

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 .



```

MATHPRINT CLASSIC
NORMAL SCI ENG
FLOAT 0 1 2 3 4 5 6 7 8 9
RADIAN DEGREE
FUNCTION PARAMETRIC POLAR SEQ
THICK DOT-THICK THIN DOT-THIN
SEQUENTIAL SIMUL
REAL a+bi re^(θi)
FULL HORIZONTAL GRAPH-TABLE
FRACTIONTYPE: n/d Unvd
ANSWERS: AUTO DEC FRAC-APPROX
GO TO 2ND FORMAT GRAPH: NO YES
STAT DIAGNOSTICS: OFF ON
STAT WIZARDS: ON OFF
SET CLOCK 11/13/18 4:35PM
  
```

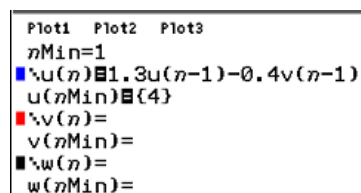
Leave $nMin=1$

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 , $u(nMin)$



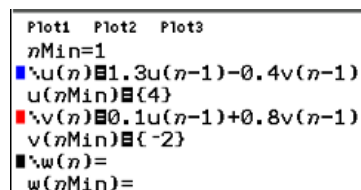
```

Plot1 Plot2 Plot3
nMin=1
1.3u(n-1)-0.4v(n-1)
u(nMin){4}
v(n)=
v(nMin)=
w(n)=
w(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 , $v(nMin)$



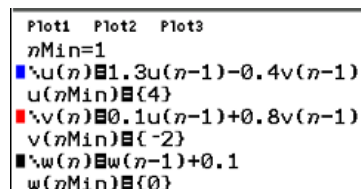
```

Plot1 Plot2 Plot3
nMin=1
1.3u(n-1)-0.4v(n-1)
u(nMin){4}
0.1u(n-1)+0.8v(n-1)
v(nMin){-2}
w(n)=
w(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 , $w(nMin)$



```

Plot1 Plot2 Plot3
nMin=1
1.3u(n-1)-0.4v(n-1)
u(nMin){4}
0.1u(n-1)+0.8v(n-1)
v(nMin){-2}
w(n-1)+0.1
w(nMin){0}
  
```

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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	84.570	20.302	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

$n=21$