

Lab Lesson 2

- 1 Consider $f(x) = \sin(x)$ and the approximations for $f'(0)$ given by the forward, backward and centered finite differences.
 - 1 Write a Matlab routine that produces the approximation for $f'(0)$ given by the three finite difference formulas, given $h > 0$.
 - 2 Run the routine defined in 1) with different values of $h_i = \frac{1}{i}$, $i = 10, 20, 30, \dots, 100$.
 - 3 Calculate the errors of the approximations obtained in 2) and estimate the order of convergence in each one of the three finite difference formulas.

2

Consider the boundary value problem
$$\begin{cases} u''(x) = f(x) & \text{in }]0, 1[\\ u(0) = u_0, & u(1) = u_1 \end{cases}$$

where u_0 , u_1 and f shall be determined in such a way that the solution of the problem is $u(x) = \frac{1}{9}(13 + 4x(-1 + \cos(3)) - 4\cos(3x))$.

- 1 Write a Matlab routine that receives the value of N , the number of sub-intervals, and calculates the numerical solution of the problem.
- 2 Test the routine by taking several choices of N and estimate the order of convergence.