Expt. No................ Page No.............. Date......./......./..........

B.Sc IInd Semester

MATHS

PRACTICAL FILE

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Practical - No. 1

Expt. No.... .... Page No......1........ Date.21./.07./..2022

Write a program to obtain characteristic equation of the matrix A,

$$A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 1 & 5 \\ 7 & 1 & 4 \end{bmatrix}$$

and verify that it is satisfied by A, find the inverse of A. Also satisfies the Cayley Hamilton Theorem.

```
// VERIFY CAYLEY HAMILTON THEOREM FOR MATRIX A
a=1; b=3; c=2; d=2; e=1; f=5; g=7;
h=1; i=4;
A = [a, b, c; d, e, f; g, h, i];
disp("Determinant of A = ", det(A),);
x= poly(0,"x")
if det(A) ~= 0 then
    a1 = -1
    a2 = a+e+i;
    a3 = a*(e+i)-e*i+f*h+b*d+c*g;
    a4 = a*e*i-a*f*h-b*d*i+b*g*f+c*d*h
         -c*g*e;
   B = a1*A^3+a2*A^2+a3*A^1+a4*A^0;
   disp("characteristic Equation = ", det(A-x*eye(3,3)))
   disp("B", B)
   disp("inverse of A = ", inv(A));
if B == zeros(3,3) then
disp("Since B is Zero Matrix So The Cayley
      Hamilton Theorem verified")
end
```

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else disp ("The Matrix A is singular so The cayley Hamilton Theorem not apply)
end

OUT PUT :

--> exec ('/Users/collegeadmin/spematrix.sce', -1)
"Determinant of X = "
70.
"Characteristic Equeation= "
$70 + 16x + 6x^2 - 1x^3$
B =

0.	0.	0.
0.	0.	0.
0.	0.	0.

"inverse of A

-0.0142857	-0.1428571	0.1857143
0.3857143	-0.1428571	-0.0142857
-0.0714286	0.2857143	-0.0714286

"Since B is Zero Matrix So The cayley Hamiltion Theorem verified"

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Practical. No. -2

Expt. No. 2 Page No. 5 Date 22/07/2022

Write scilab code to find the solution of the system of linear equation

$$4x + 6y + 0z = 4$$
$$3x + 5y + 1z = 5$$
$$8x + 2y + 3z = 1$$

=>

$$A = \begin{bmatrix} 4. & 6. & 0. \\ 3. & 5. & 1. \\ 8. & 2. & 3. \end{bmatrix} \quad X \begin{bmatrix} x \\ y \\ z \end{bmatrix} \quad B = \begin{bmatrix} 4 \\ 5 \\ 1 \end{bmatrix}$$

```
--> A = [4 6 0; 3 5 1; 8 2 3]
A =
     4.   6.   0.
     3.   5.   1.
     8.   2.   3

--> X = ['x'; 'y'; 'z']

X =
      'x'
      'y'
      'z'
--> B = [4; 5; 1]

 B =
        4.
        5.
        1.
```

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--> X = inv(A) * B   // Syntax "inv(A) * B" and "A\B are equivalent

X =

-0.6956522
1.1304348
1.4347826

Practical. No. 3

Expt. No. .... Page No. 9 .... Date....../....../........

Write scilab code to find addition, subtraction multiplication and division of two complex numbers.

Let us take two complex numbers $z_1 = 1 + 2.i$ and $z_2 = 2 - 3i$ and perform various mathematical operations on them in console window of Scilab.

```
--> z1 = complex (1,2)
     z1 =
    1. + 2. i
--> z2 = complex (2,-3)
     z2 =
     2.  - 3. i
--> a = z1 + z2
    a =
        3.  - i
--> b = z1 - z2
     b =
       -1. + 5. i
--> c = z1 * z2
     c =
          8 + i
--> d = z1 / z2
     d =
       -0.3076923 + 0.5384615 i
```

