SESSION 1

SOLVING ORIDINARY DIFFERENTIAL EQUATIONS

1 PROBLEM 1

xdot= cos(t), and $x(t_0) = x_0$

1.1 FUNCTION

```
1 function xdot=der1(t,x)
2     xdot=cos(t)
3 endfunction
4
```

FIGURE 1. FUNCTION WRITTEN IN SCILAB

1.2 CODE AND GRAPH

```
--> exec('C:\Users\shahi\AppData\Local\Temp\SCI_TMP_8272_26520\untitled.sce', -1)

--> t=[0:0.01:10]
 t  =

        column 1 to 15

  0.   0.01   0.02   0.03   0.04   0.05   0.06   0.07   0.08   0.09   0.1   0.11   0.12   0.13   0.14

        column 16 to 30

  0.15   0.16   0.17   0.18   0.19   0.2   0.21   0.22   0.23   0.24   0.25   0.26   0.27   0.28   0.29

        column 31 to 45

  0.3   0.31   0.32   0.33   0.34   0.35   0.36   0.37   0.38   0.39   0.4   0.41   0.42   0.43   0.44

        column 46 to 60

  0.45   0.46   0.47   0.48   0.49   0.5   0.51   0.52   0.53   0.54   0.55   0.56   0.57   0.58   0.59

        column 61 to 75

  0.6   0.61   0.62   0.63   0.64   0.65   0.66   0.67   0.68   0.69   0.7   0.71   0.72   0.73   0.74

        column 76 to 90

  0.75   0.76   0.77   0.78   0.79   0.8   0.81   0.82   0.83   0.84   0.85   0.86   0.87   0.88   0.89

        column 91 to 105

  0.9   0.91   0.92   0.93   0.94   0.95   0.96   0.97   0.98   0.99   1.   1.01   1.02   1.03   1.04

        column 106 to 120

  1.05   1.06   1.07   1.08   1.09   1.1   1.11   1.12   1.13   1.14   1.15   1.16   1.17   1.18   1.19

        column 121 to 135
```

FIGURE 2. CODE WRITTEN IN SCILAB

```
--> sol = ode(x_0, t_0, t, der1);

--> plot(t,sol)

--> size(sol)
 ans  =

   1.   1001.

--> z=sint+1;

Undefined variable: sint

--> z=sin(t)+1;

--> size(z)
 ans  =

   1.   1001.

--> y=ode(x_0, t_0, t, rtol, atol, der1);

Undefined variable: rtol

--> rtol=1e-7
 rtol  =

   0.0000001

--> atol=1e-7;

--> max(abs(z-y'))

Undefined variable: y

--> max(abs(z-sol));

--> max(abs(z-sol))
 ans  =
```

FIGURE 3. CODE WRITTEN IN SCILAB

```
--> max(abs(z-sol))
 ans  =

   2.0000005

--> z=sin(t)-1;

--> y=ode(x_0, t_0, t, rtol, atol, der1);

--> rtol=1e-7;

--> atol=1e-7;

--> max(abs(z-sol));

--> max(abs(z-sol))
 ans  =

   0.0000005

--> atol=1e-10;

--> rtol=1e-10;

--> max(abs(z-sol))
 ans  =

   0.0000005

--> y=ode(x_0, t_0, t, rtol, atol, der1);

--> max(abs(z-sol))
 ans  =

   0.0000005

--> y=ode(x_0, t_0, t, rtol, atol, der1);
```

FIGURE 4. CODE WRITTEN IN SCILAB

```
--> atol=1e-10;

--> rtol=1e-10;

--> max(abs(z-sol))
 ans  =

    0.0000005

--> y=ode(x_0, t_0, t, rtol, atol, der1);

--> max(abs(z-sol))
 ans  =

    0.0000005

--> y=ode(x_0, t_0, t, rtol, atol, der1);

--> atol=1e-10;

--> rtol=1e-10;

--> max(abs(z-sol))
 ans  =

    0.0000005

--> plot(t,sol)

--> max(abs(z-y))
 ans  =

    7.603D-10

--> plot(t,sol)

  "Environment saved."
-->
```

