Extraneous Solutions
ID: 13294

Activity Overview

Students will solve quadratic equations step by step graphically. They will discover that some of the equations have an extraneous solution and they will investigate at which step in solving the equation that these "extra" solutions appear.

Topic: Rational & Radical Functions

- *Evaluate a rational function for any real value of the variable*
- *Evaluate a radical function for any real value of its variable.*
- *Solve radical equations algebraically and check for extraneous roots.*

Teacher Preparation and Notes

- *This investigation offers an extension after students have learned how to solve equations, or may serve as an introduction to solving more difficult equations.*
- *This activity is intended to be **teacher-led**. Students will follow along using their handhelds.*
- *This activity could be used in Algebra 2 as an extension after students have solved different types of equations. This activity could also be used in Precalculus as review of the different types of equations that students solved in Algebra 2.*
- *Begin by reviewing with students how to solve equations graphically by treating each side of an equation as a separate function—the solution to the equation is the functions' point of intersection.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "13294" in the keyword search box.***

Associated Materials

- *ExtraneousSolns_Student.doc*
- *ExtraneousSolns.tns*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Solving Equations with Two Radicals (TI-Nspire technology) — 8625*
- *Roots of Radical Equations (TI-Nspire technology) — 12213*
- *Finding Extraneous Solutions (TI-Nspire technology) — 8109*

Problem 1 – Solving a radical equation

In Problem 1, students will work through the solving of the equation $\sqrt{x+11}+1=x$ graphically and step-by-step. They simply need to change the equations in **f1(x)** and **f2(x)** to represent the left- and right-hand sides, respectively, of the equation in each step. The functions can be altered by double-clicking in the **f1(x)** or **f2(x)** text boxes
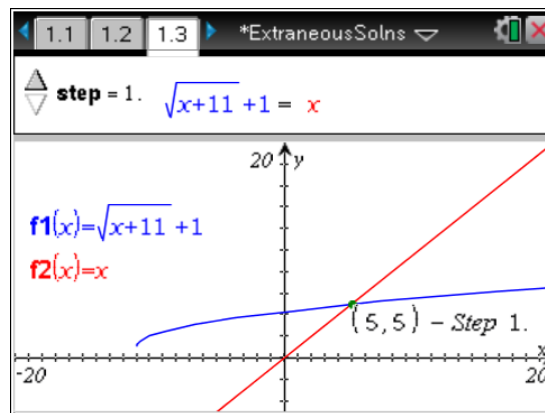
Step 1

You may wish to work though this problem with students if they are unfamiliar with solving equations graphically. Encourage them to write the solution(s)—i.e., the *x*-coordinates of the point(s) of intersection of functions **f1** and **f2**—on their worksheet.

They will observe the appearance of an extraneous solution during the graphing of the functions in Step 3. The graphs of the functions at each step in the solution are shown at the right.
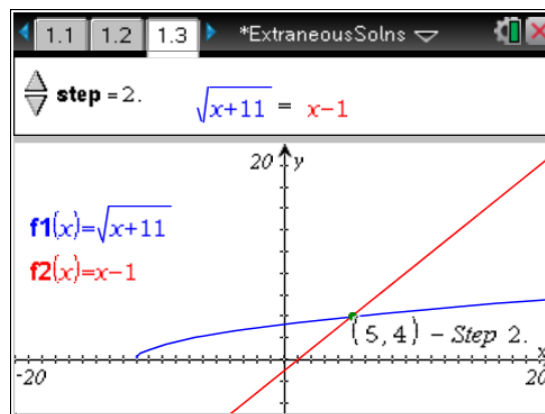
Step 2

