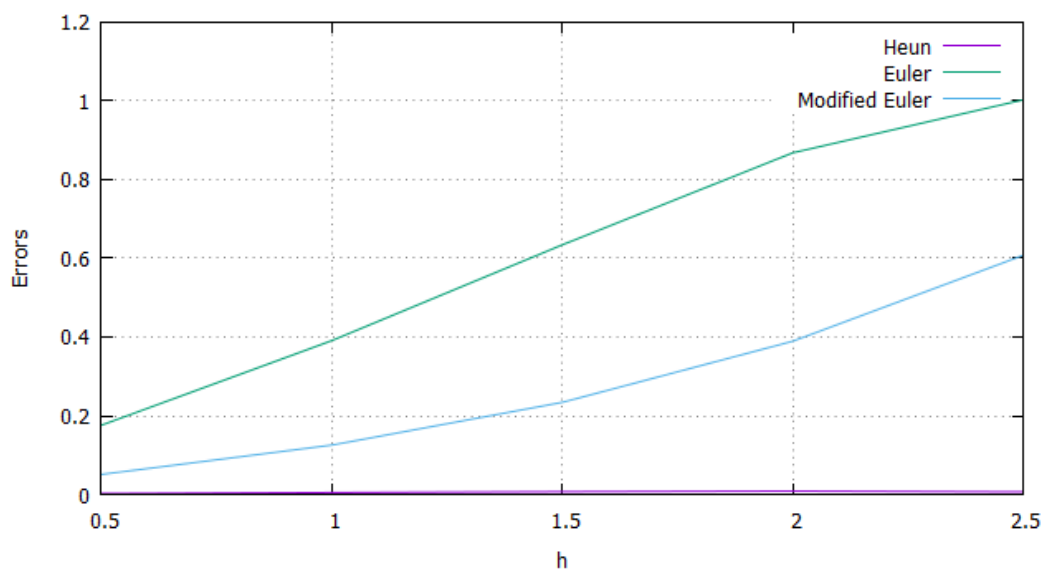


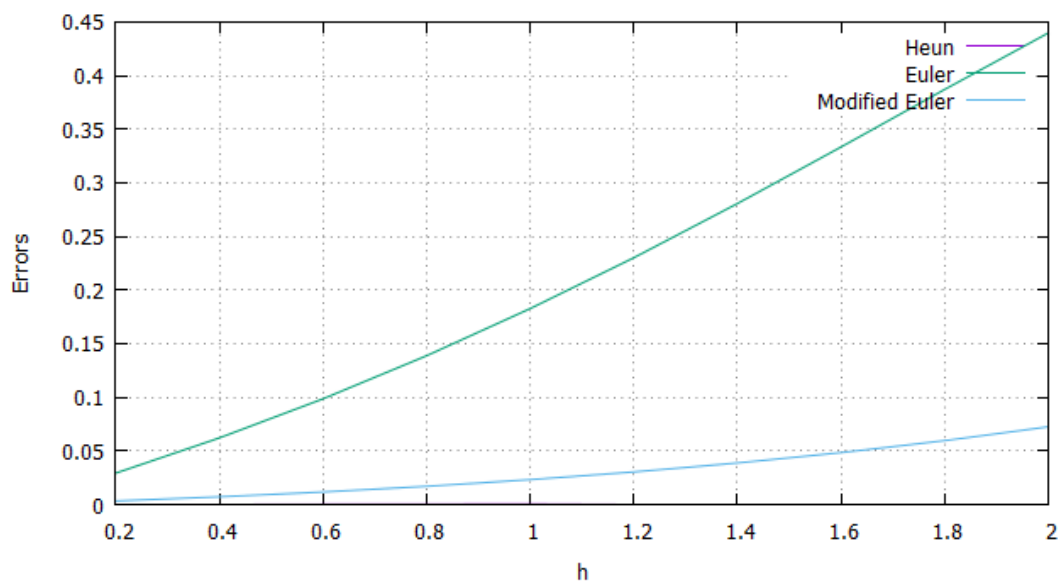
```

4
5 float f(float x,float y) {
6     float m;
7     m = y - (x*x) + 1;
8     return m;
9 }
10
11 int main() {
12     float x0,y0,m1,m2,m3,k1,k2,m,y,x,h,xn;
13     float heun, euler, meuler;
14     float heun_error, euler_error, meuler_error;
15     FILE* file = fopen("output05.csv", "w");
16     printf("Enter x0,y0,xn,h:");
17     scanf("%f %f %f %f",&x0,&y0,&xn,&h);
18     x = x0;
19     y = y0;
20     heun = y0;
21     euler = y0;
22     meuler = y0;
23     printf("\n\nX\t\tY\t\tHeun\t\tHeun_Err\t\tEuler\t\tEuler_Err\t\tMod_Euler\t\tMeuler_Err\n");
24     while(x <= xn) {
25         //Heun Method
26         m1 = f(x,heun);
27         m2 = f((x + (h/3)),(heun + m1*(h/3)));
28         m3 = f((x + (h*2/3)),(heun + m2*(h*2/3)));
29         m = m1 + 3*m3;
