Quadratic Formula

ID: 12384

Time required
20 minutes

Activity Overview

In this activity, students will make connections between the visual ways to find zeros of a parabola and algebraic ways. The quadratic formula is heavily emphasized in this document, and is utilized in both the Calculator and Lists & Spreadsheet applications.

Topic: Quadratic Formula

- *Students will see the graph of a parabola, and identify its zeros (x-intercepts).*
- *Students will solve the quadratic by using the quadratic formula, with the discriminant being highlighted by its calculation in the spreadsheet application.*
- *Students will define a function in the calculator to solve the quadratic completely in the calculator application.*

Teacher Preparation and Notes

- *Students will need to enter a formula into the entry line in the spreadsheet.*
- *Students will answer questions in multiple-choice format, and navigate between pages and among different frames of a page.*
- *Students will learn to store a formula in the calculator using the* ***Define*** *command. The students will then use the same formula for several problems with different values for a, b, and c.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "12384" in the quick search box.***

Associated Materials

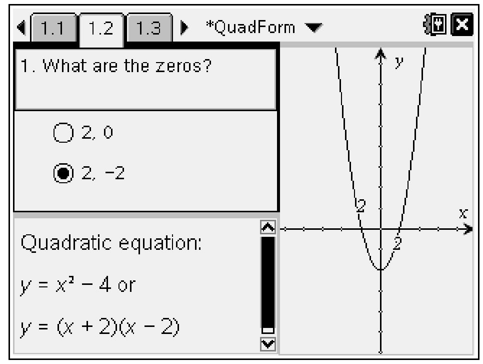
- *QuadForm_Student.doc*
- *QuadForm.tns*
- *QuadForm_Soln.tns*

Suggested Related Activities

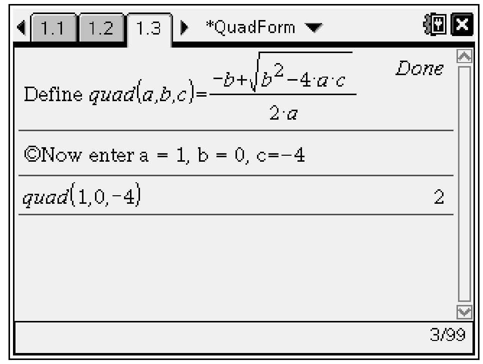
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Bridge on the River Quad (TI-Nspire technology) — 9531*
- *The Discriminant (TI-Nspire technology) — 9505*
- *Quadratic Functions (TI-84 Plus and TI-Navigator) — 3512*
- *Connecting Factors and Zeros (TI-84 Plus) — 1250*
- *Quadratic Intercepts (TI-84 Plus and TI-Navigator) — 2119*

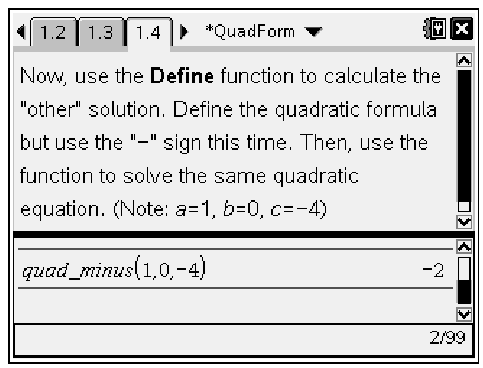
Exercise 1



On page 1.2, students are asked to identify the zeros by looking at the graph or the equation. Students may know the zero product property, and thus may be able to solve by that method on their papers. The questions in this file are self-check.

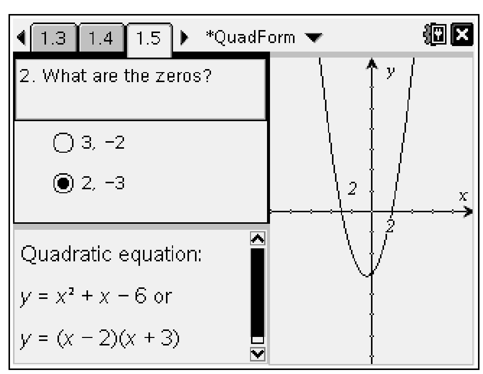


On page 1.3, the formula for **quad(a,b,c)** is already defined to be the quadratic formula with the "+" sign. The students are instructed to enter the correct values for *a*, *b*, and *c* from the function given on page 1.2. The boldfaced **quad(** indicates that this is where the student should complete the entry using the values 1, 0, –4. When the student presses (enter), the calculation will be done.



However, this only presents one solution from the quadratic formula. On page 1.4, a second function is requested from the students: **quad_minus(*a*,*b*,*c*)**. This is where the students must correctly rewrite the quadratic formula from the previous page with the subtraction sign. Be sure that students have entered the formula in precisely so that they get the correct answer returned to them. Certain details are important here: a multiplication sign must be used between *a* and *c* in 4**a***c*, and the fraction template should be used to guarantee that the 2**a* part is in the denominator.

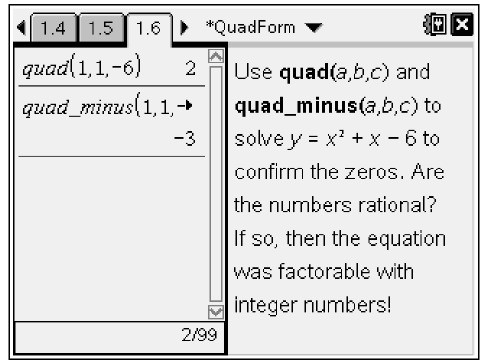
Exercise 2



The students see the graph, determine the zeros, and see the factored form as well as the standard form again.