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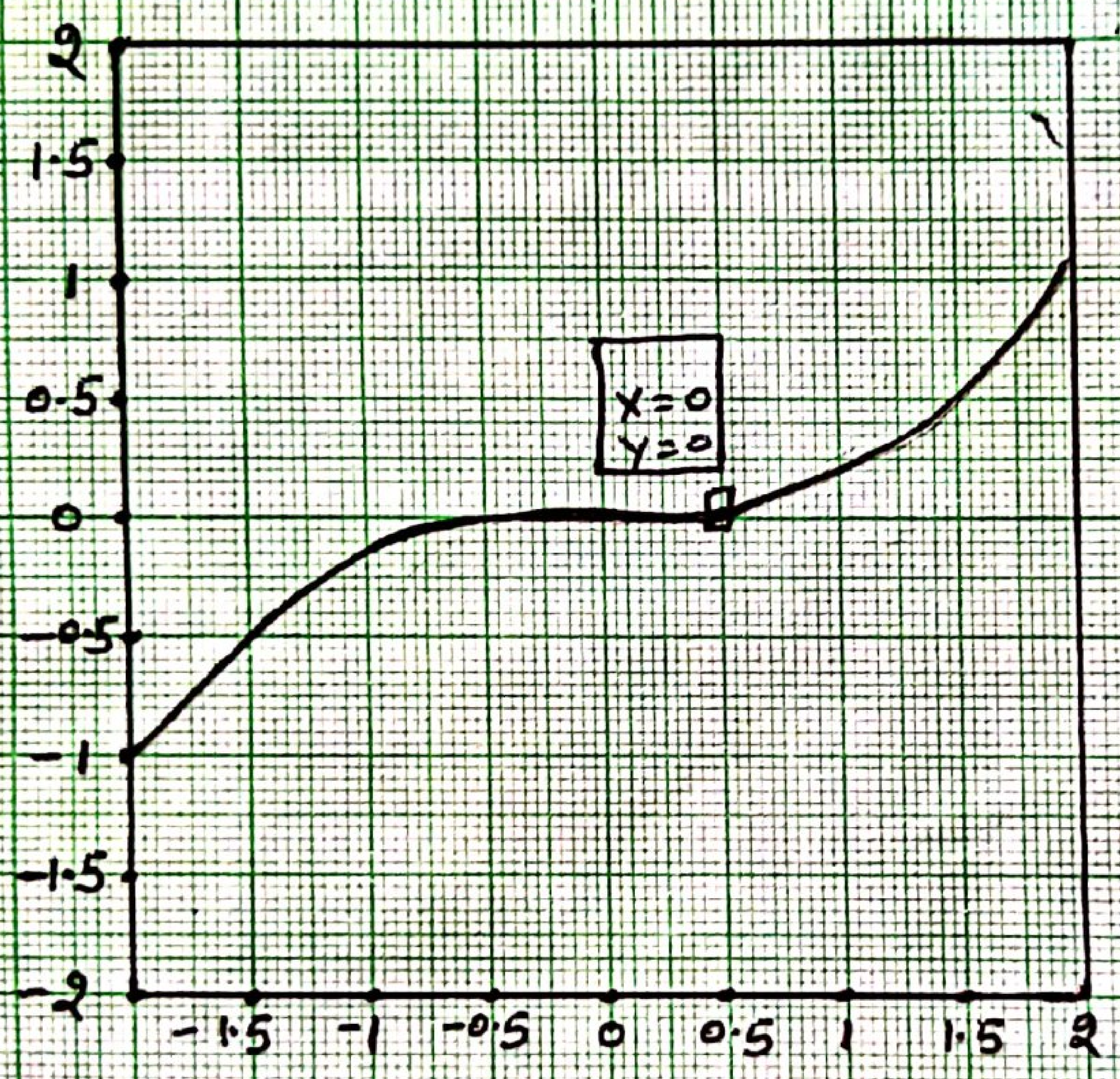


From the above graph of the function $f(x) = x - \sin(x)$ we observe that the curve cuts the x-axis at origin only so the equation $f(x) = 0$ has only one real solution $x = 0$

