**SERIES SOLUTIONS FOR ODE**

**Aim**

To find the power series solution and visualize it for the second order initial value problem with ordinary point using MATLAB

**clc**

clear all

syms x a0 a1 a2 a3 a4 m c1 c2

y=a0\*x^m+a1\*x^(m+1)+a2\*x^(m+2)+a3\*x^(m+3)+a4\*x^(m+4)

eq=x^2\*diff(y,x,2)+x\*diff(y,x,1)+x^2\*y

eq1=collect(eq)

eq2=coeffs(simplify(eq1),x)

eq3=solve(eq2(1),m)

a1=solve(eq2(2),a1)

a2=solve(eq2(3),a2)

a3=subs(solve(eq2(4),a3))

a4=subs(solve(eq2(5),a4))

ss=a0\*x^m+a1\*x^(m+1)+a2\*x^(m+2)+a3\*x^(m+3)+a4\*x^(m+4)

y1=subs(ss,m,eq3(1))

y2=subs(diff(ss,m),m,eq3(1))

gs=c1\*y1+c2\*y2

fs=subs(gs,{c1,c2,a0},{1,2,3})

ezplot(fs)

output:

ss =

a0\*x^m - (a0\*x^(m + 2))/(m^2 + 4\*m + 4) + (a0\*x^(m + 4))/((m^2 + 4\*m + 4)\*(m^2 + 8\*m + 16))

y1 =

(a0\*x^4)/64 - (a0\*x^2)/4 + a0

y2 =

(a0\*x^2)/4 - (3\*a0\*x^4)/128 + a0\*log(x) - (a0\*x^2\*log(x))/4 + (a0\*x^4\*log(x))/64

gs =

c1\*((a0\*x^4)/64 - (a0\*x^2)/4 + a0) + c2\*((a0\*x^2)/4 - (3\*a0\*x^4)/128 + a0\*log(x) - (a0\*x^2\*log(x))/4 + (a0\*x^4\*log(x))/64)

fs =

6\*log(x) - (3\*x^2\*log(x))/2 + (3\*x^4\*log(x))/32 + (3\*x^2)/4 - (3\*x^4)/32 + 3

