# Patterns to Graphs
# Teacher Notes

## Introduction

The aim of this activity is to allow students to experience the connection between a numerical relationship (number pattern) and its graphical representation. Students are encouraged to 'spot the hidden rule' and to express it algebraically. They can then self-check their answer by plotting the 'rule' as a function.

In addition, by classifying their results at the end of the lesson and looking for similarities in the functions, students can identify the effects of the different parameters on the function.

## Resources

Students will need a copy of the TI-Nspire document entitled PatternsToGraphs transferred onto their handhelds.

There is also an 8-page student worksheet entitled PatternsToGraphsWorksheet, a copy of which is needed for each student.

## Length of time required (approx)

The core part of the activity (Problems 1-10), including teacher demonstration and whole class plenary, could take approximately 1½-2 hours. There are also 4 optional extension problems.

## Skills required

To undertake this activity, students will need to be able to:

- open a TI-Nspire document and move between the pages of the document;
- move the cursor around the screen;
- increase/decrease a variable using a minimised slider.

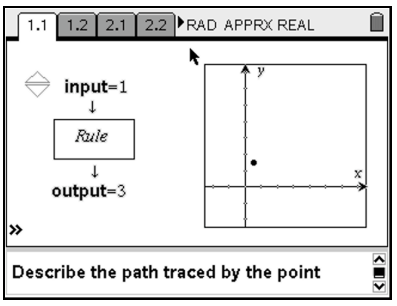
## The activity

The TI-Nspire document PatternsToGraphs contains 14 student problems, each of two pages in length. Problem 15 could be used by the teacher for demonstration purposes, possibly prior to the student activity.

The first page of each problem shows a vertical number/function machine with a hidden rule.

The input value is a discrete variable which is changed by clicking on the up/down arrows of the slider. As the input value changes, the output value is automatically updated.

In addition, a point is plotted on the grid on the right-hand side of the page. As students change the value of the input variable, the point appears to move.



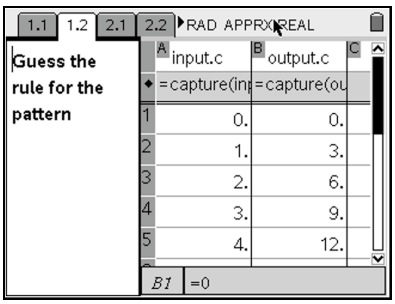
As the input value is changed, students are asked to draw a plot of the points on their worksheets.

They are then asked to explain, in words, the type of path traced by the points.

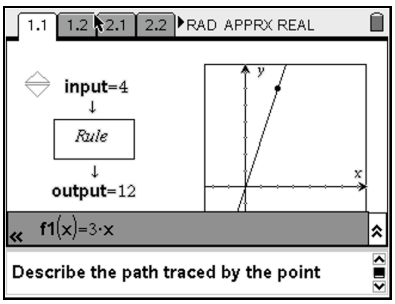
- Is it linear or non-linear?
- Does it go uphill (from left to right) or downhill?
- Does it cut the y-axis above or below the origin?
- Does it pass through the origin?

Students are then asked to guess the hidden rule (initially in words) and then to express the rule algebraically in terms of x (the input value) and note them on their worksheet.

If necessary, they can move to the second page of the problem where the input and output data have been automatically captured to help identify the hidden rule.




Students are then asked to go back to the first page of the problem and to check their rule by inputting it as a function. They will need to click on the **>>** symbol near the bottom left of the page to bring up the graph entry line. They can then enter their function and press (enter). The function will automatically be drawn onto the grid and, if correct, as the student changes the value of the input variable, the point should move along the function.




The first ten problems demonstrate linear relationships of increasing complexity.

Once students have completed the problems, they are asked to classify the equations of their functions into the categories on the last page of the worksheet. They are then asked to note the similarities between the equations for each category, eg. under the category 'Uphill, linear', the equations from Problems 1-6 would be listed and the similarity between these equations (eg. 'all these equations have a positive number before the x-variable') would be noted.

1. $f1(x) = 3x$
2. $f1(x) = x + 2$
3. $f1(x) = 0.5x$
4. $f1(x) = 2x + 3$
5. $f1(x) = 3x - 2$
6. $f1(x) = \frac{1}{2}x - 3$
7. $f1(x) = -x$
8. $f1(x) = -x + 4$
9. $f1(x) = -2x$
10. $f1(x) = -3x + 8$

The remaining four problems demonstrate non-linear relationships and could be used as an extension exercise.

11. $f1(x) = x^2$
12. $f1(x) = x^2 - 3$
13. $f1(x) = 2^x$
14. $f1(x) = \frac{10}{x}$