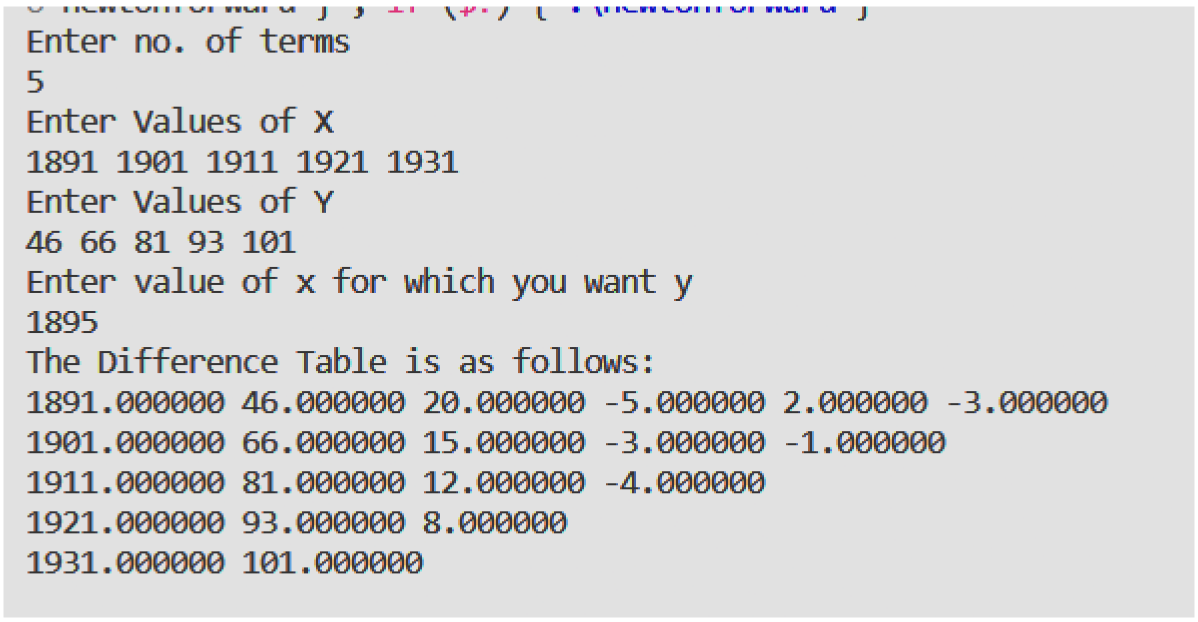
**Newton Forward Interpolation:**

**Code:**

```
#include<stdio.h>

#include<math.h>

int main()

{

    float x,u1,u,y;

    int i,j,n,fact;

    printf("Enter no. of terms\n");

    scanf("%d",&n);

    float a[n][n+1];

    printf("Enter Values of X\n");

    for(i=0;i<n;i++)

          scanf("%f",&a[i][0]);

    printf("Enter Values of Y\n");

    for(i=0;i<n;i++)

          scanf("%f",&a[i][1]);

    printf("Enter value of x for which you want y\n");

    scanf("%f",&x);

    for(j=2;j<n+1;j++){

        for(i=0;i<n-j+1;i++)

            a[i][j] = a[i+1][j-1]-a[i][j-1];

    }

    printf("The Difference Table is as follows:\n");

    for(i=0;i<n;i++){

     for(j=0;j<=n-i;j++)

        printf("%f ",a[i][j]);

     printf("\n");

    }

    u= (x - a[0][0])/(a[1][0]-a[0][0]);
    y=a[0][1];

    u1=u;

    fact=1;

    for(i=2;i<=n;i++){

        y=y+(u1*a[0][i])/fact;

        fact=fact*i;

        u1=u1*(u-(i-1));

    }

    printf("\n\nValue at X=%g is = %f", x,y);

    return 0;


}
```