30         heun = heun + m*(h/4);
31
32         //Euler Method
33         euler = euler + (h * f(x, euler));
34
35         //Modified Euler Method
36         k1 = f(x, meuler);
37         k2 = f(x + h, meuler + h*k1);
38         meuler = meuler + (h/2)*(k1 + k2);
39
40         //Exact value
41         y = (x+h+1)*(x+h+1) - 0.5*exp(x+h);
42
43         //Compute errors
44         heun_error = y - heun;
45         euler_error = y - euler;
46         meuler_error = y - meuler;
47
48         x = x + h;
49         printf("%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\n",x,y,heun,heun_error,euler,euler_error,meuler,meuler_error);
50         fprintf(file, "%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\n",x,heun_error,euler_error,meuler_error);
51     }
52 }
53

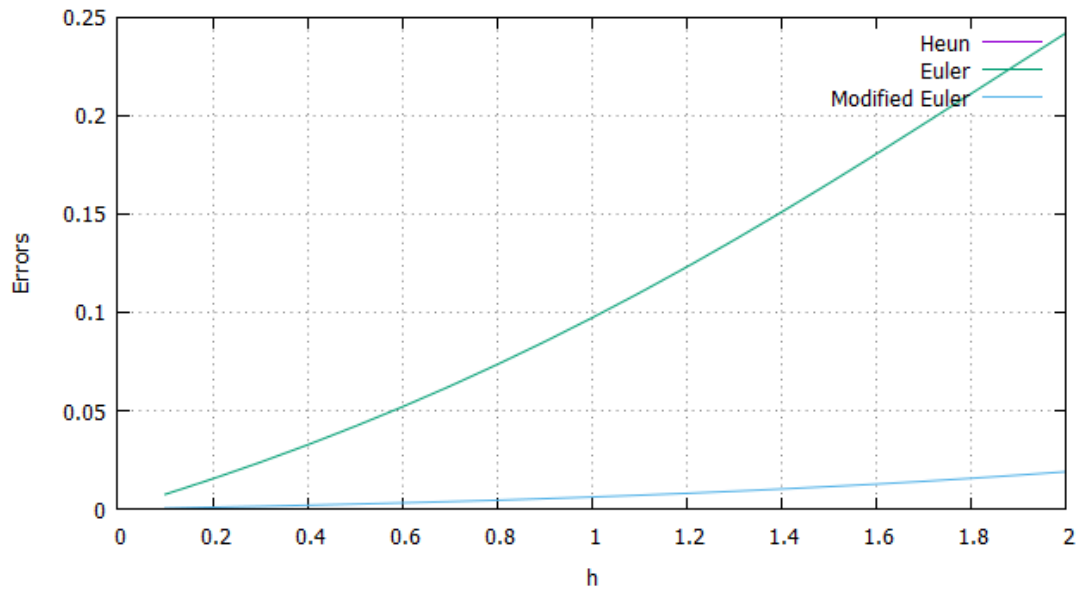
```

