"Quick-and-Dirty" implementation of the exponential function

C. S. Overgård

June 2021

1 Math

An 'exponential function' is any fucntion with the general form:

$$f(x) = ab^x \tag{1}$$

When refering to *the* exponential funtion it is one which base is the constant e (approximatly eqaul to 2.71828). This special exponential function is unique as the derivative of the fucntion is the function itself.

$$\frac{d}{dx}e^x = e^x \tag{2}$$

Additionally the exponential function is often used to describe a function whose growth rate depens on its value.

1.1 Approximations

When Computing the exponential function a number approximations can be used. The most famouse one being the Taylor expansion of the exponential function

$$e^x \approx 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!}... \tag{3}$$

This function can be simplified to the "Quick-and-Dirty" approximation

$$e^x \approx 1 + x(1 + \frac{x}{2}(1 + \frac{x}{3}(1 + \frac{x}{4}(1 + \frac{x}{5}...(1 + \frac{x}{n})))...) \tag{4}$$

Where increases in n increases the accuracy of the approximation (for the pourpose of this report 10 is more than adequate). It is obvious that mulitplying everything into the parentheses one returns at Eq. (3). To determine the accuracy of the "Quick-and-Dirty" approximation the result of the function have been plotted against the *exp(x)* function from "*math.h*". The resulting graph can be found in section **2**. The "Quick-and-Dirty" function also includes a inbuilt statement which reduces the value given to the function. This is done as the Taylor expansion, on which the "Quick-and-Dirty" function is based, is accurate at smaller x values.

2 Figures

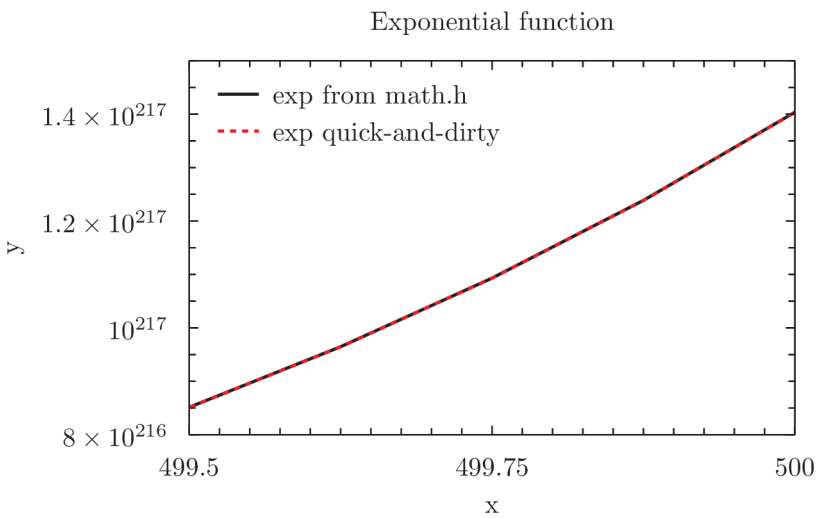

Figure 1: Exponential fucntion (black) compare with the "Quick-and-Dirty" implementation (red) (4)