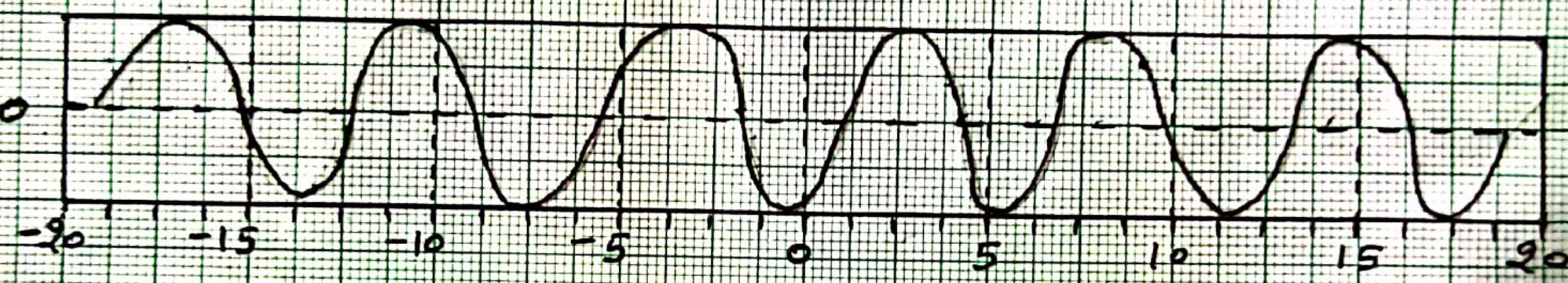
Practical. No- 4

Write a program to plot f(x) = x - sin(x) and find a solution for f(x) = 0 if it exists.

```
// Program to plot f(x) = x- sin(x)
x= -2 : .01 : 2 ;
plot (x, x- sin(x))

[r] = roots (x- sin(x))
if imag (r) = = 0
    then
    disp (real(r))
end
xgrid (5, 1, 3)
x title ("Graph of the function y= x - sin(x)")
p= gca ();

p. isoview = "on" ;
p. data_bounds = [-2 , -2; 2 2];
```

