§4.5 Exponential & Logarithmic Equations

FACT: If $a^x = a^y$ then $x = y$

(The exponential function with base a is one-to-one!)

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

ex. $10^{2x-3} = \frac{1}{10}$

GUIDELINES FOR SOLVING EXPONENTIAL EQUATIONS

1. Isolate the exponential expression on one side of the equation.
2. Take the logarithm of each side, then use the Laws of Logarithms to "bring down the exponent."
3. Solve for the variable.

ex. $5^{3x-1} = 8$

ex. $2e^{3x} = 9$

28. $2(5 + 3^{x+1}) = 100$

30. $1 + e^{4x+1} = 20$

32. $125^x + 5^{3x+1} = 200$

34. $10^{1-x} = 6^x$

36. $7^{x/2} = 5^{1-x}$

38. $\dfrac{10}{1 + e^{-x}} = 2$

GUIDELINES FOR SOLVING LOGARITHMIC EQUATIONS

1. Isolate the logarithmic term on one side of the equation; you might first need to combine the logarithmic terms.
2. Write the equation in exponential form (or raise the base to each side of the equation).
3. Solve for the variable.

CHECK SOLUTIONS! REMEMBER YOU CANNOT TAKE Log OF 0 OR NEG. #'s!

49. $\log x + \log(x - 1) = \log(4x)$ *FALSE SOL'N*

50. $\log_5 x + \log_5(x + 1) = \log_5 20$

51. $2 \log x = \log 2 + \log(3x - 4)$

52. $\ln(x - \frac{1}{2}) + \ln 2 = 2 \ln x$

53. $\log_2 3 + \log_2 x = \log_2 5 + \log_2(x - 2)$

54. $\log_4(x + 2) + \log_4 3 = \log_4 5 + \log_4(2x - 3)$

62. $\log_2(x^2 - x - 2) = 2$

63. $\log_2 x + \log_2(x - 3) = 2$

64. $\log x + \log(x - 3) = 1$

65. $\log_9(x - 5) + \log_9(x + 3) = 1$

66. $\ln(x - 1) + \ln(x + 2) = 1$

67. $\log_5(x + 1) - \log_5(x - 1) = 2$

68. $\log_3(x + 15) - \log_3(x - 1) = 2$