Math 124, 4.4 Exponential and Logarithmic Equations

Strategy for solving exponential and logarithmic equations:

- Rewrite each side of the equation as a single exponential or logarithm.
- Eliminate the exponential or logarithm using one of the rules on the right.
- Solve the resulting equation.

$$\boxed{a^u = a^v \Longrightarrow u = v}$$
$$\boxed{\log_a(u) = \log_a(v) \Longrightarrow u = v}$$
$$\boxed{a^u = b^v \Longrightarrow \log(a^u) = \log(b^v)}$$
$$\boxed{a^u = b \Longrightarrow \log(a^u) = \log(b)}$$
$$\boxed{\log_a(x) = y \Longleftrightarrow x = a^y}$$

Laws of Logarithms:

$$\boxed{\log_a(x) + \log_a(y) = \log_a(x \cdot y)} \qquad \boxed{\log_a(x) - \log_a(y) = \log_a\left(\frac{x}{y}\right)} \qquad \boxed{r \cdot \log_a(x) = \log_a(x^r)}$$

Solve each of the following equations. Remember to check your answers.

1.) $2^{3x+5} = 2^{5x-1}$

2.) $5^{x-2} = 625$

3.) $9^x = 27$

4.) $\ln(x+3) = \ln(4x-1)$

5.) $\log_{11}(x) + \log_{11}(x-5) = \log_{11}(x+27)$

6.) $\log(x) + \log(x+1) = \log 12$

7.) $e^{5x} = 12$

8.) $3 \cdot 7^{x} = 81$

9.) $2^{x+5} = 3^{2x-4}$

10.) $e^{x} = 2^{x+1}$

11.) $\log_5(2x+3) = 2$

12.) $\log_2(x) + \log_2(x+2) = 3$

13.) $\ln(x) + \ln(2-x) = 0$

14.) $2\ln(x+3) = \ln 49$