STRAIGHT-LINE GRAPHS
Teacher Notes

References

Foundation	-
Foundation Plus	A1.5 Equations of straight lines
Higher	A1.1 Straight-line graphs
Higher Plus	A2.3 Straight-line graphs

Introduction

This TI-Nspire activity introduces students to the connection between linear equations and straight-line graphs. They begin by revising how, using a linear equation, values of y are calculated for particular values of x and how these values when plotted on coordinate axes form points that always lie on a straight line. Moving from discrete to continuous values of x, students are asked first to visualise straight lines and then to draw them by entering functions.
There is then an investigation of the effect on the graph of changing the values of m and c in the equation y=mx+c. In a final section, students reinforce their understanding by moving a straight line around and seeing the automatically produced linear equation.

Resources

The TI-Nspire document ***StraightLines.tns*** is designed primarily for use by students using handhelds, but it can also be demonstrated on a screen using the TI-Nspire Navigator System, which also makes it easy to compare and discuss students' different results.

There is a 3-page handout for students, which guides their use of the TI-Nspire document.

TI-Nspire skills students will need

Transferring a document to the handheld.
Opening a document on the handheld.
Moving from one page of a document to another.
Grabbing and dragging points.

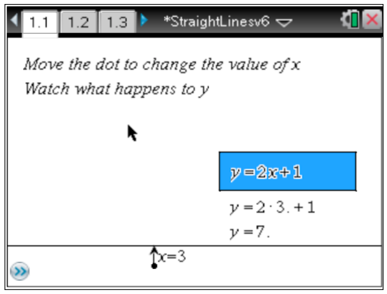
The activity

The student handout takes students step-by-step through the activity using the 19 pages of the TI-Nspire document. The numbered sections in the handout and in the notes for teachers below relate to the pages of that TI-Nspire document.

1.1 Moving x and calculating y

Students start by moving in unit steps along a horizontal number line.

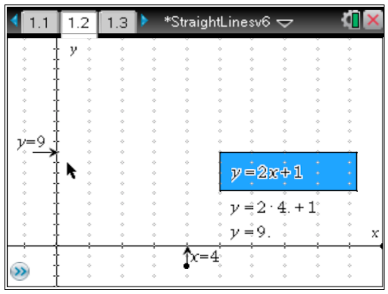
It is worth stressing that, as the x-value changes, the steps in the calculation of y also change.



Although not mentioned in the student notes, it is possible to change the equation here. Move the cursor over either of the numbers in the blue rectangle. Press enter enter del enter a new number and press enter again.

1.2 Using some axes

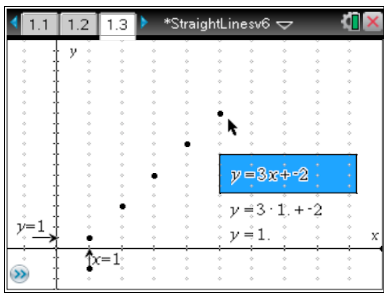
On this page the y-value is also marked on the vertical axis. This may seem a small step forward, but for any students meeting this idea for the first time it can be a big conceptual leap.

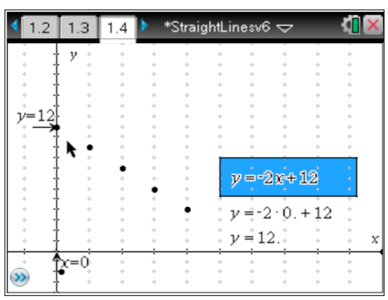


The student notes give instructions for plotting the points. However, an alternative approach is to ask students to imagine or visualise these points as the x values change

1.3 Change the equation

Two more equations on pages 1.3 and 1.4 provide practice with plotting points and allow students to compare the patterns of dots formed. Students are able to move back to the previous pages for help to make these comparisons.



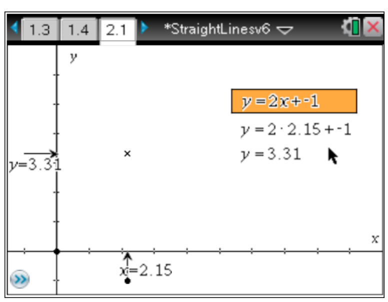


Note that if the equations on any page are changed as described above, any plotted points will remain plotted. To remove them, position the cursor and press enter del.

