TI-Nspire

Introduction to Sequences

Aim

To introduce students to sequences on the calculator

Calculator objectives

By the end of this unit, you should be able to:

- generate a sequence recursively using the Calculator App.
- evaluate sequences, defined both as explicit formula and recurrence relations, at specific values
- plot sequences
- analyse a sequence using both the Function Table and a List & Spreadsheet (L&S) page

Contents

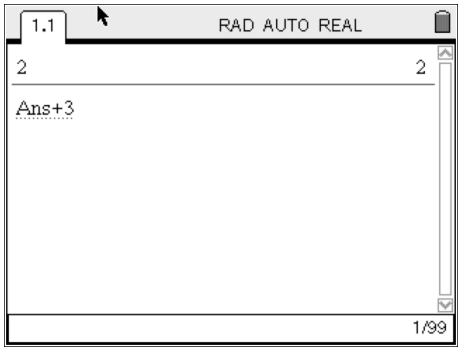
Generating Sequences

A linear sequence of numbers of numbers, such as 2, 5, 8, … can be generated very easily in the Calculator App.

1. The sequence 2, 5, 8, … has an initial term 2. We then add 3 to get the next term.

   Type 2 then press *[Enter]*.

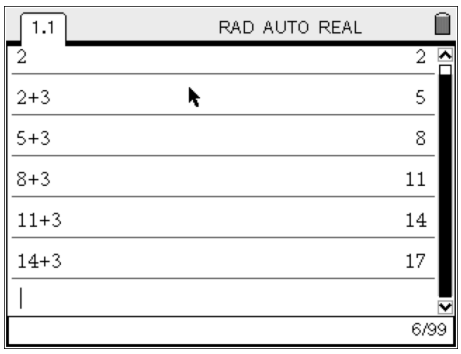
   Press ⊖ (this will paste an 'Ans') + 3.



2. The question is now 'Ans + 3'. When you press press *[Enter]*, this is evaluated as '2 + 3', which returns 5.

   Pressing *[Enter]* again will re-evaluate the question (which is Ans + 3) as '5 + 3', giving an answer of 8.

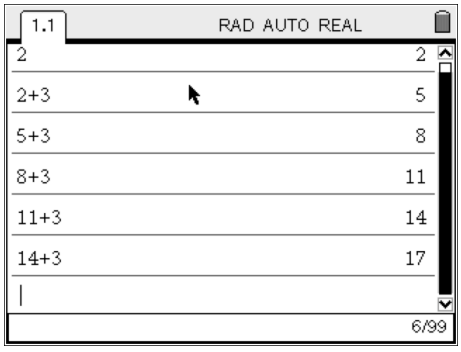
   This can be continued as many times as needed, thus generating a linear sequence.



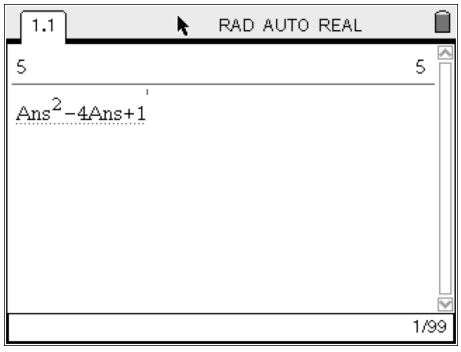
More complex sequences can be generated in a similar way, through the use of 'Ans'.
For example:

3. The sequence 4, 11, 32, can be generated by starting with 4, then multiplying the previous term by 3 and adding 1. This is done on the calculator as shown:

   'Ans' is obtained by pressing ctrl (−).



4. The sequence 5, 6, 13, 118, … can be generated by starting with 5. Subsequent terms are generated using the 'formula': $Ans^2 - 4Ans + 1$.