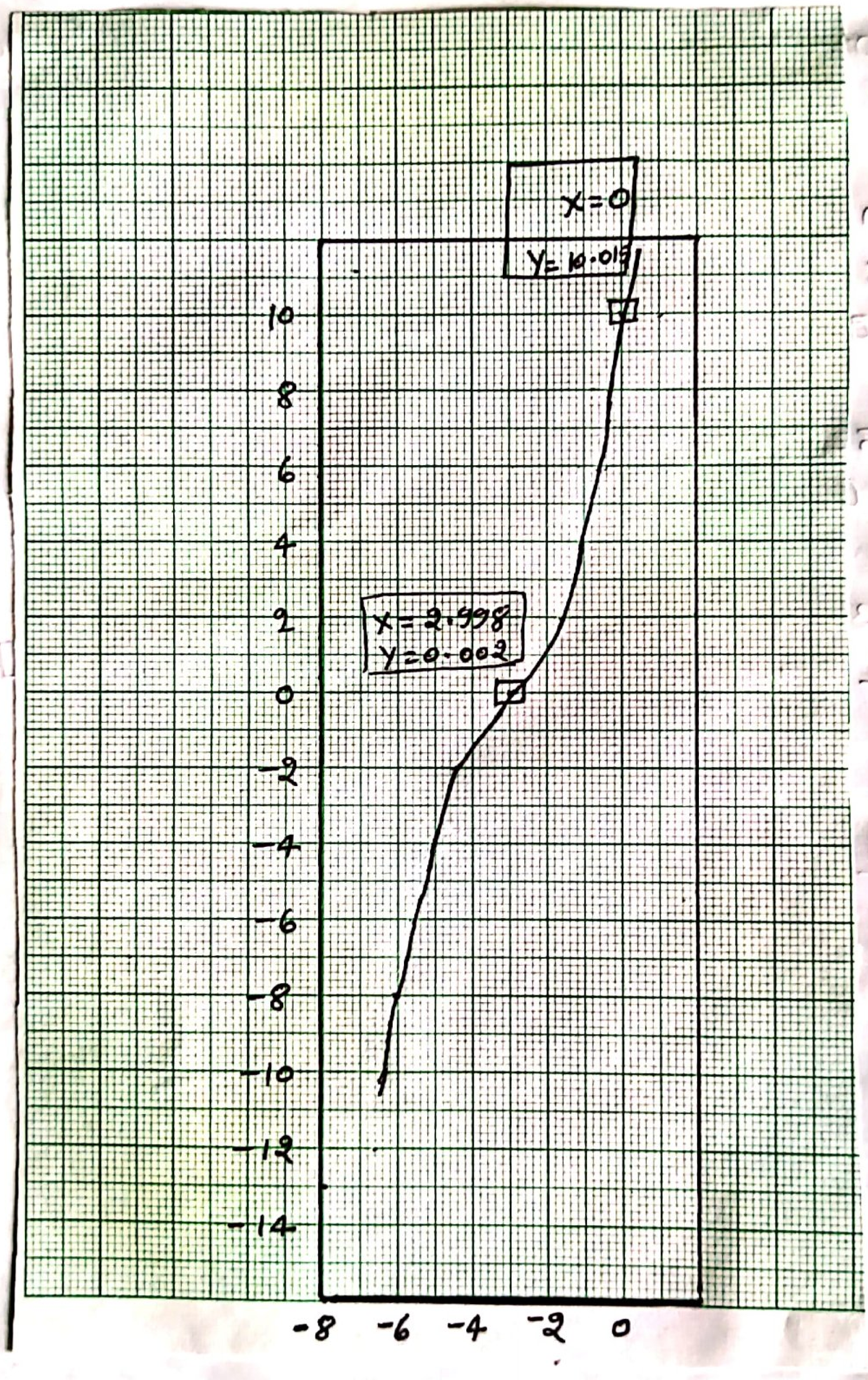


Graph of circular function 2. Sin(t)

Practical · No · 5

Write a program to draw circular function 2 · sin(t)

```
// Draw the Graph of Circular Function 2· sin(t)
a = 2 ;
t = linspace (-6*%pi , 6*%pi , 100)
plot (t , a*sin (t))
x grid (5, 1, 2)
x label "Graph of the Circular Function 2·sin(t)"
p = gca ( ) ;
p. isoview = "on"
p. data_bounds = [-20 , -a ; 20 , a] ;
```



Graph of Hyperbolic function sin h (t+3)

Practical No - 6

Write a program to draw Hyperbolic function sinh(t+3)

```
// Draw the Graph of Hyperbolic function a.Sinh(t+b)

a =1 ;        b =  3 ;

t = linspace (-2*%pi , 2*%pi , 1000)

plot (t, a* sinh (t + b) )

xgrid (4, 1, 2)

xlabel " Graph of the circular Function sinh(t+3)"

p = gca ( ) ;

p. isoview = "on" ;

p. data_bounds = [-8 , -15*a ; 1, 15*a] ;
```

