

ME 542

Assignment – 9

Numerical Differentiation

- Students need to save all the programs in a zipped file and named after their roll number and submit on MS TEAMS.
- The programs are to be compiled and checked before submitting.
- Make a text file for providing input and your code should read data from the text file.
- Results obtained by your code should be written (do not copy image file of your run) in a pdf file and keep it in the same zipped folder.

1. Differentiate the following function with respect to different step size ($h = 0.03, 0.06, 0.09$) using backward, forward and centered divide difference methods. Also, compare the accuracy with respect to the true value at $x = 0.6$ and error of each method for different step size. Show your results up to 8 decimal places. Use both the formulas of backward, forward and centered divide difference methods as mentioned during the lecture.

$$f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x^5$$

2. The velocity v (m/s) of air flowing past a flat surface is measured at several distances y (m) away from the surface. Determine the shear stress τ (N/m²) at the surface ($y = 0$), using Newton's viscosity law $\tau = \mu \frac{dv}{dy}$. Assume value of dynamic coefficient $\mu = 1.8 \times 10^{-5}$ N.s/m². Use second order Lagrange function.

$y, \text{ m}$	0	0.002	0.006	0.012	0.018	0.024
$v, \text{ m/s}$	0	0.287	0.899	1.915	3.048	4.299