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EX.NO:1	FAMILY OF DIFFERENTIAL EQUATIONS

QUESTION:

Solve the Lorentz equation $\frac{dx}{dt} = -\sigma x + \sigma y$; $\frac{dy}{dt} = \beta x - y - xz$; $\frac{dz}{dt} = -\theta z + xy$; $\sigma = 10, \theta = \frac{8}{3}, \beta = 28$.

$$x(0) = -8, y(0) = 8, z(0) = 27$$

AIM:

To plot the 2end order solution of family of differential equation in MATLAB script file with an example

ALGORITHM:

STEP:1

Start the program

STEP:2

Computes the derivatives involving in solving the Lorenz equation

STEP:3

Use tspan commands to defined the t interval

STEP:4

Use ode45 building function for solving the differential equation

STEP:5

Use the commands plot, subplot to plot the Lorenz equation

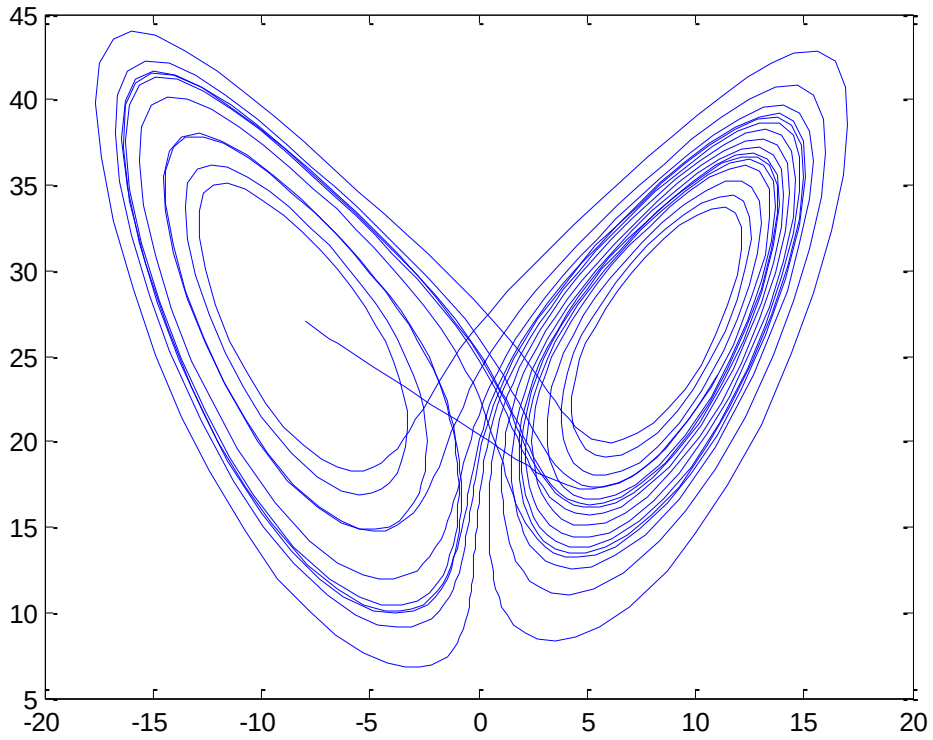
STEP:6