When they have graphed the equations in Step 3, students may wish to adjust the window. To accomplish this, one option is to simply grab a tick mark on the positive *y*-axis and drag it down towards the origin. Another way is to select **MENU > Window > Window Settings** and enter the desired values.
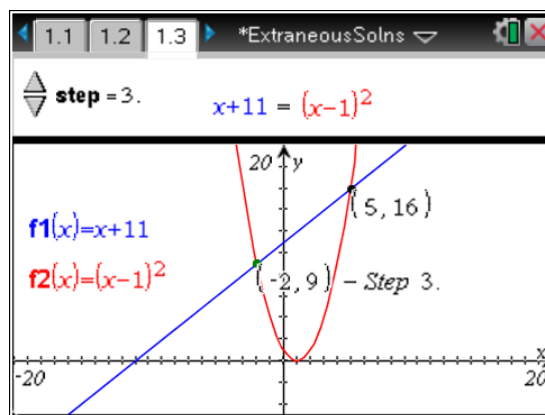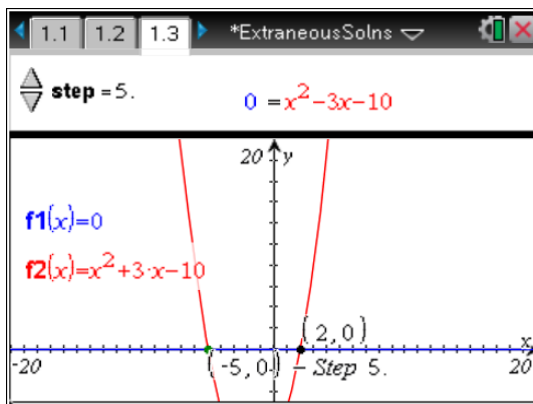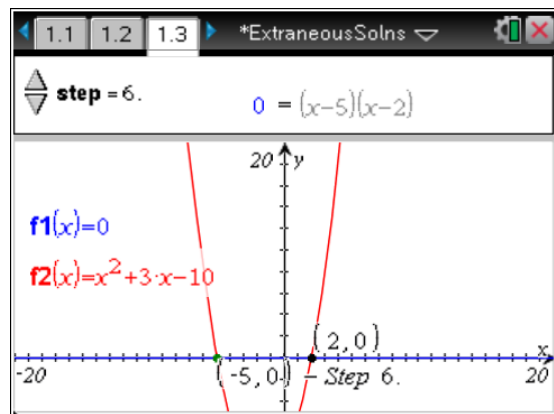
Step 3

In graphing the equations for Step 4, students should observe that the graph of the function $y = (x - 1)^2$ did not change position as it was altered to the function $y = x^2 - 2x + 1$. Ask students to explain why this happened. (The expressions $(x - 1)^2$ and $x^2 - 2x + 1$ are equivalent—the former is merely the factored form of the latter. Thus, their graphs are identical.)
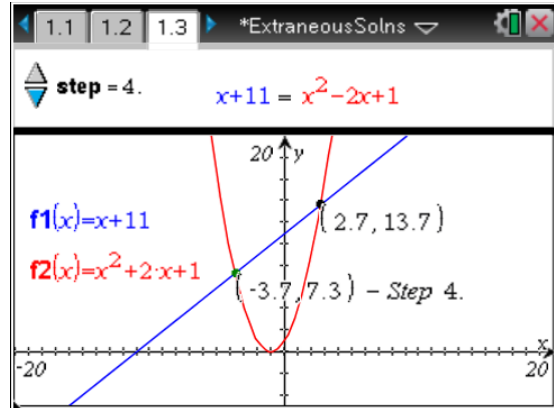
Step 4

Step 5

Step 6

On page 1.4, students can check their solutions algebraically and by using a table of values. To use the table, they will need to return to the previous page and re-enter the Step 1 equations as **f1(*x*)** and **f2(*x*)**. For the *Calculator* application, students are to check the first and second solution by entering **f1(5)=f2(5)** and **f1(−2)=f2(−2)** and pressing ⏎ enter. If the result is **true**, then the value is, in fact, a solution. If the result is **false**, then the value is not a solution.

Students should find that only *one* of their solutions, $x = 5$, makes the equation true. Explain to them that $x = -2$ is called an "extra" or *extraneous* solution.