TI-*nspire*™

Investigating Parent Graphs
by – Marco A. Gonzalez

Activity overview
By using the dynamic capabilities of the Nspire handheld, students will explore the different types of parent graphs. Students will be encouraged to anticipate changes and also make predictions to the changes of different types of parent graphs.

Concepts
Graphs of linear functions and quadratic functions.

Teacher preparation
This activity is designed for use in an Algebra 2 classroom. Prior to beginning this activity, students should have prior knowledge of the different types of parent graphs being used in this lesson.

Classroom management tips
This activity is intended to be a teacher-led activity in which students will make their own discoveries pertaining to the different types of parent graphs. Students should be encouraged to make predictions of how the equation of the graphed function will change after altering the graph of the parent function.

TI-Nspire Applications
Graphs and Geometry

Step-by-step directions
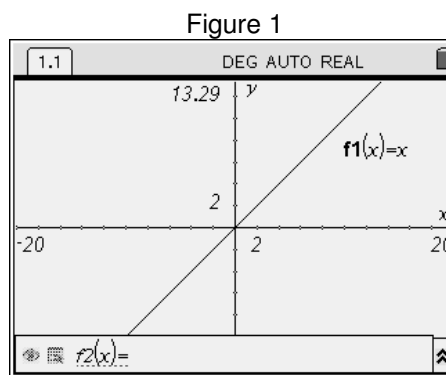The following step-by-step directions are the same as the student directions.

Parent Graph: Linear Function

Open a Graphs & Geometry Page by pressing ⌂ and scrolling to the "graphs and geometry icon or by simply pressing ②.

In the entry line, enter the function "f1(x)=x" and press ⏎ . (see figure 1)

Now, let's "change" the graph of the function. Press ⊞ to get the cursor to go from the entry line to the screen.

Move the cursor using the NavPad over the function until the entire line is "blinking". The cursor will change into "cross-arrows". Press ⊛ (click) and hold for 1.7 seconds until the function is "grabbed". Now using the NavPad, move the function up or down. Notice how the equation on the screen also changes along with every translation. (see figure 2)

Figure 1

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Grade level: 9th – 12th
Subject: Algebra 1 & 2
Time required: 45 to 90 minutes

Materials: TI-Nspire

Note to Educator: Here is where the "y-intercept" can be introduced and discussed.

Discussion Questions.

What do you notice changes when the graph of the function is translated up or down?

What do you call this "change"?

Now release the function by pressing ⓔₛ𝒸.

Move the cursor to one of the "edges" of the function. You should see the cursor change into a different type of cursor. Press ⊛ and hold for 1.7 seconds until the function is "grabbed." Now pull the graph down by using the NavPad and notice the change in the equation of the function. (see figure 3)

Note to Educator: Here is where the "slope" can be introduced and discussed.

Discussion Questions

What do you notice changes when the graph of the function is translated up or down?

What do you call this "change"?

Press ⊛ to lock the equation. Move the cursor to the function label on the screen and double click ⊛ . The entire function label should be highlighted. Using the NavPad, scroll to the very front of the equation and enter a "negative". The equation should look like this: f1(x)=-.62x+2.92 . Now press ⏎ . (see figure 4)
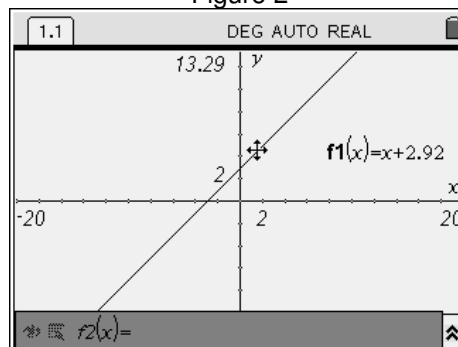
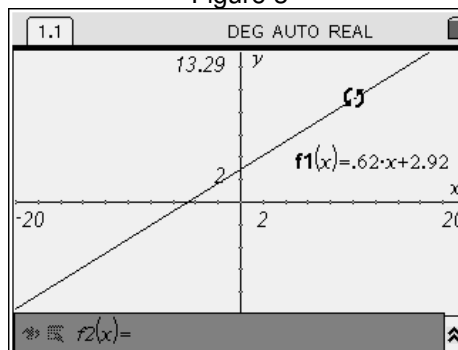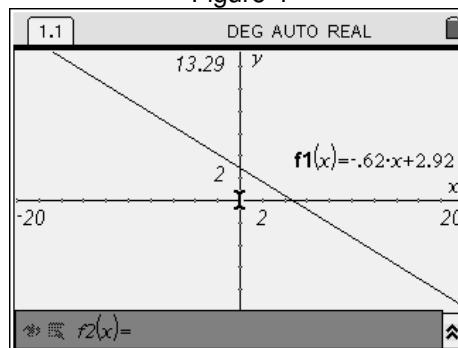What happens to the graph of the function?

