A series expansion for the Fresnel integral $C(x) = \int_0^x cos(\pi t^2/2)dt$ is given by :

$$C(x) = \sum_{k=0}^{\infty} \frac{(-1)^k (\pi/2)^{2k} x^{4k+1}}{(2k)!(4k+1)}$$

where $(2k)! = 1.2.3.4.5\ldots(2k)$ is the factorial of $(2k)$.

(a) Define a C or C++ function `double fresnel1(double x, int n)` that evaluates the series expansion for the Fresnel integral using the expansion up to the n-th term in the series for a given value of the arguments x and n. You may want to define your own function `factorial(n)` to calculate $n!$ and call it appropriately. [6]

(b) Plot your function `fresnel(x,n)` with $n = 20$, for $x \in [0.0, 2.0]$ using `gnuplot` and save the plot as a postscript file. [2+1]

```
#include <iostream>

#include <cstdlib>

#include <cmath>

#include <fstream>


using namespace std;


double factorial(int n)

{

 if(n<0) exit(1);

 if(n==0 || n==1) return 1.0;

 else return n * factorial(n-1);

}



double fresnel1(double x, int n)
```

```
{
  double sum = 0;
  for(int k=0; k<=n; k++) {
    sum += (pow(-1, k) * pow(M_PI_2, 2*k) * pow(x, 4*k+1)) / (factorial(2*k) * (4*k+1));
  }

  return sum;
}

int main()
{
  ofstream fout("fres.txt");
  int n = 20;

  for(double x=0; x<=20; x+=0.1) {
    fout << x << "  " << fresnel1(x, n) << endl;
    cout << x << "  " << fresnel1(x, n) << endl;
  }

  fout.close();

  cout << "x->inf = " << fresnel1(1000, 200) << endl;

  return 0;
}
```