1. Write a program to solve first order ODE dy/dx or f'(x)=f(x,y) at the given point using Euler's method.

Algorithm:

1. Enter the initial values of x and y
2. Enter the value of x at which y is to be calculated, xp.
3. Enter the step-size h
4. N = $\frac{xp-x}{h}$
5. For i=1 to N do
    a. **dy= h*f(x,y)**
    b. **x=x+h**
    c. **y=y+dy**
6. Display the value of y at xp

Source Code:

```
#include<stdio.h>
#include<math.h>
#define f(x,y) (3*(x)*(x)+1) //3x^2+1
int main()
{
   float x,y,h,xp,dy;
   int i,n;
   printf("Enter initial values of x and y: ");
   scanf("%f%f",&x,&y);
   printf("Enter x-value at which y is required: ");
   scanf("%f",&xp);
   printf("Enter step-size: ");
   scanf("%f",&h);
   n=(xp-x)/h;
   for(i=1;i<=n;i++)
   {
      dy=h*f(x,y);
      x=x+h;
      y=y+dy;
   }
   printf("\nThe value of y at x=%.2f is %.4f  ",x,y);
   return 0;
}
```

Output:

```
Enter initial values of x and y: 1 2
Enter x-value at which y is required: 2
Enter step-size: 0.5

The value of y at x=2.00 is 7.8750 :
```

2. Write a program to solve first order ODE dy/dx or f'(x)=f(x,y) at the given point using RK 4th order method.

Algorithm:

1. Enter the initial values of x and y
2. Enter the value of x at which y is to be calculated, xp.
3. Enter the step-size h
4. N = $\frac{xp-x}{h}$
5. For i=1 to N do
   a. **m1=f(x,y);**
   b. **m2=f(x+h/2,y+(m1*h/2));**
   c. **m3=f(x+h/2,y+(m2*h/2));**
   d. **m4=f(x+h,y+(m3*h));**
   e. **x=x+h;**
   f. **y=y+((m1+2*m2+2*m3+m4)*h)/6;**
6. Display the value of y at xp

Source Code:

```
#include<stdio.h>
#include<math.h>
#define f(x,y) ((x)*(x)+(y)*(y)) //x^2+y^2
int main()
{
   float x,y,h,xp,m1,m2,m3,m4;
   int i,n;
   printf("Enter initial values of x and y: ");
   scanf("%f%f",&x,&y);
   printf("Enter x-value at which y is required: ");
   scanf("%f",&xp);
   printf("Enter step-size: ");
   scanf("%f",&h);
   n=((xp-x)/h);
   for(i=1;i<=n;i++)
   {
      m1=f(x,y);
      m2=f(x+h/2,y+(m1*h/2));
      m3=f(x+h/2,y+(m2*h/2));
      m4=f(x+h,y+(m3*h));
      x=x+h;
      y=y+((m1+2*m2+2*m3+m4)*h)/6;
   }
   printf("\nThe value of y at x=%.2f is %.4f : ",x,y);
   return 0;
}
```

Output:

```
Enter initial values of x and y: 0 0
Enter x-value at which y is required: 0.2
Enter step-size: 0.2

The value of y at x=0.20 is 0.0027 :
Process returned 0 (0x0)   execution time : 34.594 s
```

3. Write a program to solve first order ODE dy/dx or f'(x)=f(x,y) at the given point using Heun's method (RK 2nd order method).

Algorithm:

1. Enter the initial values of x and y
2. Enter the value of x at which y is to be calculated, xp.
3. Enter the step-size h
4. N = $\frac{xp-x}{h}$
5. For i=1 to N do
   a. **m1=f(x,y);**
   b. **m2=f(x+h,y+(m1*h));**
   c. **x=x+h;**
   d. **y=y+(m1+m2)*h/2;**
6. Display the value of y at xp

Source Code:

```
#include<stdio.h>
#include<math.h>
#define f(x,y) (2*(y)/(x)) //   2y/x
int main()
{
   float x,y,h,xp,m1,m2;
   int i,n;
   printf("Enter initial values of x and y: ");
   scanf("%f%f",&x,&y);
   printf("Enter x-value at which y is required: ");
   scanf("%f",&xp);
   printf("Enter step-size: ");
   scanf("%f",&h);
   n=((xp-x)/h);
   for(i=1;i<=n;i++)
   {
      m1=f(x,y);
      m2=f(x+h,y+(m1*h));
      x=x+h;
      y=y+(m1+m2)*h/2;
   }
   printf("\nThe value of y at x=%.2f is %.4f : ",x,y);
   return 0;
}
```

Output:

```
Enter initial values of x and y: 1 2
Enter x-value at which y is required: 2
Enter step-size: 0.25

The value of y at x=2.00 is 7.8608 :
```