

## A brief introduction to the exponential function

Martin Mikkelsen

–201706771–

May 11, 2021

This is a brief introduction to the exponential function. In mathematics, an exponential function is a function of the form

$$f(x) = ab^x, \quad (1)$$

where  $b$  is a positive real number, and the argument  $x$  occurs as the exponent. The real exponential function  $\exp : \mathbb{R} \rightarrow \mathbb{R}$  can be characterized in a variety of equivalent ways. It is commonly defined by the following power series

$$\exp x = \sum_{k=0}^{\infty} \frac{x^k}{k!} \quad (2)$$

A quick and dirty implementation of the exponential function could be

```
double ex(double x){
  if(x<0)return 1/ex(-x);
  if(x>1./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)))))))));
```

This implementation makes use of the Taylor expansion of the exponential function. The third line makes use of a trick that effectively increases the step size and raising the function to the same exponent will return the original function. In figure 1 is a plot of the exponential function using the implementation above.

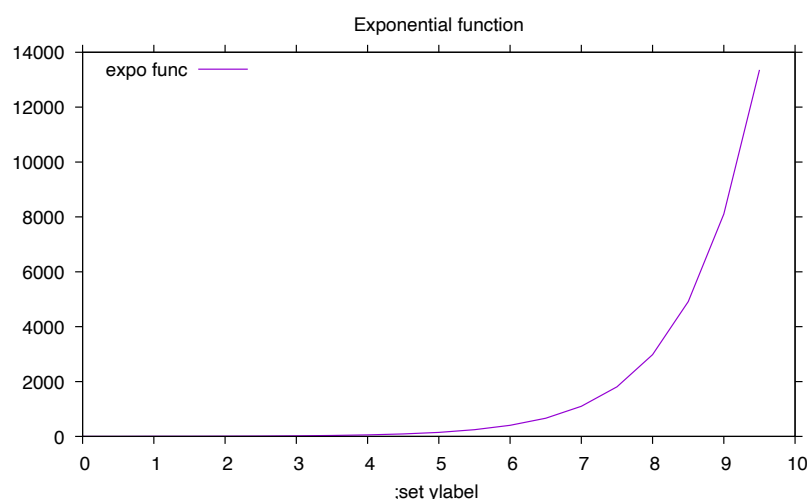


Figure 1: The exponential function using the code above

This is a test