Figure 2

Figure 3

Figure 4

Materials: TI-Nspire
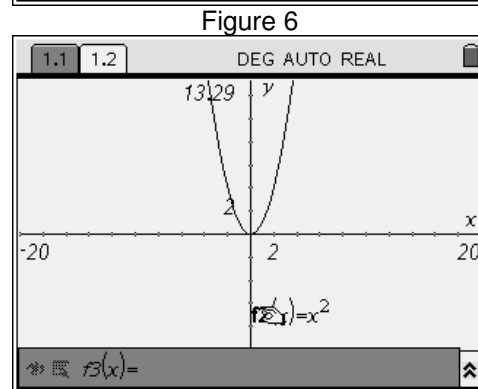
Parent Graph: Quadratic Function

Open another Graphs and Geometry Page by pressing the (on) and scrolling to the "graphs and geometry icon or by simply pressing (2). The result should be an "clean" graph and geometry page with the cursor blinking in the entry line showing "f2(x)=". Note: f1(x) is being occupied by the first graphs and geometry page.

In the entry line, enter the function "f2(x)=x^2" by pressing (x)(x²)(enter). The result should be like figure 5.
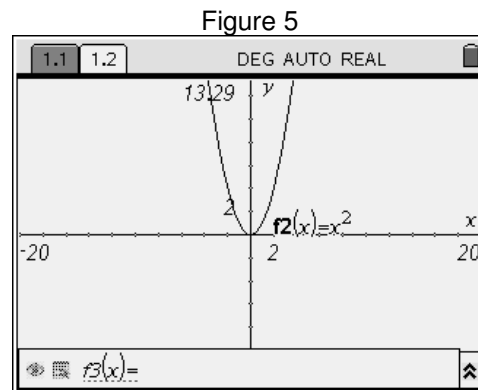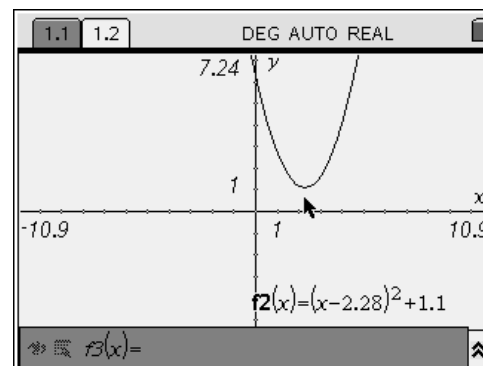
Now, let's move the label of the function to a spot in Quadrant IV where it is out of the way. To do this, we need to move the cursor to the screen. Press (tab) twice. Using the NavPad, move the cursor above the equation of the function. Click (✧) and hold for 1.7 seconds to "grab" the equation. Once the equation is "grabbed", move the equation down to a spot in quadrant IV and press (✧) to lock the equation in that spot. (see figure 6)

To be able to grab the function by the vertex, we need to alter the increments on both of the axes. Move the cursor to one of the increments on the x-axis until the axes are blinking. Click (✧) hold for 1.7 seconds until it is being "grabbed". Now, using the NavPad, drag the increments to the right until the increments change from 2 to 1.

