

## The **abc**'s of Quadratic Functions

### **Activity overview**

Students at all of levels of high school and college math struggle to understand the effect of changing the **a**, **b** or **c** values of the quadratic equation  $ax^2+bx+c=0$ . The Nspire handheld provides a great systems for exploring the effect of change each. The students will start with the parent function  $f(x)=x^2$ . Using the graphing function of the handheld they will be able to change the shape of the parabola. They can “open/close” the parabola. They can move the parabola vertically and/or move the parabola vertically. As they manipulate the graph they will notate the change in the equation displayed at the bottom of the screen. This activity really helps students visualize the effect of changes in **a**,**b**, and **c**.

### **Concepts**

Quadratic equations in standard and vertex forms. Effects of changing a, b and c values.

### **Teacher Preparations:**

This investigation offers many possible extensions. Algebra II students are the ideal audience for this activity.

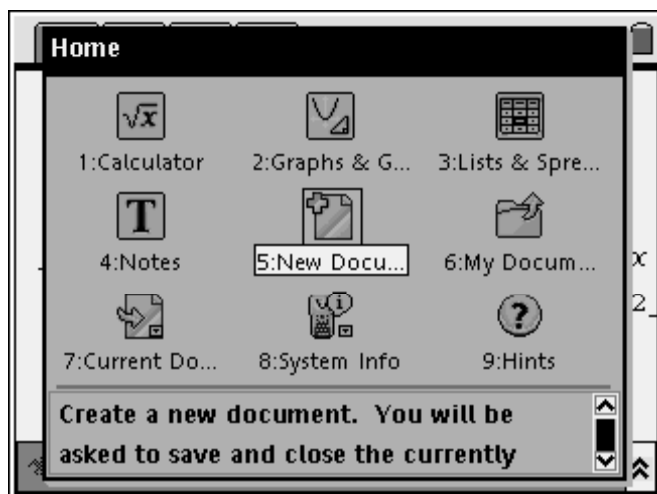
As always teachers should spend some time (10-15 minutes) practicing this technique with handheld before presenting it to students.

### **Classroom Management**

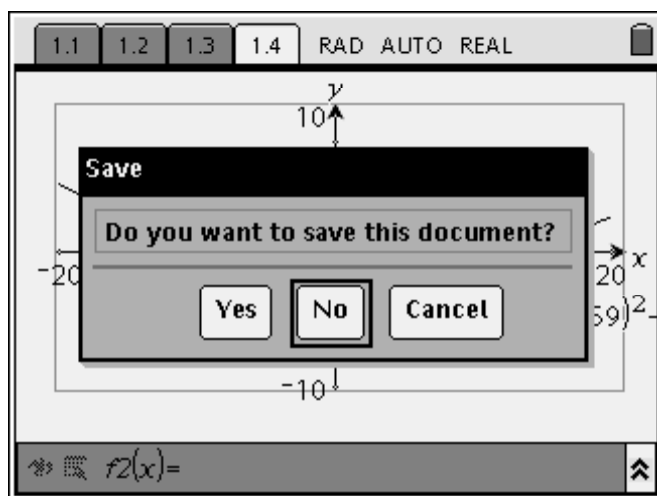
This investigation is meant to begin **teacher-led**. Students will be able to gradual investigate on their own as the activity progresses.

Objective: Students will be able to describe the effects of changing the a b and c values of the quadratic equation  $ax^2+bx+c=0$ . We will use the equation  $X^2$  as the parent function.

