4.6: Exponential and Logarithmic Equations in PreCalculus

How to Solve Most Exponential equations in PreCalculus

Using the Exponential Rules to simplify: If needed, use any of the rules (1) \( e^x e^y = e^{x+y} \), (2) \( \frac{e^x}{e^y} = e^{x-y} \), (3) \( (e^x)^y = e^{xy} \), to create single exponential term on each side.

Setting an Equation Using the Exponents of Both Sides: Take logarithm of both sides to get an equation without any exponential terms. In this step, you will use the rule \( \ln(e^x) = x \).

Solve for the Variable: Solve the equation from previous step.

Extraneous Solutions: Eliminate all solutions that were generated as results of our methods of solving the equation but are not solutions.

How to Solve Most Logarithmic Equations in PreCalculus

Using the Logarithmic Rules to Simplify: If needed, use any of the rules (1) \( \log(xy) = \log(x) + \log(y) \), (2) \( \log\left(\frac{x}{y}\right) = \log(x) - \log(y) \), (3) \( k \log(x) = \log(x^k) \), to create single logarithmic term on each side.

Setting an Equation Using the Exponents of Both Sides: Raise the base to power both sides to get an equation without any logarithmic terms. In this step, you will use the rule \( e^{\ln(x)} = x \).

Solve for the Variable: Solve the equation from previous step.

Extraneous Solutions: Eliminate all solutions that were generated as results of our methods of solving the equation but are not solutions.

- Sometimes Substitution is needed.
1. Solve $2^{x^2+1} = 2^5$.

2. Solve $\log_{10}\left(\frac{x}{10}\right) = 2$

3. Solve $\frac{50}{1 + 4e^{2t}} = 20$ for $t$.

4. Solve $2e^{2x} + 3e^x - 9 = 0$, for $x$.

5. Solve $e^{2x}e^{2x} = (e^x)^x e^{-5}$ for
6. Solve $2^{t+1} = 2^{t+11}$ for $t$.

7. Solve $7^{4r+1} = 7^{r^27^5}$ for $r$. 
8. Solve \((e^{2m})^4 = e^{3-2m}\) for \(m\).

9. Solve \((7^x)^x = (7^{49})^x\) for \(x\).

10. Solve \(\ln(7x - 3) = \ln(23) + \ln(2)\) for \(x\).

11. Solve \(\ln(x + 3) - \ln(x) = 1\) for \(x\).
12. Solve $\ln(x) = \ln(64) - 2\ln(x)$ for $x$.

13. Solve $\ln(4p) + \ln\left(p + \frac{7}{4}\right) = \ln(2)$ for $p$.

14. Solve $\ln(3x) + \ln\left(x - \frac{2}{3}\right) = \frac{1}{2}\ln(64)$ for $x$.

15. Factor and simplify the following function as much as possible. Then find the **zeros** and the **domain** of the function.

   $$f(x) = 18(x + 2)^2(x - 1)^{-\frac{1}{2}} - 6(x + 2)(x - 1)^{\frac{1}{2}}$$

16. Factor and simplify the following function as much as possible. Then find the **zeros** and the **domain** of the function.

   $$f(x) = 15(x + 3)^2(x - 2)^{-\frac{2}{3}} - 5(x + 3)(x - 2)^{\frac{1}{3}}$$
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