Now move the cursor to the vertex of the quadratic function which should be at the origin. The cursor should change to some "cross-arrows". Click (✧) and hold for 1.7 seconds until the vertex is "grabbed". Move the vertex to a place in Quadrant I and press (✧) to lock the function in place. (see figure 7)

Discussion Question

Did you notice any changes when the graph of the function was translated to Quadrant I?

Let's explore that change.

We are now going to place a point on the graph of the Quadratic function. To do this, we press (menu), (6) : Points & Lines, (2) : Point On . By using the NavPad, move the cursor to the right side of the graph of the quadratic function. When the cursor is

Figure 5

Figure 6

Figure 7

Materials: TI-Nspire

above the graph of the quadratic function, the cursor should change into a pencil. Press ⊙ to place a point on the graph and then press (esc) to release this feature. A point on the graph should appear along with it's coordinate. Move the cursor above the point until it is blinking and click ⊙ and hold until the point is "grabbed". Once the point is grabbed, using the NavPad, translate the point down to the vertex of the graph. (see figure 8) Press ⊙ to lock the point at the vertex.

Discussion Questions

What do you notice about the coordinate of the vertex of the graph of the quadratic function and the equation of the quadratic function?

What does the little "m" stand for?

Now, let's move the cursor (by using the NavPad) to one of the sides of the graph of the quadratic function. The cursor should change once it is placed above one of the sides of the graph of the quadratic function. Click ⊙ and hold until the side of the graph is "grabbed". Using the NavPad, drag the sides to the right or left. (see figure 9) Press ⊙ to lock the graph in place.

Discussion Questions

What do you notice about the equation of the quadratic function?

If the number that appeared is changed to a whole number greater than 1, how will it change the graph of the quadratic function?

Now, press the (tab) once so that the cursor is once again blinking in the entry line. Press up on the NavPad to recall the equation of the quadratic function "f2(x)". Press "left" on the NavPad until the cursor is immediately to the right of the equal sign. Enter a negative by pressing ⊙. Press ⊙. (see figure 10)

Discussion Question

How did this change affect the graph of the quadratic function?

Figure 8

$$f2(x)=(x-2.28)^2+1.1$$

Figure 9

$$f2(x)=.23 \cdot (x-2.28)^2+1.1$$

Figure 10

$$f2(x)=-.23 \cdot (x-2.28)^2+1.1$$

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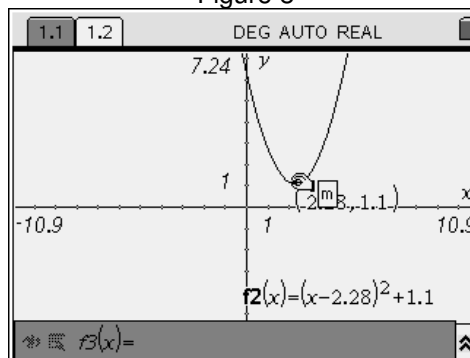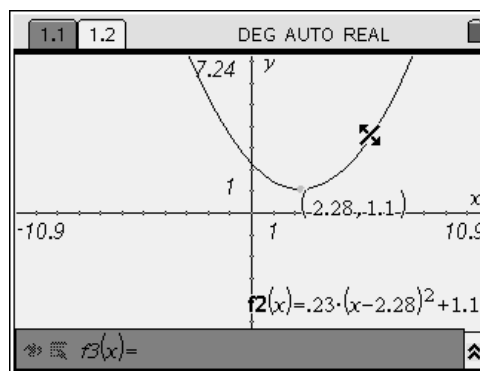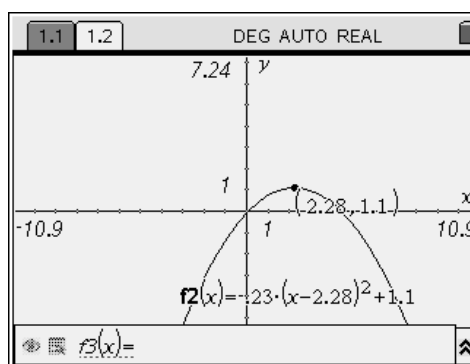
Activity extensions