**Output:**



```
Enter no. of terms
5
Enter Values of X
1891 1901 1911 1921 1931
Enter Values of Y
46 66 81 93 101
Enter value of x for which you want y
1895
The Difference Table is as follows:
1891.000000 46.000000 20.000000 -5.000000 2.000000 -3.000000
1901.000000 66.000000 15.000000 -3.000000 -1.000000
1911.000000 81.000000 12.000000 -4.000000
1921.000000 93.000000 8.000000
1931.000000 101.000000
```

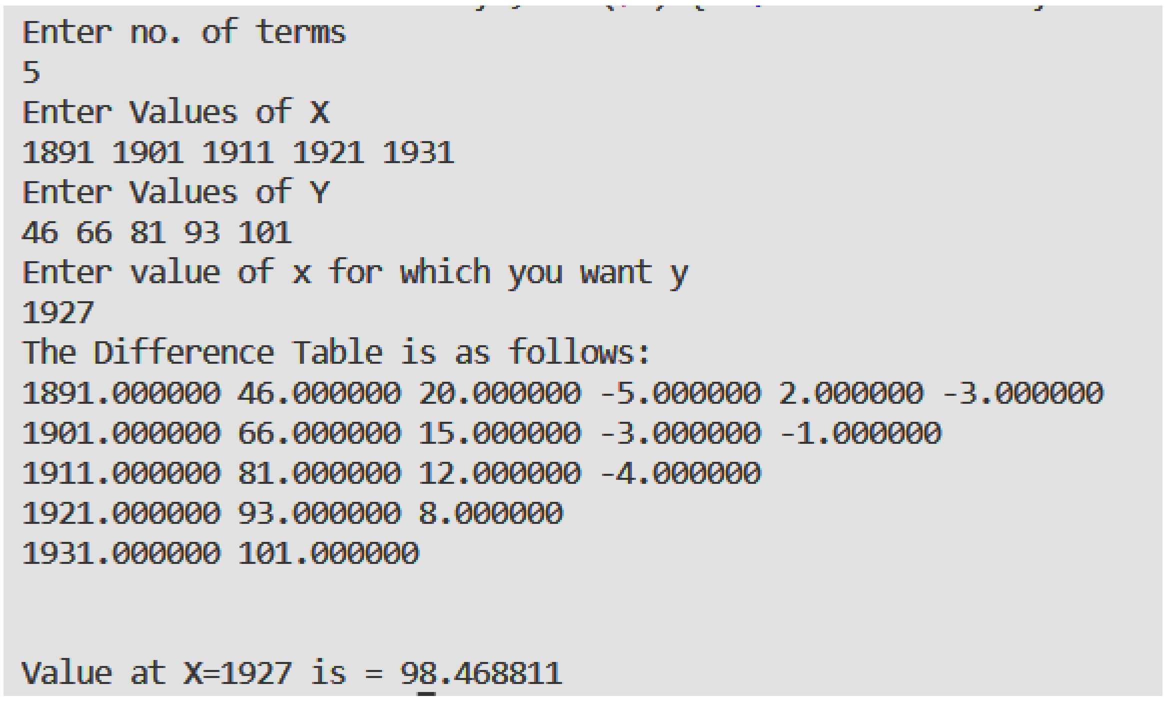
**Newton Backward Interpolation:**

**Code:**

```
#include<stdio.h>

#include<math.h>

int main(){

   float x,u1,u,y;

   int i,j,n,fact;

   printf("Enter no. of terms\n");

   scanf("%d",&n);

   float a[n][n+1];

   printf("Enter Values of X \n");

   for(i=0;i<n;i++)

        scanf("%f",&a[i][0]);

   printf("Enter Values of Y\n");

   for(i=0;i<n;i++)

        scanf("%f",&a[i][1]);


   printf("Enter value of x for which you want y\n");

   scanf("%f",&x);


   for(j=2;j<n+1;j++){

      for(i=0;i<n-j+1;i++)

         a[i][j] = a[i+1][j-1]-a[i][j-1];

   }

   printf("The Difference Table is as follows:\n");

   for(i=0;i<n;i++){

    for(j=0;j<=n-i;j++)

      printf("%f ",a[i][j]);

    printf("\n");

   }
```

```
    u= (x - a[n-1][0])/(a[1][0]-a[0][0]);

    y=a[n-1][1];

    u1=u;

    fact=1;

    j=2;

    for(i=n-2;i>=0;i--){

        y=y+(u1*a[i][j])/fact;

        fact=fact*j;

        u1=u1*(u+(j-1));

        j++;

    }

    printf("\n\nValue at X=%g is = %f", x,y);

}
```

