

MAE6220
Homework 2
Due September 26 (at 6pm via email)

1. Consider the following finite-difference formulas for the first derivative, $\partial\phi/\partial x$, on a uniform grid with spacing, h :

$$\frac{\delta\phi_j}{\delta x} = \frac{-\phi_{j+2} + 8\phi_{j+1} - 8\phi_{j-1} + \phi_{j-2}}{12h} \quad (1)$$

$$= \frac{2\phi_{j+1} + 3\phi_j - 6\phi_{j-1} + \phi_{j-2}}{6h} \quad (2)$$

Using Taylor series expansions demonstrate the formal order of accuracy of each of the above formulas.

2. Consider the non-uniform grid shown in the figure. Construct an one-sided finite-difference formula, which is 3^{rd} order accurate, to compute the first derivative, $\partial\phi/\partial x$, at point j on the wall.

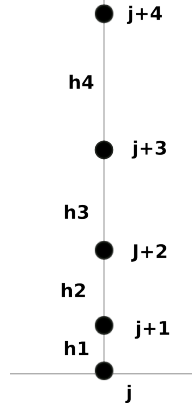


Figure 1: Stretched one-dimensional grid near a wall