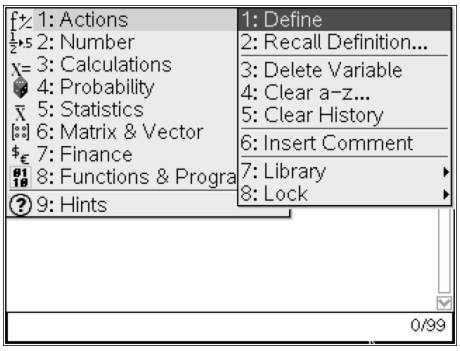


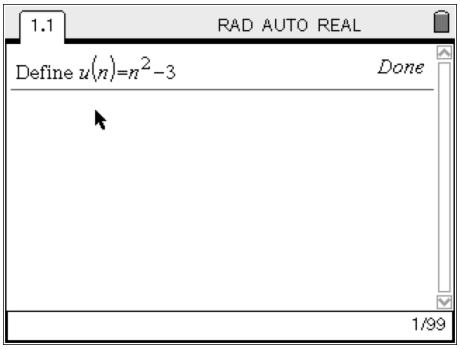
Explicit Formulae

1. In a Calculator page, define your explicit formula: Press:

   [Menu], [1:Actions], [1:Define].

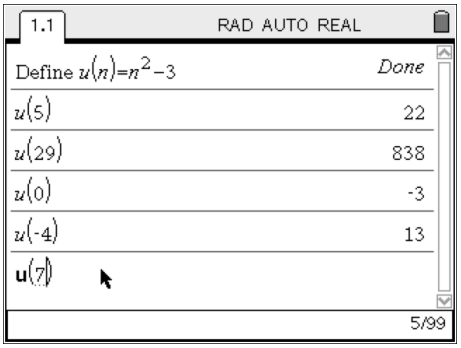
   and type $u(n)=n^2 - 3$





2. Evaluate the explicit formula at various values of n: Notice that:

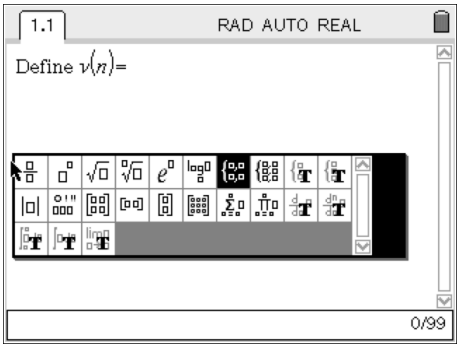
   - before evaluating, the 'u' is in bold, to show that it is an assigned variable
   - the formula is defined for all values of n (including rational values)

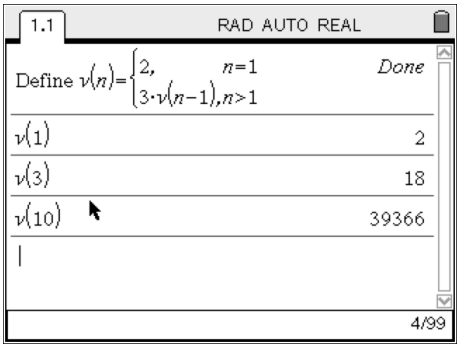


Recurrence relations

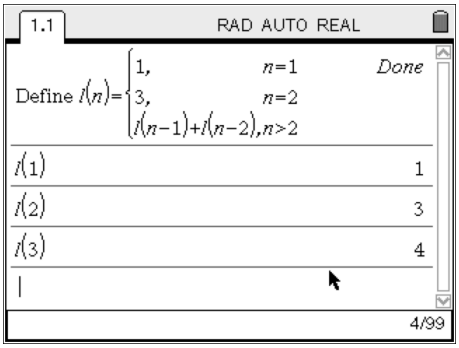
Defining a recurrence relation in the Calculator App is slightly more complicated, as a piecewise function needs to be defined.

1. Define the recurrence relation, *v*. Use the templates found on [CTRL]+[x] to set up the piecewise function. The initial condition must be in the first row of the piecewise function.





