Mathematics 172

Quiz 29 Name: Key

You must show your work to get full credit.

We are going to use Euler's method on the SIR system

$$S' = -bSI$$
$$I' = bSI - kI$$
$$R' = kI$$

As discussed on the last homework assignment to do this on the calculator need to rewrite the system as

$$u(n) = u(n-1) - bu(n-1)v(n-1)$$
$$v(n) = v(n-1) + bu(n-1)v(n-1) - kv(n-1)$$
$$w(n) = w(n-1) + kv(n-1).$$

We will be using the values

$$b = .0001,$$
$$k = .08$$
$$u(0) = S_0 = 9990$$
$$v(0) = I_0 = 10$$
$$w(0) = R_0 = 0.$$

Store $b = .0001$ and $k = .08$ in the B and K registers. Press the [MODE] key and edit to look like

[NORMAL] SCI ENG
[FLOAT] 0 1 2 3 4 5 6 7 8 9
[RADIAN] DEGREE
FUNC PAR POL [SEQ]
[CONNECTED] DOT
[SEQUENTIAL] SIMUL
[REAL] a+bi re^θi
[FULL] HORIZ G-T

Press 2ND TABLESET and edit until it looks like

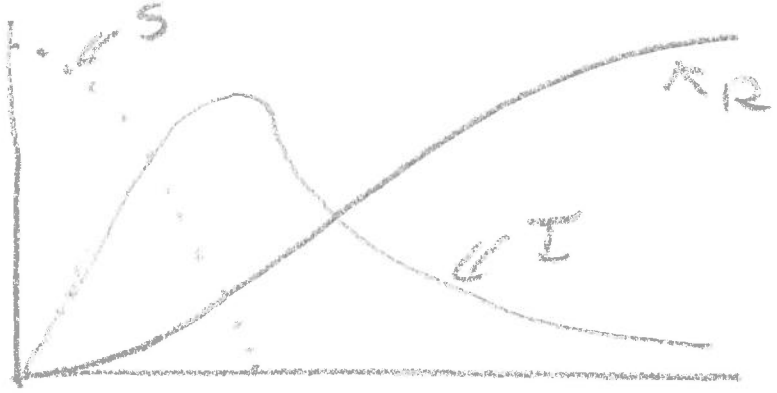
TABLE SETUP
TblStart=0
ΔTbl=1
Indpnt : [Auto] Ask
Depend: [Auto] Ask

Plot1 Plot2 Plot2
nMin=0
\u(n)=u(n-1)-Bu(n-1)v(n-1)
u(nMin)=9990
\v(n)=v(n-1)+Bu(n-1)v(n-1)-Kv(n-1)
v(nMin)=10
\w(n)=w(n-1) + Kv(n-1)
w(nMin)=0

1. For this data complete the following table:

n	$S(n)$	$I(n)$	$R(n)$
0	9990	10	0
1	9980	19.19	.8
2	9960.4	36.906	2.3392
10	9871.8	9612.1	516.13

2. Draw the graphs of S, I, and R by using setting
   $n\mathsf{Min} = 0$
   $n\mathsf{Max} = 30$
   and doing ZoomFit. Make a drawing of the result here:



3. Change the values of b and k to $b = .00005$ and $k = .05$ and also set $S_0 = 9950$, $I_0 = 50$ and $R_0 = 0$ and fill in the following table:

n	$S(n)$	$I(n)$
0	9950	50
1	9925.1	72.375
2	9899.2	104.67
10	8092.7	1798.7

4. Make a drawing of the graphs of S, I, and R from $n = 0$ to $n = 30$.