



4.4A Exponential and Logarithmic Equations

- Use like bases to solve exponential equations
- Use logarithms to solve exponential equations

LT: Use like bases to solve exponential equations

One-to-One Property: If $b^M = b^N$, then $M = N$

Steps to use One-to-One Property for solving:

1. Rewrite the equation in the form $b^M = b^N$
2. Set $M = N$
3. Solve for the variable.

Example 1: Solve

a. $2^{3x-8} = 16$

$$2^{3x-8} = 2^4$$

$$3x - 8 = 4$$

$$3x = 12$$

$$x = 4$$

b. $27^{x+3} = 9^{x-1}$


$$3^{3(x+3)} = 3^{2(x-1)}$$

$$3(x+3) = 2(x-1)$$

$$3x + 9 = 2x - 2$$

$$3x - 2x = -2 - 9$$

$$x = -11$$



Your Turn 1: Solve

a. $5^{3x-6} = 125$

$$5^{3x-6} = 5^3$$

$$3x - 6 = 3$$

$$3x = 9$$

$$x = 3$$

b. $8^{x+2} = 4^{x-3}$

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

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

$$3x + 6 = 2x - 6$$

$$3x - 2x = -6 - 6$$

$$x = -12$$

LT: Use logarithms to solve exponential equations

Steps to use Natural logs to solve:

1. Isolate the exponential expression
2. Take the natural log on both sides of the equation
3. Simplify by using the properties of logs
4. Solve for the variable.



Example 2: Solve $4^x = 15$

$$\ln 4^x = \ln 15$$

$$x \ln 4 = \ln 15$$

$$x = \frac{\ln 15}{\ln 4}$$

$$x \approx 1.95$$

Your Turn 2: Solve $5^x = 134$

$$\ln 5^x = \ln 134$$

$$x \ln 5 = \ln 134$$

$$x = \frac{\ln 134}{\ln 5}$$

$$x \approx 3.04$$

Example 3: Solve $40e^{0.6x} - 3 = 237$

$$40e^{0.6x} = 240$$

$$e^{0.6x} = \frac{240}{40}$$

$$e^{0.6x} = 6$$

$$\ln e^{0.6x} = \ln 6$$

$$0.6x = \ln 6$$

$$x = \frac{\ln 6}{0.6}$$

$$x \approx 2.99$$

Your Turn 3: Solve $7e^{2x} - 5 = 58$

$$7e^{2x} = 63$$

$$e^{2x} = \frac{63}{7}$$

$$e^{2x} = 9$$

$$\ln e^{2x} = \ln 9$$

$$2x = \ln 9$$

$$x = \frac{\ln 9}{2}$$

$$x \approx 1.10$$