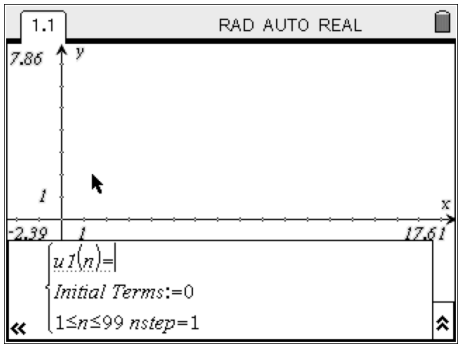
2. Defining a more complicated recurrence relation, e.g. the Lucas sequence, can be defined in the same way, with more rows in the piecewise definition. The initial terms must be in ascending order.

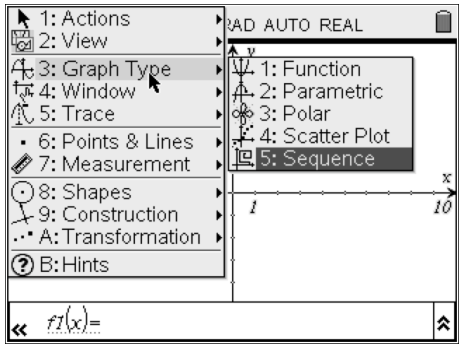


Plotting sequences

Open a new G&G page and change the Graph Type to Sequence:

[MENU], [3: GRAPH TYPE], [5:SEQUENCE]



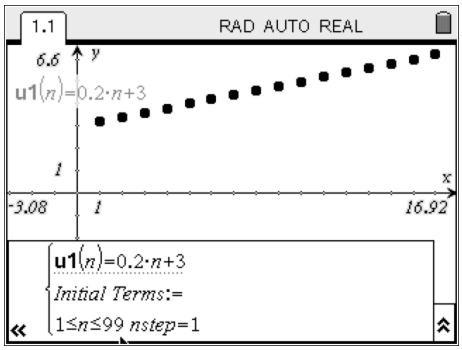


In the formula entry bar, we now have space for the explicit formula or recurrence relation, initial terms for a recurrence relation, and the option to change values of n and the step size.

Plotting an explicit formula:

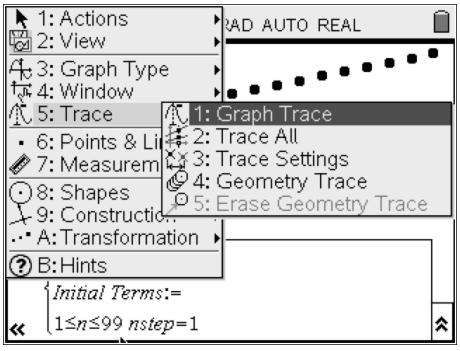
1. In the formula entry bar, enter $u1(n) = 0.2n + 3$.
   The initial term, $u1(1)$ should be left blank (you will need to delete the 0 that is there by default), unless you want the initial term to have a value different from what the formula would give.

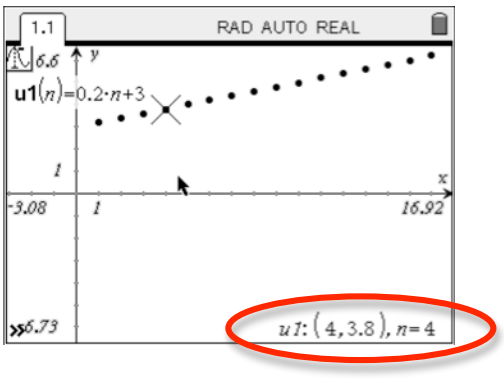
2. On pressing [ENTER], the formula entry bar will disappear. To bring it back, press [TAB], or [CTRL] + G.