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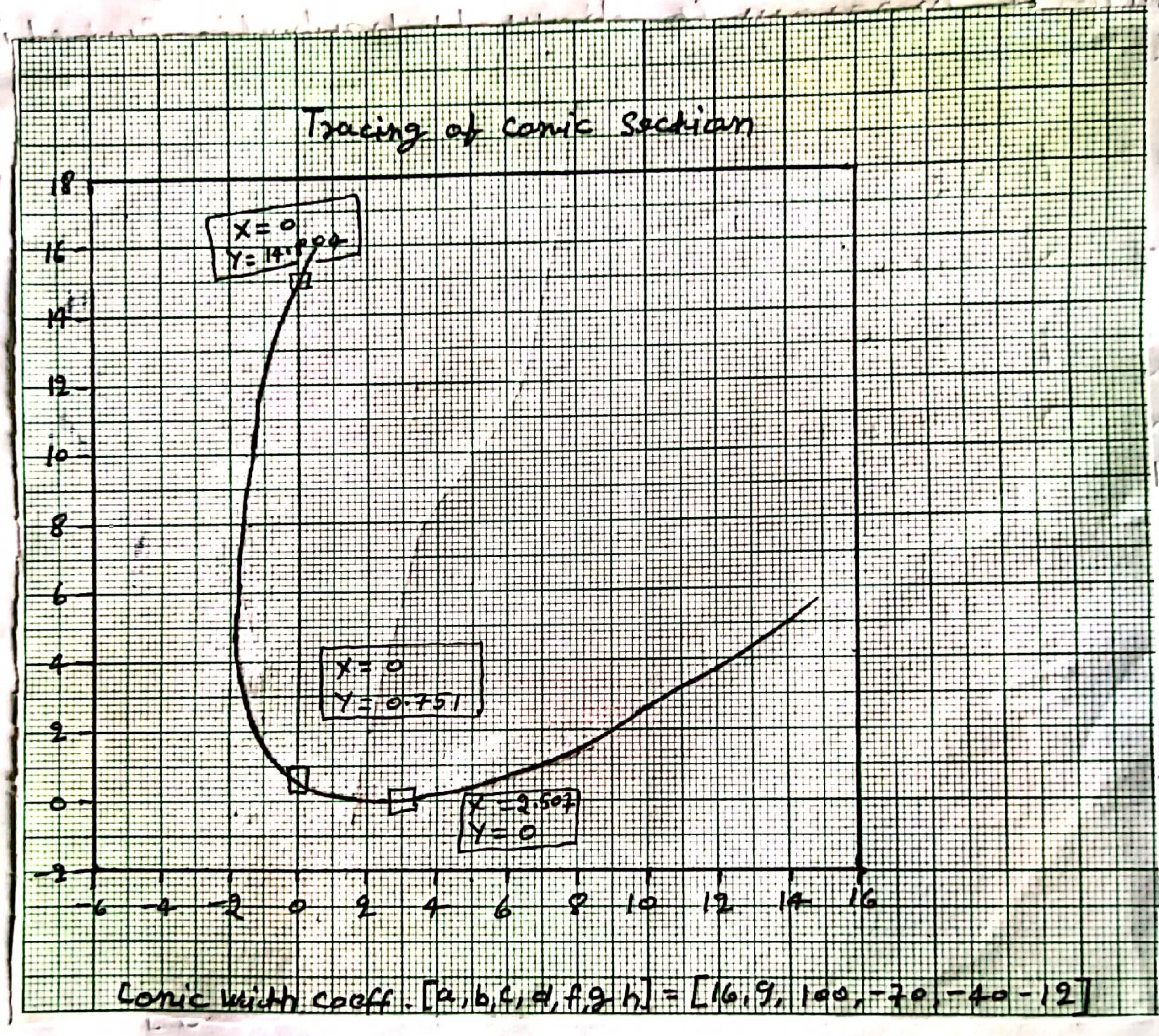

Tracing of conic section
X = 0
Y = 14.904
X = 0
Y = 0.751
X = 2.507
Y = 0
18
16
14
12
10
8
6
4
2
0
-2
-6 -4 -2 0 2 4 6 8 10 12 14 16
Conic with coeff. [a,b,c,d,f,g,h] = [16,9,100,-70,-40,-12]

Practical. No. 7

Write a program to trace a conic section for equation $16x^2 - 24xy + 9y^2 - 80x - 140y + 100 = 0$

```
// Draw the equation of conic
a = 16 ;
b = 9 ;
c = 100;
f = -70 ;
g = -40 ;
h = -12 ;
plotimplicit ("a*x^2 + b*y^2 + 2*h*x*y + 2*g*x + 2*f*y + c = 0",
              [-5, 15] , [-12, 16] )

xgrid (5, 1, 2)

xlabel " Conic with coeff. [a, b, c, f, g, h] = [16 9 100 -70 -40 -12]";

p = gca ( );

p.isoview = "on" ;

p.data_bounds = [-5, -1 ; 15, 18] ;

xtitle (" Tracing of the conic Section ")
```

Practical No. 8

Write a program to define a polynomial function of degree nine with unite coefficients. Evaluate its first, secound and third derivatives

Scilab commands.

