www.MathWorksheetsGo.com
On Twitter: twitter.com/mathprintables

I. Model Problems.
II. Practice
III. Challenge Problems
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Web Resources

YouTube How To Solve Logarithmic Equations
www.mathwarehouse.com/logarithm/equation/how-to-solve-logarithmic-equations.php
Logarithms:
www.mathwarehouse.com/logarithm/
Logarithm Rule and Formulas:
www.mathwarehouse.com/logarithm/rules-and-formula.php

Online Graphing Calculator(free):
http://www.meta-calculator.com/online/

I. Model Problems

To solve logarithmic equation, remember that if two logs with the same base are equal, their insides must also be equal.

Example 1 Solve: $\log_2(x - 1) = \log_2(4)$.

$x - 1 = 4$	Set the inside of the logs equal to each other.
$x = 5$	Add 1 to each side.

The answer is $\boldsymbol{x = 5}$.

Sometimes you need to combine logs before solving the equation.

Example 2 Solve: $\log_{10}(x + 1) + \log_{10}(x - 1) = \log_{10}(8)$

$\log_{10}((x + 1)(x - 1)) = \log_{10}8$	Use the Product Rule for Logarithms to simplify the left-hand side of the equation.
$(x + 1)(x - 1) = 8$	Set the inside of the logs equal ot each other.
$x^2 - 1 = 8$	Simplify.
$x^2 = 9$	Add 1 to each side.
$x = -3, x = 3$	Take the square root of each side.

Recall that the inside of a logarithm cannot be negative. If x equals –3, then $\log_{10}(x + 1)$ would equal $\log_{10}(-2)$, which does not exist. Therefore the only solution is $\boldsymbol{x = 3}$.

When the logarithm equals a number, rewrite the logarithm as an exponential equation, then solve.

Example 3 Solve: $\log_2(x + 2) = 5$

$\log_2(x + 2) = 5$	
$2^5 = x + 2$	Rewrite the logarithm as an exponential equation.
$32 = x + 2$	Simplify.
$x = 30$	Subtract 2 from each side.

The answer is $x = 30$.

II. Practice

Solve the following logarithmic equations. If there is no solution, so state.

1. $\log_3(4 - x) = \log_3(x + 8)$

2. $\log_4(x + 2) = \log_4(55)$

3. $\log_2(2x + 1) = \log_2(15)$

4. $\log_5(x + 1) = \log_5(2x + 7)$

5. $\log_3(x + 2) = \log_3(3x - 5)$

6. $\log_7(x + 3) = \log_7(5x - 8)$

7. $\log_5(-x + 1) = \log_5(5 + x)$

8. $\log_8(2x + 4) = \log_8(60)$

9. $\log_4(x + 1) = \log_4(10)$

10. $\log_4(3x + 1) = \log_4(2x)$

11. $\log_2(x + 2) + \log_2(x + 1) = \log_2(x) + \log_2(x + 4)$

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

13. $\log_2(x - 2) + \log_2(x - 5) = \log_2(x - 1) + \log_2(x + 6)$

14. $\log_2(x) + \log_2(x - 6) = \log_2(2x - 7)$

15. $\log_2(x - 2) + \log_2(x - 8) =$

16. $2 \bullet \log_3(x + 1) = \log_3(x + 2) +$

$\log_2(x + 1) + \log_2(x - 9)$ $\log_3(x - 3)$

17. $2 \bullet \log_4(x + 3) = \log_4(25)$ **18.** $3 \bullet \log_2(x + 1) = \log_2(27)$

19. $\log_2(x + 5) = -1$ **20.** $\log_3(x - 2) = 3$

21. $\log_2(2 + 3x) = 0$ **22.** $\log_2(2x + 1) = 4$

23. $\log_4(17x - 4) = 3$ **24.** $\log_4(x - 1) = -2$

III. Challenge Problems

25. Solve: $\log_2(x) - \log_2(\sqrt{x} - 1) = 2$.

26. Solve: $\log_5(x - 3) = \log_5(\sqrt{x+3})$

27. Correct the Error
There is an error in the student work shown below:

$$2 \bullet \log_2(x + 1) = \log_2 9$$
$$\log_2(x + 1)^2 = \log_2 9$$
$$(x + 1)^2 = 9$$
$$x + 1 = 3 \text{ or } x + 1 = -3$$
$$x = 2 \text{ or } x = -4$$

What is the error? Explain how to solve the problem.

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IV. Answer Key

1. $x = -2$
2. $x = 53$
3. $x = 7$
4. no solution
5. $x = 3.5$
6. $x = 11/4$
7. $x = -2$
8. $x = 28$
9. $x = 9$
10. $x = 1$
11. $x = 2$
12. no solution
13. no solution
14. $x = 7$
15. $x = 12.5$
16. no solution
17. $x = 2$
18. $x = 2$
19. $x = -4.5$
20. $x = 29$
21. $x = -1/3$
22. $x = 7.5$
23. $x = 4$
24. $x = 17/16$
25. $x = 4$
26. $x = 6$
27. $x = -4$ cannot be a solution to the equation; the inside of a logarithm cannot be negative.