

# 7.4 Logarithm Equations & Inequalities - Day 2 Notes

Key

Extend/Review:

Solve for x.

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

$x = 5^{-2}$

$x = \frac{1}{5^2}$

$x = \frac{1}{25}$

2.  $\log_{\frac{1}{2}}(x) = 3$

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

$x = \frac{1}{8}$

3.  $\log_8(x) = \frac{4}{3}$

$8^{\frac{4}{3}} = x$

$x = (\sqrt[3]{8})^4$

$x = 2^4$

$x = 16$

4.  $\log_{16}(x) = -\frac{3}{4}$

$16^{-3/4} = x$

$\frac{1}{16^{3/4}} = x$

$(\sqrt[4]{16})^3 = x$

$\frac{1}{2^3} = x$

$x = \frac{1}{8}$

5.  $\log_9(x^2 - 4x) = \log_9(3x - 10)$

$x^2 - 4x = 3x - 10$

$x^2 - 7x = -10$

$x^2 - 7x + 10 = 0$

$(x-5)(x-2) = 0$

$x = 5$     ~~$x = 2$~~

Check: Argument must be  $> 0$ .

$[5^2 - 4(5)]$

$25 - 20$

$= 5 \checkmark$

$[3(5) - 10]$

$15 - 10$

$= 5 \checkmark$

$[2^2 - 4(2)]$

$4 - 8 = -4$

X

6.  $\log_3(x) > 4$

$x > 3^4$

$x > 81$

7.  $\log_4(x) < 2$

$x < 4^2$

$x < 16$

\* Argument  $> 0$

$x > 0$

$(0, 16)$

Logs on both sides of the equation: if  $b > 1$ , and  $\log_b(x) > \log_b(y)$  then  $x > y$   
 $\log_b(x) < \log_b(y)$  then  $x < y$

example:

solve.  $\log_9(11x - 12) \geq \log_9(9x + 4)$

$$\begin{array}{r} 11x - 12 \geq 9x + 4 \\ -9x \quad -9x \end{array}$$

$$\begin{array}{r} 2x - 12 \geq 4 \\ +12 \quad +12 \\ \hline 16 \end{array}$$

$$2x \geq 16$$

$$x \geq 8$$

$$[8, \infty)$$

Practice:

8.  $\log_2(4x - 6) > \log_2(2x + 8)$

$$\begin{array}{r} 4x - 6 > 2x + 8 \\ -2x \quad -2x \end{array}$$

$$\begin{array}{r} 2x - 6 > 8 \\ +6 \quad +6 \\ \hline 14 \end{array}$$

$$2x > 14$$

$$x > 7$$

$$(7, \infty)$$

Example:

Solve.  $\log_5(12x + 5) \leq \log_5(8x + 9)$ .

$$\begin{array}{r} 12x + 5 \leq 8x + 9 \\ -8x \quad -8x \end{array}$$

$$\begin{array}{r} 4x + 5 \leq 9 \\ -5 \quad -5 \end{array}$$

$$\frac{4x}{4} \leq \frac{4}{4}$$

$$x \leq 1$$

\* argument  $> 0$

$$12x + 5 > 0$$

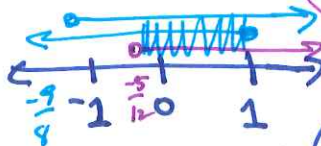
$$12x > -5$$

$$x > -\frac{5}{12}$$

$$8x + 9 > 0$$

$$8x > -9$$

$$x > -\frac{9}{8}$$



$$(-\frac{5}{12}, 1]$$

Practice:

9.  $\log_3(7x - 6) < \log_3(4x + 9)$ .

$$\begin{array}{r} 7x - 6 < 4x + 9 \\ -4x \quad -4x \end{array}$$

$$\begin{array}{r} 3x - 6 < 9 \\ +6 \quad +6 \end{array}$$

$$3x < 15$$

$$x < 5$$

\* Argument  $> 0$

$$7x - 6 > 0$$

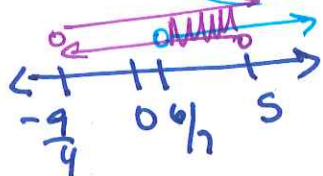
$$7x > 6$$

$$x > \frac{6}{7}$$

$$4x + 9 > 0$$

$$4x > -9$$

$$x > -\frac{9}{4}$$



$$(\frac{6}{7}, 5)$$