2.1 Sliding along the axis

The important difference here is that the x-values are able to change continuously, rather than in integer steps.

This means that rather than a series of discrete points we are able to talk about a continuous line of points.

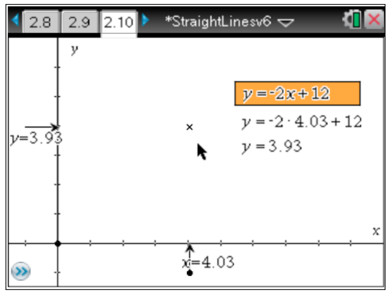


Asking students to imagine the line traced out by the plotted point, now marked with a cross, is an important prelude to drawing that line.

2.2 Imagining more lines

A variety of equations using positive and negative numbers for m and c provide plenty of practice of visualising the associated straight lines.

Again you may wish to let students see the effect of changing some of the equations. The procedure for doing this is described above (section 1.1)



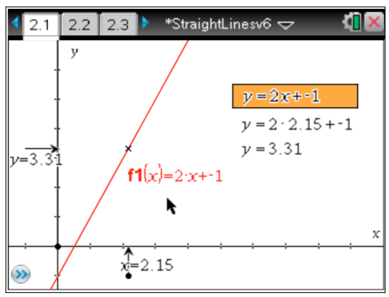
The equations used are:

- 2.1 $y = 2x + {}^{-}1$
- 2.2 $y = 3x + {}^{-}1$
- 2.3 $y = 1x + 1$
- 2.4 $y = 0x + 2$
- 2.5 $y = {}^{-}1x + 6$
- 2.6 $y = {}^{-}1x + 3$
- 2.7 $y = 2x + 2.5$
- 2.8 $y = 0.5x + 1$
- 2.9 $y = 1.5x + {}^{-}2$
- 2.10 $y = {}^{-}2x + 12$

2.3 Drawing the lines

Students use the Entry Line to superimpose the graph of each function.

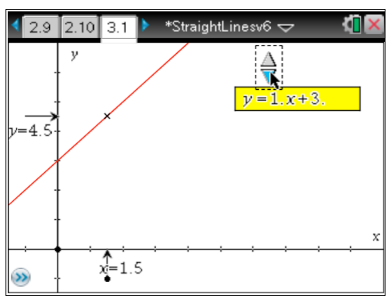
Notice this is the first use of the words: “the graph of the function”.



There is no mention in the student notes to explain the use of the alternative functional form f(x)=mx+c of the equation y=mx+c.

3.1 The gradient of the graph

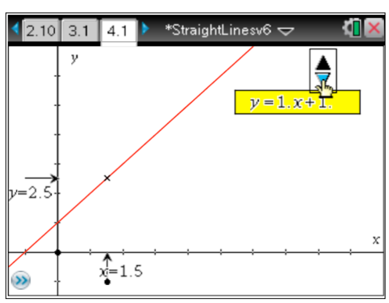
The slider makes it easy to change the value of m, the coefficient of x in the equation.



Students should notice that as m is decreased the graph gets lets steep i.e. its gradient decreases.

4.1 The intercept on the y-axis

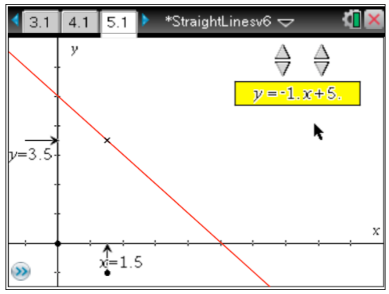
A different slider is used to change c, the constant term in the function. As c is increased the graph cuts the y-axis higher up and the intercept is at y=c.



It is possible to change the range and steps of the slider by pressing ctrl menu 1.

5.1 From function to graph

Page 5.1 offers students the chance to use both sliders, changing both the gradient of the graph and its intercept on the y-axis.



You could challenge students to plot a point such as (5,5) and find different functions whose graphs pass through it.

Or they could plot two points and try to form the line passing through them both.

6.1 From graph to function

The final page, 6.1, allows students to change a graph by dragging either of the two white-centred points and to see the effect on the function.