- *The student should be encouraged to continue "experimenting" with the graph of the quadratic function.*
- *The student should also be encouraged to graph other types of functions (e.g.: absolute value functions, cubic functions, etc.) and experiment in the same fashion as with the quadratic function.*

Student TI-Nspire Document

Parent Graph: Linear Function

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and scrolling to the "graphs and geometry icon or
by simply pressing ②.

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Now, let's "change" the graph of the function.
Press ⓣⓐⓑ to get the cursor to go from the entry line
to the screen.

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function is translated up or down?

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Now release the function by pressing ⓔⓢⓒ.

Move the cursor to one of the "edges" of the
function. You should see the cursor change into a
different type of cursor. Press ⊛ and hold for 1.7
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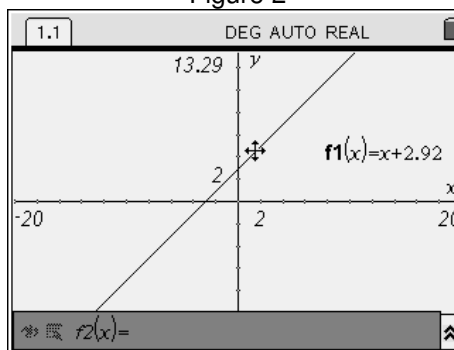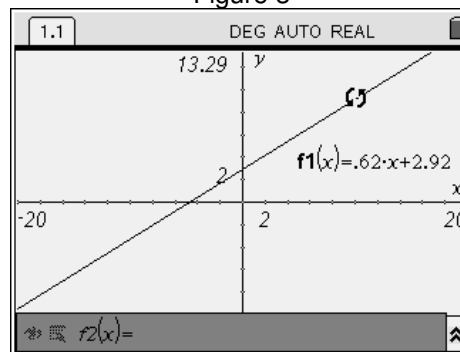
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Figure 1
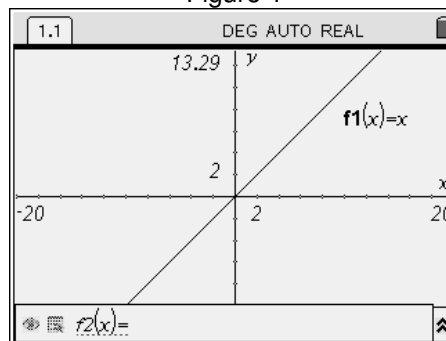
Figure 2

Figure 3

Press ⊛ to lock the equation. Move the cursor to the function label on the screen and double click ⊛ . The entire function label should be highlighted. Using the NavPad, scroll to the very front of the equation and enter a "negative". The equation should look like this: f1(x)=-.62x+2.92 . Now press ⏎ . (see figure 4)

What happens to the graph of the function?