--> z = poly (0 , "z")

--> p4 = poly (ones (1, 10), 'z', 'coeff') //define polynomial p4 with coefficient ones of 10 terms.

p4 =

$1+z+z^2+z^3+z^4+z^5+z^6+z^7+z^8+z^9$

--> derivat (P4) //derivative of the polynomial P4

ans =

$1+2z+3z^2+4z^3+5z^4+6z^5+7z^6+8z^7+9z^8$

--> p5 = derivat (P4) // first derivative of P4 is P5

p5 =

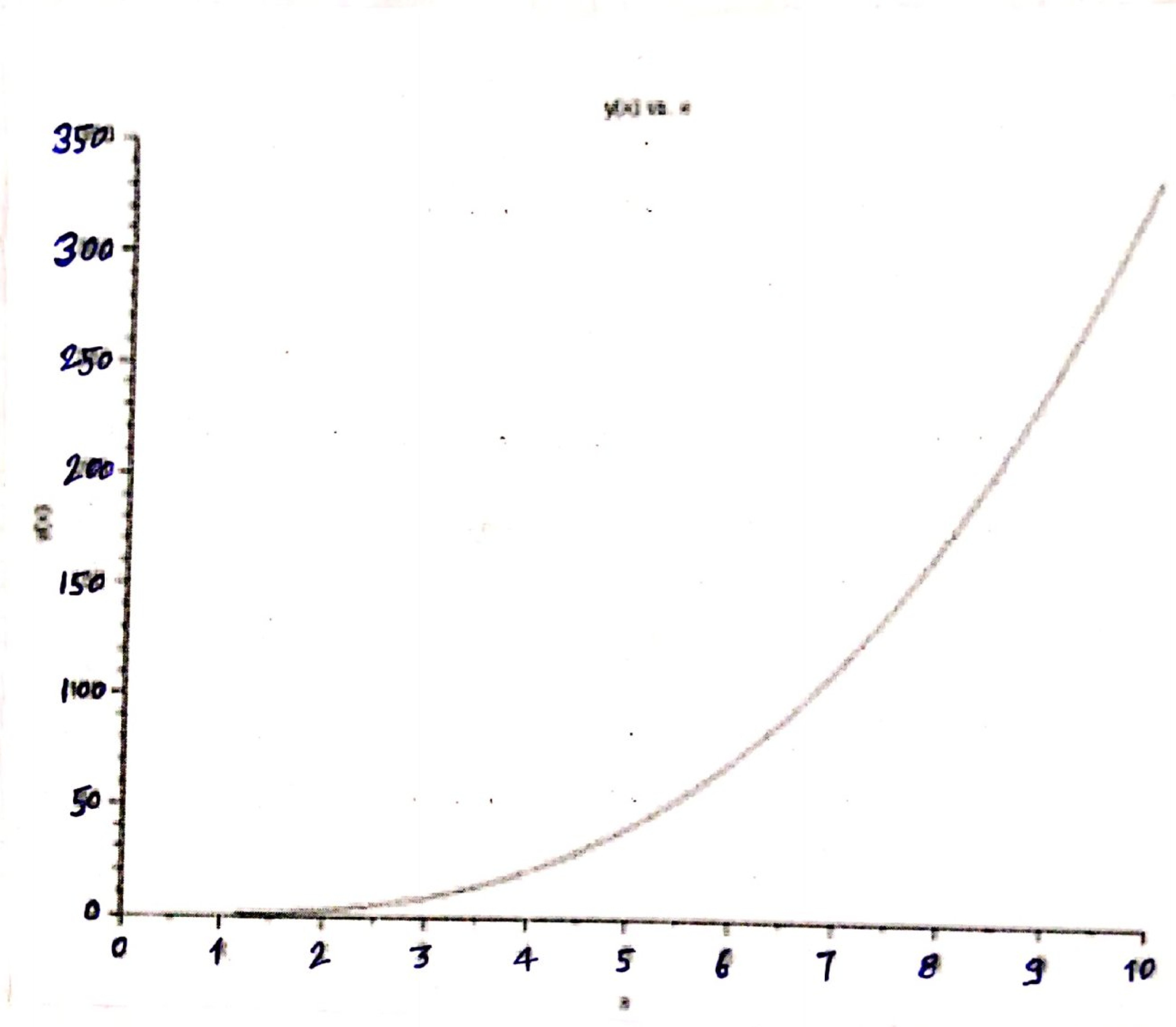
$1+2z+3z^2+4z^3+5z^4+6z^5+7z^6+8z^7+9z^8$