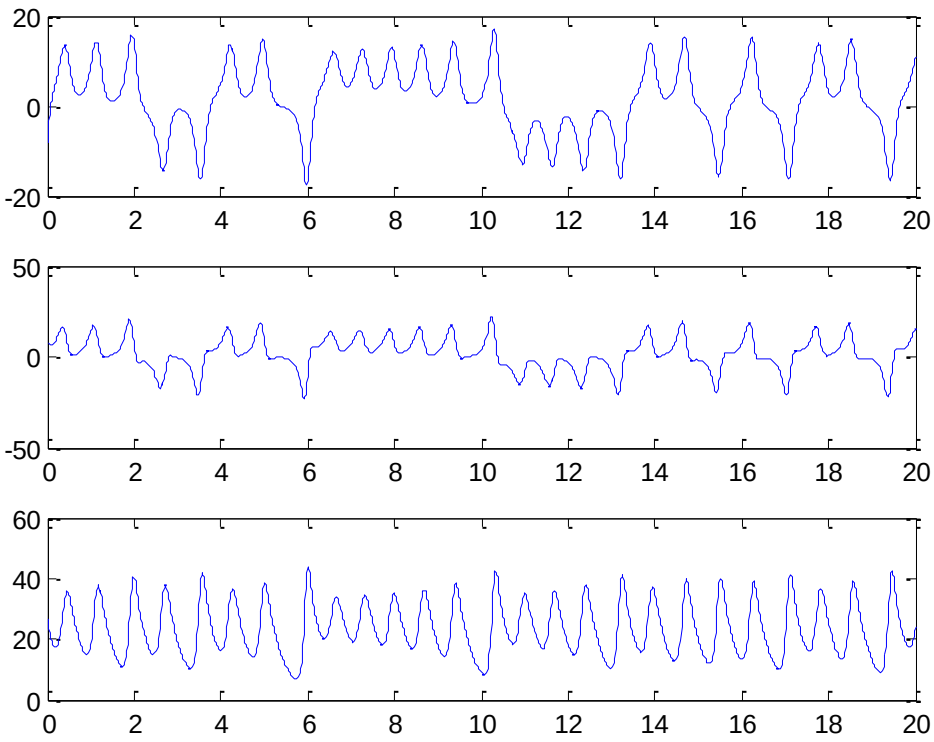
Stop the process

PROGRAM:

```
function xprime=lorenz(t,x);
%Computes the derivatives involved in solving the lorenz equations
sig=10;
beta=8/3;
rho=28;
xprime=[-sig*x(1)+sig*x(2);rho*x(1)-x(2)-x(1)*x(3);-beta*x(3)+x(1)*x(2)];
x0=[-8 8 27];
tspan=[0,20];
[t,x]=ode45(@lorenz,tspan,x0);
plot(x(:,1),x(:,3))
subplot(3,1,1)
plot(t,x(:,1))
subplot(3,1,2)
plot(t,x(:,2))
subplot(3,1,3)
plot(t,x(:,3))
```

OUTPUT:




20
0
-20
0 2 4 6 8 10 12 14 16 18 20
50
0
-50
0 2 4 6 8 10 12 14 16 18 20
60
40
20
0
0 2 4 6 8 10 12 14 16 18 20

EX.NO:2	GROWTH MODEL(EXPONENTIAL CASE)

QUESTION:

Plot the population growth in the exponential case.

AIM:

To plot the growth model of the exponential cause in MATLAB using the script file

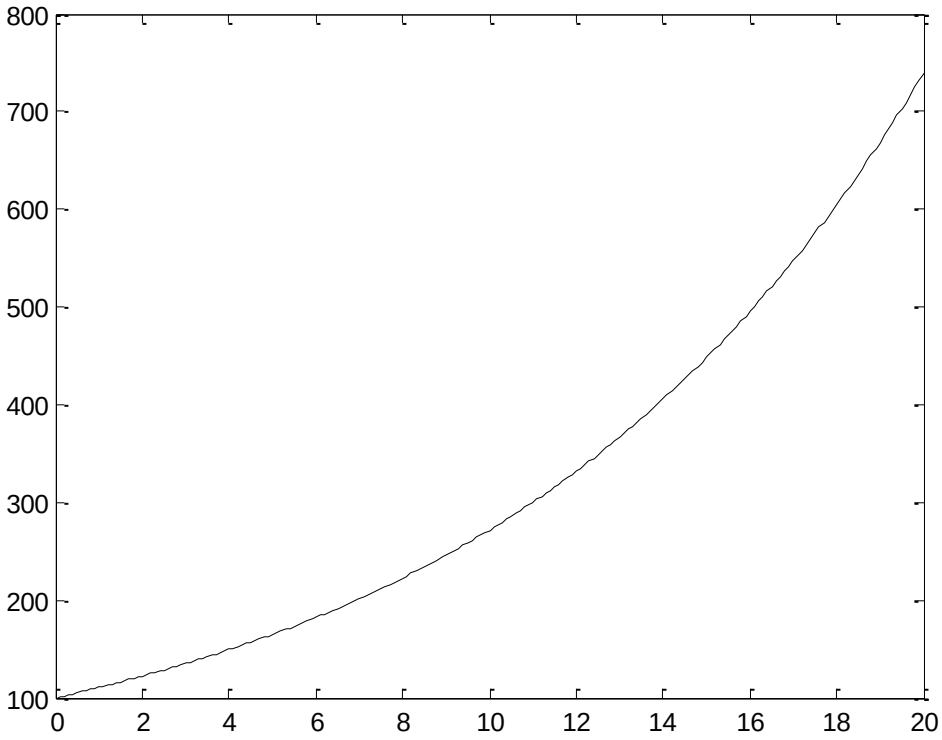
ALGORITHM:

