

Chapter 11 / Example 25

Euler's method

Use Euler's method with step size 0.1 to approximate the solution to the initial value problem $\frac{dy}{dx} = xy$ and $y(1) = 1$, and estimate the value of $y(2)$.

To enter iterative formulas press **MODE**. Use the **|** **}** **~** **†** keys to place the cursor on SEQ in the Mode menu, and then press **ENTER** to highlight it.

```
MATHPRINT CLASSIC
NORMAL SCI ENG
FLDRT 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: DND Unvd
ANSWERS: AUTO DEC FRAC-APPROX
GO TO 2ND FORMAT GRAPH: NO YES
STAT DIAGNOSTICS: OFF ON
STAT WIZARDS: ON OFF
SET CLOCK 01/05/19 9:37AM
```

Press **[F1]** **[Y=]** to display the sequence entry screen.

When using Euler's method, since the boundary condition is (x_0, y_0) , the minimum value of n is 0.

set $nMin$ to 0 and press **ENTER**.

```
Plot1 Plot2 Plot3
nMin=0
█u(n)=
u(nMin)=
█v(n)=
v(nMin)=
█w(n)=
w(nMin)=
```

The TI-84 Plus C uses u and v in place of x and y .

$$x_n = x_{n-1} + 0.1$$

Set $u(n)$ to $u(n-1) + 0.1$ and press **ENTER**.

To enter u , press **[2nd]** **[7]** **[u]** and to enter n press **[X,T,θ,n]**.

```
Plot1 Plot2 Plot3
nMin=0
█u(n)█u(n-1)+0.1
u(nMin)█
█v(n)=
v(nMin)=
█w(n)=
w(nMin)=
```

Since an iterative formula defines each term in terms of the previous one, you must enter the first term, $u(0)$.

Set $u(nMin)$ to 1 and press **ENTER**.

```
Plot1 Plot2 Plot3
nMin=0
█u(n)█u(n-1)+0.1
u(nMin)█{1}
█v(n)=
v(nMin)=
█w(n)=
w(nMin)=
```

$$y_n = y_{n-1}(1 + 0.1x_{n-1})$$

Set $v(n)$ to $v(n-1)(1 + 0.1u(n-1))$ and press **ENTER**.

To enter v , press **[2nd]** **[8]** **[v]**.

```
Plot1 Plot2 Plot3
nMin=0
█u(n)█u(n-1)+0.1
u(nMin)█{1}
█v(n)█v(n-1)(1+0.1u(n-1))
v(nMin)█
█w(n)=
w(nMin)=
```

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Enter the initial value of $v(n)$.

Set $v(nMin)$ to 1 and press **ENTER**.

```

Plot1 Plot2 Plot3
nMin=0
▀%u(n)▀u(n-1)+0.1
u(nMin)▀1
▀%v(n)▀v(n-1)(1+0.1u(n-1))
v(nMin)▀1
▀%w(n)=
w(nMin)=
  
```

To view the sequences open the table of values by pressing **2nd** **GRAPH** **TABLE**.

From the table, $y(2) = 3.86$.

n	$u(n)$	$v(n)$			
0	1	1			
1	1.1	1.1			
2	1.2	1.221			
3	1.3	1.3675			
4	1.4	1.5453			
5	1.5	1.7616			
6	1.6	2.0259			
7	1.7	2.35			
8	1.8	2.7495			
9	1.9	3.2444			
10	2	3.8609			

$n=0$