

ECE 3340 Numerical Methods

Homework 6: Precision Loss

Name:

ID:

Problem 1: Reformulation

Reformulate $f(x) = \sqrt[4]{x+4} - \sqrt[4]{x}$ to mitigate catastrophic cancellation.

$$f(x) =$$

Calculate the relative error before and after using $f(14) = .125$ and **3 digits of precision**.

$$E_b =$$
$$E_a =$$

Problem 2: Reformulation

Reformulate $f(x) = \frac{1 - \cos x}{2}$ to mitigate catastrophic cancellation.

$$f(x) =$$

Calculate the relative error before and after using $f(.15) = .561 \times 10^{-2}$ and **3 digits of precision**.

$$E_b =$$
$$E_a =$$

Problem 3: Maclaurin Series

Use a 2nd-order Maclaurin series to reformulate $f(x) = e^x - \cos(x)$ and mitigate catastrophic cancellation.

$$f(x) =$$

Calculate the relative error before and after using $f(0.0123) = 0.0125$ and **3 digits of precision**.

$$E_b =$$

$$E_a =$$

Problem 4: Mean Value Theorem

Use the Mean Value Theorem to reformulate $f(x) = \sqrt{100} - \sqrt{101}$ and mitigate catastrophic cancellation.

$$f(x) =$$

Calculate the relative error before and after using **3 digits of precision**.

$$E_b =$$

$$E_a =$$