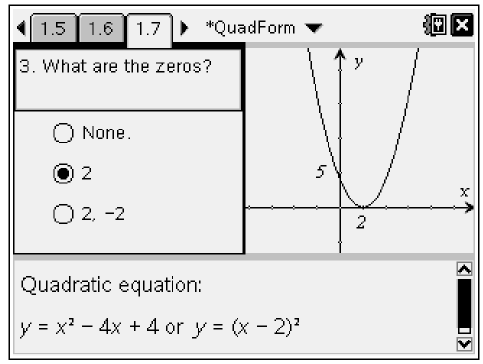
Now, the procedure is familiar. The formula for **quad(a,b,c)** and **quad_minus(a,b,c)** are both already defined in the calculator. The students only needs to enter in the correct values for *a*, *b*, and *c*.

On page 1.6, the students will use both **quad(** and **quad_minus(** to confirm their answers for the *x*-intercepts. If the students do not like typing in the letter keys for **quad_minus**, or have trouble doing so, they may access the variable by using the var button.

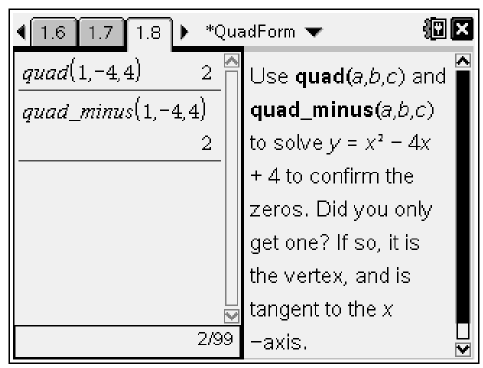


Exercise 3

On page 1.7, the students will see the graph, determine the zeros, and see the factored form as well as the standard form again.



On page 1.8, the students will use both **quad(** and **quad_minus(** to confirm their answers for the *x*-intercepts.



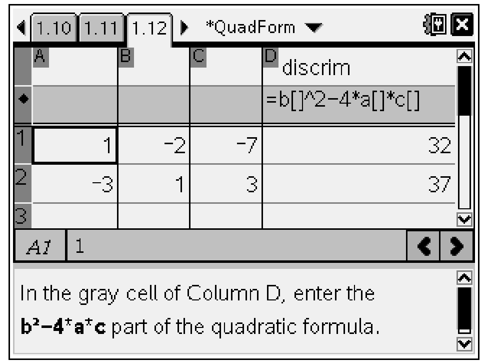
Exercise 4

Students may ask why this quadratic is not factorable using integers and the previous examples were. A discussion of the discriminant and what it tells us about the roots (zeros) would be appropriate here. However, students will discover in the next few slides that the value of the discriminant for this example is not a perfect square, and will thus create an irrational number in the solution.

Students will first obtain the solutions for the functions on pages 1.10 and 1.11 by using the functions **quad** and **quad_minus**.

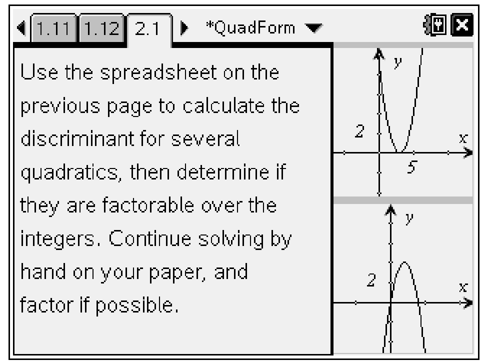
Finally, the spreadsheet is used on page 1.12 to calculate the value of the discriminant for the previous two problems, whose solutions were irrational.

Now, the spreadsheet is available for students to use to calculate the discriminant for other problems provided on the student worksheet as homework, or it can be used to rework the problems from pages 1.2–1.8.

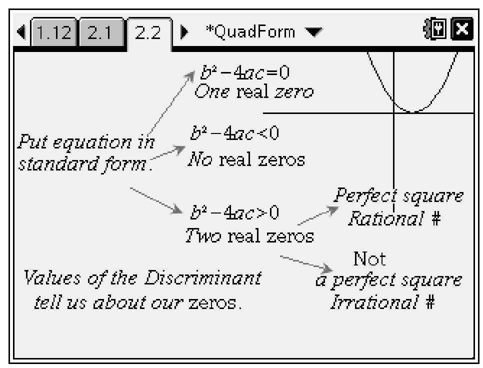


Homework/Extensions

Students will use the spreadsheet provided on page 1.12 to calculate the discriminant for several other quadratics. Special note, since this spreadsheet was already set up, students will receive an error message about a Dimension Mismatch in Column D. They should ignore the message, click OK, and keep entering values.



On page 2.2, students are to examine the flow chart and discuss with students how to use it to answer their homework problems. Ask students to sketch a different graph for each scenario, though one is already pictured.



To display both answers using one formula, the formula can be entered using curly brackets, i.e. **Define quad(*a*,*b*,*c*)** $= \left\{ \left(\frac{-b + \sqrt{b^2 - 4*a*c}}{2*a} \right), \left(\frac{-b - \sqrt{b^2 - 4*a*c}}{2*a} \right) \right\}$. Students can try this out in a new Problem.