STEP:1
Start the program
STEP:2
Define the time interval using the increment function in MATLAB
STEP:3
Define exponential the growth formula in MATLAB
STEP:4
Use plot command for plotting the reguring values
STEP:5
Stop the Process

PROGRAM:

```
tim=[0:0.1:20];

r=0.1;

N_0=100;

N=N_0*exp(r*tim);

plot(tim,N,'k')
```

OUTPUT



EX.NO:3	DECAY MODEL

QUESTION:

Suppose that salt decomposers in water into chloride and sodium ions according to the laws of exponential decay if the initial amount of the salt is 25kg and after 10 hours ,15kg of salt is left. How much salt is left after one day. How long does it take until 0.5kg of salt is left.

AIM:

To solve the given problem by using the decay model of exponential case in MATLAB.

ALGORITM:

STEP :1

Start the program.

STEP :2

Defining the beginning amount and the final amount and time in MATLAB.

STEP :3

Using half life of decay model to define the half life.

STEP :4

Defining the inamount and by using appropiate formula in MATLAB command window.

STEP :5

Run the program and verify the result.

STEP :6

Stop the process.

PROGRAM:

```
beg_amt=25;

fin_amt=15;

time=10;

half_life=log10(2)*time/log10(beg_amt/fin_amt)

time=24;

n=time/half_life;

end_amt=beg_amt/2^n

fin_amt=0.5;

t=half_life*log10(beg_amt/fin_amt)/log10(2)
```

OUTPUT

```
half_life = 13.5692

end_amt =703367

t =76.5824
```

EX.NO:4	LAKE POLLUTION MODEL

QUESTION:

Plot a contour curves for a pollutant at different times.

AIM:

To plot a contour covers for a pollution at different times in 2D

ALGOROTHM:

STEP:1

Start the program

STEP:2

The MATLAB code simulate a large is spli of a pollutant along the south waste boundary of a lake

STEP:3

The sources of spill is controlled after 25 times steps

STEP:4

The pollution 'cloud' moves across a lake as debicted by contour plot for different times