FIGURE 5. CODE WRITTEN IN SCILAB

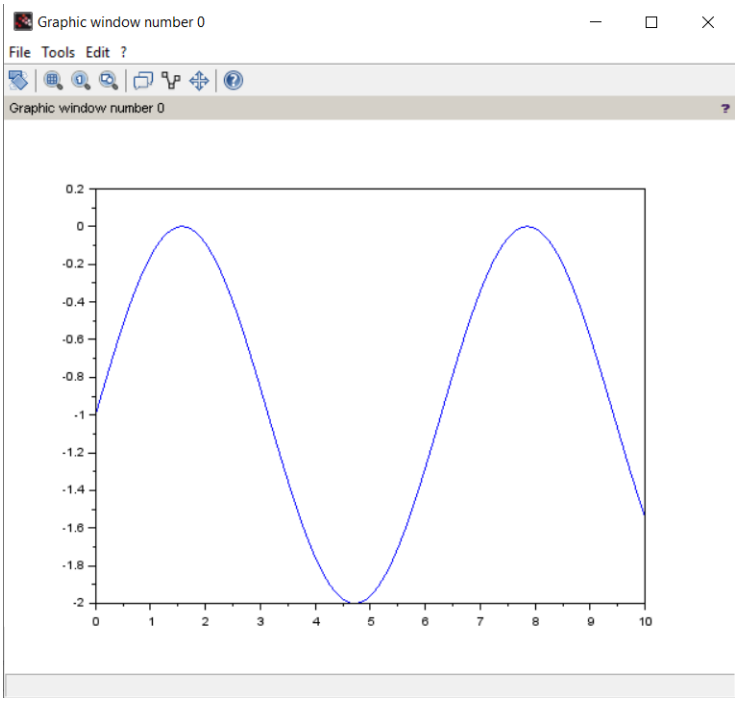

FIGURE 6. GRAPH DRAWN IN SCILAB

2 PROBLEM 2

$$x1dot = a11 \times x1 + a12 \times x2$$
$$x2dot = a21 \times x1 + a22 \times x2$$

f.sce

```
1 function xdot = f(t,x, A)
2     xdot=A*x
3
4 endfunction
5
```

FIGURE 7. FUNCTION WRITTEN IN SCILAB

```
--> exec('C:\Users\shahi\AppData\Local\Temp\SCI_TMP_8316_25771\f.sce', -1)

--> A=[1 2; 3 4]
 A  =

   1.   2.
   3.   4.

--> x0=[5; 6]
 x0  =

   5.
   6.

--> t0=0
 t0  =

   0.

--> t=[0:1:10]
 t  =

   0.   1.   2.   3.   4.   5.   6.   7.   8.   9.   10.

--> x=ode( x0, t0, t, list(f, A))
 x  =

         column 1 to 9

   5.   708.26457   152273.42   32792467.   7.062D+09   1.521D+12   3.275D+14   7.053D+16   1.519D+19
   6.   1544.9679   332888.78   71688945.   1.544D+10   3.325D+12   7.160D+14   1.542D+17   3.321D+19

         column 10 to 11

   3.271D+21   7.044D+23
   7.151D+21   1.540D+24

--> plot(t, x')
```

