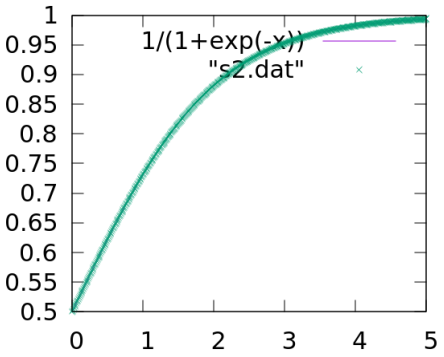
The code:

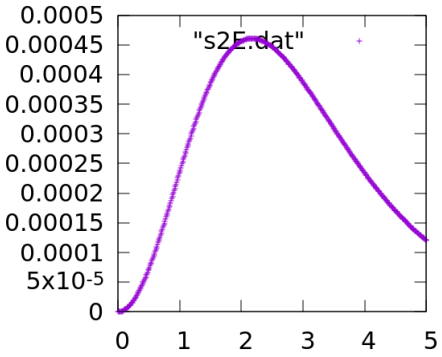
```
#include <math.h>
#include <stdio.h>


double Euler( double (*v)(double,double), double x0, double h,
   double T, int flagDataWrite, int flagErrorWrite, FILE *f, FILE *
   fERR){

        double t = 0;
        double x = x0;

        while(t < T){

                if(flagDataWrite)
                fprintf(f, "%f␣\t␣%f\n", t, x);
                if(flagErrorWrite)
                fprintf(fERR, "%f␣\t␣%f\n",t, fabs(x-1/(1+expf(-t)))
                   );
                x = x + h*(*v)(x,t);
                t += h;
        }

        return x;
}

double revEuler(double x0, double h, double T, int flagDataWrite,
   int flagErrorWrite, FILE *f, FILE *fERR){

        double t = 0;
        double  x = x0;

        while(t < T){
                if(flagDataWrite) fprintf(f, "%f␣\t␣%f\n", t, x);
                x = x/(1+201*h);
                t += h;
        }
        return x;

}

double midpoint( double (*v)(double,double), double x0, double h,
   double T, int flagDataWrite, int flagErrorWrite, FILE *f, FILE *
   fERR){

        double t = 0;
        double x = x0;
```

```
        while(t < T){

                if(flagDataWrite) fprintf(f, "%f␣\t␣%f\n", t, x);
                if(flagErrorWrite) fprintf(fERR, "%f␣\t␣%f\n",t,
                   fabs(x-1/(1+expf(-t))));


                x = x + h*(*v)(x + (h/2)*(*v)(x,t),t + (h/2));
                t += h;
        }

        return x;
}

double v2(double x, double t){

        return x*(1-x);

}

double v3(double x, double t){
        return cos(pow(x,3)) -cos(pow(x,2) -t);

}

double v4(double x, double t){
        return -201*x;
}

int main(int argc, char* argv[]){

        FILE *s2, *s2E, *s3, *s4, *s5, *s6, *s6E;

        s2 = fopen("s2.dat", "w+");
        s2E = fopen("s2E.dat","w+");
        s3 = fopen("s3.dat", "w+");
        s4 = fopen("s4.dat", "w+");
        s5 = fopen("s5.dat", "w+");
        s6 = fopen("s6.dat", "w+");
        s6E = fopen("s6E.dat", "w+");

        printf("Solution␣to␣2:␣%f\n", Euler( &v2, 0.5, 0.01, 5, 1,
           1, s2, s2E));

        Euler( &v3, 1, 0.01, 5, 1, 0, s3, NULL);
```

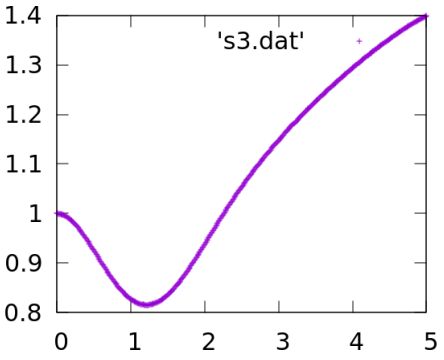
```
        Euler(&v4, 1, 0.01, 0.5, 1, 0, s4, NULL);

        revEuler(1,0.01,0.5,1,0,s5,NULL);

        midpoint(&v2, 0.5, 0.01, 5, 1, 1, s6, s6E);

        fclose(s2E);
        fclose(s2);
        fclose(s3);
        fclose(s4);
        fclose(s5);
}
```

1. First function in the program
2. The solution at $t = 5$ is 0.993493. The order of the greatest error is 10^{-3}.

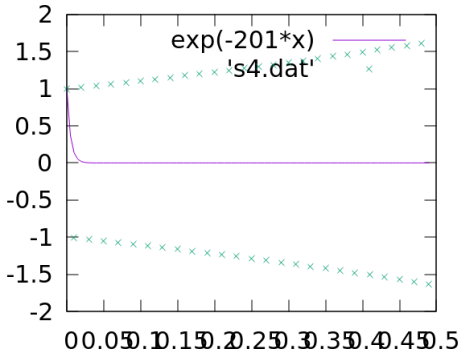




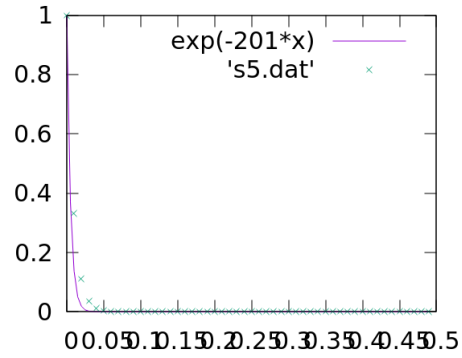
3. Approximation of $x'(t) = \cos(x^3(t)) - \cos(x^2(t) - 3t), x(0) = 1$.



4.



5.



6. The order of the greatest error is 10^{-6}. Compared to the standard Euler method, the error is 3 orders of magnitude less.