STEP:5

The MATLAB code flow 2D generates the 3D array of the consfortion

STEP:6

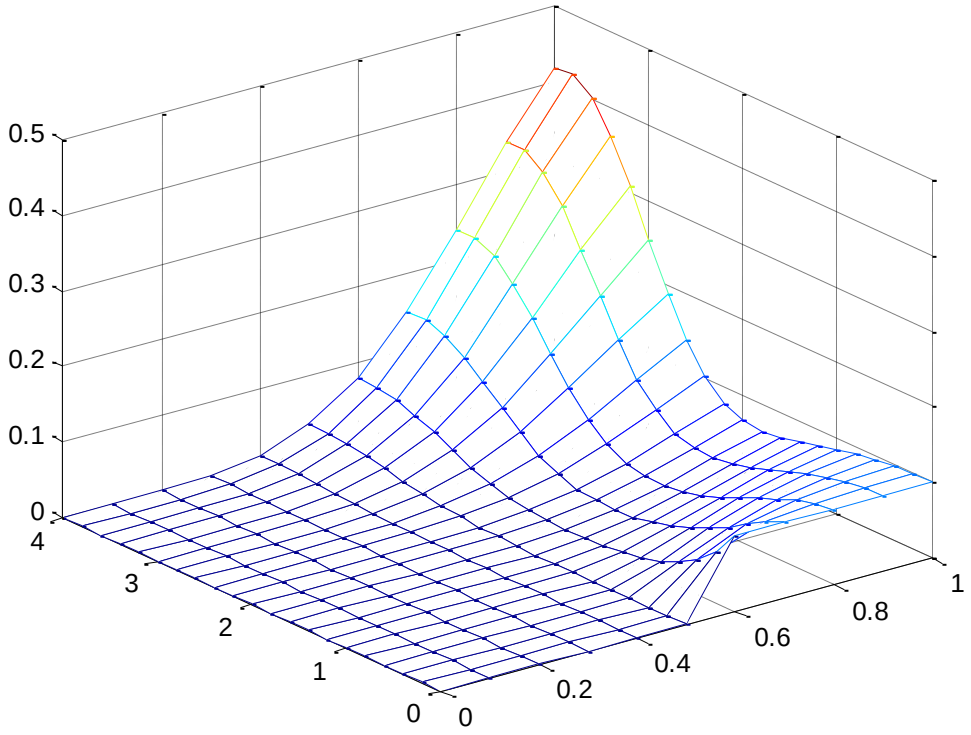
Stop the process

PROGRAM:

```
clear;
L=1.0;
W=4.0;
T=10.;
k=200;
dt=T/k;
n=10.;
dx=L/n;
m=20.;
dy=W/m;
velx=.1;
vely=.4;
decay=.0;
for i=1:n+1
x(i)=(i-1)*dx;
for j=1:m+1
y(j)=(j-1)*dy;
u(i,j,1)=0.;
end
end
for k=1:k+1
time(k)=(k-1)*dt;
for j=1:m+1
```

```
u(1,j,k)=.0;
end
for i=1:n+1
u(i,1,k)=(i<=(n/2+1))*(k<26)*5.0*sin(pi*x(i)*2)+(i>(n/2+1))*.1;
end
end
for k=1:k
for i=2:n+1;
for j=2:m+1;
u(i,j,k+1)=(1-velx*dt/dx-vely*dt/dy-decay*dt)*u(i,j,k)+velx*dt/dx*u(i-1,j,k)+vely*dt/dy*u(i,j-1,k);
end
end
end
mesh(x,y,u(:,:,k)')
```

OUTPUT



EX.NO:5	LIMITED GROWTH OF POPULATION (WITH AND WITHOUT HARVESTING)

QUESTION:

Use MATLAB to find the sides of the bacterium after 4 minutes.

AIM:

To find volume of bacterium using function call type in MATLAB

ALGORITHM:

STEP:1

Start the program

STEP:2

Volume of define the formula d=0.4+0.02*t

STEP:3

Use the elongation function for calling the function in MATLAB script file

STEP:4

Subsutting a time duration in the formula by using the elongation function

STEP:5

Run the program and verified the out put

STEP:6

Stop the process

PROGRAM:

```
function V=elongation(t)
%Function elongation has input variable
   t and output variable V
%It gives the bacterium volume after
  time t: V=0.4+0.02*t
V=0.4+0.02*t;
elongation(4)
```

OUTPUT

```
elongation(4)

ans =

   0.4800
```

EX.NO:6	PLOTTING OF RECURSIVE SEQUENCES

QUESTION:

Compute the first 100 items in the sequence defined recursively.

