

Folding Parabolas

ID: 9465

Time required

20 minutes

Activity Overview

In this activity, students graph a quadratic function and investigate its symmetry by choosing pairs of points with the same y -value. They then calculate the average of the x -values of these points and discover that not only do all the points have the same x -value, but the average is equal to the x -value of the vertex.

Topic: Quadratic Functions

- Graph a quadratic function $y = ax^2 + bx + c$ and display a table of integral values of the variable.
- Trace along the graph of a quadratic function to approximate its vertex, real zeros, extrema, and axis of symmetry.

Teacher Preparation and Notes

- Prior to beginning this activity, students should have seen the graph of a quadratic function and be familiar with the term “vertex.” There is an option to incorporate solving quadratic functions by factoring or using the quadratic formula.
- Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.
- **To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter “9465” in the keyword search box.**

Associated Materials

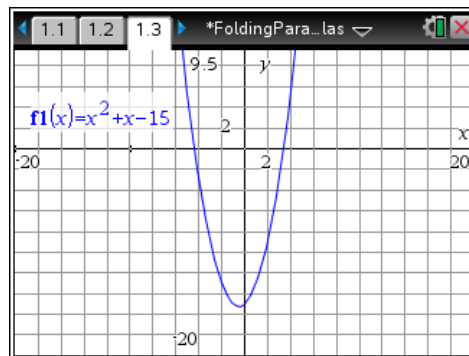
- *FoldingParabolas_Student.doc*
- *FoldingParabolas.tns*
- *FoldingParabolas_Soln.tns*

Suggested Related Activities

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

- *Key Features of a Parabola (TI-Nspire technology)* — 9145
- *Introducing the Parabola (TI-84 Plus family)* — 8197
- *NUMB3RS – Season 1 – “Structural Corruption” – Exploring Parabolas (TI-84 Plus family)* — 7721

To begin the activity, students are prompted on page 1.2 to graph the equation $y = x^2 + x - 15$ on page 1.3. They should adjust the window to bring the vertex of the parabola into view. Examining the graph, students should notice that it appears symmetric.

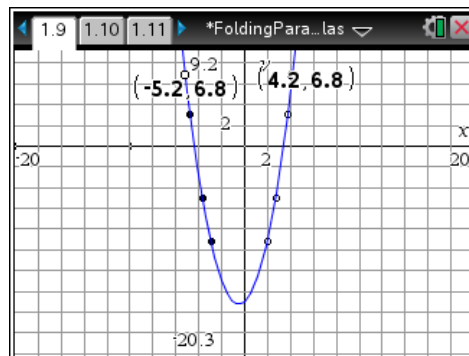


TI-Nspire™ Navigator™ Opportunity: Quick Poll
See Note 1 at the end of this lesson.

Page 1.9 is set up for students to gather data from the graph of the function. Instructions for doing so are provided on page 1.8.

Students should drag the two white points on the graph to make their y-values equal. Pressing **ctrl** + **.** “marks” the point on the graph and records its coordinates in the spreadsheet on page 1.11.

If students mark a pair of points incorrectly, they should simply delete that row from the spreadsheet on page 1.11.



Page 1.10 directs students to enter a formula in Column D of page 1.11 that calculates the average of the two x-values that yield the same y-value.

If you wish, direct students to solve the equation $y = x^2 + x - 15$, either by factoring or the quadratic formula, when they reach page 1.12. They can then check their answers by dragging the white points on page 1.9 to make both of their y-values are equal to 0.

Alternatively, you can skip the step of solving the equation algebraically and have students just drag the points to the appropriate places.

	x1val	x2val	yval	avg
1	-2.95077	1.96726	-9.2437...	-0.491754
2	-3.69566	2.70655	-5.0377...	-0.494557
3	-4.78562	3.78633	3.11651	-0.499642
4	-5.19161	4.19656	6.76118	-0.497522
5	-5.19161	4.19656	6.76118	-0.497522
A7	=-2.9507667208682			

Students should capture a total of 5 sets of points on page 1.9 and find the averages of their x-values on page 1.11. If the students positioned their points correctly, all of the averages should be very close to -0.5.

Encourage students to look at the graph and picture folding so that the points they marked lined up. Where would the fold be? Students should hypothesize that the average value they calculated corresponds to the x -value of the vertex.

On page 1.15, students test their hypothesis by using the **Graph Trace** tool to move the cursor to the point on the graph where $x = -0.5$, the vertex of the parabola.

By changing the equation in **f1** and repeating the activity, students can examine other parabolas and see that this same relationship between the average of x -values that yield the same y -value and the x -value of the vertex holds.

TI-Nspire™ Navigator™ Opportunities

Note 1

Problem 1: *Quick Poll*

Use Quick Poll to verify students understand the concepts of symmetry and vertex. The questions provided on the student worksheet may be used for this purpose.