What's my line?

Teacher Notes and Answers

7   8   **9   10   11**   12

Introduction

This activity, designed to be conducted as a 'whole class' activity, requires the teacher to program TI-Nspire CAS to generate a random line from a predefined family of lines. Students are then asked to determine the equation of that randomly generated graph. It requires an IWB or data projector so that students may easily view the calculator screen (i.e. via TI-Nspire CAS software). There is a student worksheet in which students can record their answers.

Making the game file

The template is designed to support a 'line-guessing' game, for use with students from Years 9-11. It makes use of only 5 commands. The first four commands initialise the game, and the fifth command generates and stores a random line.

[Note: the screens shown have been taken using the TI-Nspire CAS Teacher Software, which best displays the needed information for the game].

To create the game template file using the TI-Nspire CAS :

- Press ⌂ **> New Document**, and then select **Add Calculator**.
- Type the command **a:={−3,−2,−1,-1/2,1/2,1,2,3}** and then press ⏎
- Type the command **b:={−3,−2,−1,0,1,2,3}** and then press ⏎

$$a:=\left\{-3,-2,-1,\frac{-1}{2},\frac{1}{2},1,2,3\right\} \qquad \left\{-3,-2,-1,\frac{-1}{2},\frac{1}{2},1,2,3\right\}$$
$$b:=\left\{-3,-2,-1,0,1,2,3\right\} \qquad \left\{-3,-2,-1,0,1,2,3\right\}$$

(Note: These 2 commands set the possible values for the gradient (a) and the y-intercept (b) of the line. The syntax ":=" means "assign to", and allows values to be stored in a variable. It can be entered by pressing ⌷ctrl ⌷ *)*
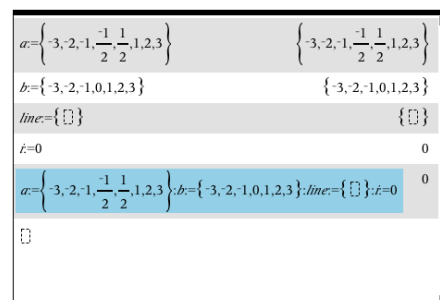
- Type the command **line:={}**

$$line:=\{\ \} \qquad \{\ \}$$
$$i:=0 \qquad 0$$

(This command creates and clears the contents of a list variable called 'line', which will be used to store a list of the linear function rules used in each game.)

- Type the command **i:=0**

(This command creates and assigns the value '0' to a variable called 'i', which will be used to store the count number of each rule (i.e. the current question number in the game).

$$a:=\left\{-3,-2,-1,\frac{-1}{2},\frac{1}{2},1,2,3\right\} \qquad \left\{-3,-2,-1,\frac{-1}{2},\frac{1}{2},1,2,3\right\}$$
$$b:=\left\{-3,-2,-1,0,1,2,3\right\} \qquad \left\{-3,-2,-1,0,1,2,3\right\}$$
$$line:=\{\ \} \qquad \{\ \}$$
$$i:=0 \qquad 0$$
$$a:=\left\{-3,-2,-1,\frac{-1}{2},\frac{1}{2},1,2,3\right\}:b:=\left\{-3,-2,-1,0,1,2,3\right\}:line:=\{\ \}:i:=0 \qquad 0$$

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Tip: If you are playing the game repeatedly, it is convenient to combine all 4 of these commands into a single entry (separate each command with a colon character ":"). This means that all the initialisation, including making any changes to the permitted set of values for *a* and *b* can be made within a single entry. The relevant command would be typed as follows:

a:={−3,−2,−1,−1/2,1/2,1,2,3}:b:={−3,−2,−1,0,1,2,3}:line:={}:i:=0

The next step is to split the window so that you can generate a new graph with each press of the
enter key (which works recursively).

