

SOLVING EXPONENTIAL AND LOGARITHMIC EQUATIONS

There are five rules for logarithms you need to solve any exponential or logarithmic equation.

Logarithmic Form

$$\log_a b = c$$

Exponential Form

$$a^c = b$$

$$\text{Base Change Formula: } \log_a b = \frac{\log b}{\log a}$$

PROPERTIES OF EXPANDING AND CONDENSING LOGS

$$1) \log_a uv = \log_a u + \log_a v \quad \text{or} \quad \ln uv = \ln u + \ln v$$

$$2) \log_a \frac{u}{v} = \log_a u - \log_a v \quad \text{or} \quad \ln \frac{u}{v} = \ln u - \ln v$$

$$3) \log_a u^v = v \log_a u \quad \text{or} \quad \ln u^v = v \ln u$$

SAMPLE PROBLEMS

EXPONENTIAL EQUATIONS

1. Solve for x: $8^{2x-4} = 16^{x+5}$

2. Solve for x: $3^{2x-5} = 12$

3. Solve for x: $2^{x-4} = 10^x$

4. Solve for x: $3^{2x-5} = 7^{x+2}$

5. Solve for x:

$$6^{2x-4} = 3^{4x+5}$$

Cannot get the bases to match, so take the log of both sides.

Pull the exponents out using the properties of logarithms.

Distribute the logs to get rid of the parenthesis.

Move anything with an x to one side of the equal sign, anything else to the other side.

Factor out x.

Now divide both sides to solve for x.

Your solution is now in "calculator ready form."

6. Solve for x: $1000e^{-5x} = 75$

7. Solve for x: $\frac{119}{e^{6x} - 14} = 7$

LOGARITHMIC EQUATIONS

1. Solve for x: $\log_3(x - 3) = 4$

2. Solve for x: $\log_4(x + 5) = \log_4 18$

3. Solve for x: $\log_6 7 + \log_6 (x - 3) = 2$

4. Solve for x: $\log_7 (x - 1) - \log_7 x = 1$

5. Solve for x: $\log_9(x+1) + \log_9 x = \log_9 2$

6. Solve for x: $2 - 6 \ln x = 10$

7. Solve for x: $\log(x+4) - \log x = \log(x+2)$

8. Solve for x: $\ln x + \ln(x - 2) = 1$