WILLIAM D. LAW, JR. LEARNING COMMONS

Logarithmic and Exponential Equations - Practice (and solutions)

Logarithmic equations can sometimes be solved by exploiting the one-to-one property of logarithmic functions. That is, $(this=that) \Leftrightarrow \log(this)=\log(that)$.

For example, if we have $\log_2(4x-3)=\log_2 13$ then we can solve this by using the one-to-one property.

4x – 3 = 13

4x = 16

x = 4

Other exponential equations can be solved using logarithms. Using the one-to-one property, if we have $this = that$ then, $\log(this) = \log(that)$

For example,

$$2^x = 7$$
$$\log 2^x = \log 7$$
$$x \log 2 = \log 7$$
$$x = \frac{\log 7}{\log 2}$$

Solve each of the following equations.

1. $\log_a(x+4) - \log_a(x+2) = \log_a x$
2. $\ln(y+2) = \ln(y-7) + \ln 4$
3. $\ln(x+1) = \ln(x-4)$
4. $\log q^2 = 1$
5. $4^x = 12$
6. $3^{2x-5} = 13$
7. $e^{2-x} = 12$
8. $10e^{3x-7} = 5$
9. $\ln x - \ln(x+1) = \ln 5$
10. $\log_4(x+3) + \log_4(x-3) = 1$

Answers:

1) $x = \frac{-1+\sqrt{17}}{2}$

2) $y = 10$

3) $\emptyset$

4) $q = \sqrt{10}$

5) $x = \frac{\log 12}{\log 4}$

6) $x = \frac{1}{2}\left(\frac{\log 13}{\log 3} + 5\right) = \frac{\log 13}{\log 9} + \frac{5}{2}$

7) $x = 2 - \ln 12$

8) $x = \frac{7+\ln\frac{1}{2}}{3} = \frac{7-\ln 2}{3}$

9) $\emptyset$

10) $x = \pm\sqrt{13}$