--> derivat(p5) // second derivative of p4 OR first derivative of p5 ans =

$2+6z+12z^2+20z^3+30z^4+42z^5+56z^6+72z^7$

--> derivat(derivat(derivat(p4))) // third derivative of p4

ans =
$6+24z+60z^2+120z^3+210z^4+336z^5+504z^6$



y(x) vs. x
350
300
250
200
150
100
50
0
0
1
2
3
4
5
6
7
8
9
10

Practical No. 9

Write scilab code to find solution of first order linear differential equation:

$$\frac{dy}{dx} + e^{-x}y = x^2 \text{ with } y=0 \text{ for } x=0$$

```
funcprot(0)

clf ;
function dx = f(x, y)
    dx = x^2 - exp(-x)*y;
endfunction
yo = 0;
xo = 0;
x = [0:0.5:10];
sol = ode (yo, xo, x, f);
plot2d (x, sol, 5)
xlabel ('x') ;
ylabel ('y(x)') ;
xtitle ('y(x)' v.s. x') ;
```

Practical No- 10

Write scilab code to solve a second order ordinary differential equation (ODE) :-

$$\frac{d^2y}{dt^2} = \frac{1}{t+1} + \sin(t)\sqrt{t}$$

with the initial condition :

$$y(0) = 0$$

$$\frac{dy}{dt}(0) = -2$$

The first step is to write the secound order differential equation as a system of two first order differential equation

$$\frac{dy}{dt} = z$$

$$\frac{dz}{dt} = \frac{1}{t+1} + \sin(t)\sqrt{t}$$

This way we have set our differential equation in the form

$$\frac{dx}{dt} = f(t, x)$$

where dx and x are

$$x = \left[z; \frac{1}{t+1} + \sin t \sqrt{t} \right]$$

$$dx = \left[\frac{dy}{dt} ; \frac{dz}{dt} \right]$$

Step-1 Define the differential equation as a custom function

```
function dx = f (t, x)
dx(1) = x(2)
dx(2) = 1 / (t+1) + sin(t) * sqrt(t) ;
end function
```