3. To trace along the plot, choose Graph Trace:
   [MENU], [5:TRACE], [1:GRAPH TRACE].

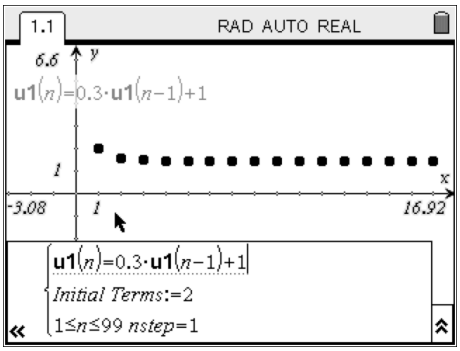
   Move left or right along the plot. Trace information is displayed in the bottom right corner as shown.



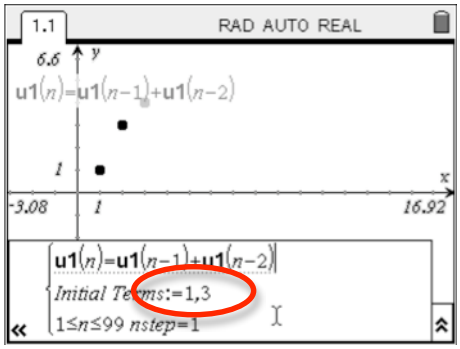


Plotting a recurrence relation:

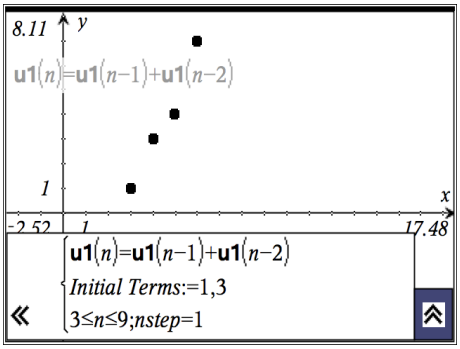
1. The plot of a recurrence relation is defined in a similar way as before. Be careful to set up the recursive part of the relation using the same notation as the left-hand side of the equation, i.e. use $u1(\ )$, $u2(\ )$, etc…



2. For more complicated recurrence relations, extra initial terms can be defined in order, i.e. $u1(1)$, $u1(2)$, etc… For example, with the Lucas sequence:



3. The values of n can also be changed from the default of $1 \le n \le 99$, by editing the 3rd row of the formula entry bar.



   To avoid the calculator slowing down (spinning clock), consider reducing the size of the domain to, say, $1 \le n \le 10$.

   The step size can also be changed to any value by editing the *nstep*.

   What is the effect of changing the domain of the function? – horizontal translation.

4. Follow the same steps to trace the plot, as for explicit formula.

Exploring Sequences with Tables

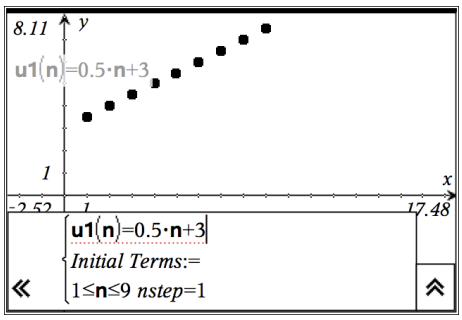
There are two ways to view a table of values generated by a graph:

i. Using a L&S page
ii. Using a Function Table in a G&G page

Both types of sequences can use the function table. A recurrence relation that was originally defined in a G&G page can only use the function table.

