

Algebra Nomograph

ID: 8266

Time required
45 minutes

Activity Overview

This activity is similar to the idea of a function machine. This manipulative, called a **nomograph**, is comprised of two vertical number lines, input on the left and output on the right. An arrow that connects a domain entry to its range value illustrates the transformation of input to output dynamically. Students try to the rule of a hidden function by entering domain values and observing how they are transformed.

Functions & Relations

- Represent a function as a set of ordered pairs, a table of values or a scatter plot and convert among these.
- Find the domain and range of a function or relation from its defining set of ordered pairs or graph.
- Trace along the graph of a quadratic or piecewise function to determine its domain and range.

Teacher Preparation and Notes

This activity is appropriate for students in Algebra 1.

- Prerequisites are: an introduction to functions (including the terms domain and range), function notation (“y=” and “f(x)=”), and some experience graphing linear functions using slope and y-intercept. It is important that the model be demonstrated to students prior to them exploring the .tns file on their own. (Perhaps work through Problem 1 as a class.)
- This activity is designed to have students explore **individually and in pairs**. However, an alternate approach would be to use the activity in a whole-class format. By using the computer software and the questions found on the student worksheet, you can lead an interactive class discussion on functions and their inverses.
- User-input nomographs are implemented on a split-screen. Graphs & Geometry on the left and Notes on the right. In the Graphs & Geometry work areas, instruct students that they are **not** to unhide the Entry Line.
- 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 “8266” in the keyword search box.**

Associated Materials

- AlgebraNomograph_Student.doc
- AlgebraNomograph.tns
- AlgebraNomograph_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.

- Function or Not a Function (TI-Nspire technology) — 11972
- Function Notation (TI-Nspire technology) — 11971

A nomograph is similar to a function machine in that it relates a number from one set (the domain) to a number in a second set (the range). Each set of numbers is represented in a pair of vertical number lines; the domain is on the left, and the range is on the right. According to the function rule, an element of the domain is mapped to its corresponding range element, and an arrow depicts this mapping.

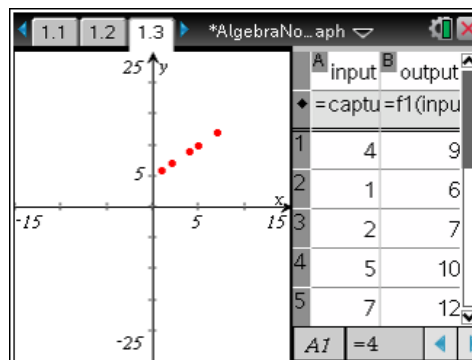
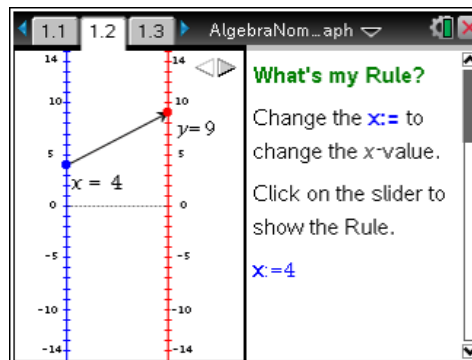
Problem 1 – “What’s my Rule?”

The first several problems are “What’s my Rule?” activities. Input values are entered, one at a time, into x:= value in the notes page on the right. The nomograph displays the input and its corresponding output, and both values are recorded in a separate spreadsheet. By repeatedly entering different inputs, the student should be able to discover the function’s rule.

For example, in working with this nomograph of Problem 1, entering domain values 1, 2, 5, and 7 one at a time would yield the respective range values 6, 7, 10, and 12, and the rule $f(x) = x + 5$ should be found.

Solutions

- Sample ordered pairs: (1, 6), (2, 7), (5, 10) and (7, 12)
- $f1(x) = x + 5$
- Sample scatter plot shown at right.



TI-Nspire Navigator Opportunity: Screen Capture

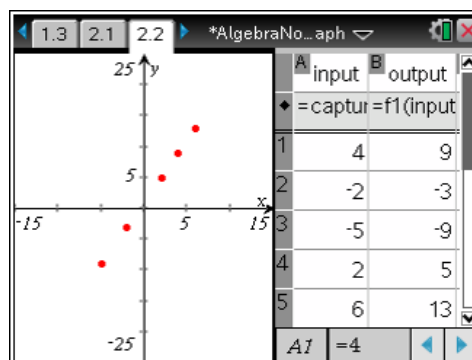
See Note 1 at the end of this lesson.

Problem 2 – More “What’s my Rule?”

This nomograph follows a different rule than the nomograph from Problem 1. Students are guided through the same steps to determine the rule.

Solutions

- $f1(x) = 2x + 1$
- Slope: 2
- Possible answer: The arrows are spread out and are not parallel.

