Solving Equations Using Intersection of Graphs (Basic) Classic

View

Objectives:

- See various ways the same question might be asked
- Understand the relationship between a solution and a point of intersection
- Use the Intersect calculation to solve an equation graphically

See various ways the same question might be asked

Different textbooks and instructors say this differently, but these instructions all mean the same thing:

"Solve graphically"

• "Approximate the solution"

"Solve numerically"

- "Find an approximate solution"
- "Use a graphing calculator to find a solution"

There are two methods: **intersection of graphs** (here) and **x-intercept of a graph** (on another exercise.) **KEY POINT:** When using graphs to solve an equation in x, create a y-variable that's not in the question!

Understand the relationship between a solution and a point of intersection

To solve an equation, find a value of x. Substituting this value of x makes a true statement. A point on a graph means an ordered pair (x, y). Substituting the value of x for x and value of y for y makes a true statement. If a point is on two graphs, it makes both true!

PRO TIP: A point (x, y) where the two graphs cross is called a **point of intersection**, or **intersection**.

THE INTERSECTION METHOD MEANS: Graph y= left side of the equal sign (LHS) and y= right side of the equal sign (RHS), then find the point of intersection using Intersect in the CALC menu.

Use the Intersect calculation to solve an equation graphically

Example 1: Solve 5(x-2)-3 = 4(x+5)-(x+9) numerically using the intersection method. **CAUTION:** If the x-coordinate of the intersection is not visible in the GC window, the GC cannot find it.

Step 1: Graph $y_1 = LHS$ and $y_2 = RHS$ for the equation and observe the point of intersection.



PRO TIP: Though these can be simplified, the calculator doesn't mind parentheses!

Step 2: If the point of intersection is not visible, adjust the window until the x-coordinate is in the window. **PATIENCE:** It may take trial and error to find the right window. A table might help.

PRO TIP: Only the x-coordinate has be to visible on the x-axis. It will work if x is visible but y is not.

Here's a window that works: Use XMAX 15, YMAX 50, YSCL 10, with other settings unchanged.

CAUTION: Don't forget to use graph, not Zoom 6!



Step 3: Use the Intersect calculation, in the CALC menu, which is .2nd TRACE.

IMPORTANT: This calculation has **four** steps:

Step **3a:** Select option 5, intersect, from the CALC menu.

Step **3b:** See y_1 in the upper left corner of the screen and press ENTER to select y_1 as "1st curve".

Step **3c:** See y_2 in the upper left corner of the screen and press ENTER to select y_2 as "2nd curve".





Step 4: The solution to 5(x-2)-3 = 4(x+5)-(x+9) is the x-coordinate ONLY. Answer: x = 12

WARNING: Don't use "Trace" to find the intersection. It may get close, but often has nasty decimals.

Try It!

Solve graphically.

- 1) 5x + 8 = -2x 13
- 2) 5(x-2)+15=20
- 3) (3x-20)-(x+14)=-2(x-6)-(1-x)
- 4) (7x+13)-(5x-29) = -6(x+10)-(x+6)

Solutions



