

# Linear, Quadratic and Cubic Function Explorer

## Teacher Notes

### Introduction

The aim of this .tns file is to provide an environment in which students can explore all aspects of linear, quadratic and cubic functions, their graphs and their equivalent algebraic representations.

Students will be able to dynamically alter any of the functions by moving coordinate points that are the basis for each function, and see how the algebraic form of the function changes accordingly, whether it is in expanded form, factorised form or homogeneous form. In addition, they can plot distinct points on the axes to verify whether they lie on the function, or not.

### Resources

Please refer to the end of these Teacher notes for ideas on how this .tns file can be used to introduce and develop students' understanding of functions, their graphs, the algebra and how they link to the coordinate system.

### Skills required

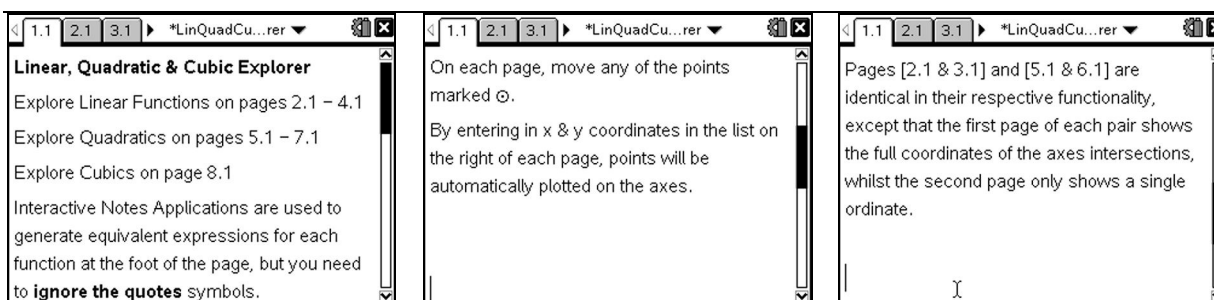
Using a Clickpad, students need to be able to move between pages, grab and release points and use CTRL+TAB to move between different applications on the same page.

Using a Touchpad, students need to be able to move between pages, and grab and release points.

Depending on the tasks set by the teacher, students may also need an interest to discover new situations on their own, checking their understanding as they go.

### The activity

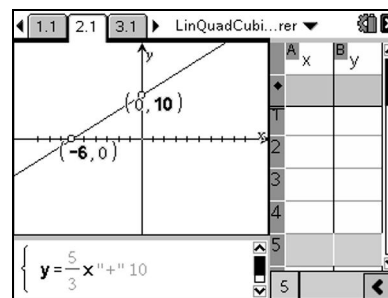
#### Linear Functions (pages 2.1 to 4.1)



Every page of this .tns file has the same three part layout:

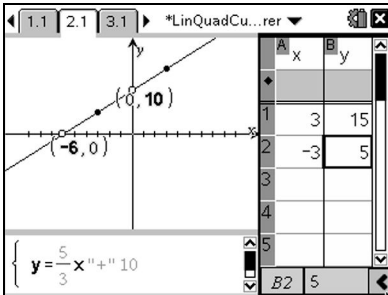
- (1) A graph, with multiple points which can be grabbed.
- (2) A list of (x,y) coordinates to be plotted
- (3) An algebraic expression of the graphed function. This is contained in an Interactive Notes Application at the foot of the screen.

The scroll bar of this Notes Application allows the student to view different, equivalent algebraic expressions, one at a time.

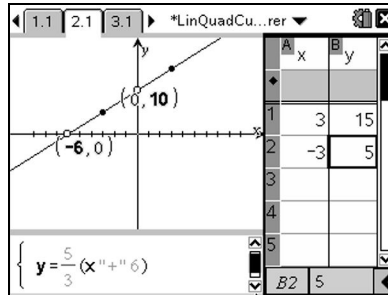


The three screenshots below exemplify the range of different expressions available.

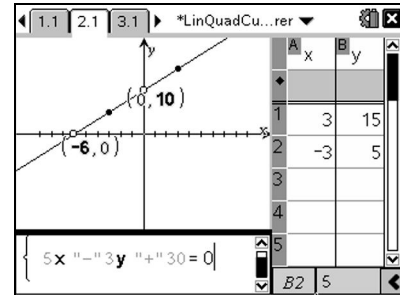
**Note:** In OS2.1, the Notes Application does not allow for suppression of the quotes symbol, so students will need to ignore them. For example,  $y=3x"+"7$  needs to be read as  $y=3x+7$ . Future OS releases are expected to address this matter.



