



Graphing Calculator

A Follow-Up of Lesson 10-4

Sharp EL-9900

Solving Exponential and Logarithmic Equations and Inequalities

You can use a Sharp EL-9900 graphing calculator to solve exponential and logarithmic equations and inequalities. This can be done by graphing each side of the equation separately and using the intersect feature on the calculator.

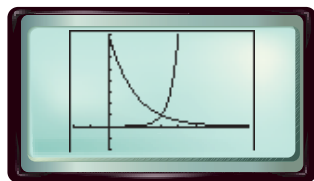
Example 1

Solve $2^{3x-9} = \left(\frac{1}{2}\right)^{x-3}$ by graphing.

Step 1 Graph each side of the equation.

- Graph each side of the equation as a separate function. Enter 2^{3x-9} as Y1. Enter $\left(\frac{1}{2}\right)^{x-3}$ as Y2. Be sure to include the added parentheses around each exponent. Then graph the two equations.

KEYSTROKES: See pages 87 and 88 to review graphing equations.

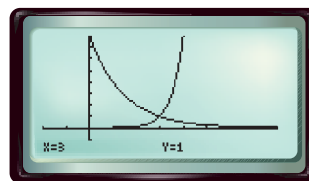


$[-2, 8]$ scl: 1 by $[-2, 8]$ scl: 1

Step 2 Use the intersect feature.

- You can use the intersect feature on the CALC menu to approximate the ordered pair of the point at which the curves cross.

KEYSTROKES: See page 115 to review how to use the intersect feature.



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The calculator screen shows that the x-coordinate of the point at which the curves cross is 3. Therefore, the solution of the equation is 3.

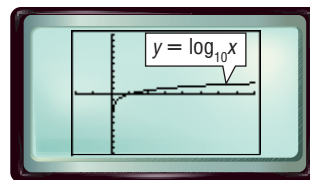
The Sharp EL-9900 has $y = \log_{10} x$ as a built-in function.

Enter $\boxed{Y=}$ $\boxed{\log}$ $\boxed{X/\theta/T/n}$ $\boxed{\text{GRAPH}}$ to view this graph. To graph logarithmic functions with bases other than 10, you must use the Change of Base Formula,

$$\log_a n = \frac{\log_b n}{\log_b a}$$

For example, $\log_3 x = \frac{\log_{10} x}{\log_{10} 3}$, so to graph $y = \log_3 x$ you

must enter $\boxed{\log}$ $\boxed{X/\theta/T/n}$ $\boxed{\div}$ $\boxed{\log}$ 3 as Y1.



$[-2, 8]$ scl: 1 by $[-5, 5]$ scl: 1

 www.algebra2.com/other_calculator_keystrokes

Investigation

Example 2

Solve $\log_2 2x \geq \log_{\frac{1}{2}} 2x$ by graphing.

Step 1 Rewrite the problem as a system of common logarithmic inequalities.

- The first inequality is $\log_2 2x \geq y$ or $y \leq \log_2 2x$. The second inequality is $y \geq \log_{\frac{1}{2}} 2x$.
- Use the Change of Base Formula to create equations that can be entered into the calculator.

$$\log_2 2x = \frac{\log 2x}{\log 2} \quad \log_{\frac{1}{2}} 2x = \frac{\log 2x}{\log \frac{1}{2}}$$

Thus, the two inequalities are $y \leq \frac{\log 2x}{\log 2}$ and $y \geq \frac{\log 2x}{\log \frac{1}{2}}$.

Step 2 Enter the first inequality.

- Enter $y \leq \frac{\log 2x}{\log 2}$ as Y1. Since the inequality includes *less than*, the shading will be below the curve.

KEYSTROKES: $\boxed{Y=}$ $\boxed{\log}$ $\boxed{(}$ $\boxed{2}$ $\boxed{X/\theta/T/n}$ $\boxed{)}$
 $\boxed{\div}$ $\boxed{\log}$ $\boxed{2}$ \boxed{ENTER}

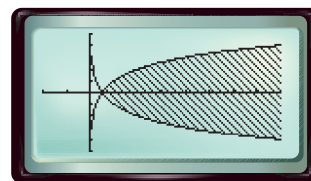
Step 3 Enter the second inequality.

- Enter $y \geq \frac{\log 2x}{\log \frac{1}{2}}$ as Y2. Since the inequality includes *greater than*, the shading will be above the curve.

KEYSTROKES: $\boxed{\log}$ $\boxed{(}$ $\boxed{2}$ $\boxed{X/\theta/T/n}$ $\boxed{)}$ $\boxed{\div}$
 $\boxed{\log}$ $\boxed{(}$ $\boxed{1}$ $\boxed{\div}$ $\boxed{2}$ $\boxed{)}$ \boxed{ENTER}
 \boxed{GRAPH}

Step 4 Graph the inequalities.

KEYSTROKES: $\boxed{2nd F}$ $\boxed{[DRAW]}$ \boxed{ALPHA} $\boxed{[G]}$ $\boxed{1}$ $\boxed{2nd F}$
 \boxed{VARS} \boxed{ALPHA} $\boxed{[A]}$ \boxed{ENTER} $\boxed{2}$ $\boxed{\blacktriangleright}$
 $\boxed{2nd F}$ \boxed{VARS} \boxed{ENTER} $\boxed{1}$ \boxed{GRAPH}



$[-2, 8]$ scl: 1 by $[-5, 5]$ scl: 1

The x values of the points in the shaded region is the solution set of the original inequality. Using the calculator's intersect feature, you can conclude that the solution set is $\{x \mid x \geq 0.5\}$.

Exercises Solve each equation or inequality by graphing. **7. $x \geq 6$**

1. $3.5^{x+2} = 1.75^{x+3}$ **-1.2**

2. $-3^{x+4} = -0.5^{2x+3}$ **-2.6**

3. $6^{2-x} - 4 = -0.25^{x-2.5}$ **1.8**

4. $3^x - 4 = 5^{\frac{x}{2}}$ **2**

5. $\log_2 3x = \log_3 (2x + 2)$ **0.7**

6. $2^{x-2} \geq 0.5^{x-3}$ **$x \geq 2.5$**

7. $\log_3 (3x - 5) \geq \log_3 (x + 7)$

8. $5^{x+3} \leq 2^{x+4}$ **$x \leq -2.24$**

9. $\log_2 2x \leq \log_4 (x + 3)$ **$0 < x \leq 1$**