

Example Assignment

Foundations of Computational Math

Due date: 11:59PM on September 23rd 2048

Problem

Consider the forward, backward, and central difference approximations to the derivative of f at x , respectively:

$$1. F_h[f](x) = \frac{f(x+h) - f(x)}{h}$$

$$2. B_h[f](x) = \frac{f(x) - f(x-h)}{h}$$

$$3. C_h[f](x) = \frac{f(x+h) - f(x-h)}{2h}$$

Analyze the absolute error in the above numerical approximations as $h \rightarrow 0$, for the following:

$$1. f_1(x) = \sin(x) \text{ at } x = 1.0 \text{ and } x = 2.0.$$

$$2. f_2(x) = \exp\left(-\frac{x^2}{2}\right) \text{ at } x = 1.1 \text{ and } x = 2.2.$$

Confirm numerically the order (with respect to h) of the respective numerical approximations.