Graphing Calculator

A Follow-Up of Lesson 10-4

Sharp EL-9600c

Solving Exponential and Logarithmic Equations and Inequalities

You can use a Sharp EL-9600c 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.

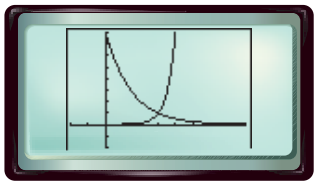
Example 1

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.*



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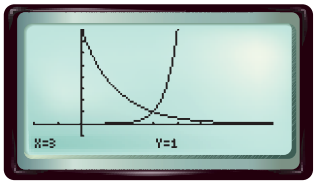
Step 2 *Use the intersect feature.*

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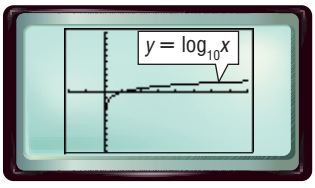
The calculator screen shows that the x-coordinate of the point at which the curves cross is 3. Therefore, the solution of the equation is 3.

The Sharp EL-9600c has $y = \log_{10} x$ as a built-in function.

Enter [Y=] [log] [X/θ/T/n] [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 [log] [X/θ/T/n] [÷] [LOG] 3 as Y1.



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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.

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

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: Y= log 2 X/θ/T/n ÷ log 2 ENTER

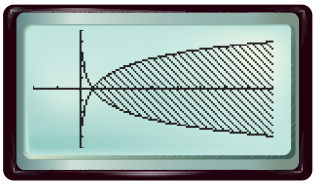
Step 3 *Enter the second inequality.*

- 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: log 2 X/θ/T/n ÷ log (1 ÷ 2)

Step 4 *Graph the inequalities.*

KEYSTROKES: 2nd F [DRAW] ALPHA [G] 1 with pen, touch Y2 ▶ with pen, touch Y1 GRAPH



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