Solving Equations Using Intersection 2 Classic View

Objectives:

- Recall the steps in the Intersection method
- Find approximate solutions
- Observe the graphs when there is no solution
- Find answers when there are two solutions

Recall the steps in the Intersection method

Step 1: Graph $y_1 = LHS$ and $y_2 = RHS$ for the equation and observe the point of intersection.
Step 2: If the point of intersection is not visible, adjust the window until the x-coordinate is in the window.
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 **3d:** Use left or right arrows to move the cursor near intersection and press ENTER for "Guess".

Step 4: The solution is the x-coordinate ONLY.

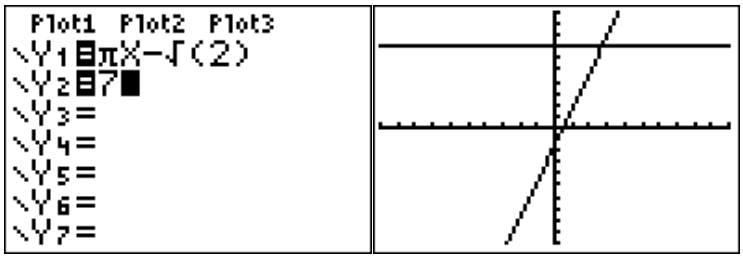
Find approximate solutions

WARNING: Don't use "Trace" to find the intersection. It may get close, but often has nasty decimals.
CAUTION: If you round the answer, you have found an approximate solution. This is also called "approximating the solution". Re-read the instructions to see a) if rounding is okay, and b) how to round.

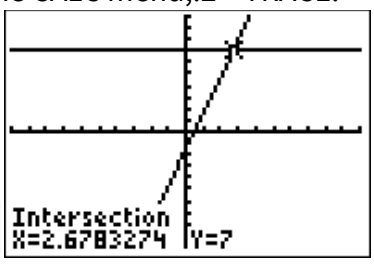
Example 1: Use a graphing calculator to find the solution to $\pi x - \sqrt{2} = 7$. Round to the nearest tenth.

Step 1: Graph $y_1 = \pi x - \sqrt{2}$ and $y_2 = 7$

Press:



Step 2: The point of intersection is visible, so don't adjust the window.
Step 3: Use the Intersect calculation in the CALC menu,.2nd TRACE.



Step 4: The solution is the x-coordinate ONLY, and the instructions said to round. Answer: $x \approx 2.7$

Observe the graphs when there is no solution

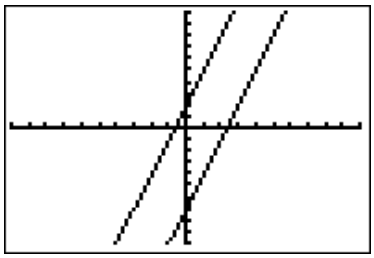
Example 2: Solve $3x - 7 = 3x + 2$ a) algebraically and b) graphically.

a) Subtract from both sides gives $-7 = 2$, a false statement, or contradiction, giving answer: No solution.

b) Press: statplot f1 L3 θ link] W u O entry solve L3 θ link mem " L2 Z format f3 L6 V

y= | 3 | X,T,θ,n | − | 7 | enter | 3 | X,T,θ,n | + | 2 | zoom | 6

See:



Notice what might be parallel lines and look again at the equation.
The two expressions are lines with the same slope but different y-intercepts, making them parallel.
Parallel lines do not intersect. If the graphs do not intersect, the answer is No solution.

EXPLORATION: But what will the calculator do if we try to calculate the point of intersection?

Press: calc f4 L5 U entry solve entry solve entry solve

2nd | trace | 5 | enter | enter | enter

See:

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ERR:NO SIGN CHNG
1:Quit
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This error usually means that there is no solution.
But, if there are two solution, it might mean your cursor for "Guess?" was too far from a solution.

Find answers when there are two solutions

NOTE: If there are two (or more) points of intersection, use the same method twice (or more): once for each solution.

IMPORTANT: You must choose the "Guess?" more carefully or you'll get the same answer repeatedly.

Example 3: Use a graphing calculator to find the solutions to $9 - x^2 = 7$. Round to the nearest thousandth.

Step 1: Graph

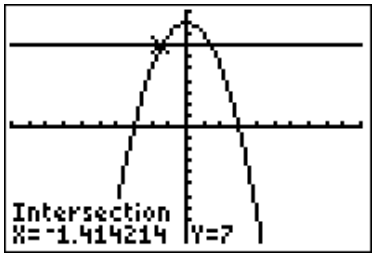
statplot f1 w Q] W link √ I entry solve u O format f3 L6 V

y= | clear | 9 | − | X,T,θ,n | x^2 | enter | clear | 7 | zoom | 6

Step 2: Both points of intersection are visible.