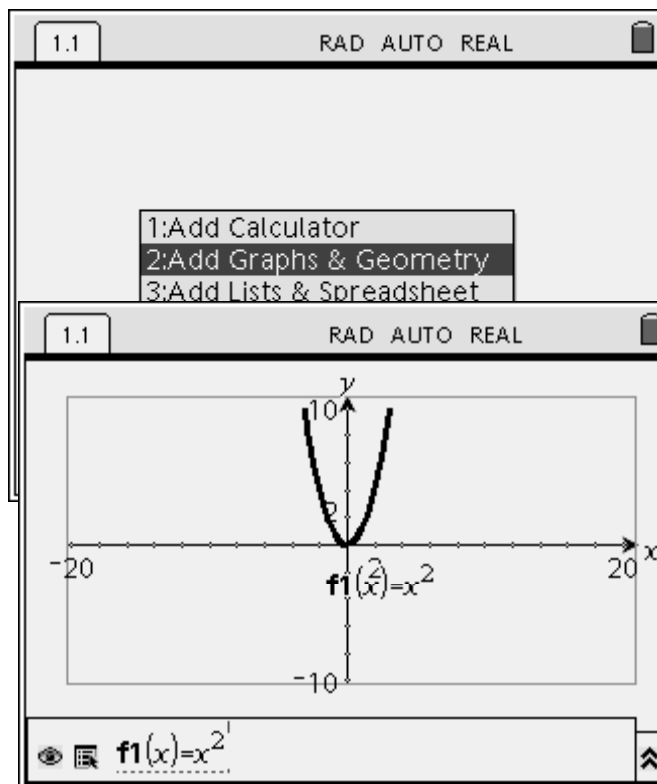
First, press the 'Home' button and select '5. New Document'. We do this to clear the previous information on the calculator so it won't interfere with our new document.



Select 'No' so you don't save the previous document.

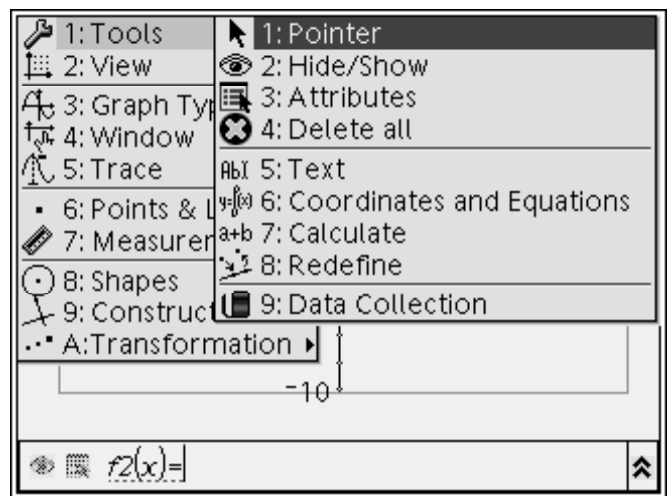


Scroll down to '2: Add Graphs & Geometry'.

