Symbolic mathematics

- Symbolic mathematics means doing mathematics on symbols (not numbers).
- To create a variables (x and y) as symbol

x = sym('x')

Y = sym('y')

Or

syms x y z …

- poly2sym
- sym2poly
- simplify(x)
- expand(x)
- factor(x)
- subs(f,2) or subs(f, x,2)
- subs(f,[x y z],[5 5 5]) [multi-variables]

Solving algebraic equations using symbolic toolbox

4x-2y+z = 7

x+y+5z = 10

-2x+3y-z =2

We can use solve function

solu = solve (equations)

x = solu.x

Y = solu.y

Z = solu.z

solu = double([x y z])

Limits

- Limit (f(x) , x, value)
- $\lim \frac{x^2 - 1}{X - 1}$ x = 1
- Ex

```
syms x
f = ( x^2 – 1 ) / ( x – 1 );
limit(f,1) or limit(f,x,1)
```

Discontinuity function at a point

- **f(x) = (x - 3)/|x - 3|**
  at x = 3 the function is not exist
- At x > 3 and at x < 3 the function is exist
- So we can find the function at these points
- limit (f , 3 , 'right') at x > 3
- limit (f , 3 , ' left') at x < 3

Differentiation and Integration

- polyder((Fx) .
- To calculate the differential at point use polyval(coef,x) .
- polyint(Fx) for indefinite integration .
- use polyval(coef,x) to get the value of definite integration .

By Symbolic

- diff(Fx , x , order) for differentiation .
- int(Fx) for indefinite integration .
- int(Fx , x1 , x2) for definite integration .

Practice

- $y = 3x^2 - 12x + 17$
- X = -10:10

find the mínimum point of the curve .

Practice

- Let us calculate the area enclosed between the x-axis, and the curve

  y = x3-2x+5 and the ordinates x = 1 and x = 2

by three ways

1- polyint

2- int(Fx)

3- trapz

Solving the ordinary differential equations

- dsolve can be used to slove the ordinary diff equ.

ex_1 :

y' = 5y

S = dsolve('Dy = 5*y')

ex_2 :

y'' – y = 0 at y(0) = -1, y'(0) = 2

s = dsolve('D2y – y = 0','y(0) = -1','Dy(0) = 2')

Laplace transform

- laplace(F(t))
- Laplace inverse :

  ilaplace (F(s))

- Use laplace transform to solve ordinary differential equations .

Fourier transform

- fourier(f)
- fourier inverse :

  ifourier(f)

practice

- syms x

  f = exp(-2*x^2)

  ezplot(f,[-2,2])

  FT = fourier(f)


Thank
you