The exponential function

Maria Hinge Pedersen

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1 Introduction of the exponential function

The exponential function is a mathematical function denoted by $f(x) = \exp(x)$ or e^x (where the argument x is written as an exponentiation). It is an important function in both mathematics and physics. It is defined in severals different ways, but for this introduction the following definition is used:

$$exp(x) = \sum_{k=0}^{\infty} \frac{x^k}{k!} = 1 + x + \frac{x^2}{x} + \frac{x^3}{6} + \frac{x^4}{24} + \dots \tag{1}$$

Its value at 1, $e = \exp(1)$ is a mathematical constant known as Euler's number. [1]

To implement the function, the code shown in figure 1 is used.

If the argument is below 0, the function returns $1/e^x$ which is equivalent to e^{-x}. For relatively large x (i.e. $x > 1/8$) the recursive definition $\exp x =$

[1] https://en.wikipedia.org/wiki/Exponential_function

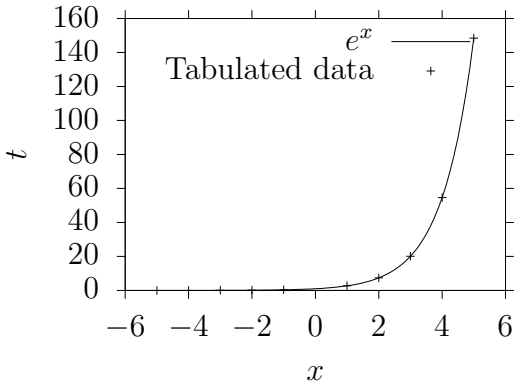

Figure 1: Plot of the exponential function by the code.

$(\exp x/2)^2$ is used, while the Taylor expansion in equation 1 can be used for smaller, but positive values of x.

The implementation is then tested by plotting it against known table values, which is done in figure 1. And it works.

```
static double ex(double x){
if(x<0)return 1/ex(-x);
if(x>1.0/8)return Pow(ex(x/2),2);
return 1+x*(1+x/2*(1+x/3*(1+x/4*(1+x/5*(1+x/6*(1+x
    /7*(1+x/8*(1+x/9*(1+x/10)))))))));
}
```