' $y=mx+c$ ' format



factorised format

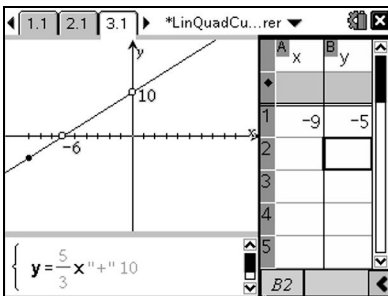


' $ax+by+c=0$ ' format

**Note:** Advise your students **not** to click on the actual algebraic formula. Doing so will allow them to edit the expression, and possibly corrupt the code that's there. They should **only** click on the window's small scroll bar, on the right.

If students do click on the algebra, then use / ⌫ (undo) to rectify the situation.

You can also see that the points (3,15) and (-3,5) have been plotted, by simply entering in the coordinates in the lists.



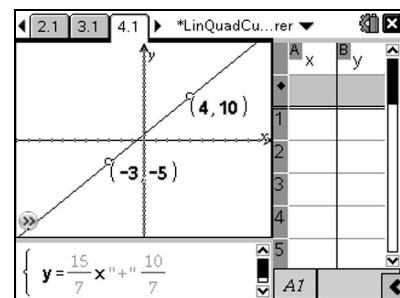
Page 3.1 is identical in functionality to page 2.1. The only difference is that the axes intercepts do not have the full coordinates displayed.

So, instead of (-6,0), just -6 is shown.

This leads to a less cluttered display, but at the price of not emphasising the values of both x and y coordinates at each point. The teacher or the student will need to decide which display format they prefer to use.

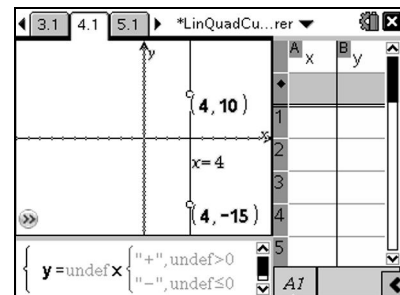
Page 2.1 & 3.1 also constrain the moveable points to finite sections of each axis. Furthermore, a vertical line on the y-axis cannot be formed.

Page 4.1 allows the student to freely move two coordinates anywhere on the plane, and not be restricted to either axis.

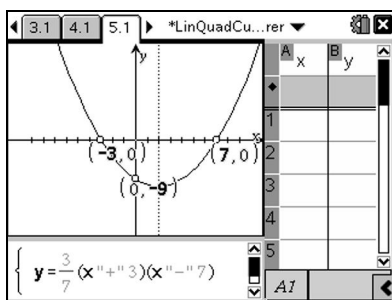


This extra flexibility then permits vertical lines to be formed (see right)

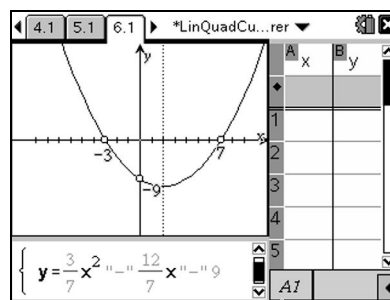
In this situation, whilst the Notes Application displays an undefined function, a new label will appear between the two points, displaying the correct equation of the vertical line.



Quadratic Functions (pages 5.1 to 8.1)

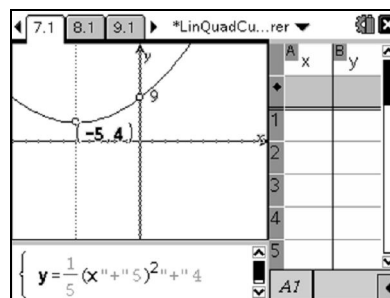


Pages 5.1 (left) and 6.1 (right) have the same functionality, with the only difference being the visual labelling of the axes' intercepts.



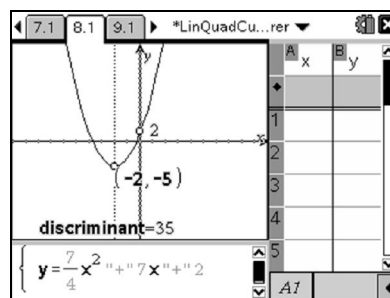
Pages 5.1 & 6.1 allow the student to move the zeros of the function, and its y-intercept.

Page 7.1 allows the student to move the turning point of the function, and its y-intercept.

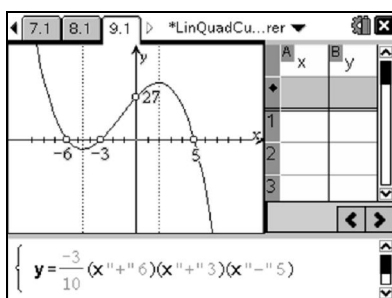


Page 8.1 is the same as 7.1, with the addition of the display of the value of the discriminant.

On all pages, factorised and expanded algebraic expressions can be viewed using the Notes Application scroll bar.



Cubic Functions (page 9.1)



Cubic functions can be explored by controlling the locations of the zeros and their y-intercepts.

Both factorised and expanded algebraic expressions can be viewed using the Notes Application scroll bar.

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