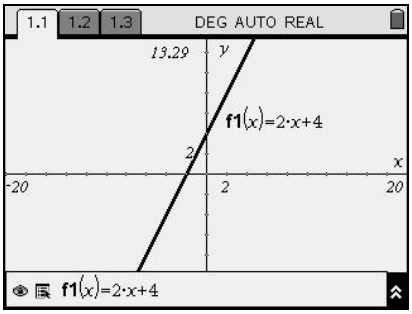
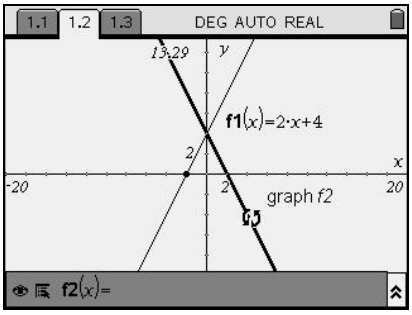
Grabbing and dragging functions - Combining approaches from algebra and geometry

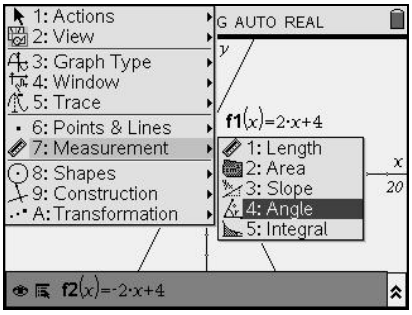
Once Cathy had seen that she could combine ideas and approaches from algebra and geometry on a Graphs and Geometry page, she came up with an innovative new approach to allow her students to explore the relationship between the gradients of linear functions where the lines intersect perpendicularly. This used an innovative feature of TI-Nspire – the ability to create a function from its equation and then drag it (by rotating or translating) and observe how its equation changes. Cathy had previously taught some work on gradients and intercepts of straight line graphs to this class and, as she wasn't sure how much the students would recall from this work, she decided to develop an activity which would allow students to revisit this topic whilst also providing them with an opportunity to explore the relationship between the gradients of lines which are perpendicular to each other.



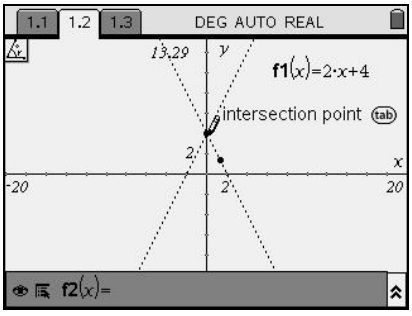
Cathy started with a blank Graphs and Geometry page and asked her students to generate a linear function by entering in its equation on the entry line at the bottom of the screen as shown. The students had to learn to use the (tab) key to move between the Graph screen and the entry line and were not put off by the function notation syntax f1(x).



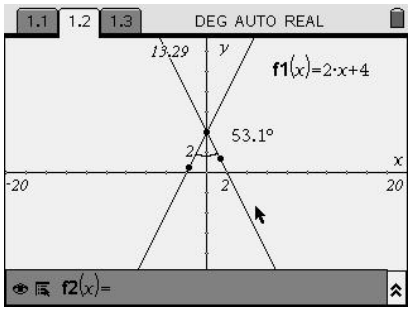
The students were asked to guess the function of a second line that would cross their initial line at right angles and enter this in a similar way to before as f2(x).



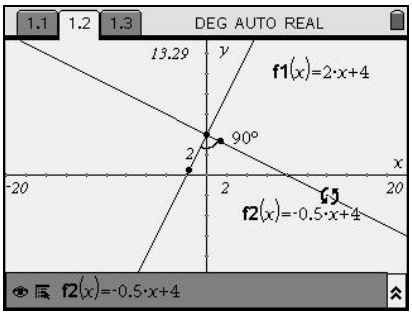
Cathy then showed the students how to check how accurate they were by measuring the angle between their two lines using the Measurement tool accessed from the (menu) key.



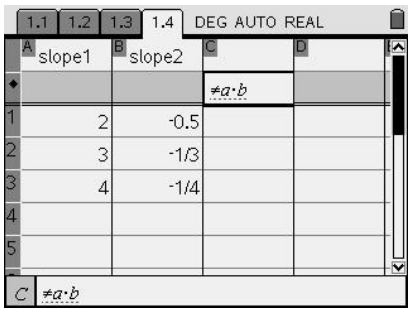
The students were shown how to measure the angle by pressing the (?) key and selecting a point on the first line, followed by the intersection point of the two lines and a point on the second line.



The angle then appears on the screen.



They were then shown how to move their pointer to one end of this new line and, when the pointer changed to ↕, grab the line by pressing ctrl and ⬚ and use the NavPad to drag the line until was as near to 90° as was possible.
Finally Cathy asked the students to "notice" the equation of the second line.



Some students inserted a Spreadsheet page and entered the values of the slopes of the pairs of lines they had explored into two lists. They could then explore the relationship between the numbers.

After the lesson Cathy commented particularly about the way that her students had worked during this lesson - all of the students drew various graphs on the handhelds and discussed their findings with each other, most were able to verbalise their findings and some were able then able to write down rules and explanations with little support (all pupils did this with some support). Cathy also said that her students really appreciated the ability to move the line on the screen and then be told the equation of the new line. What is particularly interesting about this lesson approach is the way in which the technology enabled to the students to connect the algebraic and geometric ideas to support them to generalise from what they were experiencing and observing. The dynamic nature of the task also meant that many more cases could be examined and this supported the students to make and test their conjectures in a mathematically engaging way.