

Key

Unit 3 Day 6 Notes: Solving Logarithmic Equations

Solving Logarithmic Equations

1. Condense logarithmic terms on one side of the equation (if necessary).
2. Re-write the problem in exponential form.
3. Simplify and solve.

Remember properties of logarithms

Examples: Solve.

1. $\log_4(x+3) = 2$
 $4^2 = x+3$
 $x = 13$

2. $\log_2(x) + \log_2(x-7) = 3$
 $2^3 = x(x-7)$
 $8 = x^2 - 7x$
 $0 = x^2 - 7x - 8$
 $0 = (x-8)(x+1)$
 $x = 8$

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

3) $\log x^2 - 3x = 1$
 $10 = x^2 - 3x$
 $x^2 - 3x - 10 = 0$
 $(x-5)(x+2) = 0$
 $x = 5$

4) $\log(x+2) + \log(x-1) = 1$
 $10 = x^2 + x - 2$
 $0 = x^2 + x - 12$
 $\log(x^2 + x - 2) = 1$
 $(x+4)(x-3) = 0$
 $x = 3$

5) $\log_9(x-5) + \log_9(x+3) = 1$

$\log_9(x^2 - 2x - 15) = 1$
 $9 = x^2 - 2x - 15$
 $0 = x^2 - 2x - 24$
 $(x-6)(x+4) = 0$
 $x = 6$

Solving Natural Log Equations . . . same steps!

1. Condense logarithmic terms on one side of the equation (if necessary).
2. Re-write the problem in exponential form *using the number e as the base.*
3. Simplify and solve.

1. $3\ln(2x) = 12$
 $\ln(2x) = 4$
 $e^4 = 2x$
 $x \approx 27.2991$

3. $2 - \ln(3-x) = 0$
 $-\ln(3-x) = -2$
 $\ln(3-x) = 2$
 $e^2 = 3-x$
 $x \approx -4.3891$

2) $\ln(x) = 10$
 $e^{10} = x$
 $x \approx 22026.4658$

4) $4\ln(3x) = 8$
 $\ln(3x) = 2$
 $e^2 = 3x$
 $x \approx 2.463$

Classwork:

1. $e^x = 0.83$
 $\ln e^x = \ln 0.83$
 $x \approx -0.1863$

2. $9e^x = 107$
 $e^x = \frac{107}{9}$
 $x \cdot \ln e = \ln \frac{107}{9}$
 $x \approx 2.4756$

3. $e^{1-8x} = 7957$
 $1-8x \cdot \ln e = \ln 7957$
 $x \approx -0.9977$

4. $5^{x-3} = 137$
 $(x-3) \log 5 = \log 137$
 $x \approx 6.057$

5. $7^{2x+1} = 3^{x+2}$
 $(2x+1) \log 7 = (x+2) \log 3$
 $x \approx 0.899$

6. $e^{4x} - 3e^{2x} - 18 = 0$
omit

1. $690x + 8451 = 4771x + 9542$

7. $\log_7(x+2) = -2$
 $1.2129x = 1091$

$7^{-2} = x+2$
 $x \approx -1.980$

8. $\log_6(x+5) + \log_6(x) = 2$

$\log_6(x^2 + 5x) = 2$
 $36 = x^2 + 5x$
 $x^2 + 5x - 36 = 0$
 $(x+9)(x-4) = 0$
 $x = 4$

9. $\log_2(x-3) + \log_2(x) - \log_2(x+2) = 2$
 $x = 8$

10. $\frac{1}{2} \ln(x+4) = 1$

$e^2 = x+4$
 $x \approx 3.3891$

$\log_2 \left(\frac{x(x-3)}{x+2} \right) = 2$
 $4 = \frac{x^2 - 3x}{x+2}$
 $4(x+2) = x^2 - 3x$
 $4x + 8 = x^2 - 3x$
 $x^2 - 7x - 8 = 0$

W #5:

1) $\log(x-4) = 3$
 $10^3 = x-4$
 $x = 1004$

2) $\log_3(2-x) = 3$
 $3^3 = 2-x$
 $x = -25$

3) $\ln(x+4) - 2 = 5$
 $e^7 = x+4$
 $x \approx 1092.6332$

4) $\log x + \log x = \log 16$
 $\log x^2 = \log 16$
 $x^2 = 16$
 $x = 4$

5) $\log x = \log 8 + \log(x-1)$
 $\log x = \log 8x - 8$
 $8x - 8 = 1x$
 $-8 = -7x$
 $x = \frac{8}{7} \approx 1.1429$

6) $\log_2 5 + \log_2 x = \log_2 3 + \log_2(x-2)$
 $\log_2 5x = \log_2(3x-6)$
 $5x = 3x - 6$
 $2x = -6$
 $x = -3$ no sol