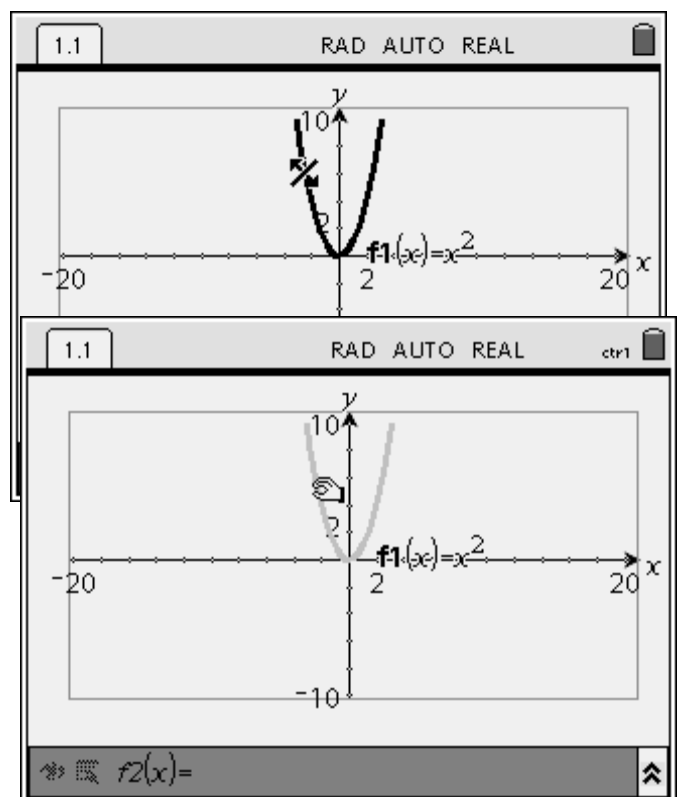


In the function box, write in the function that we are using, ' $x^2$ '. Your graph should appear in the X Y plane.

Press 'menu' then '1: Tools' and '1: Pointer'. Your cursor should then appear in the X Y plane.

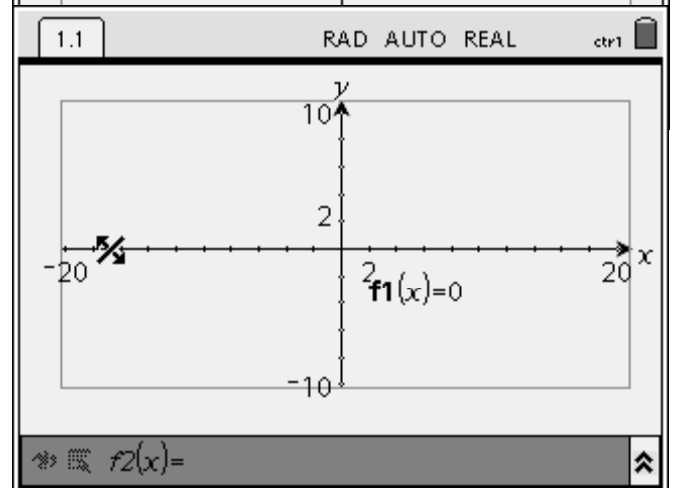
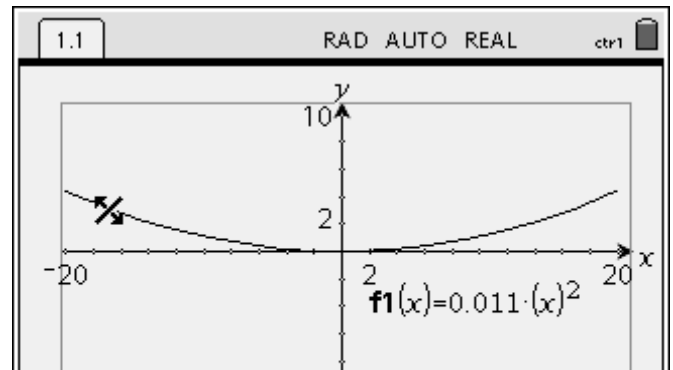
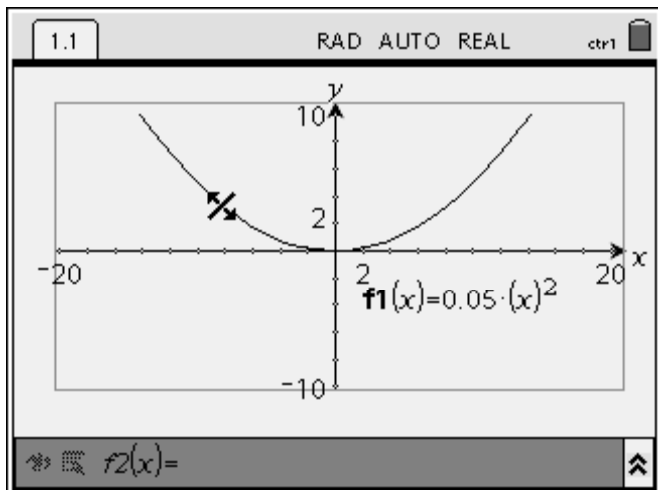
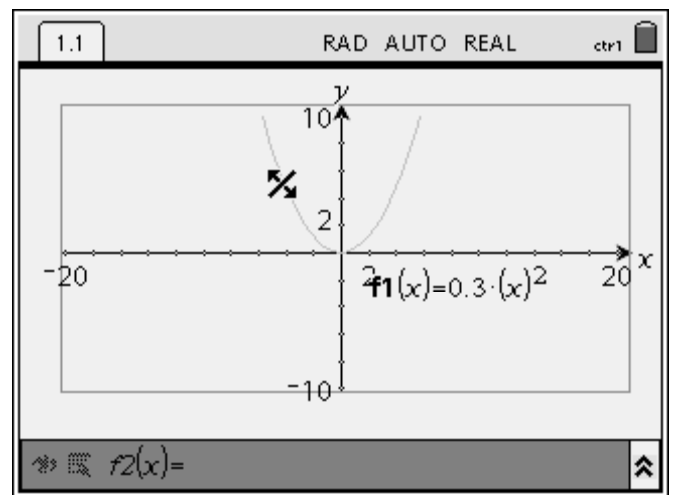