AIM:

To compute the first 100 term in the sequence defined recursively by a(n)=0.75*(1-a(n-1)) with a1=1

ALGORITH:

STEP:1

Start the program

STEP:2

The recursive formula is define in MATLAB

STEP:3

Using for loop the formula is define and value for n is given using the increate operation in MATLAB

STEP:4

Use plot command to this sequence in MATLAB figure window

STEP:5

Use the title command to display the title of the sequence in MATLAB

STEP:6

Run the program and check the output

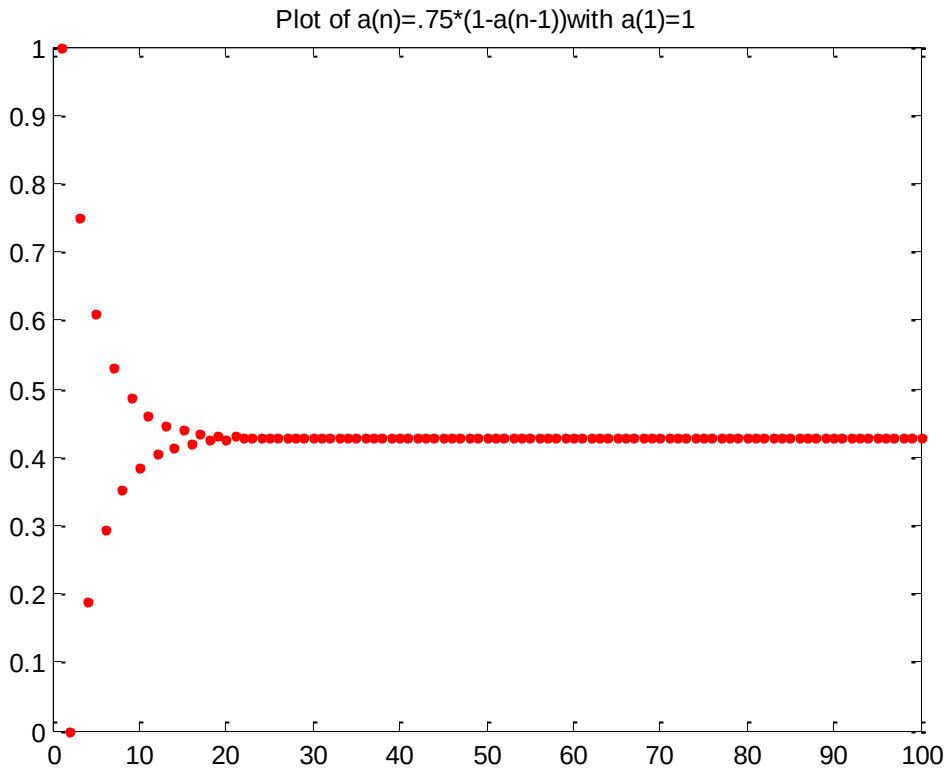
STEP:7

Stop the process

PROGRAM:

```
a(1)=1;
for n=2:100;
a(n)=.75*(1-a(n-1));
end
plot(a,'r.')
title('Plot of a(n)=.75*(1-a(n-1))with a(1)=1')
```

OUTPUT:



EX.NO:7	CAUCHY'S ROOT TEST BY PLOTTING N^{TH} ROOTS

QUESTION:

Test the convergency of cauchy sequence $\sum_{x=1}^{k} \frac{4(-1)^{x+1}}{(2x-1)}$, $1 \leq k \leq 30$.

AIM:

TO test the convergence of the given series by using cauchy's root test in MATLAB

ALGORITHM:

STEP:1

Start the program

STEP:2

The sequence term of define in MATLAB with a help of special operation of MATLAB

STEP:3

Define series term by using the MATLAB 'cunsum' for finding cumulative for sum

STEP:4

Using plot command to plot the series in MATLAB figure window

STEP:5

X-axis and y-axis are define using x-label y-label in MATLAB figure window.

STEP:6

Run the program and verified the output.

