

### Classwork-Practice Problems 3.4-Exponential and Logarithms Equations

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In exercises 1-14, solve the exponential equations exactly for x.

4.  $\left(\frac{3}{5}\right)^{x+1} = \frac{25}{9}$

8.  $125^x = 5^{2x-3}$

12.  $16^{x-1} = 2^{x^2}$

14.  $10^{x^2-8} = 100^x$

In Exercises 15-40, solve the exponential equations exactly and then approximate your answers to the three decimal places.

16.  $15 = 7^{3-2x}$

20.  $21 - 4e^{0.1x} = 5$

22.  $3(2^x) + 8 = 35$

26.  $4(10^{3x}) = 20$

34.  $(3^x - 3^{-x})(3^x + 3^{-x}) = 0$

36.  $\frac{17}{e^x+4} = 2$

40.  $\frac{28}{10^x+3} = 4$

In Exercises 41-58, solve the logarithmic equations exactly.

42.  $\log_2(3x - 1) = 3$

46.  $\log x^2 + \log x = 3$

50.  $\log_2(x + 1) + \log_2(4 - x) = \log_2(6x)$

54.  $\log_3(7 - 2x) - \log_3(x + 2) = 2$

58.  $\log_2(x + 1) + \log_2(x + 5) - \log_2(2x + 5) = 2$

In Exercises 59-72, solve the logarithmic equations and then approximate your answers, if possible, to three decimal places.

60.  $\ln(4x - 7) = 3$

64.  $\log(3x - 5) = -1$

68.  $\ln(4x) + \ln(2 + x) = 2$

70.  $\log_5(x + 1) - \log_5(x - 1) = \log_5 x$

72.  $\log(\sqrt{1 - x}) - \log(\sqrt{x + 2}) = \log x$

74. **Business.** A local business purchased a new company van for \$45,000. After 2 years the book value of the van is \$30,000.

- a. Find an exponential model for the value of the van using  $V(t) = V_0 e^{kt}$ , where  $V$  is the value of the van in dollars and  $t$  is time in years.
- b. Approximately how many years will it take for the book value of the van to drop to \$20,000?

84. **Investments.** Money invested in an account that compounds interest continuously at a rate of 3% a year is modeled by  $A = A_0 e^{0.03t}$ , where  $A$  is the amount in the investment after  $t$  years and  $A_0$  is the initial investment. How long will it take the initial investment to double?

**In Exercises 89-94, determine whether each statement is true or false.**

92.  $e^x = -2$  has no solution.

94. The division of two logarithms with the same base is equal to the logarithm of the subtraction.

**Challenging Questions:**

95. Solve for  $x$  in terms of  $b$ :

$$\frac{1}{3}\log_b(x^3) + \frac{1}{2}\log_b(x^2 - 2x + 1) = 2$$



95.  $x = \frac{1 + \sqrt{1 + 4b^2}}{2}$

96. Solve exactly:

$$2 \log_b(x) + 2 \log_b(1 - x) = 4.$$

98. State the range of values of  $x$  that the following identity holds:  $e^{\ln(x^2 - a)} = x^2 - a$ .