Move to the parabola until you get the symbol showed here.



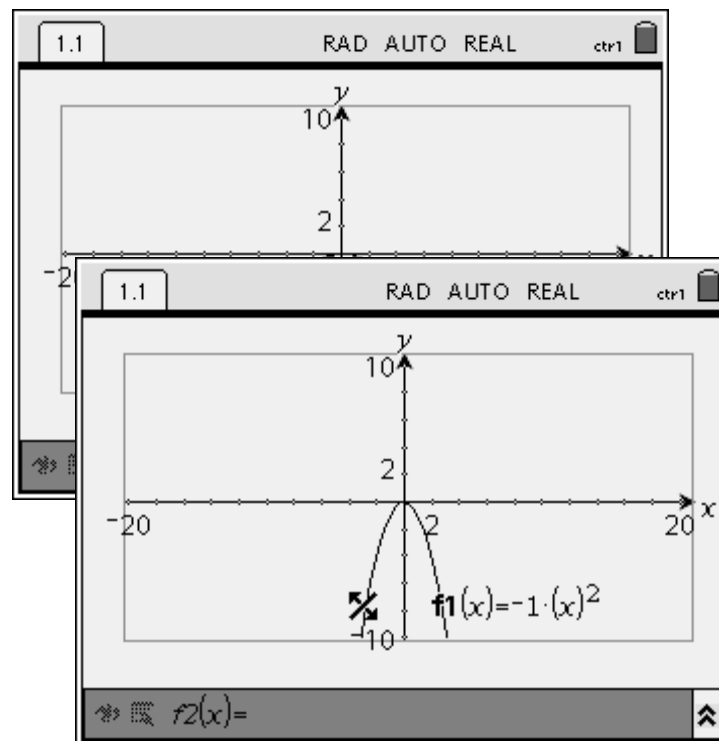
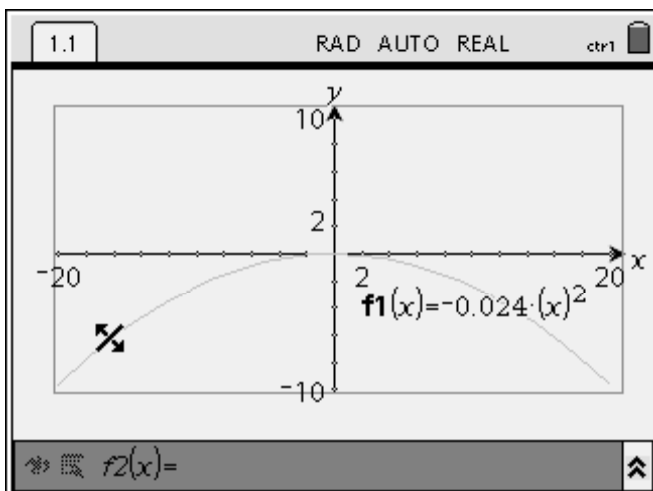
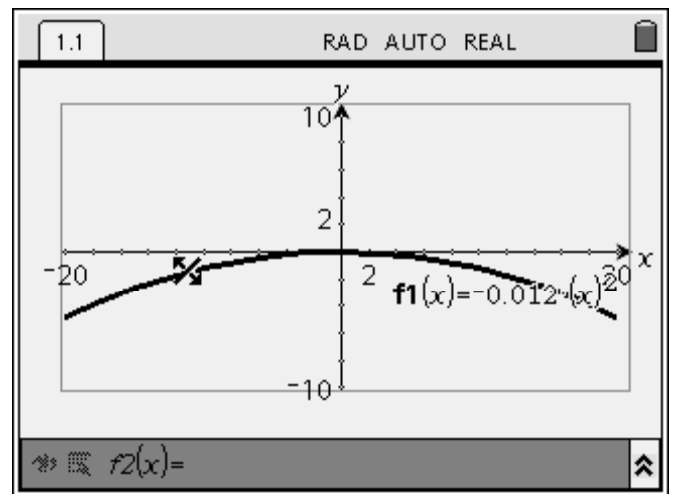
Press 'ctrl' and then the pointer button found in the center of the scroll disk. This allows you to grab the graph and shift it a value.