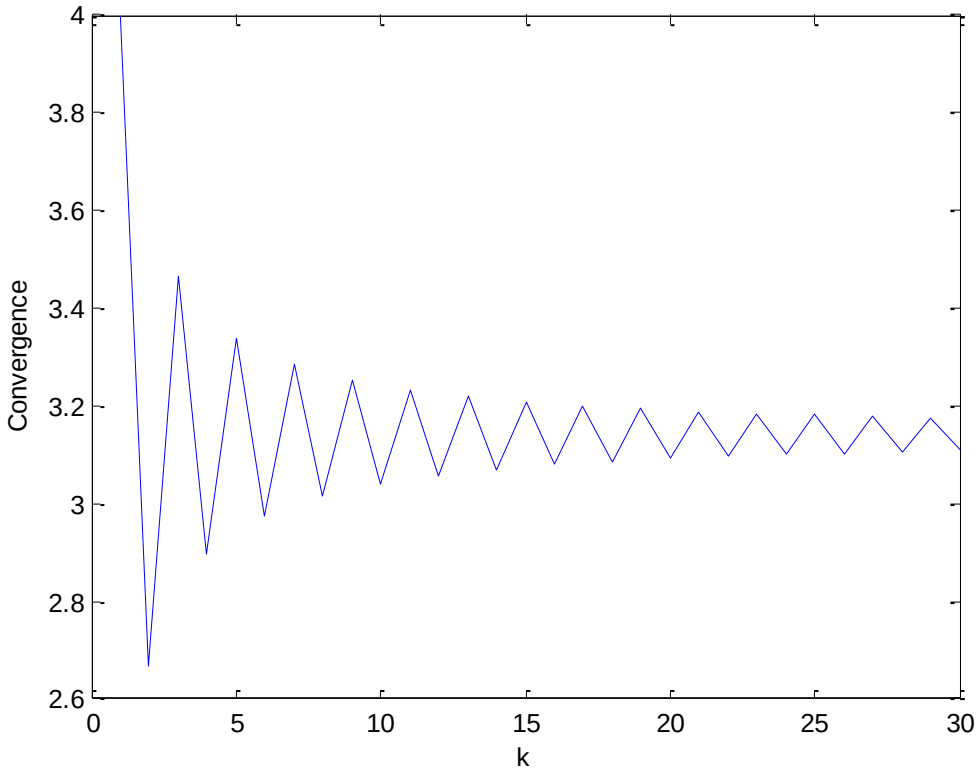
STEP:7

Stop the process.

PROGRAM:

```
n=30;
 k=1:n;
 sequenceterms = 4*((-1).^(k+1))./(2*k-1);
 seriesterms = cumsum(sequenceterms);
 plot (k, seriesterms)
 xlabel ('k')
 ylabel ('Convergence')
```

OUTPUT:



EX.NO:8	PREDATORY-PREY MODEL

QUESTION:

Solve the following equations with initial condition x(0)=100,y(0)=90 and z(0)=80.

$x' = -0.5x$+0.01xy+0.02xz; $y' = 0.01(100 - y)$y-0.01xy; $z' = 0.04(80 - z)z - 0.03xz$

AIM:

To solve two prey one predator model by using an example.

ALGORITHM:

STEP :1

Start the program.

STEP :2

Creating two m files to represent in symbol y(1) fox,y(2) rabbits and y(3) turkeys.

STEP :3

In the second m file the initial conditions are assigned in the array form.

STEP :4

Using ode45 builtin function to solve the differential equation in MATLAB.

STEP :5

Run the program and verify the output.

