Stretching the Quads

ID: 11640

Time required
45–60 minutes

Activity Overview

In this activity, students will stretch and translate the parabola given by $y = x^2$ and determine the effects on the equation. Students will also explore finding the vertex and zeros of a parabola and relate them to the equation.

Topic: Quadratics

- *Transformations*
- *Finding Roots*
- *Minimum/Maximum*
- *Standard form, Intercept form*

Teacher Preparation and Notes

- *This activity is meant to be explored using the TI-Nspire.*
- *Students will need to grab the parabola and points to move them around. The teacher should be familiar with the two ways a parabola can be translated and how to grab objects.*
- *Teacher will need to connect all parts of this activity in a follow up lesson or use the activity over two days to allow for students to algebraically manipulate equations between forms.*
- *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 TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "11640" in the keyword search box.***

Associated Materials

- *StretchingTheQuads_Student.doc*
- *StretchingTheQuads.tns*

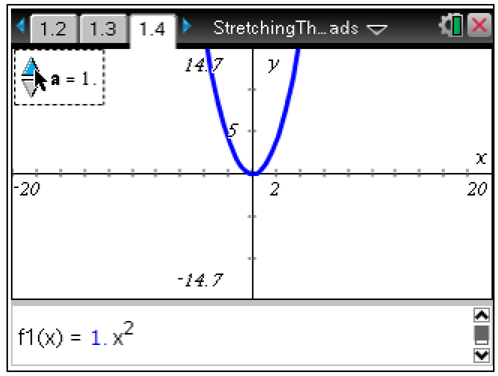
Suggested Related Activities

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

- *Bridge on the River Quad (TI-Nspire technology) — 9531*
- *Folding Parabolas (TI-Nspire technology) — 9465*
- *Graphing Quadratic Functions (TI-Nspire technology) — 9186*

Problem 1 – Stretching a Parabola

In this problem, students are told $y = x^2$ is the basic equation for the standard form a parabola. Students then use a slider to change the value of *a* to stretch the graph and observe how the equation changes. Students will make a connection between the curvature of the parabola and the equation. Several questions follow to determine if students have made a connection

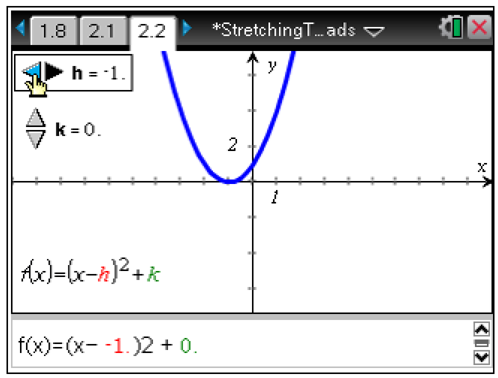


TI-Nspire Navigator Opportunity: *Quick Poll*

See Note 1 at the end of this lesson.

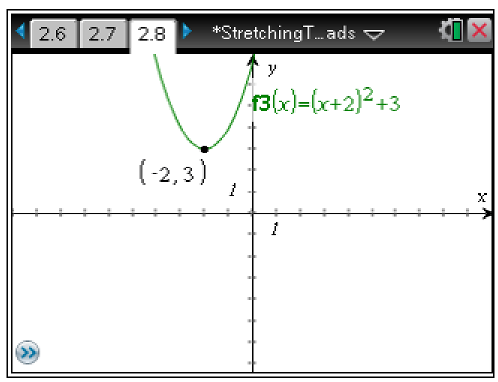
Problem 2 – Translating a Parabola

In this problem, students will translate the parabola $y = x^2$ by grabbing the vertex. Students will observe how the graph changes and make a connection between the vertex and equation. Several questions follow to determine if students have made a connection.



<u>Discussion Questions</u>:

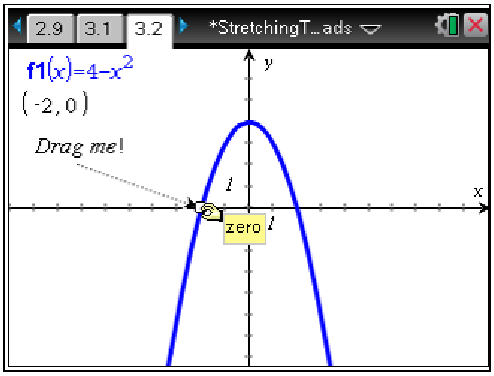
- How is the equation different when the vertex is in the first quadrant compared to the second quadrant?
- How can we change the equation to standard form?



TI-Nspire Navigator Opportunity: *Quick Poll*

See Note 1 at the end of this lesson.

Problem 3 – Finding Zeros of Quadratic Graphically

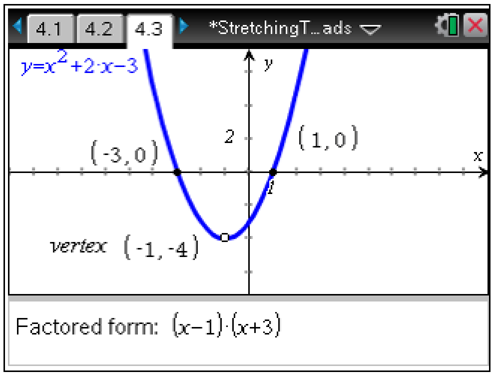


In this problem, the students will move a point on the graph of a parabola to find the zeros and the maximum/minimum. Students will answer a question about the zeros found in the exploration.

Discussion Questions:

- What is similar about the coordinates of the points representing the *x*-intercepts?
- How does the *x*-coordinate of the vertex relate to the two *x*-intercepts?
- What happens to the maximum/minimum when there is only one intercept?
- How can we algebraically find the zeros of the functions?

Problem 4 – Connecting Zeros to the Equation



In this problem, students will find the zeros of the parabola by finding the intersection of the parabola and the *x*-axis. Students will see the factored form of the quadratic equation and draw a connection between the zeros and the factored form. Students will then view the intercept form of a quadratic equation to determine how to use this form to find the zeros of the function without a graph.

Discussion Questions:

- How can we use the factored form of the quadratic equation to find the zeros?
- Is there an algebraic way to find the zeros?
- How can you find the zeros of a quadratic without the graph?
- How do we change the equation from intercept form to standard form?

Student Solutions

1. The coefficient of x^2 changes.
2. The graph opens down.
3. Negative
4. 0.5 (other acceptable answers are between 0 and 1)
5. There is now a number subtracted from *x* before *x* is squared and a constant term outside of the square.
6. The vertex of the parabola
7. (–4, –2)
8. (3, 1)
9. $c(x) = -3(x + 1)^2 + 1$
10. Sample answer: $y = (x + 2)^2 + 3$
11. Sample answer: $y = -3(x + 2)^2 + 3$
12. The *x*-intercepts.
13. –2 and 2
14. –1 and 4
15. The numbers subtracted from *x* are the zeros.
16. The *x*-intercepts
17. –2 and 4

TI-Nspire Navigator Opportunities

Note 1
Problem 1, *Quick Poll*

Develop a deeper understanding with the class of the effects that the coefficient of x^2 has on the graph by posing the following questions:

> What happens to the graph if the coefficient of x^2 between 0 and 1? Greater than 1? Less than 0? Equal to 0?

Note 2
Problem 2, *Quick Poll*

Send a few quick polls to the class asking what happens to the graph of $y = x^2$ when the constant *k* is positive? Negative? What happens to the graph of $y = x^2$ when the constant *h* is positive? Negative?