Taylor series expansion

Algorithm:

1. Start
2. function *variable* = *function name* (*variable* x)
3. Define no. of terms n = initial value : final value
4. Apply *for* loop for variable (i.e x axis range)
5. Define the equation $y = f(x)$
6. Give *end* for *for loop.*
7. Give *end* for main *function.*
8. Give *variable* x value i.e required value of x
9. Call function name
10. Display output.
11. For plotting, give plot command.
12. Stop.

Problem :

(1) To find the value of sin(x) using Taylor series expansion and its graph

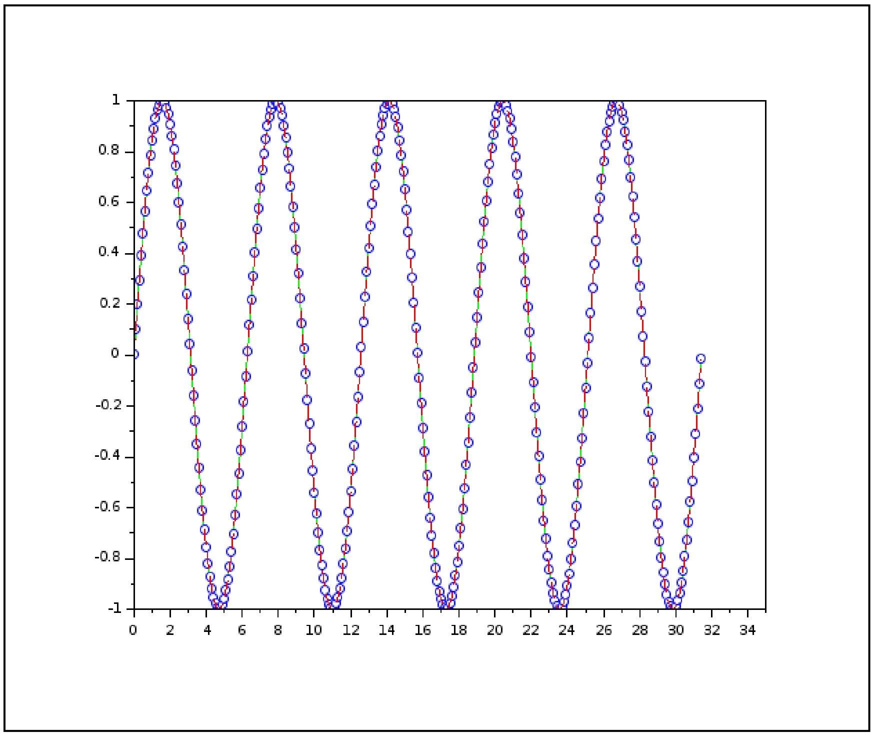
Expansion of sin(x) is $\sum_{n=1}^{\infty} \frac{(-1)^{n-1} x^{2n-1}}{(2n-1)!}$

SCILAB COMMANDS

```
-->function y=taylor2(x);
>n=1:100;
> c=2*n-1;
>s=(-1).^(n-1);
>f=factorial(c);
>for i=1: length(x);
>y(i)=sum(s.*x(i).^c./f);
```

>end;end;
--> x=0.1
X=0.1
-->taylor2(x)
Ans=0.0998334
Graph

Graph ploting
-->x=0:0.1:10*%pi
--
>plot(x,taylor2(x),"ob
",x,sin(x),"--r")



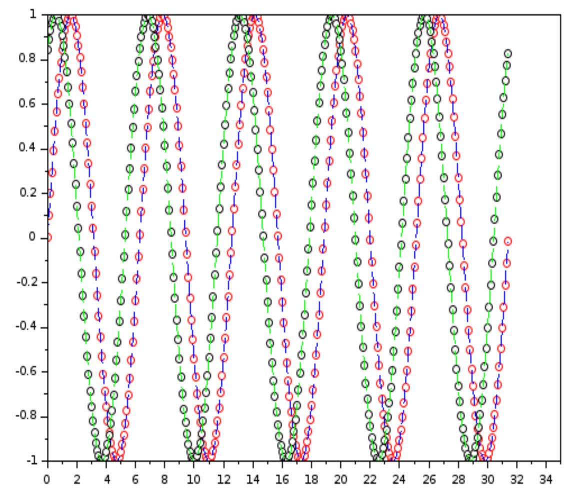
Here Taylor series expansion graph of sin(x) is represented by blue color and graph of sin(x) by red color