Using the scroll disk, you can shift the graph as shown in the following pictures.

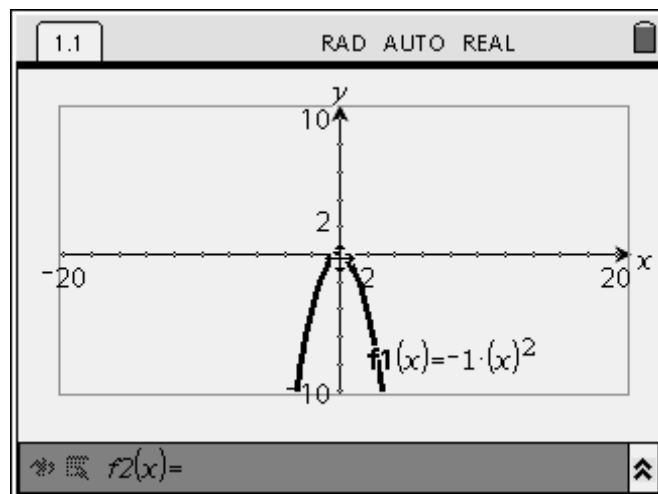


You can even give the graph a slope of zero, turning into a line on the X axis.

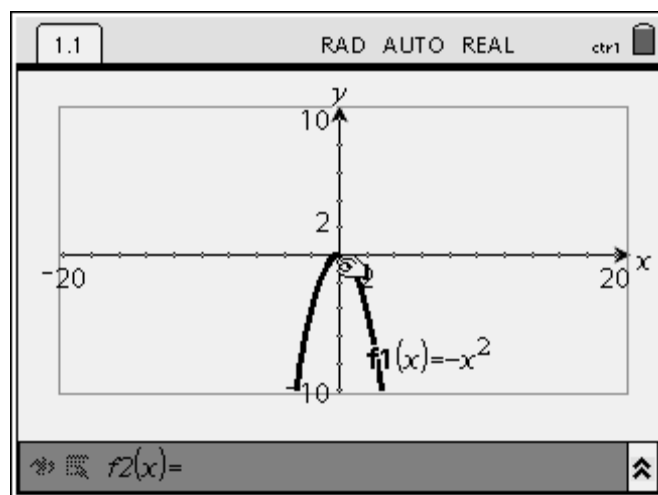
If u keep shifting the graph's A value, you will generate a graph with a negative slope as shown in the following pictures.



