

Project 1

Given the differential equation:

$$a \frac{d^2 u}{dx^2} + b \frac{du}{dx} + cu = f(x), \quad x \in (0,1)$$

Depending on the first letter of your last name choose a,b,c,f.

Last Name	a	b	c	f(x)	Boundary Conditions	Exact Solution
A – Z	1	1	$\pi^2 - \pi$	$\pi(\cos \pi x - \sin \pi x) - 1$	$u(0) = 0, \quad u(1) = -1$	$\sin \pi x - x$
H – M	1	-1	4	$1 - 2(2x + \cos 2x)$	$u(0) = 0, \quad u(1) = \sin 2 - 1$	$\sin 2x - x$
N – Σ	1	6	7	$30(1 - x^2)e^{-3x}$	$u(0) = 0, \quad u(1) = 15e^{-3}$	$u(x) = 15x^2 e^{-3x}$
T – Ω	1	4	6	$3(1 + x^2)e^{-2x}$	$u(0) = 0, \quad u(1) = (3/2)e^{-2}$	$u(x) = (3/2)x^2 e^{-2x}$

Solve the given boundary value problem with:

- 1D Linear Finite Elements
- 1D Quadratic Finite Elements

- Find the approximate solution and its derivative.
- Compare the approximate solution with the exact.