**Output:**



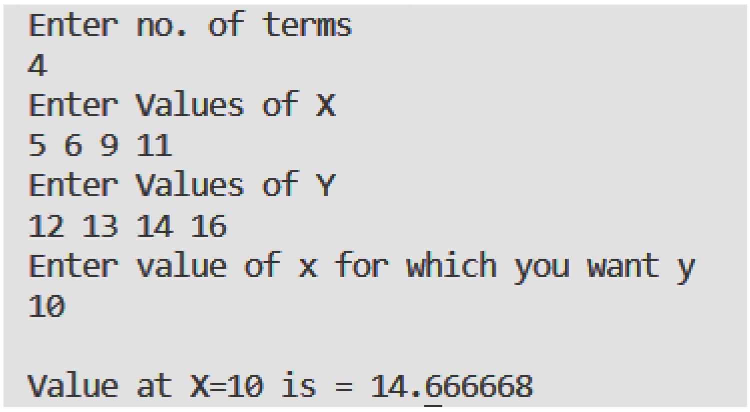
```
Enter no. of terms
5
Enter Values of X
1891 1901 1911 1921 1931
Enter Values of Y
46 66 81 93 101
Enter value of x for which you want y
1927
The Difference Table is as follows:
1891.000000 46.000000 20.000000 -5.000000 2.000000 -3.000000
1901.000000 66.000000 15.000000 -3.000000 -1.000000
1911.000000 81.000000 12.000000 -4.000000
1921.000000 93.000000 8.000000
1931.000000 101.000000


Value at X=1927 is = 98.468811
```

## Lagrange Interpolation:

## Code:

```
#include<stdio.h>

int main()

{

   int n;

   printf("Enter no. of terms\n");

   scanf("%d",&n);

   float X[n],Y[n],x,sum=0,term;

   int i,j;


   printf("Enter Values of X \n");

   for(i=0;i<n;i++)

        scanf("%f",&X[i]);

   printf("Enter Values of Y\n");

   for(i=0;i<n;i++)

        scanf("%f",&Y[i]);


   printf("Enter value of x for which you want y\n");

   scanf("%f",&x);

   for(i=0;i<n;i++){

      term=1;

      for(j=0;j<n;j++){

         if(i!=j)

            term = term * ((x - X[j])/(X[i]-X[j]));

      }

      sum=sum + term * Y[i];

   }

   printf("\nValue at X=%g is = %f", x,sum);

}
```

**Output:**



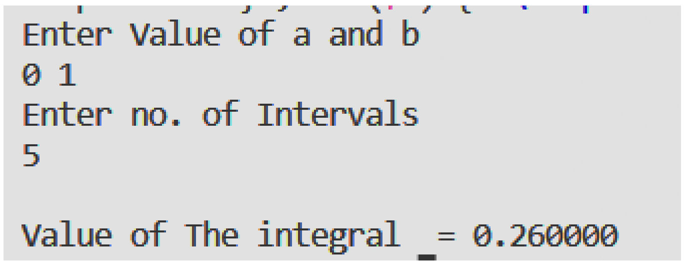
```
Enter no. of terms
4
Enter Values of X
5 6 9 11
Enter Values of Y
12 13 14 16
Enter value of x for which you want y
10

Value at X=10 is = 14.666668
```