Comparison of graph of sin(1+x) and sin(x)

Graph ploting

```
-->x=0:0.1:10*%pi
-->plot(x,taylor2(x),"or",x,sin(x),"--b",x,taylor3(x),"ok",x,sin(x+1),"--g")
```

Here taylor3(x) if for sin(1+x)



Here Taylor series expansion graph of sin(x), sin(1+x) is represented by red, black color respectively and graph of sin(x), sin(x+1) by blue, green color respectively

(2) To find the value of exp(x) using Taylor series expansion and its graph

Expansion of exp(x) is $\sum_{n=0}^{\infty}\frac{x^n}{(n)!} = 1 + x + x^2/2!$

SCILAB COMMANDS

```
-->function y=taylor(x);
> n=0:100;
>fori=1:length(x);
>y(i)=sum(x(i).^n./factorial(n));
>end;end;
--> x=0
x  =
0.
-->taylor(x)
ans  =
1.
--> x=1
x  =
1.

-->taylor(x)
ans  =
```

2.7182818

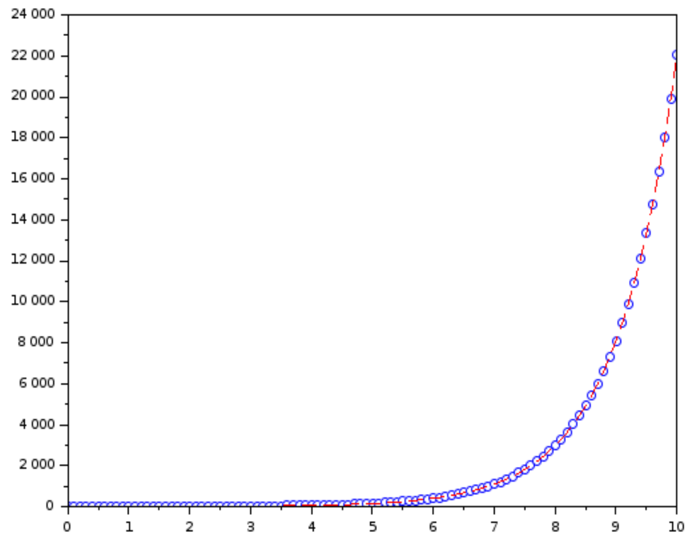
Graph ploting

-> x=0:0.1:10;

--

>plot(x,taylor(x),"ob",x,exp(x

),"--r")



Here Taylor series expansion graph of exp(x) is represented by blue color and graph of exp(x) by red color

(3) To find the value of sinh(x) using Taylor series expansion and its graph

Expansion of exp(x) is $\sum_{n=1}^{\infty}\frac{x^{2n-1}}{(2n-1)!}$

SCILAB COMMANDS

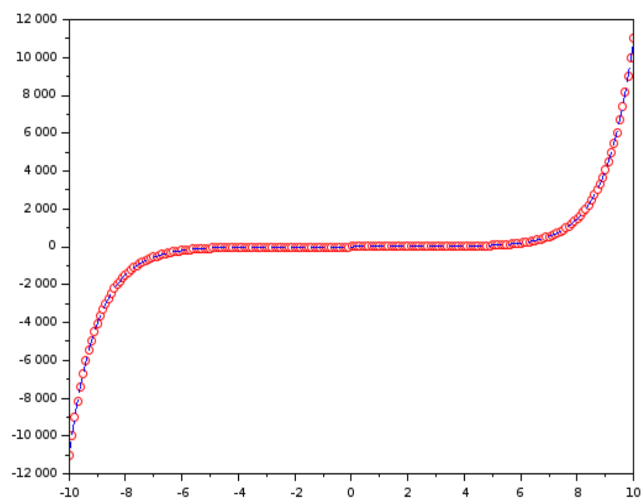
```
-->function y=hyperbolic1(x);
> n=1:200;
> c=2*n-1;
>fori= 1:length(x);
>y(i)= sum(x(i).^c./factorial(c));
>end;end;
--> x=0
x  =
0.
--> hyperbolic1(x)
ans  =
0.

--> x=1
x  =
1.
-->hyperbolic1(1)
ans  =
1.1752012
-->sinh(1)
ans  =
1.1752012
```

