9459 \approx 2.31.$$

Scoring: 1 point for the quotient setup, 1 point for the value.

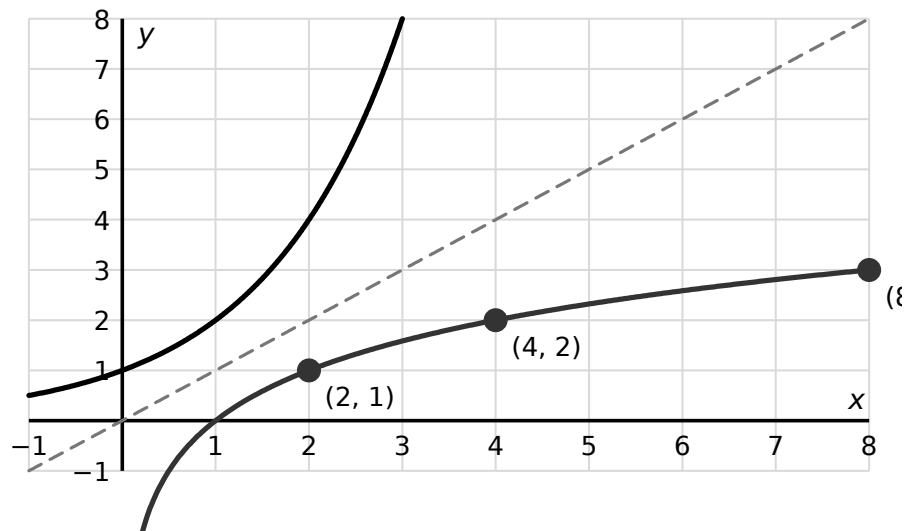
Question 7 pH of a solution (2 points)

$$\text{pH} = -\log(4 \times 10^{-9}) = 9 - \log 4 \approx 9 - 0.602 = 8.40. \text{ Since } 8.40 > 7, \text{ the solution is basic.}$$

Scoring: 1 point for the pH value, 1 point for the conclusion.

Question 8 Inverse from a graph (2 points)

Swap coordinates: (2, 1), (4, 2), (8, 3). The inverse is $y = \log_2 x$.



Reflecting the points over $y = x$ gives the inverse.

Scoring: 1 point for the three points, 1 point for the equation.

Question 9 Decibels (2 points)

$I/I_0 = 8 \times 10^6$. $\log(8 \times 10^6) = 0.9031 + 6 = 6.9031$, so $L = 69.031$. $\approx$ **69.0 dB**.

Scoring: 1 point for the ratio, 1 point for the value.