**Trapezoidal Rule:**

**Code:**

```
#include<stdio.h>

float findValueAt(float x){

   return x*x*x;

}

int main(){

   int n;

   float i,a,b,sum=0,h;

   printf("Enter Value of a and b\n");

   scanf("%f%f",&a,&b);

   printf("Enter no. of Intervals\n");

   scanf("%d",&n);

   h=(b-a)/n;

   sum = findValueAt(a) +findValueAt(b);

   for(i=a+h;i<b;i=i+h)

     sum = sum + 2*findValueAt(i);

   sum = (h * sum)/2;

   printf("\nValue of The integral  = %f",sum);

   }
```

**Output:**



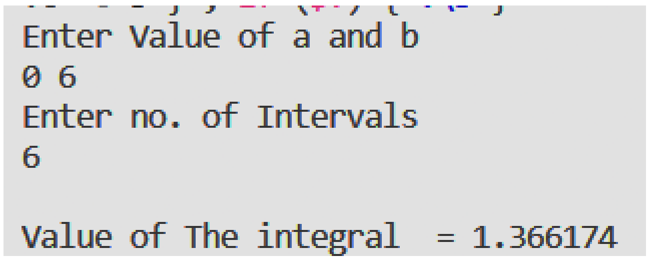
```
Enter Value of a and b
0 1
Enter no. of Intervals
5

Value of The integral  = 0.260000
```

**Simpson's 1/3 Rule:**

**Code:**

```
 #include<stdio.h>


float findValueAt(float x){

   return 1/(1+x*x);

}

int main(){

   int n;

   float i,a,b,sum=0,h;

   int position_of_term=1;

   printf("Enter Value of a and b\n");

   scanf("%f%f",&a,&b);

   printf("Enter no. of Intervals\n");

   scanf("%d",&n);

   h=(b-a)/n;

   sum = findValueAt(a) +findValueAt(b);

   for(i=a+h;i<b;i=i+h){

     if(position_of_term %2 ==0)

       sum = sum + 2*findValueAt(i);

     else

       sum = sum + 4*findValueAt(i);

     position_of_term++;

   }

   sum = (h * sum)/3;


   printf("\nValue of The integral  =
%f",sum);

   return 0;

}
```

**Output:**



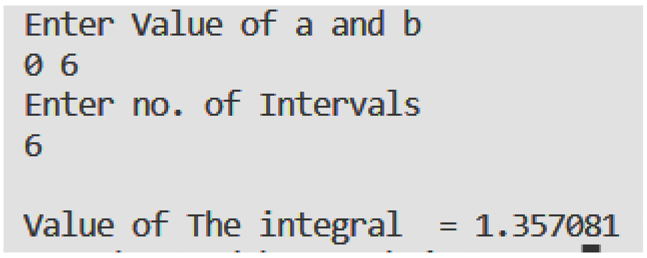
```
Enter Value of a and b
0 6
Enter no. of Intervals
6

Value of The integral  = 1.366174
```

**Simpson’s 3/8 Rule:**

**Code:**

```
#include<stdio.h>
float findValueAt(float x){
   return 1/(1+x*x);
}
int main(){
   int n;
   float i,a,b,sum=0,h;
   int position_of_term=1;
   printf("Enter Value of a and b\n");
   scanf("%f%f",&a,&b);
   printf("Enter no. of Intervals\n");
   scanf("%d",&n);

   h=(b-a)/n;
   sum = findValueAt(a) +findValueAt(b);

   for(i=a+h;i<b;i=i+h){
     if(position_of_term %3 ==0)
       sum = sum + 2*findValueAt(i);
     else
       sum = sum + 3*findValueAt(i);
     position_of_term++;
   }
   sum = (3*h)/8 * sum;
   printf("\nValue of The integral  = %f",sum);

}
```

**Output:**



```
Enter Value of a and b
0 6
Enter no. of Intervals
6

Value of The integral  = 1.357081
```