Question 1:

Given the initial value x0x0 we want to calculate the sequence $x_1, x_2, x_3...x_k...$ where each x_k is defined as:

$$x_k = x_{k-1} - \frac{x_{k-1}^3 + 4x_{k-1}^2 - 1}{3x_{k-1}^2 + 8x_{k-1}}$$

Write a program which obtains from the user x0x0 and ZZ; both values must be in the interval]0, 1[(ie the bounds 0 and 1 are not included in the interval). When one of the two inputs is not valid, the program should not proceed with the calculation of the sequence $x_1, x_2, x_3...x_k...$ and it should stop.

Only when both inputs are valid, calculate the sequence $x_1, x_2, x_3...x_k$ for a value k such that $|x_k - x_{k-1}| < Z$. Output the sequence $x_1, x_2, x_3...x_k$.

Answer:

```cpp
#include<iostream>
#include<math.h>
using namespace std;

int main()
{
    float x0,z,x,p;

     do{
        cout<<"enter: ";
        cin>>x0>>z;

        if (!(x0 <= 0 || x0 >=1 && z <=0 || z >=1)) {

     do{
        x = x0 - ((pow(x0,3) + 4*(pow(x0,2)) - 1) / (3*(pow(x0,2)) + 8*x0));
        cout<<x<<endl;

        p = fabs((x)-(x0));
        x0 = x;
     }while(p > z);

}else{
    cout<<"invalid input! the program is terminated"<<endl;
    break;
}

}while (!(x0 <= 0|| x0 >=1 && z <=0 || z >= 1));

return 0;
}
```

Question 2:

The Fibonacci sequence is defined as follows:

$F_0=1$, $F_1=1$, $F_n=F_{n-1}+F_{n-2}$ for any $n\geq2$.
Write a program which gets the value n from the user

1) which calculates the sequence F_2, F_3, F_4,..., F_n.
2) which calculates the quantity : $Q=a_n-b_n/\sqrt{5}$ where : $a=1+\sqrt{5}/2$ and $b=1-\sqrt{5}/2$. Do not use the function pow(x, y), instead, use a for loop to calculate a^n and b^n
Output the complete sequence F_2, F_3, F_4,..., Fn and Q.
Answer:

```cpp
#include<iostream>
#include<stdio.h>
#include<math.h>
using namespace std;

int main()
{
    float n,F,f,i,a,b,x,y,q;
    int f0=1,f1=1;

    cout<<"Enter the value of n ";
    cin>>n;

    for(i=2;i<=n;i++) {
        f=f0+f1;

        cout<<f<<" , ";
        f0=f1;
        f1=f;
    }

    a = (1 + sqrt(5)) / 2;
    b = (1 - sqrt(5)) / 2;
    x = a;
    y = b;
    for(i=1;i<n;i++) {
        x = a*x;
        y = b*y;
    }
    q = (x-y)/sqrt(5);
    cout<<"Quantity: "<<q;

    return 0;
}
```

Question 3:

The following function $f(x)=x^4+2x^3+8x^2+5x$ has a minimum on the interval [-2, 1]. Define xmin the location of that minimum. Using the search method presented in class, determine an upper bound of xmin, using the value of a variable step (to be obtained from the user).

Answer:

```cpp
#include<iostream>
#include<stdio.h>
#include<math.h>
using namespace std;


int main ()
{

double x1 = -3;

double step;

double x0, y0, y1;


cout << "enter the input";

cin >> step;


  do
   {

x0 = x1;

x1 = x0 + step;


y0 = pow(x0, 4) + 2*pow(x0, 3) + 8*pow(x0, 2) + 5*x0;
y1 = pow(x1,4) + 2*pow(x1,3) + 8*pow(x1,2) + 5*x1;
}
while (y0>y1);
cout<<"xmin :"<<x1;

return 0;

}
```