Notes Answer Key

Notes Solving Exponential Equations and Logarithmic Equations

Solving Exponential Equations:

Method 1: When bases can be expressed with a COMMON base→ set exponents equal to each other.

$3^{x+4} = 27^x$

$3^{x+4} = (3^3)^x$

$x+4 = 3x$

$4 = 2x$

$\boxed{x = 2}$

$4^{2x} = 8^{x+2}$

$(2^2)^{2x} = (2^3)^{x+2}$

$4x = 3(x+2)$

$\cancel{4x} = 3x + 6$

$\boxed{x = 6}$

$\left(\frac{1}{4}\right)^{-x} = 32^{x-3}$

$(2^{-2})^{-x} = (2^5)^{x-3}$

$2x = 5(x-3)$

$2x = 5x - 15$

$\boxed{x = 5}$

Method 2: When Bases cannot be expressed with a COMMON base → take log of both sides, use power property to solve for x.

$2^x = 9$

$\log 2^x = \log 9$

$\frac{x \cdot \cancel{\log 2}}{\cancel{\log 2}} = \frac{\log 9}{\log 2}$

$x \approx 3.170$

Power Property of Logarithms

$log_b m^x = x \cdot log_b m$

$3^{4x} = 11$

$\log 3^{4x} = \log 11$

$\frac{4x \cdot \log 3}{\log 3} = \frac{\log 11}{\log 3}$

$x \approx .546$

$4^{x+2} = 7$

$\log 4^{(x+2)} = \log 7$

$\frac{(x+2) \log 4}{\log 4} = \frac{\log 7}{\log 4}$

$x + 2 = \frac{\log 7}{\log 4} - 2$

-2

$x \approx -.596$

You can also solve some questions by converting it into a logarithmic equation: Try the next 2 on your own.

ALPHA → WINDOW → 5

$4^{x+2} = 7$

$\log_4(7) = x + 2$

$1.404 = x + 2$

$-2 \qquad -2$

$\boxed{x \approx -.596}$

$5^{2x} - 6 = 14$

$+6 \quad +6$

$5^{2x} = 20$

$\log_5(20) = 2x$

$\log_5(20) = 2x$

$\frac{1.861}{2} = \frac{2x}{2}$

$\boxed{x \approx .931}$

$5^{x-2} = 200$

$\log_5(200) = x - 2$

$x \approx 5.292$

$10^{3x} + 6 = 25$

$-6 \quad -6$

$10^{3x} = 19$

$\log_{10}(19) = 3x$

$x \approx .426$

Solve Logarithmic Equations

Method 1: Given equation in the form $log_b x = log_b y$ (both log_b) → set $x = y$ and solve for variable You may need to use properties of logarithms to simplify.

$log_2\boxed{(x+4)} = log_2\boxed{(2x-5)}$

$x+4 = 2x-5$

$-x \quad -x$

$4 = x-5$

$+5 \quad +5$

$\boxed{x=9}$

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

$\log\boxed{3(x+1)} = \log\boxed{(4x-10)}$

$3x+3 = 4x-10$

$-3x \quad -3x$

$3 = 4x-10$

$\boxed{x=13}$

$\log(x+1) + \log(x-2) = \log(4)$

$\log\boxed{(x+1)(x-2)} = \log\boxed{(4)}$

$x^2 - x - 2 = 4$

$-4 \quad -4$

$x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$

$\boxed{x=3}$ $\boxed{\cancel{x=-2}}$

Use when log bases are the same

Extraneous solutions (check answers)

$x=3$ $\log(3+1) + \log(3-2) = \log 4$

$\log(4) + \log(1) = \log(4)$

$\log(4) = \log(4)$ ✓

$x=-2$ $\log(-2+1) + \log(-2-2) = \log(4)$

$\log(-1) + \log(-4) = \log(4)$ X

Cannot take log of negative number

Method 2: Given equation in the form $log_b x = y$ → convert to exponential form $b^y = x$ and solve for variable. You may need to use properties of Logarithms to simplify to a single log.

$log_4(x-2) = 2$

$4^2 = x-2$

$16 = x-2$

$\boxed{x=18}$

$log_2(x-3) + log_2(4) = 5$

$\log_2(4(x-3)) = 5$

$2^5 = 4(x-3)$

$32 = 4x-12$

$44 = 4x$

$\boxed{x=11}$

$log_2(x) + log_2(x-2) = 3$

$\log_2 x(x-2) = 3$

$2^3 = x(x-2)$

$8 = x^2 - 2x$

$0 = x^2 - 2x - 8$

$(x-4)(x+2) = 0$

$x=4$ $\cancel{x=-2}$

Use when log function is equal to a constant

check for extraneous solutions

$\cancel{x=-2}$ $\log_2\boxed{(-2)} + \log_2\boxed{(-2-2)} \neq 3$

extraneous

$\boxed{x=4}$ $\log_2(4) + \log(4-2) = 3$

$\log_2(8) = 3$ ✓

Solution

GLUE HERE

itutoring.com
username: bowiehs
password: bulldogs
Algebra 2: Chapter 11, Lessons 13 - 14