

**Property of Equality:** If  $\log_x a = \log_x b$ , then  $a = b$ .

If  $\log_x$

1. Condense each side, if necessary. 1.
2. Use the Property of Equality to solve the equation. 2.
3. If it is a quadratic equation, you will need to factor to solve. 3.
4. Be sure to go back and check your answer(s) in the expressions. 4.
5. The expressions cannot be a zero or a negative. 5.

1.  ~~$\log_3(x^2 + 3x) = \log_3(x + 15)$~~

check - positive answer  
 $(-5)^2 + 3(-5) = 10 \checkmark$   
 $3^2 + 3(3) = 18 \checkmark$

$\begin{array}{r} -15 \\ 5 \times -3 \\ \hline 2 \end{array}$

$x^2 + 3x = x + 15$   
 $x^2 - x - 15 = 0$   
 $(x+5)(x-3) = 0$   
 $x = -5 \quad x = 3$

2.  $\log_3(x + 5) + \log_3(x - 2) = \log_3 18$

check  
 $-7 + 5 = -2$   
 Not positive

$\begin{array}{r} x+5 \\ x \quad \begin{array}{|c|c|} \hline x^2 & 5x \\ \hline \end{array} \\ -2 \quad \begin{array}{|c|c|} \hline -2x & -10 \\ \hline \end{array} \end{array}$

$\log_3[(x+5)(x-2)] = \log_3 18$

$x^2 + 3x - 10 = 18$   
 $x^2 + 3x - 28 = 0$

$\begin{array}{r} -28 \\ 7 \times -4 \\ \hline 3 \end{array}$

$x^2 + 3x - 28 = 0$   
 $(x+7)(x-4) = 0$   
 $x = -7 \quad x = 4$

3.  $\log_6 x = \frac{1}{2} \log_6 9 + \frac{1}{3} \log_6 27$

3

$\log_6 x = \log_6 9^{1/2} + \log_6 27^{1/3}$

$\log_6 x = \log_6 \sqrt{9} + \log_6 \sqrt[3]{27}$

$\log_6 x = \log_6 3 + \log_6 3$

$\log_6 x = \log_6 9$

$x = 9$

multiply

Property of Equality: If  $\log_r a = \log_r b$ , then  $a = b$ .

1. Condense each side, if necessary.
2. Use the Property of Equality to solve the equation.
3. If it is a quadratic equation, you will need to factor to solve.
4. Be sure to go back and check your answer(s) in the expressions.
5. The expressions cannot be a zero or a negative.

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

$$\begin{aligned} 2x - 6 &= x \\ -6 &= -x \\ 6 &= x \checkmark \end{aligned}$$

2.  $\log(-3b + 7) = \log(-2b + 7)$

$$\begin{aligned} \cancel{-3b} + 7 &= \cancel{-2b} + 7 \\ \underline{+3b} & \quad \underline{+3b} \\ 7 &= b + 7 \\ 0 &= b \checkmark \end{aligned}$$

3.  $\log_{19}(8x + 3) = \log_{19}(x^2 + 15)$

$$\begin{aligned} 8x + 3 &= x^2 + 15 \\ 0 &= x^2 - 8x + 12 \\ 0 &= (x - 6)(x - 2) \\ x &= 6 \checkmark \quad x = 2 \checkmark \end{aligned}$$

4.  $\log_{17}(9 - n) = \log_{17}(n^2 + 7n)$

$$\begin{aligned} 9 - n &= n^2 + 7n \\ 0 &= n^2 + 8n - 9 \\ 0 &= (n + 9)(n - 1) \quad n = 1 \quad n = -9 \end{aligned}$$

5.  $\log_7 x + \log_7(x + 72) = \log_7 73$

$$\begin{aligned} x^2 + 72x &= 73 \\ x^2 + 72x - 73 &= 0 \\ (x + 73)(x - 1) &= 0 \\ x &= -73 \quad x = 1 \checkmark \end{aligned}$$

6.  $\log 5x^2 - \log 9 = \log 5$

$$\begin{aligned} \frac{5x^2}{9} &= 5 \\ 5x^2 &= 45 \\ x^2 &= 9 \\ x &= 3 \checkmark \quad x = -3 \checkmark \end{aligned}$$

7.  $\log_6(x + 2) + \log_6 x = \log_6 63$

$$\begin{aligned} x^2 + 2x &= 63 \\ x^2 + 2x - 63 &= 0 \\ (x + 9)(x - 7) &= 0 \\ x &= -9 \quad x = 7 \checkmark \end{aligned}$$

8.  $\log_3(x + 5) - \log_3 x = \log_3 58$

$$\begin{aligned} \frac{x + 5}{x} &= 58 \\ x + 5 &= 58x \\ 5 &= 57x \\ x &= \frac{5}{57} \end{aligned}$$

9.  $\log_7 x = 3 \log_7 5$

$$\log_7 x = \log_7 5^3$$

$$x = 125$$

10.  $\log_2 x + 3 \log_2 2 = \log_2 64$

$$\log_2 x + \log_2 2^3 = \log_2 64$$

$$\log_2 8x = \log_2 64$$

$$8x = 64$$

$$x = 8$$

Logarithmic Equations  
Algebra II with Support

Name:

Solve each equation.

1.  $\log_5(3x - 7) = \log_5(7x - 21)$

$$3x - 7 = 7x - 21$$

$$14 = 4x$$

$$\frac{14}{4} = x$$

$$\frac{7}{2} = x \checkmark$$

3.  $\log_5 x = 4\log_5 3$

$$x = 3^4$$

$$x = 81 \checkmark$$

5.  $\log_9(5x) = \log_9 6 + \log_9(x - 2)$

$$5x = 6x - 12$$

$$-x = -12$$

$$x = 12 \checkmark$$

7.  $\log_3 x + \log_3(x - 1) = \log_3(3x + 12)$

$$x^2 - x = 3x + 12$$

$$x^2 - 4x - 12 = 0$$

$$(x - 6)(x + 2) = 0 \quad x = 6 \checkmark \quad x = -2 \text{ (crossed out)}$$

9.  $\log_3 14 + \log_3 m = \log_3 42$

$$14m = 42$$

$$m = 3$$

2.  $\log_6(4x + 4) = \log_6 64$

$$4x + 4 = 64$$

$$4x = 60$$

$$x = 15$$

4.  $\log_3(x^2 + 3x) = \log_3(x + 15)$

$$x^2 + 3x = x + 15$$

$$x^2 + 2x - 15 = 0$$

$$(x + 5)(x - 3) = 0 \quad x = -5 \quad x = 3 \checkmark \checkmark$$

6.  $\log_6 x = \frac{1}{2}\log_6 9 + \frac{1}{3}\log_6 27$

$$x = \sqrt{9} \cdot \sqrt[3]{27}$$

$$x = 3 \cdot 3$$

$$x = 9$$

8.  $\log_2 10 - \log_2 x = \log_2 5$

$$\frac{10}{x} = 5$$

$$10 = 5x$$

$$2 = x$$

10.  $\log_3(x + 5) + \log_3(x - 2) = \log_3 18$

$$(x + 5)(x - 2) = 18$$

$$x^2 + 3x - 10 = 18$$

$$x^2 + 3x - 28 = 0$$

$$(x + 7)(x - 4) = 0$$

$$x = -7 \quad x = 4 \checkmark$$