

Numerical Analysis Semester 081 Problem Set 10

Reference: Chapter 02.02 Derivatives

1. Write down the following formulas for finding an approximation to the derivative of a function.

- a) Forward Difference Formula
- b) Backward Difference Formula
- c) Central Difference Formula (of order $O((\Delta x)^2)$).

2. (Carry out computations to 8 decimal places).

Use *each* of the above formulas to approximate $f'(0.8)$ for $f(x) = \sin(x)$ where x is measured in radians and:

$$\Delta x = 0.01 \text{ and } \Delta x = 0.001$$

Compute the relative *true* error for each.

3. Assume that the distance traveled by an object is given by the following table:

Time t (milliseconds)	Distance t (meters)
8	17.453
9	21.460
10	25.752
11	30.301
12	35.084

a) Calculate the approximate derivative at $t = 10$ (i.e. the velocity) using the central difference formulas of order $O((\Delta x)^2)$ and $O((\Delta x)^4)$.

b) The values for the distance were computed using $D(t) = -70 + 7t + 70e^{-t/10}$

Compute the actual $V(10)$ as the derivative of this function and compare to your computations for a).