



Graphing Calculator

A Follow-Up of Lesson 10-4

TI-73

Solving Exponential and Logarithmic Equations and Inequalities

You can use a TI-73 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.

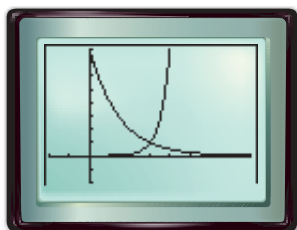
Example 1

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.

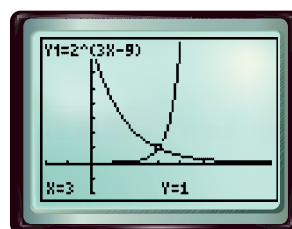


$[-2, 8]$ scl: 1 by $[-2, 8]$ scl: 1

Step 2 Use the trace feature.

- You can use the **TRACE** feature to approximate the ordered pair of the point at which the curves cross.

KEYSTROKES: See page 268 to review how to use the trace feature.



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

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.

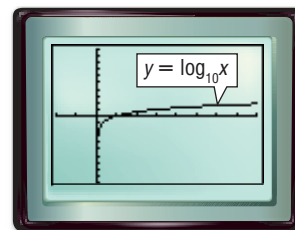
The TI-73 has $y = \log_{10} x$ as a built-in function. Enter

$\boxed{Y=}$ $\boxed{\text{MATH}}$ $\boxed{\rightarrow}$ $\boxed{\rightarrow}$ $\boxed{\rightarrow}$ $\boxed{1}$ \boxed{x} $\boxed{)}$ $\boxed{\text{GRAPH}}$ 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 $\boxed{\text{MATH}}$ $\boxed{\rightarrow}$ $\boxed{\rightarrow}$ $\boxed{\rightarrow}$ $\boxed{1}$ \boxed{x} $\boxed{)}$ $\boxed{\div}$ $\boxed{\text{MATH}}$ $\boxed{\rightarrow}$ $\boxed{\rightarrow}$ $\boxed{\rightarrow}$ $\boxed{1}$ $\boxed{3}$ $\boxed{)}$ 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*, shade below the curve.

KEYSTROKES: $\boxed{Y=}$ $\boxed{\text{MATH}}$ $\boxed{\leftarrow}$ $\boxed{1}$ $\boxed{2}$ \boxed{x} $\boxed{)}$ $\boxed{\div}$
 $\boxed{\text{MATH}}$ $\boxed{\leftarrow}$ $\boxed{1}$ $\boxed{2}$ $\boxed{)}$

Use the arrow and $\boxed{\text{ENTER}}$ keys to choose the shade below icon, $\boxed{\text{■}}$.



Step 3 Enter the second inequality.

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

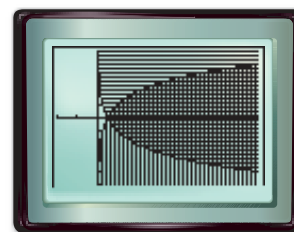
KEYSTROKES: $\boxed{\text{MATH}}$ $\boxed{\leftarrow}$ $\boxed{1}$ $\boxed{2}$ \boxed{x} $\boxed{)}$ $\boxed{\div}$
 $\boxed{\text{MATH}}$ $\boxed{\leftarrow}$ $\boxed{1}$ $\boxed{1}$ $\boxed{\div}$ $\boxed{2}$ $\boxed{)}$

Use the arrow and $\boxed{\text{ENTER}}$ keys to choose the shade above icon, $\boxed{\text{■}}$. Then press $\boxed{\text{GRAPH}}$.



Step 4 Graph the inequalities.

KEYSTROKES: $\boxed{\text{GRAPH}}$



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

The x values of the points in the region where the shadings overlap is the solution set of the original inequality. 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. $\log_2 2x \leq \log_4 (x + 3)$ **$0 < x \leq 1$**