If you are using the *TI-Nspire CAS Teacher Software*, select the split window option as shown.
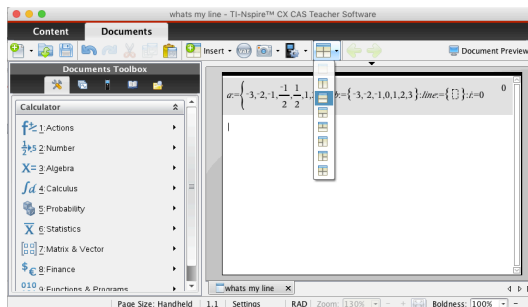
If you are using the handheld, press
doc▾ > **Page Layout > Select Layout > Layout 3**
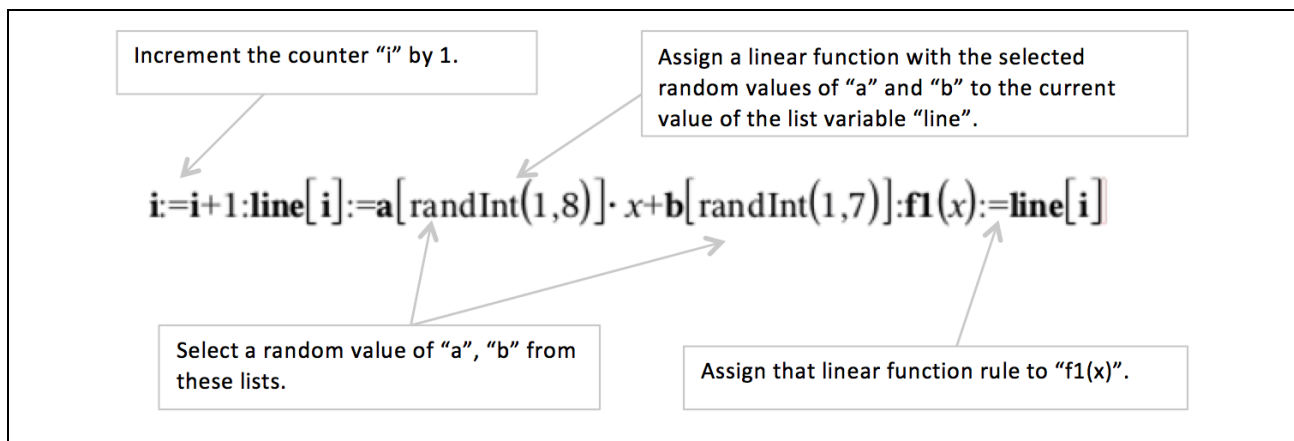to select the split window as shown.

To set up the graph part of the screen

- Press ctrl tab to switch to the bottom half of the new 'split' window

- Select **Add Graphs**.
- Press menu > **Window/Zoom > Window Settings** to make the graph screen have dimensions [−10,10] by [−5,5], and the **Xscale** and **Yscale** values as 1.
- Press menu > **View > Grid > Lined Grid** to make a lined grid visible (see result right).
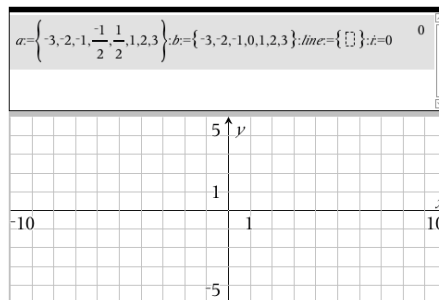
The final command is to generate the 'random' line (random within the given values of a and b). This command is explained in the screen below.

Increment the counter "i" by 1.

Assign a linear function with the selected random values of "a" and "b" to the current value of the list variable "line".

$$i:=i+1:line[i]:=a[\text{randInt}(1,8)]\cdot x+b[\text{randInt}(1,7)]:f1(x):=line[i]$$

Select a random value of "a", "b" from these lists.

Assign that linear function rule to "f1(x)".
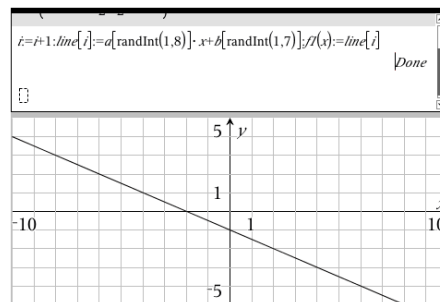
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Now click in the top of the split window, and type this command:

i:=i+1:line [i]:=a[randInt(1,8)]*x+b[randInt(1,7)]:f1(x):=line[i]

Press `enter` to plot the first line. If no plot appears, click on the
graph part of the split window, and then press `ctrl` `G`.
Locate the rule for **f1(x)** and press `enter`.
The graph will then be displayed as shown right.

To get a new graph, press `ctrl` `tab` to move to the **Calculator** page, and press `enter`.

With each press of the `enter` key, a new 'random' function is created and its graph is drawn.

[Note: The position of the horizontal 'split' line can be adjusted by hovering over the line and clicking it and dragging it to the desired position.]

When you have finished a group of lines (five lines
works pretty well), and you wish to check answers,
type "**line**" to display a list of the lines generated (the
variable 'line' displays the right hand side of equation
y = ax + b).

The screen at right shows the five expressions used from a 'five-line' game.

Note: To reset the game, remember to first copy and paste the command, before enter the line 'generator' command. This restates the saved parameters, and initialises the two key variables.
a:={−3,−2,−1,−1/2,1/2,1,2,3}:b:={−3,−2,−1,0,1,2,3}:line:={}:i:=0

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Teacher notes

- This task is intended to be attempted after students have completed at least some work on linear functions, or as a revision in Year 10 or 11 depending on the cohort of students.

- The focus is on the graphs of reinforcing students ability to quickly determine the rule for a linear function from the graph.

- The finished file is included with this task, but the value of creating yourself as a teacher is that you will be clearer about how to modify the parameter values or window dimensions to suit your intended focus.

- It is intended that this be a whole class activity using the TI-Nspire CAS Teacher Software and an IWB. Once the game has been completed a few times, it is possible for students to pair up and challenge each other.

- A side benefit of this task is that it demonstrates to students how a limited set of commands can be combined from the calculator page to mimic common programming ideas (eg initialisation, looping, storing of the results of loop iterations)

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