Error Comparison with $h = 0.5$ 

X	Y	Heun	Heun_Err	Euler	Euler_Err	Mod_Euler	Meuler_Err
0.500000	1.425639	1.423611	0.002028	1.250000	0.175639	1.375000	0.050639
1.000000	2.640859	2.636429	0.004430	2.250000	0.390859	2.515625	0.125234
1.500000	4.009155	4.002317	0.006838	3.375000	0.634155	3.775391	0.233765
2.000000	5.305472	5.297217	0.008255	4.437500	0.867972	4.916260	0.389212
2.500000	6.158753	6.152364	0.006389	5.156250	1.002503	5.551422	0.607331

Error Comparison with $h = 0.2$ 

X	Y	Heun	Heun_Err	Euler	Euler_Err	Mod_Euler	Meuler_Err
0.200000	0.829299	0.829244	0.000054	0.800000	0.029299	0.826000	0.003299
0.400000	1.214088	1.213975	0.000113	1.152000	0.062088	1.206920	0.007168
0.600000	1.648941	1.648766	0.000175	1.550400	0.098541	1.637242	0.011698
0.800000	2.127229	2.126991	0.000238	1.988480	0.138749	2.110236	0.016994
1.000000	2.640859	2.640556	0.000303	2.458176	0.182683	2.617687	0.023172
1.200000	3.179942	3.179577	0.000365	2.949811	0.230131	3.149579	0.030363
1.400000	3.732400	3.731981	0.000419	3.451773	0.280627	3.693686	0.038714
1.600000	4.283484	4.283024	0.000460	3.950128	0.333356	4.235097	0.048387
1.800000	4.815177	4.814697	0.000480	4.428154	0.387023	4.755618	0.059559
2.000000	5.305473	5.305008	0.000465	4.865784	0.439689	5.233054	0.072419

Error Comparison with $h = 0.1$ 

X	Y	Heun	Heun_Err	Euler	Euler_Err	Mod_Euler	Meuler_Err
0.100000	0.657415	0.657411	0.000003	0.650000	0.007415	0.657000	0.000415
0.200000	0.829299	0.829292	0.000007	0.814000	0.015299	0.828435	0.000864
0.300000	1.015070	1.015060	0.000011	0.991400	0.023670	1.013721	0.001350
0.400000	1.214088	1.214073	0.000015	1.181540	0.032548	1.212211	0.001876
0.500000	1.425639	1.425621	0.000018	1.383694	0.041945	1.423193	0.002446
0.600000	1.648941	1.648918	0.000023	1.597063	0.051877	1.645879	0.003062
0.700000	1.883124	1.883097	0.000027	1.820770	0.062354	1.879396	0.003728
0.800000	2.127230	2.127199	0.000031	2.053847	0.073383	2.122783	0.004447
0.900000	2.380199	2.380164	0.000035	2.295232	0.084967	2.374975	0.005224
1.000000	2.640859	2.640820	0.000039	2.543755	0.097104	2.634797	0.006062
1.100000	2.907917	2.907874	0.000043	2.798130	0.109787	2.900951	0.006967
1.200000	3.179942	3.179895	0.000047	3.056943	0.122999	3.172001	0.007942
1.300000	3.455352	3.455302	0.000051	3.318637	0.136715	3.446361	0.008992
1.400000	3.732400	3.732347	0.000053	3.581501	0.150899	3.722278	0.010121
1.500000	4.009156	4.009100	0.000056	3.843651	0.165505	3.997818	0.011339
1.600000	4.283485	4.283426	0.000059	4.103016	0.180470	4.270838	0.012647
1.700000	4.553027	4.552968	0.000059	4.357317	0.195709	4.538976	0.014050
1.800000	4.815176	4.815117	0.000059	4.604049	0.211127	4.799619	0.015558
1.900000	5.067053	5.066995	0.000059	4.840454	0.226599	5.049879	0.017175
2.000000	5.305473	5.305416	0.000057	5.063499	0.241973	5.286566	0.018907