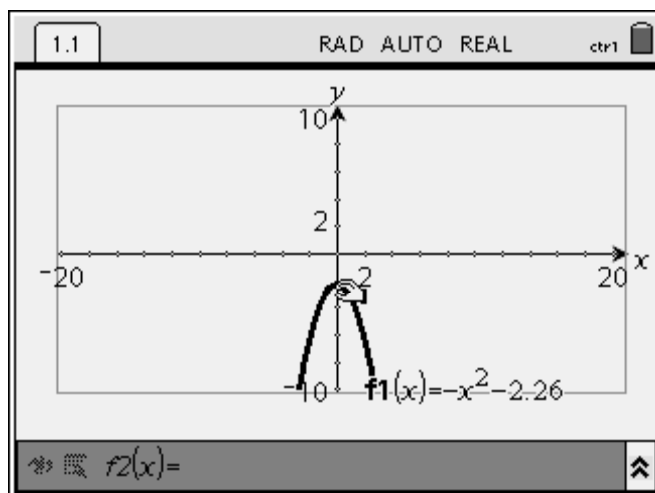
We will now shift the graph on its C value. Press the pointer again to drop the graph. Move the pointer until you get this cross symbol.

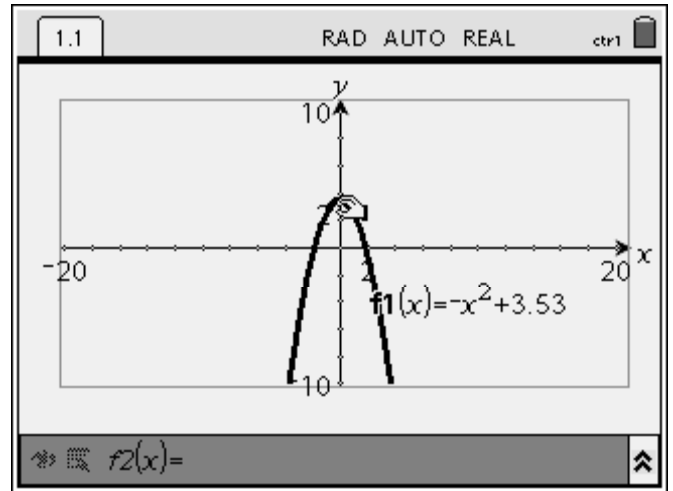
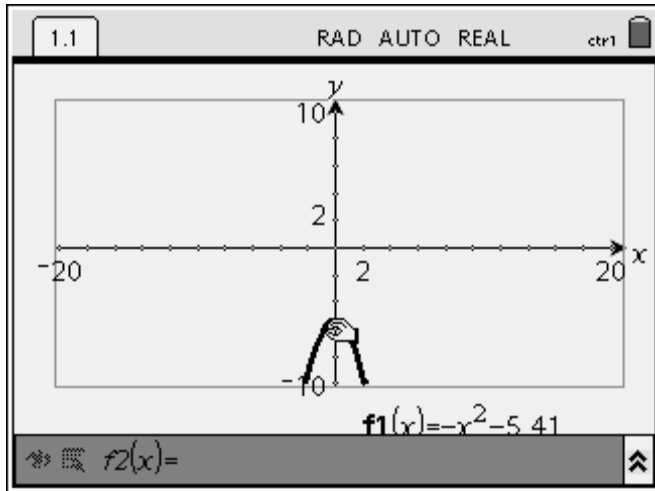


Now press the 'ctrl' button followed by the pointer button that's in the center of the scroll disk. You should now have this hand symbol.



Now, using the scroll disk, you can shift the graph based on its C value. Unfortunately, unless you are being very precise, you might start shifting the graph based on its B value which we will cover next.





We will now shift the graph based on its B value. To do this, you will not have to drop the graph. You can just

scroll left and right and it will shift the graphs B value.