FIGURE 8. CODE WRITTEN IN SCILAB

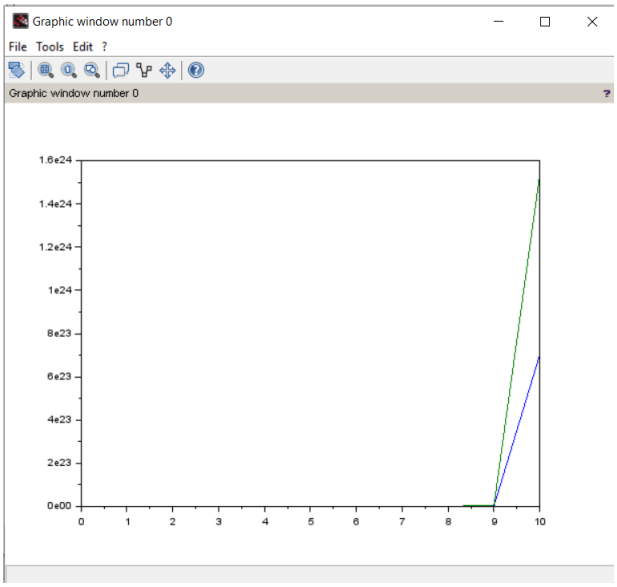

FIGURE 9. GRAPH DRAWN IN SCILAB

3 PROBLEM 3

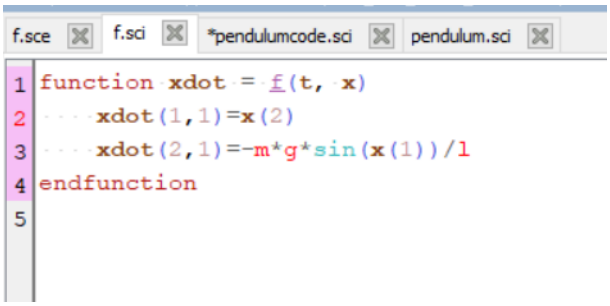

FIGURE 10. FUNCTION WRITTEN IN SCILAB

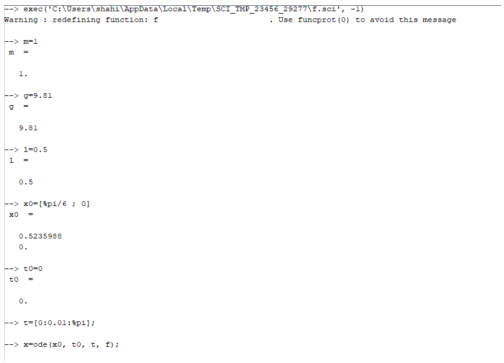

FIGURE 11. CODE WRITTEN IN SCILAB

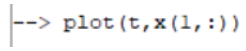

FIGURE 12. CODE WRITTEN IN SCILAB

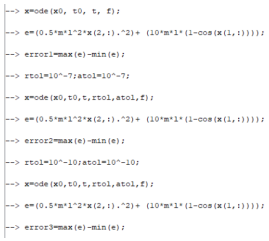

FIGURE 13. CODE WRITTEN IN SCILAB

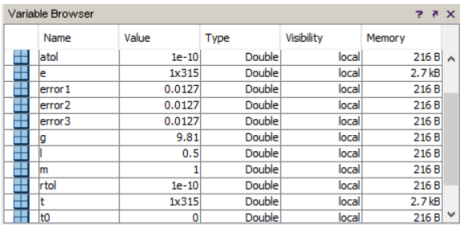

FIGURE 14. CODE WRITTEN IN SCILAB

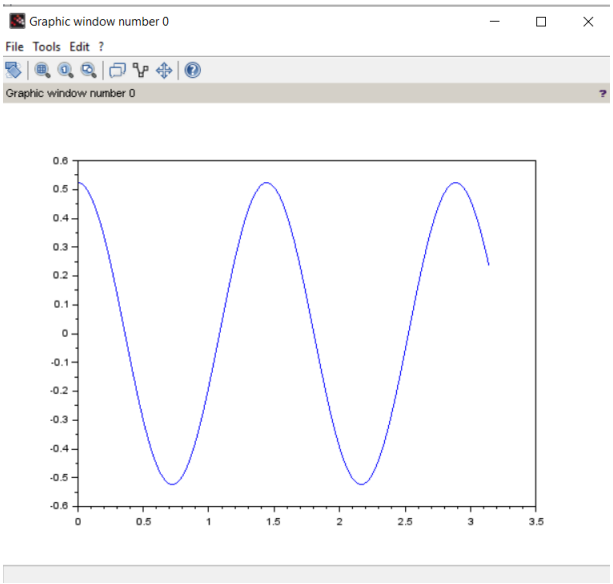

FIGURE 15. GRAPH DRAWN IN SCILAB