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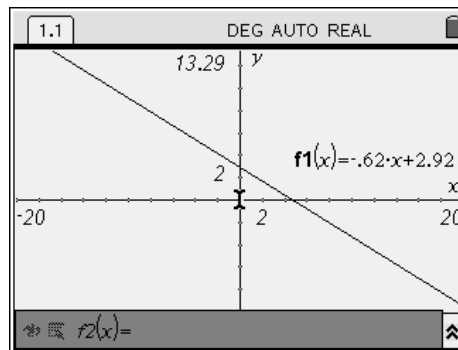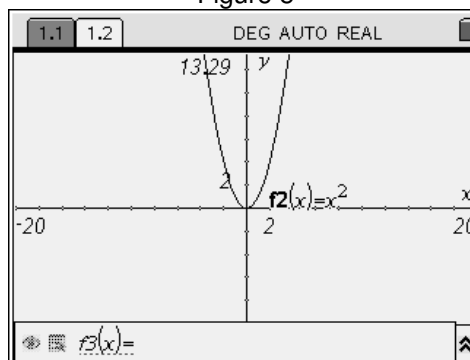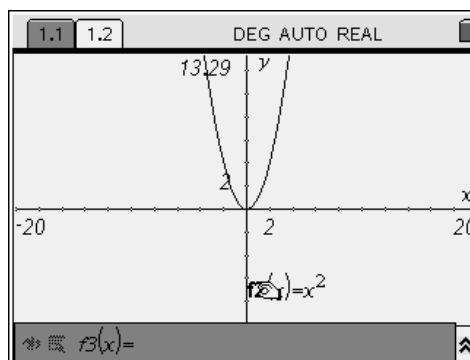
Figure 4

Figure 5

Figure 6

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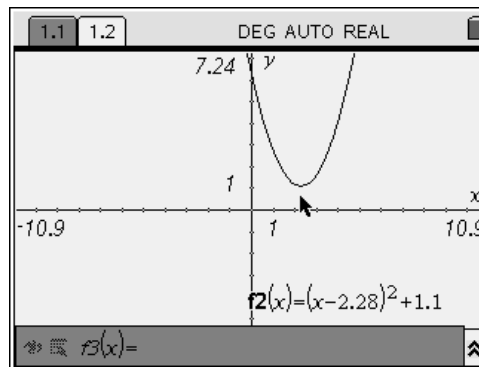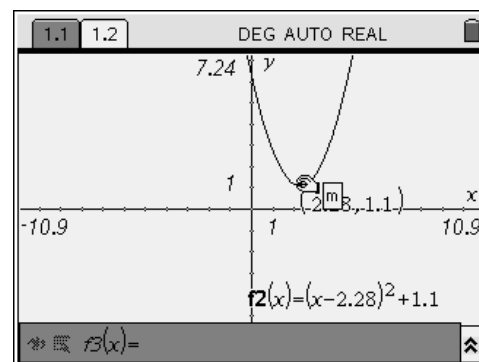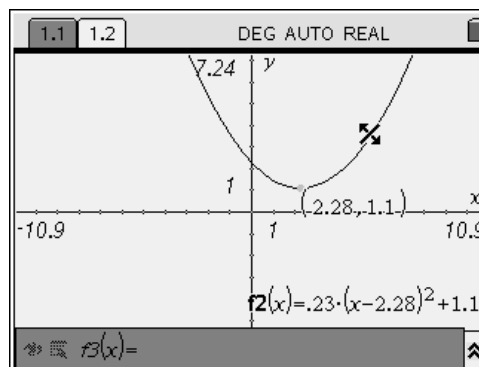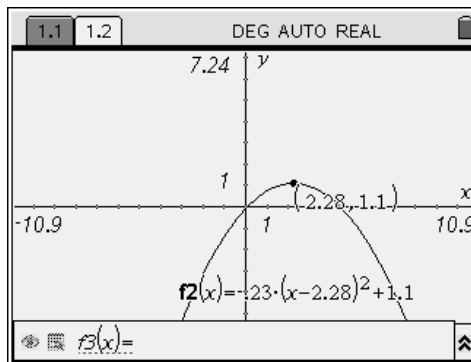
Figure 7

Figure 8

Figure 9

NavPad to recall the equation of the quadratic function "f2(x)". Press "left" on the NavPad until the cursor is immediately to the right of the equal sign. Enter a negative by pressing ⌨. Press ⏎. (see figure 10)

Figure 10

Discussion Question

How did this change affect the graph of the quadratic function?

Extensions

- Graph another type of function (absolute value function, cubic function, etc.) and "experiment" in the same fashion as with the quadratic function.
- Try to make similar connections between the graphs of the functions and their equations.