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:

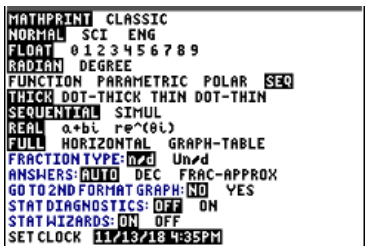
$\dot{x} = 3x - 4y$

$\dot{y} = x - 2y$

and $x = 4$ given $y = -2$ when $t = 0$.

To enter sequence mode press [mode]. Use the [◄] [▲] [►] [▼] keys to place the cursor on SEQ in the Mode menu, and then press [enter] to highlight it.

The first equation is $x_{n+1} = 1.3x_n - 0.4y_n$ To enter this in the TI-84 Plus C you will need to use $u(n)$ in place of x_{n+1}, $u(n-1)$ in place of x_n and $v(n-1)$ in place of y_n.



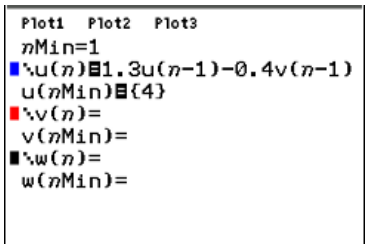
Leave nMin=1

Press [f1] [y=] to display the equation entry screen.

Type $1.3u(n-1) - 0.4v(n-1)$ and press [enter] to enter the first sequence as u(n).

Press [X,T,θ,n] to enter n, [2nd] [7] [u] to enter u and [y=] [8] [v] to enter v.

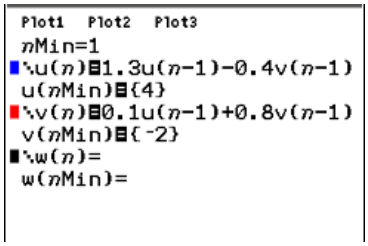
Type 4 to enter the initial value of x, u(nMin)



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

Type $0.1u(n-1) + 0.8v(n-1)$ and press [enter] to enter the second sequence as v(n).

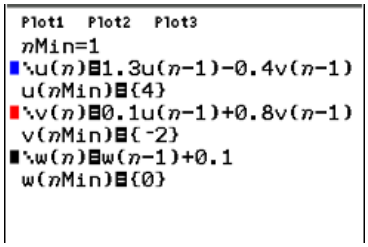
Type −2 to enter the initial value of y, v(nMin)



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

Type $w(n-1) + 0.1$ and press [enter] to enter the second sequence as w(n).

Type 0 to enter the initial value of t, w(nMin)



Chapter 12 / **Example 6**

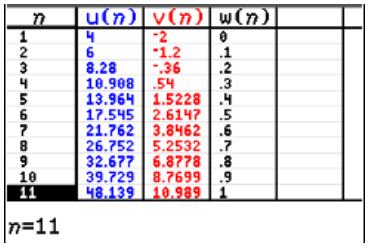
The Euler Method

Press [2nd] [f5] [table]

You can scroll down the table using ▼.

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

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



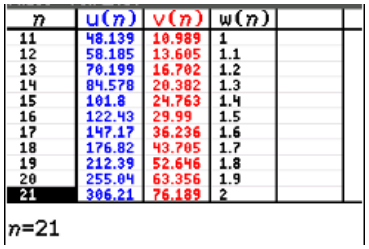
n	u(n)	v(n)	w(n)
1	4	-2	0
2	6	-1.2	.1
3	8.28	-.36	.2
4	10.908	.54	.3
5	13.964	1.5228	.4
6	17.545	2.6147	.5
7	21.762	3.8462	.6
8	26.752	5.2532	.7
9	32.677	6.8778	.8
10	39.729	8.7699	.9
11	48.139	10.989	1

n=11

Scroll down the table using ▼.

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

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



n	u(n)	v(n)	w(n)
11	48.139	10.989	1
12	58.185	13.605	1.1
13	70.199	16.702	1.2
14	84.578	20.382	1.3
15	101.8	24.763	1.4
16	122.43	29.99	1.5
17	147.17	36.236	1.6
18	176.82	43.705	1.7
19	212.39	52.646	1.8
20	255.04	63.356	1.9
21	306.21	76.189	2

n=21