Step 3: Calculate the first point of intersection:

Move the cursor closer to the intersection on the left by pressing:

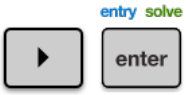


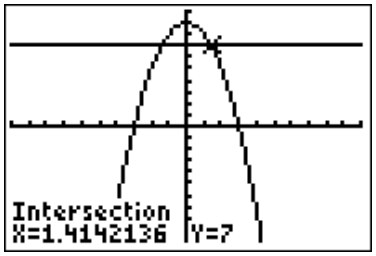
Solution: $x \approx -1.414$

<u>Repeat Step 3</u>: Calculate the second point of intersection:

Move the cursor closer to the intersection on the right:

Many times:





Solution: $x \approx 1.414$

Answers: $x \approx 1.414, -1.414$

Bonus: If you know how, solve the equation in the last example and double-check these answers.

Try It!

1) Solve the equation $-2x + 6 = -2x - 4$ graphically.
2) Solve $2x - \pi = 4 - x$ graphically. Round to the nearest hundredth.
3) Solve $5 + x^2 = 8$ graphically. Round to the nearest hundredth.
4) Solve $5 - x^2 = 7$ graphically.

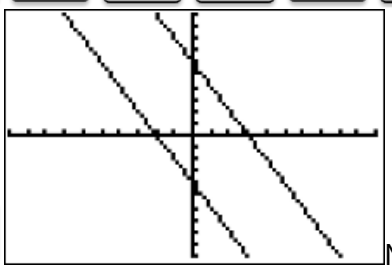
Solutions

1) statplot f1 | ans ? L2 Z link | mem " L6 V entry solve | ans ? L2 Z] W L4 T format f3

y= | clear | (–) | 2 | X,T,θ,n | + | 6 | enter | clear | (–) | 2 | – | 4 | zoom

L6 V

6



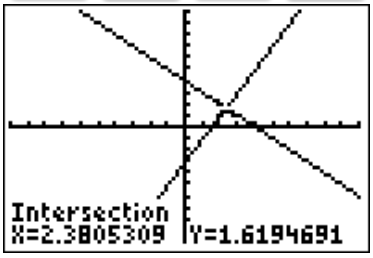
No solution.

2) statplot f1 | L2 Z link |] W | π H entry solve | L4 T] W link | format f3 L6 V

y= | clear | 2 | X,T,θ,n | – | 2nd | ^ | enter | clear | 4 | – | X,T,θ,n | zoom | 6

calc f4 L5 U entry solve | entry solve | entry solve

2nd | trace | 5 | enter | enter | enter



Answer: $x \approx 2.38$

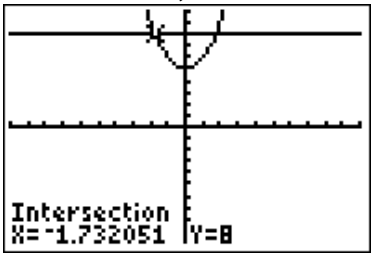
3) statplot f1 | L5 U mem " link | √ I entry solve | v P format f3 L6 V

y= | clear | 5 | + | X,T,θ,n | x^2 | enter | clear | 8 | zoom | 6

There are two intersections, so two solutions to find.

calc f4 L5 U entry solve | entry solve | entry solve

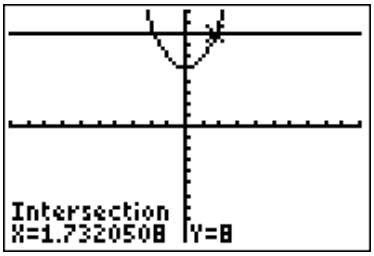
2nd | trace | 5 | enter | enter | ◀ | ◀ | ◀ | enter



calc f4 L5 U entry solve | entry solve | entry solve

2nd | trace | 5 | enter | enter

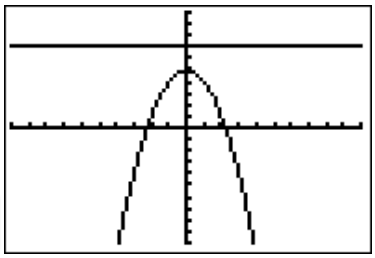
Several times ▶ | entry solve | enter



Answer: $x \approx 1.73, -1.73$

4) statplot f1 | L5 U] W link | √ I entry solve u O format f3 L6 V

y= | clear | 5 | – | X,T,θ,n | x^2 | enter | 7 | zoom | 6



The graphs do not intersect. Answer: no solution