Step 2. Define the integration time t, initial time to and initial values

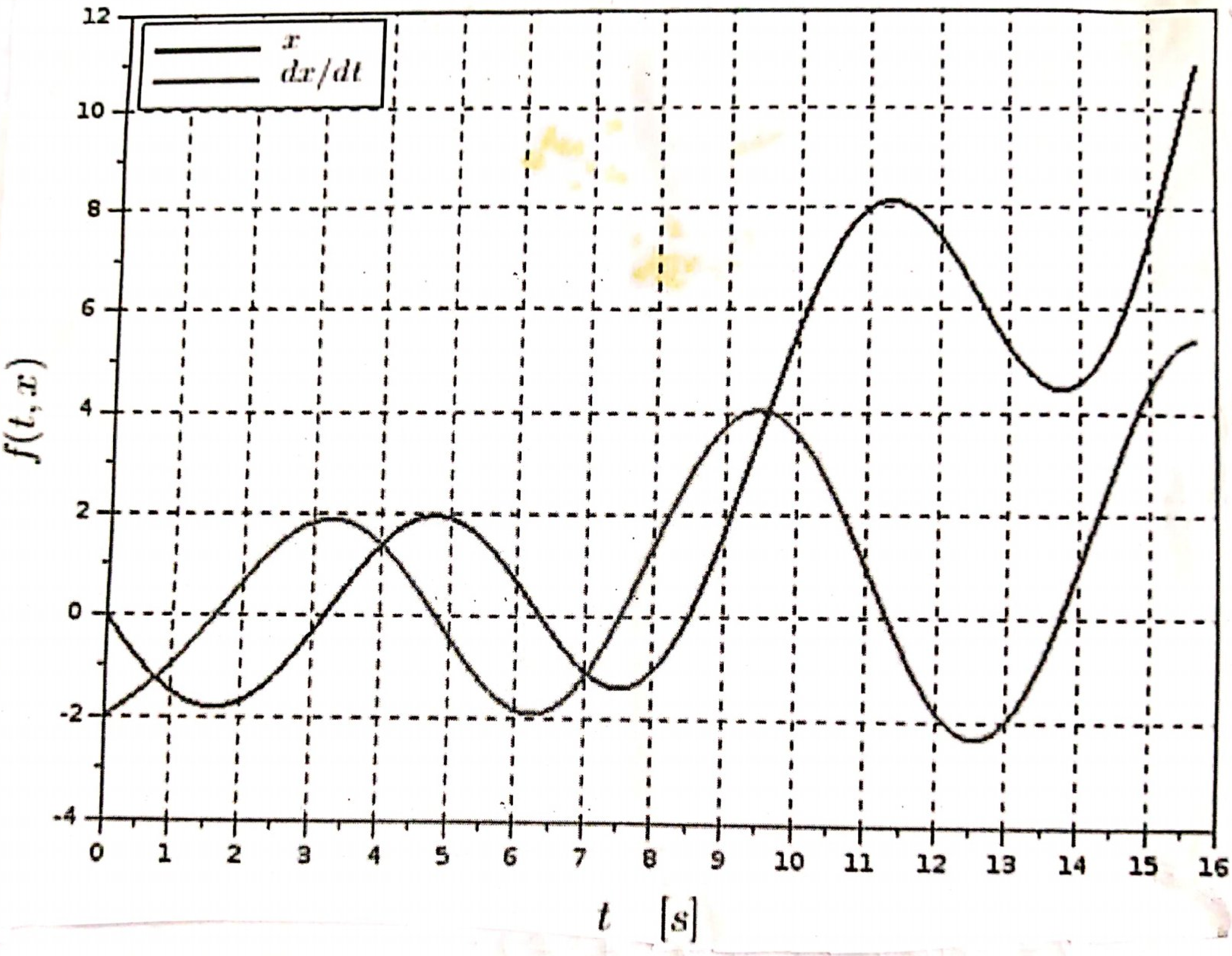
```
t = 0:0.01:5*%pi;
to = min(t);
yo = [0; -2];
```

Step-3 Call the ode() function above parameters.

```
y = ode(yo, to , t, f)
```

Step-4 Plot the result.

Notice that the numerical solution y contains the second and first integration results, y and y'


x
dx/dt
f(t, x)
t [s]
12
10
8
6
4
2
0
-2
-4
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

```
plot(t,y(1,:), 'LineWidth', 2)
plot (t,y(2,:), 'r' 'LineWidth'. 2)
xgrid();
xlabe ('$t \quad [s] $'; 'FontSize, 3)
ylabe ('$ f (t,x) $', 'FontSize', 3)
title (['Integration of ' '$\ frac{d^2 x} {dt^2}
   =\ frac {1} {t+1} + sint(t)\ sqrt{t} $'], 'FontSize'3)
legend (['$\ Large{x} $' '$\ Large {dx/dt} $'], 2)
```