



In this activity, you will investigate the behavior of functions defined with square root functions, or radicals. You will be using a special type of graph called a **nomograph** that shows function input and output pairs on parallel axes.

Listen as your teacher explains how the model of the nomograph works. Then open the file **NOMORAD** program on your graphing calculator.



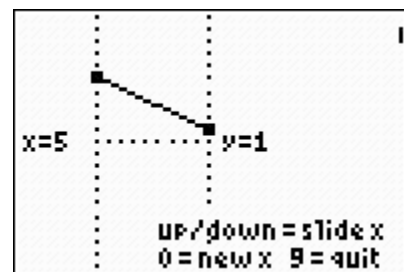
Introduction

A **nomograph** is similar to a function machine in that it relates a number in one set (the *domain*) to a number in a second set (the *range*). The nomograph takes the form of a pair of vertical number lines; the one on the left represents the domain; the one on the right represents the range. The function rule mapping an element in the domain to its corresponding element in the range is shown by an arrow.

Problem 1 – Domain of a Simple Radical Function

Run the **NOMORAD** program and select **1:RadFunction** from the main menu. In this section of the program, you can investigate $f(x) = \sqrt{x - 4}$.

The program asks for an input value to start. Type **5** and press **ENTER**. The input to the radical function $f(x) = \sqrt{x - 4}$ is the coordinate of a point on the x -axis on the left. The function output is shown as the coordinate of a point on the y -axis to the right.



Press **0** and you will be prompted to enter another input value. To exit the nomograph, press **9**.

1. Enter the following values for x and record the outputs:

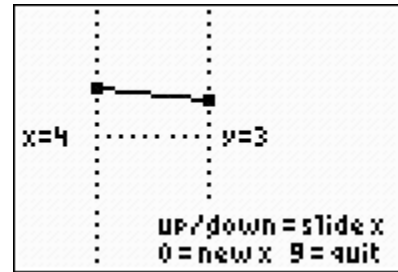
Input	4	6	8	13	20	29
Output						

You can also press the up and down arrows to increase and decrease the input value by 0.1. Move the point until the line connecting the input to the output disappears.

2. Near what value of x does the ray disappear?
3. Why do you think the ray vanishes?
4. What is the domain of the function $f(x) = \sqrt{x - 4}$?

Problem 2 – Guess the Radical

Return to the main menu and choose **2:GuessTheRad**. In this section of the program, there is a different radical function defined. Using the questions below as a guide, determine the formula for the function that maps the inputs and outputs.



5. At what value of x does the ray vanish?

6. Determine the value of x (the input) that makes the value of $f(x)$ (the output) equal to each number below:

Input	→	Output
-4	→	_____
-1	→	_____
4	→	_____

7. This function rule involves a square root. What is the rule?
 $f(x) =$ _____

8. What is the domain of the function defined in this problem?

9. Define a radical function with each of these domains:

a. $\{x|x \geq 10\}$
 $g(x) =$ _____

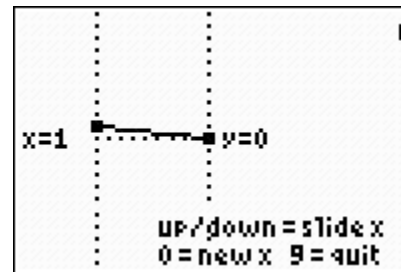
b. $\{x|x \geq 13\}$
 $h(x) =$ _____

c. $\{x|x \leq 29\}$
 $j(x) =$ _____

d. $\{x|x < 10\}$ (Hint: Think fractions.)
 $k(x) =$ _____

Problem 3 – A More Complicated Radical

Return to the main menu and choose the **AnotherRad** option. In this section of the program, you will investigate the radical function $f(x) = \sqrt{(x-1)(x+4)}$.



10. Enter the following values for x in the spreadsheet on page 3.2, and record the outputs. If there is no output, write “does not exist.”

Input	Output
1	→ _____
-4	→ _____
5	→ _____
-8	→ _____
-2	→ _____

11. There are two inputs at which the arrow disappears or reappears. What are they?

12. a. Is the function defined for the values of x you listed for Exercise 11?

b. If so, what are their outputs? If not, explain why.

13. What is the domain of the function $f(x) = \sqrt{(x-1)(x+4)}$?



Extension – Connection to Cartesian Graphs

As you investigate these radical functions, the calculator stores the outputs in lists. Return to the main menu and choose the **ClearData** option to clear out the inputs and outputs from the work you have done so far. Then return to the **RadFunction** section of the program. Enter 10–15 different valid inputs (from the domain of the function), then exit the program.

Press $\text{\textcircled{0}}$ then **1** to enter the **ListEditor**. You should see that data you collect in **L1** and **L2**. Graph this data as a scatter plot.

14. Why are there no points in the scatter plot with an x -coordinate less than 4?

15. Why are there no points in the scatter plot with a y -coordinate less than 0?

16. Enter the function $f(x) = \sqrt{x-4}$ in **Y1**. View the graph. What do you notice?

