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\documentclass[12pt]{article}
\begin{document}
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\title{The exponential function}
\author{Mari Valle Kjelby}
\date{June 18th 2022}
\maketitle
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\paragraph{Introduction}
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The exponential function is a mathematical function denoted by $f(x) = e^x$, and it is generally referring to the positive-valued function of a real variable. It can also be generalized to other mathematical objects and complex numbers. The mathematician Walter Rudin called it "the most important function in mathematics."

You will get an exponential function whenever a quantity grows or decays at a rate that is proportional to its current value.

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\paragraph{Formal definition}
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The real exponential function can also be represented using a power series, also called the "quick-and-dirty" method.

```
\begin{equation}
\exp(x) = \sum_{k=1}^{\infty} \frac{x^k}{k!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots
\end{equation}
```

This is also applicable to all complex numbers seeing as the radius of convergence of this power series is infinite.

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\paragraph{Implementation}
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The implementation of the "quick-and-dirty" method is here made in C#, and it is done with the following code:

```
{static double ex(double x){
if(x<0)return 1/ex(-x);
if(x>1.0/8)return Pow(ex(x/2),2); // explain this
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))))))))));
}}
```

For "large" x-values, meaning $x > 1/8$, it uses the recursive definition, which is $\exp(x) = (\exp(x/2))^2$. For smaller but positive x values it uses the Taylor expansion.

If the argument is below zero it will return e^{-x}

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