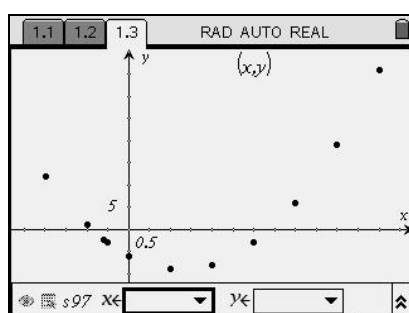


Exploiting multiple representations - Solving quadratics

When it came to teaching a trial and improvement approach to the solving of quadratic equations to her year 11 group, Cathy has previously taught this by encouraging the students to record the results in a table whilst they substituted values of x into any given function. However, she often felt that difficulties with substitution (particularly negative numbers) and following an instrumental approach meant that the students did not seem to make the connections between what they were doing and what this meant graphically. She decided to use the multiple representations within TI-Nspire to try to bring these two experiences together.

$f(x)$	Value
$f(x) := 2 \cdot x^2 - 5 \cdot x - 6$	Done
$f(1)$	-9
$f(2)$	-8
$f(3)$	-3

A	B	C	D
x	y		
	$= 2 \cdot a [] ^ 2 - 5 \cdot a [] - 6$		
1	-2	12	
2	-1	1	
3	0	-6	
4	-0.5	-3.	
5	-0.6	-2.28	



Initially she introduced her students to function notation within a new Calculator page. They defined a quadratic function and substituted some values to evaluate the function and make sense of what TI-Nspire was doing. They continued to substitute decimal and fractional values for x and discussed what the “answers” meant. Cathy spent time discussing with students the concept that the “solution” of an equation was the value of x when the equation was equal to zero.

Cathy showed the students how to set up the spreadsheet such that, for any value typed into column A, the equivalent value of the function would be automatically calculated in column B. (To do this, the students typed \ominus $\langle 2 \rangle$ $\langle \text{A} \rangle$ $\langle \wedge \rangle$ $\langle 2 \rangle$ \ominus $\langle 5 \rangle$ $\langle \text{A} \rangle$ \ominus $\langle 6 \rangle$ into the cell shown opposite. The students defined column A as x and column B as y which allows the variables x and y to be used anywhere in the TI-Nspire file.

In the final stage, Cathy asked the students to add a new Graphs and Geometry page and, by pressing $\langle \text{ctrl} \rangle$ $\langle \text{menu} \rangle$, selecting a Scatter plot. Pressing $\langle \text{ctrl} \rangle$ $\langle \text{enter} \rangle$ enabled the students to assign the variable x to be plotted on the x -axis and similarly the variable y to be plotted on the y -axis. This produced a graph of all the data the students had generated in the spreadsheet. As new data was generated, so the graph would continue to be updated.

After the lesson, Cathy concluded that she would use this approach again as it seemed to really link the idea of the graphical solution with the process of trial and improvement – something that she had not been able to do easily previously. She could also see a way of bringing in the factorised form for a quadratic as it would be possible to superimpose functions of the form $f(x) = (x - x_1)(x - x_2)$ where x_1 and x_2 are the solutions found from the trial and improvement strategy.