# Dynagraphs[1]

Teacher Notes

This activity uses an alternative representation to explore a variety of functions in a novel context. The basic premise is that rather than having two number lines at right-angles to each other in the traditional x- and y-axes, we make the two number lines parallel to each other:

As you drag the open dot on the input line the corresponding closed dot on the output line moves to its value. The idea is for the student to try and identify the function by exploring the properties of the function in this new context.
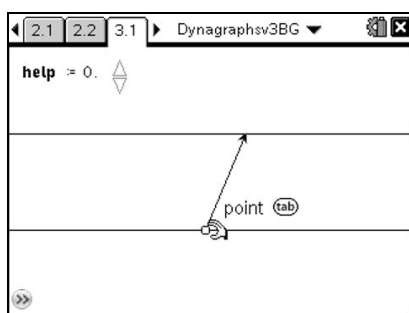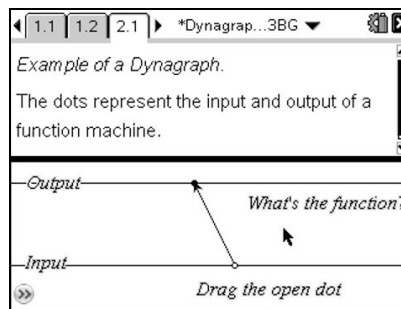
To aid the investigation there are various levels of built-in help that the student can use. Initially the two number lines give no indication of scale.

However by increasing the value of the help variable to 1, tick marks are placed on the number line.
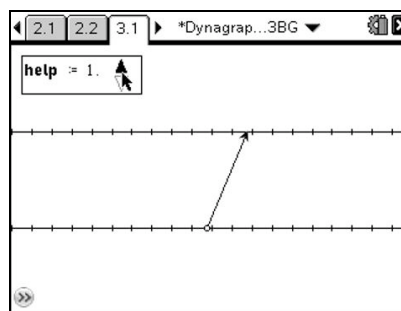
Should the students need more help then they can increase the value of the help variable again and this will add a scale to the lines.
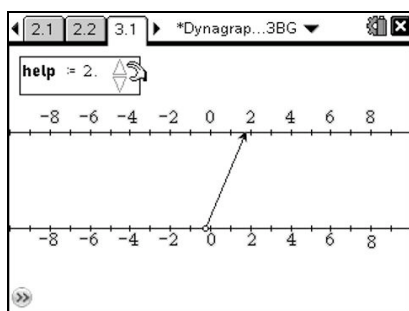
Finally, if the students are really stuck and making no progress, they can increase the level of help to 3 which will reveal what the function is.
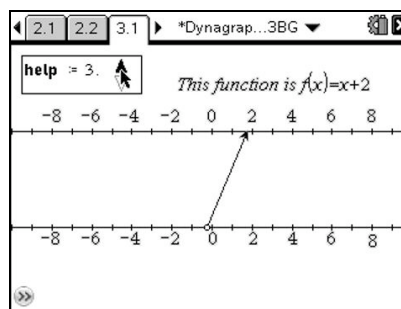
Describing the functions
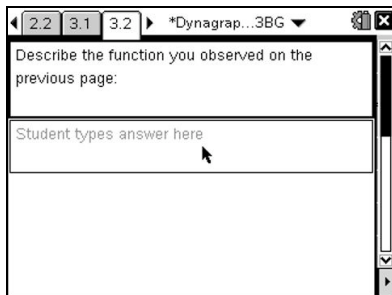
Following each function is a Question page asking students to describe the function on the previous page.

They should include a description of the properties of the function as well as its definition.

Once students have entered their answer (but only then) they can check it against the suggested answer by

pressing (menu) (2).
This will display the suggested response.
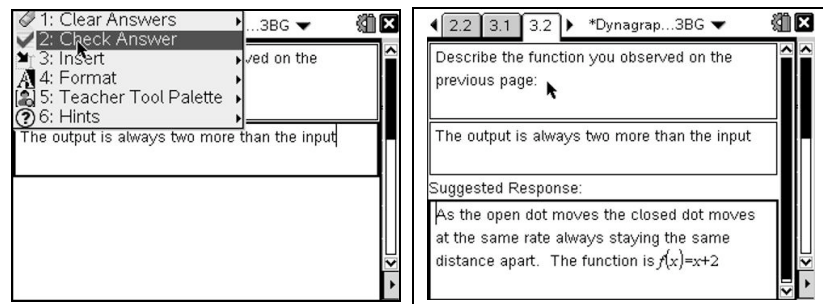
Adding extra functions

Adding your own additional functions to the activity is more easily done using the software than on the handheld.

- Insert a new problem into the document.
- Copy the graph page from a previous example, and paste it into the new problem.
- Copy the question page from the same example, and paste it into the new problem.
- Delete the blank page that the "Insert New Problem" command created.
- Go to your new graph page.
- Press Ctrl-G or click on >> to bring up the input line, press ▲ and change f1(x) to your new function.
- Press Ctrl-G to or click on << to hide the entry line.
- Change the **help** value to 3.
- Edit the text "This function is..." to reflect your new function.
- Set **help** back to 0.
- Go to the Question page, display the copied suggested response and edit it. Note the suggested response remains displayed but it will not be shown when the document is next opened.

Answers

Page 3.1	$f(x)=x+2$
Page 4.1	$f(x)=x$
Page 5.1	$f(x)=x^2$
Page 6.1	$f(x)=|x|$
Page 7.1	$f(x)=\text{round}(x)$
Page 8.1	$f(x)=2x-1$
Page 9.1	$f(x)=\sqrt{x}$
Page 10.1	$f(x)=1/x$
Page 11.1	$f(x)=2^x$
Page 12.1	$f(x)=(1/2)^x$

Credit is given to Paul Goldenberg, Philip Lewis, and James O'Keefe for originating the term "dynagraph". The relevant study is "Dynamic Representation and the Development of a Process Understanding of Functions", published by Education Development Center, Inc., supported in part by NSF. The ideas were explored further in Exploring Algebra 2 (which contains several dynagraph activities) and the authors of this book are Paul Kunkel, Steven Chanan, and Scott Steketee.