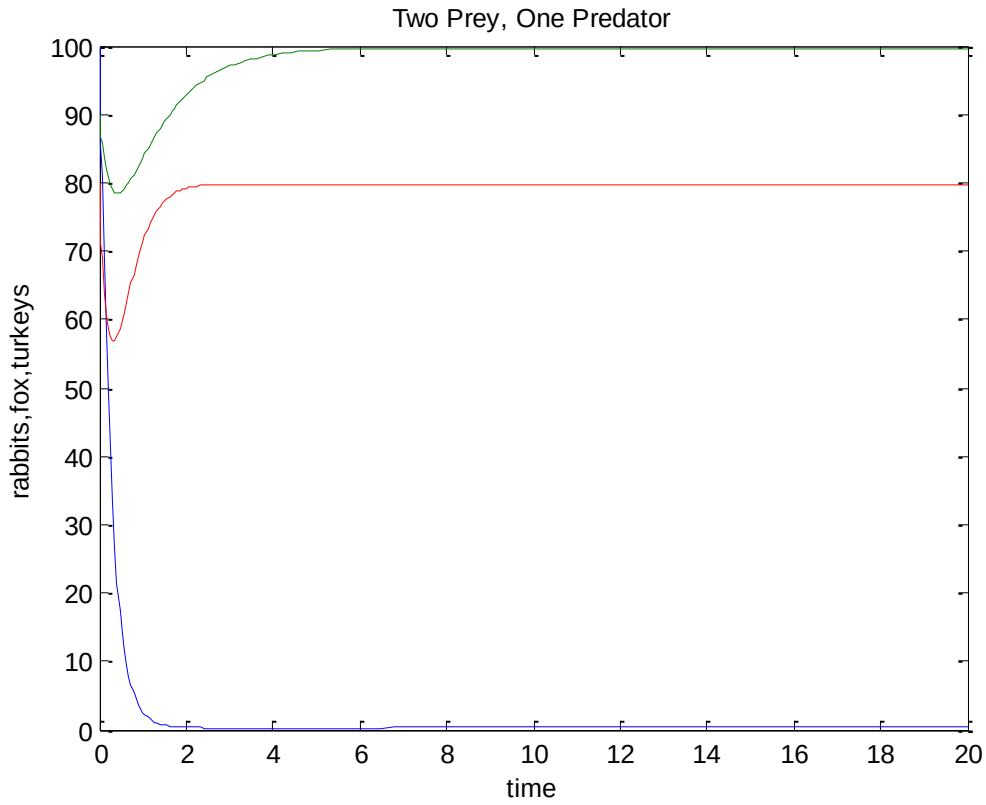
STEP :6

Stop the process.

ROGRAM:

```
% yprft.m

function yprft=yprft(t,y)

yprft(1)=-5*y(1)+.01*y(2)+.02*y(1)*y(3);

yprft(2)=.01*(100-y(2))*y(2)-.01*y(1)*y(2);

yprft(3)=.04*(80-y(3))*y(3)-.03*y(1)*y(3);

yprft=[yprft(1) yprft(2) yprft(3)]';


% rft.m

clear;

t0=0;

tf=20;

y0=[100 90 80];

[t y]=ode45('yprft',[t0 tf],y0);

plot(t,y(:,1),t,y(:,2),t,y(:,3))

title('Two Prey, One Predator')

xlabel('time')

ylabel('rabbits,fox,turkeys')
```

OUTPUT:


Two Prey, One Predator
rabbits,fox,turkeys
time
0
10
20
30
40
50
60
70
80
90
100
0
2
4
6
8
10
12
14
16
18
20

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Semester II

		L	T	P	C
17MMU211	**DIFFERENTIAL EQUATIONS (PRACTICAL)**	**0**	**0**	**3**	**2**

List of Practical (using any software)
(Any 8 programs)

1. Plotting of second order solution family of differential equation.
2. Growth model (exponential case only).
3. Decay model (exponential case only).
4. Lake pollution model (with constant/seasonal flow and pollution concentration).
5. Case of single cold pill and a course of cold pills.
6. Limited growth of population (with and without harvesting).
7. Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
8. Plotting of recursive sequences.
9. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
10. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
11. Cauchy's root test by plotting n_{th} roots.
12. Ratio test by plotting the ratio of n_{th} and $(n+1)_{th}$ term.