Graph ploting

```
--> x=-10:0.1:10;

--
>plot(x,hyperbolic1(x),"or",x
,sinh(x),"--b")
```



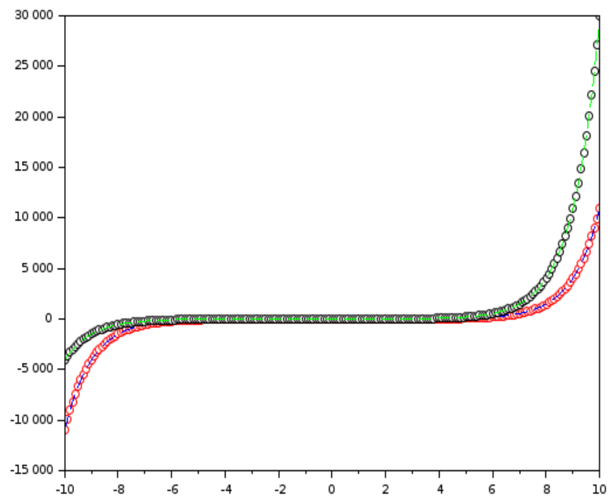
Comparison of graph of sinh(1+x) and

Here Taylor series expansion graph of sinh(x) is represented by red color and graph of sinh(x) by blue color

Graph ploting

-->x=-10:0.1:10;>plot(x,hyperbolic1(x),"or",x,sinh(x),"--b",x,hyperbolic2(x),"ok",x,sinh(1+x),"--g")

Here hyperbolic2(x) if for sinh (1+x)



Here Taylor series expansion graph of sinh(x), sinh(1+x) is represented by red, black color respectively and graph of sinh(x), sinh(x+1) by blue, green color respectively

(4) To find the value of log(1+x) using Taylor series expansion and its graph

Expansion of exp(x) is $\sum_{n=1}^{\infty} \frac{x^n}{n}(-1)^{n-1}$

SCILAB COMMANDS

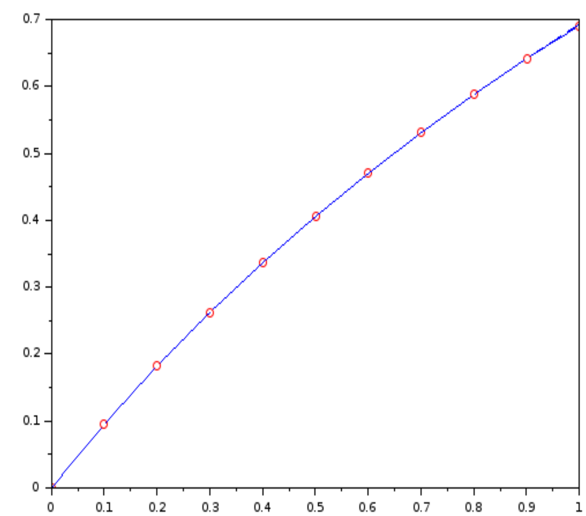
```
-->function y=logarthmic1(x);
> n=1:100;
> c= (-1).^(n-1);
>fori= 1:length(x);
>y(i)= sum(x(i).^n.*c./n);
>end;end;
--> x=0
x  =
0.
--> logarthmic1 (x)
ans  =
0.
--> x=1
x  =
1.
--> logarthmic1 (x)
ans  =
```

0.6881722

Graph ploting

```
--> x=0:0.1:1;

--
>plot(x,logarthmic1(x),"or",x,
log(1+x),"--b")
```



Here Taylor series expansion graph of log(1+x) is represented by red color and graph of log(x) by blue color