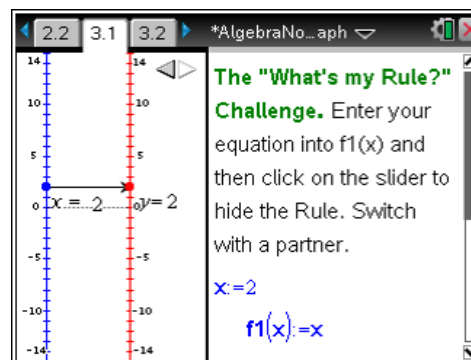


TI-Nspire Navigator Opportunity: Quick Poll

See Note 2 at the end of this lesson.

Problem 3 – The “What’s my Rule?” Challenge

Instruct students to create their own functions of the form $y = ax + b$ (where a and b are integers). Each student should use the *Notes* work area on page 3.1 and redefine $f1$ to their own function by clicking into the $f1:=x$ and changing the function. Students should then hide the function and exchange handhelds with a partner. It is the partner’s task to use the nomograph and the graph on page 3.2 to identify the mystery function. Encourage students to repeat this activity several times.



Solutions

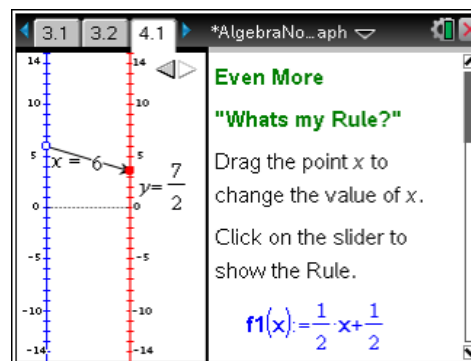
- Functions will vary.

TI-Nspire Navigator Opportunity: Screen Capture

See Note 3 at the end of this lesson.

Problem 4 – Even more “What’s my Rule?”

The next two problems are additional examples of “What’s my Rule?” activities, except that the input is now controlled by dragging the point on the domain, rather than entering a value into a spreadsheet. Students will need to record the ordered pairs obtained by dragging the point in order to determine the rule for the function.



Solutions

- Sample ordered pairs: (12, 6.5), (10, 5.5), (8, 4.5), (4, 2.5), (-2, -0.5), and (-6, -2.5)
- $y = \frac{1}{2}(x + 1)$ or $y = \frac{x + 1}{2}$ or $y = \frac{1}{2}x + \frac{1}{2}$

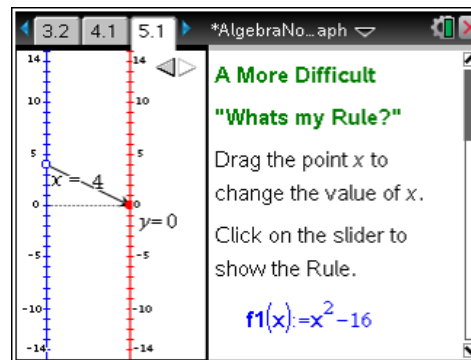
TI-Nspire Navigator Opportunity: Quick Poll

See Note 4 at the end of this lesson.

Problem 5 – A more difficult “What’s my Rule?”

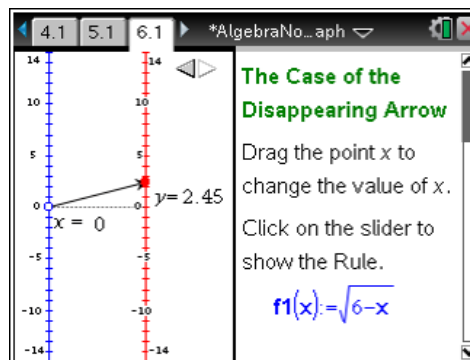
Solutions

- Sample ordered pairs: (6, 20), (4, 0), (2, -12), (0, -16), (-2, -12), (4, 0)
- $y = x^2 - 16$



Extension: Problem 6 – The case of the disappearing arrow

The nomograph on page 6.1 displays a function with restricted domain: $f(x) = \sqrt{6-x}$. As students drag the point through x values that are not in the domain, the function arrow disappears. Students are asked to explain when and why this happens for this specific function. To avoid confusion, make sure the arrow is visible when students first open the file (that is, $x \leq 6$).

**Solutions**

- $x > 6$
- Possible answer: The square root of a negative number is undefined.

TI-Nspire Navigator Opportunities**Note 1****Problem 1, Screen Capture**

This would be a good place to do a screen capture to verify students are entering values into the $x:=$ and observing the graph of the scatter plot on page 1.3.

Note 2**Problem 2, Quick Poll**

You may choose to use Quick Poll to assess student understanding. The worksheet questions can be used as a guide for possible questions to ask.

Note 3**Problem 3, Screen Capture**

This would be a good place to do a screen capture to verify students are trading with their partners and hiding the rule before passing to their partner.

Note 4**Problem 4, Quick Poll**

You may choose to use Quick Poll to assess student understanding. The worksheet questions can be used as a guide for possible questions to ask.