Precalculus
 3.5 Logarithmic and Exponential Equations

Name______
 Date______

Solve each logarithmic equation. Don't forget to check domain and eliminate extraneous solutions! Express irrational solutions in exact form and as decimals rounded to 3 decimal places.

1.
$$\log_4 x = 2$$

2. $\log(x+6) = 1$
3. $\log_3(3x-1) = 2$

4.
$$\log_x \left(\frac{1}{8}\right) = 3$$
 5. $5 \ln x - 3 = -1$ 6. $\frac{1}{4} \ln (x+7) = 1$

7.
$$\log_4(x+2) = \log_4 8$$

8. $\frac{1}{2}\log_3 x = 2\log_3 2$
9. $2\log_3(x+4) - \log_3 9 = 2$

10.
$$\log x + \log(x+15) = 2$$

11. $\log(2x+1) = 1 + \log(x-2)$

12.
$$\log_8(x+6) = 1 - \log_8(x+4)$$
 13. $\ln(x+2) + \ln(x-5) = \ln(x+11)$

14.
$$\log_a(x-1) - \log_a(x+6) = \log_a(x-2) - \log_a(x+3)$$

Solve each exponential equation. Express irrational solutions in exact form and as decimals rounded to 3 decimal places.

15.
$$e^{-2x} = \frac{1}{3}$$

16. $10^{x-9} = 15$
17. $e^{2x+5} = 8$
18. $5e^{0.2x} = 7$
19. $4e^{x+1} = 5$
20. $8(10)^{2x-7} = 3$
21. $2^x = 10$
22. $8^{-x} = 1.2$
23. $5(2^{3x}) = 8$
24. $e^{2x-3} = 7^x$
25. $10^{x+5} = 3^{3x-2}$
26. $2^{4x+1} = 5^{2-x}$

27. $3^{1-2x} = 4^x$



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Solve each problem.

28. The pH of a chemical solution is given by the formula

 $pH = -log[H^+]$

where $[H^+]$ is the concentration of hydrogen ions in moles/liter. Values of pH range from 0 (acidic) to 14 (basic or alkaline).

- a) What is the pH of a solution for which $[H^+]$ is 0.1 moles/liter?
- b) What is the pH of a solution for which $[H^+]$ is 0.01 moles/liter?
- c) What is the pH of a solution for which $[H^+]$ is 0.001 moles/liter?
- d) What happens to the pH as the hydrogen ion concentration decreases?

e) Determine the hydrogen ion concentration of an orange (pH = 3.5).

f) Determine the hydrogen ion concentration of human blood (pH = 7.4).

- 29. The normal healing of wounds can be modeled by the formula $A(n) = A_0 e^{-0.35n}$, where A_0 is the original area of a wound, and *A* is the area of the wound *n* days after an injury. Suppose that a wound initially had an area of 100 square millimeters.
 - a) What will the area of the wound be after 3 days?

b) How long will it take for the area of the wound to be half its original area?

30. A model for the number *N* of people in a college community who have heard a certain rumor is $N = P(1 - e^{-0.15d})$, where *P* is the total population and *d* is the number of days that have elapsed since the rumor began. In a community of 1000 students, how many days will elapse before 450 students have heard the rumor?