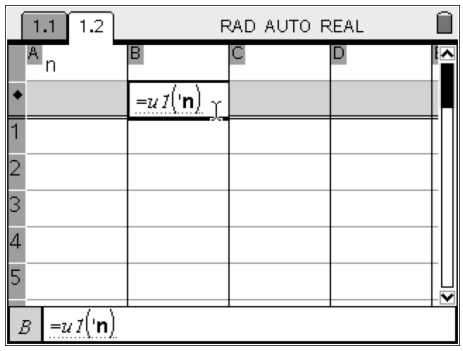
Table in a L&S page

1. In a G&G page, define the sequence $u1(n) = 0.5n + 3$.

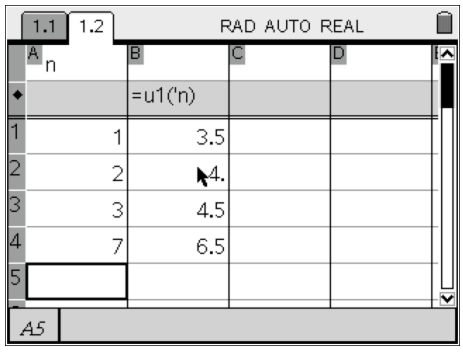


2. Insert a new L&S page: [HOME], [3:Lists & Spreadsheets].

3. Give column A the name 'n', and in the formula cell of column B, enter u1(n). Remember to use the [var] key to choose the variable *n*.

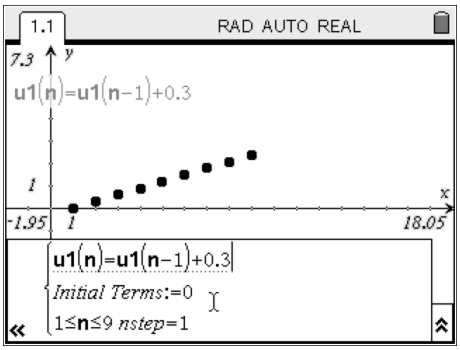


4. Enter the value of the independent variable, *n*, in column A; the value of the dependant variable, $u1(n)$ is automatically calculated in column B.

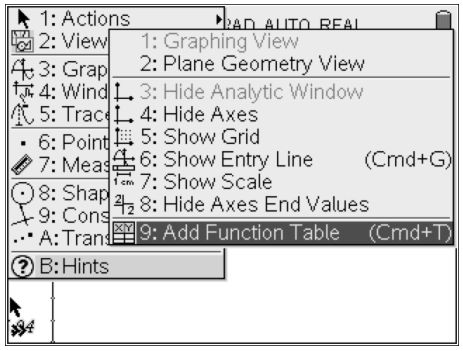


Function Table

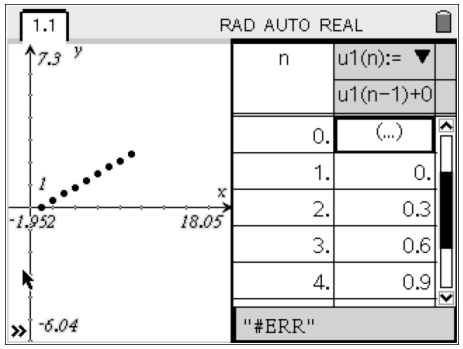
1. In a G&G page, define the sequence $u1(n) = u1(n) + 0.3$.



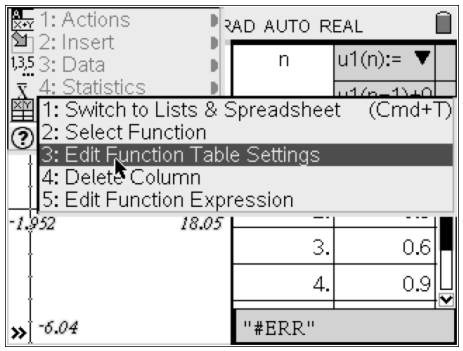
2. Create a function table, either by pressing [CTRL] + T, or by pressing [MENU], [2:VIEW], [9: Add Function Table].



3. Scroll up or down the function table using the cursors.



4. To change the table set up, select:
[Menu], [5:Function Table],
[3:Edit Function Table Settings]



Reminder: Only sequences defined by an explicit formula in a G&G page can be analysed in a L&S page. A recurrence relation can be analysed in a L&S page if it is defined there.