Numerical Implementation of the Exponential Function

Daniel Holleufer

The exponential function $\exp : \mathbb{C} \to \mathbb{C}$ is defined as

$$\exp(z) \coloneqq \sum_{n=0}^{\infty} \frac{z^n}{n!}. \tag{1}$$

The infifinte series in this definition poses some issues when it comes to implementing the exponential function numerically. A naive implentation would simply be truncating the series after N terms

$$\exp(z) \approx \sum_{n=0}^{N} \frac{z^n}{n!}. \tag{2}$$

This can be rewritten into

$$\exp(z) \approx 1 + z\Big(1 + \frac{z}{2}\Big(1 + \frac{z}{3}\Big(1 + \ldots\Big)\Big)\Big). \tag{3}$$

A plot of eq. (3) for real z and with $N = 10$ is shown on fig. 1.

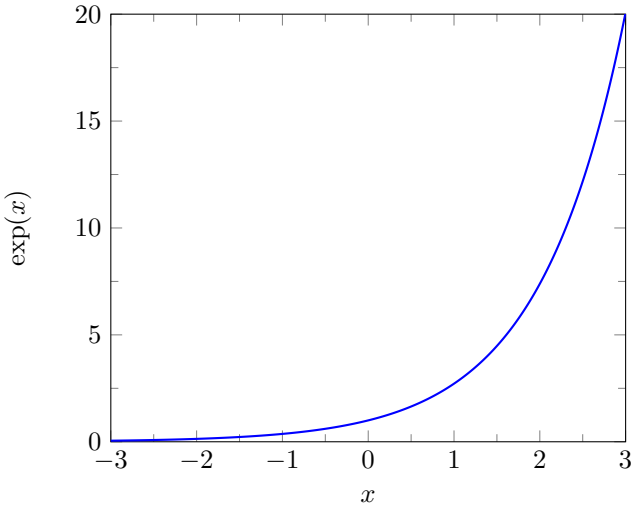

Figure 1: Numerical implentation of exponential function.