

Lesson 14: Solving Logarithmic Equations

Classwork

Opening Exercise

Convert the following logarithmic equations to equivalent exponential equations.

- a. $\log(10,000) = 4$
- b. $\log(\sqrt{10}) = \frac{1}{2}$
- c. $\log_2(256) = 8$
- d. $\log_4(256) = 4$
- e. $\ln(1) = 0$
- f. $\log(x+2) = 3$









Examples

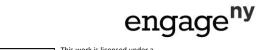
Write each of the following equations as an equivalent exponential equation, and solve for x.

1. $\log(3x + 7) = 0$

2. $\log_2(x+5) = 4$

3. $\log(x+2) + \log(x+5) = 1$











Exercises

1. Drew said that the equation $\log_2[(x + 1)^4] = 8$ cannot be solved because he expanded $(x + 1)^4 = x^4 + 4x^3 + 6x^2 + 4x + 1$ and realized that he cannot solve the equation $x^4 + 4x^3 + 6x^2 + 4x + 1 = 2^8$. Is he correct? Explain how you know.

Solve the equations in Exercises 2-4 for x.

2. $\ln((4x)^5) = 15$

3. $\log((2x+5)^2) = 4$









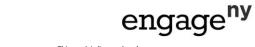
4. $\log_2((5x+7)^{19}) = 57$

Solve the logarithmic equations in Exercises 5–9, and identify any extraneous solutions.

5. $\log(x^2 + 7x + 12) - \log(x + 4) = 0$

6. $\log_2(3x) + \log_2(4) = 4$







ALGEBRA II

7. $2\ln(x+2) - \ln(-x) = 0$

8. $\log(x) = 2 - \log(x)$

9. $\ln(x+2) = \ln(12) - \ln(x+3)$







Problem Set

1. Solve the following logarithmic equations.

a.
$$\log(x) = \frac{5}{2}$$

- b. $5\log(x+4) = 10$
- c. $\log_2(1-x) = 4$
- d. $\log_2(49x^2) = 4$
- e. $\log_2(9x^2 + 30x + 25) = 8$
- 2. Solve the following logarithmic equations.
 - a. $\ln(x^6) = 36$
 - b. $\log[(2x^2 + 45x 25)^5] = 10$
 - c. $\log[(x^2 + 2x 3)^4] = 0$
- 3. Solve the following logarithmic equations.
 - a. $\log(x) + \log(x 1) = \log(3x + 12)$
 - b. $\ln(32x^2) 3\ln(2) = 3$
 - $\operatorname{c.} \quad \log(x) + \log(-x) = 0$
 - d. $\log(x+3) + \log(x+5) = 2$
 - e. $\log(10x + 5) 3 = \log(x 5)$
 - f. $\log_2(x) + \log_2(2x) + \log_2(3x) + \log_2(36) = 6$
- 4. Solve the following equations.
 - a. $\log_2(x) = 4$
 - b. $\log_6(x) = 1$
 - c. $\log_3(x) = -4$
 - d. $\log_{\sqrt{2}}(x) = 4$
 - e. $\log_{\sqrt{5}}(x) = 3$
 - f. $\log_3(x^2) = 4$
 - g. $\log_2(x^{-3}) = 12$
 - h. $\log_3(8x + 9) = 4$

i.
$$2 = \log_4(3x - 2)$$

j.
$$\log_5(3 - 2x) = 0$$

- k. $\ln(2x) = 3$
- I. $\log_3(x^2 3x + 5) = 2$

- m. $\log((x^2 + 4)^5) = 10$
- n. $\log(x) + \log(x + 21) = 2$
- o. $\log_4(x-2) + \log_4(2x) = 2$
- p. $\log(x) \log(x+3) = -1$
- q. $\log_4(x+3) \log_4(x-5) = 2$
- r. $\log(x) + 1 = \log(x + 9)$
- s. $\log_3(x^2 9) \log_3(x + 3) = 1$
- t. $1 \log_8(x 3) = \log_8(2x)$
- u. $\log_2(x^2 16) \log_2(x 4) = 1$
- v. $\log\left(\sqrt{(x+3)^3}\right) = \frac{3}{2}$
- w. $\ln(4x^2 1) = 0$
- x. $\ln(x+1) \ln(2) = 1$





