

Day 2 – Solving Exponential **inequalities**

$\neq \geq >$
 $\leq <$

Solve Exponential Inequalities An exponential inequality is an inequality involving exponential functions.

Property of Inequality for Exponential Functions	If $b > 1$ then $b^x > b^y$ if and only if $x > y$ and $b^x < b^y$ if and only if $x < y$.
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Example	Solve $5^{2x-1} > \frac{1}{125}$.
$5^{2x-1} > \frac{1}{125}$	Original inequality
$5^{2x-1} > 5^{-3}$	Rewrite $\frac{1}{125}$ as 5^{-3} .
$2x - 1 > -3$	Prop. of Inequality for Exponential Functions
$2x > -2$	Add 1 to each side.
$x > -1$	Divide each side by 2.

		Powers		
		2	3	4
Bases	0	0	0	0
	1	1	1	1
	2	4	8	16
	3	9	27	81
	4	16	64	256
	5	25	125	625
	6	36	216	1296
	7	49	343	2401
	8	64	512	4096
	9	81	729	6561
	10	100	1000	10000

EXPONENTIAL INEQUALITIES: * Remember, when solving inequalities you need to flip the inequality sign when dividing or multiplying by a negative number. You also need to check your solutions to make sure they make sense.

Examples

a. $25^{2x+3} > 125^{5x-9}$
 $5^{2(2x+3)} > 5^{3(5x-9)}$
 $5^{4x+6} > 5^{15x-27}$
 $4x+6 > 15x-27$
 $-11x > -33$
 $x < 3$

b. $16 \geq 4^{x+5}$
 $4^2 \geq 4^{x+5}$
 $2 \geq x+5$
 $x \leq -3$

c. $7^{3x} < 49^{1-x}$
 $7^{3x} < 7^{2(1-x)}$
 $3x < 2(1-x)$
 $3x < 2 - 2x$
 $5x < 2$
 $x < \frac{2}{5}$

Step
 1. Same base ✓
 2. Solve exponents

e. $10^{4x+1} > 100^{x-2}$
 $10^{4x+1} > 10^{2(x-2)}$
 $4x+1 > 2(x-2)$
 $4x+1 > 2x-4$
 $2x > -5$
 $x > -\frac{5}{2}$

f. $27^{x-2} \leq 81^{x+7}$
 $3^{3(x-2)} \leq 3^{4(x+7)}$
 $3x-6 \leq 4x+28$
 $-x \leq 34$
 $x \geq -34$

g. $\frac{1}{81} < 9^{2x-4}$
 $9^{-2} < 9^{2x-4}$
 $-2 < 2x-4$
 $2 < 2x$
 $1 < x$

h. $\left(\frac{1}{9}\right)^{2x+7} \leq 27^{6x-12}$
 $9^{-2(x+7)} \leq 3^{3(6x-12)}$
 $9^{-2(6x+3)} \leq 3^{18x-36}$
 $9^{-12x-6} \leq 3^{18x-36}$
 $9^{-12x-6} \leq 9^{9x-18}$
 $-12x-6 \leq 9x-18$
 $-21x \leq -12$
 $x \geq \frac{4}{7}$