

Chapter 12 / Example 6

The Euler Method

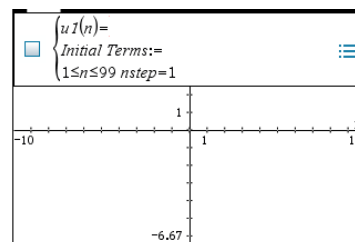
- a** Use the Euler method with a step size of 0.1 to find the approximate values of x and y when $t = 1$ and $t = 2$ for the following system of differential equations:
- $$\dot{x} = 3x - 4y$$
- $$\dot{y} = x - 2y$$
- and $x = 4$ given $y = -2$ when $t = 0$.

Open a new document and add a Graphs page.

Press **menu** 3:Graph Entry/Edit | 7:Sequence | 1:Sequence

The first equation is $x_{n+1} = 1.3x_n - 0.4y_n$.

To enter this in the TI-Nspire CX you will need to use $u1(n)$ in place of x_{n+1} , $u1(n-1)$ in place of x_n and $u2(n-1)$ in place of y_n .

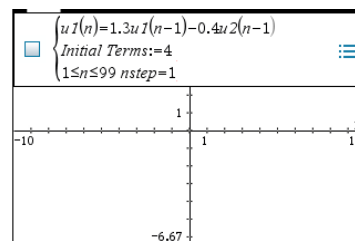


Type $1.3u1(n-1) - 0.4u2(n-1)$ to enter the first sequence as $u1(n)$.

Type 4 as the initial term.

Leave the range of values of n .

Press **enter** when you have finished.



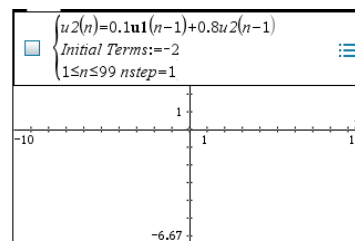
Press **tab** to display the entry line again. This time ' $u2(n) =$ ' is displayed.

The second equation is $y_{n+1} = 0.1x_n + 0.8y_n$

Type $0.1u1(n-1) + 0.8u2(n-1)$ to enter the second sequence.

Type -2 to enter the initial term

Press **enter** when you have finished.



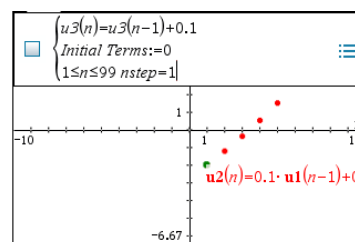
Press **tab** to display the entry line again. This time ' $u3(n) =$ ' is displayed.

The value of t is given by $t_{n+1} = t_n + 0.1$

Type $u3(n-1) + 0.1$ to enter the sequence.

Type 0 to enter the initial term

Press **enter** when you have finished.



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Press **ctrl** **doc** (**+page**) and add a Lists & Spreadsheet page.

Press **ctrl** **T** to change from a spreadsheet to a table.

Press **enter** to select u_1 .

Ignore the error messages.

	u_1	u_2	u_3
1.			
2.			
3.			
4.			
5.			

Press **►** to move to the next column and press **enter** to select u_2 .

Press **►** to move to the next column and press **enter** to select u_3 .

n	$u_1(n)$	$u_2(n)$	$u_3(n)$
1.	4.	-2.	0.
2.	6.	-1.2	0.1
3.	8.28	-0.36	0.2
4.	10.908	0.54	0.3
5.	13.9644	1.5228	0.4

You can scroll down the table using **▼**.

From the table, $t = 1$ when $n = 11$

At $t = 1$, $x = 48.1$, $y = 11.0$

n	$u_1(n)$	$u_2(n)$	$u_3(n)$
7.	21.7621	3.8462	0.6
8.	26.7523	5.25317	0.7
9.	32.6767	6.87777	0.8
10.	39.7286	8.76988	0.9
11.	48.1392	10.9888	1.

Scroll down the table using **▼**.

From the table, $t = 2$ when $n = 21$

At $t = 2$, $x = 306$, $y = 76.2$

n	$u_1(n)$	$u_2(n)$	$u_3(n)$
17.	147.166	36.2356	1.6
18.	176.822	43.7051	1.7
19.	212.386	52.6463	1.8
20.	255.044	63.3557	1.9
21.	306.214	76.1889	2.