

**MATH3201 Practical Session**  
**Week 9**

**Question 1**

Use the inbuilt Matlab routine `bvp4c` to solve the boundary value problem (BVP):

$$y'' = 18 y^2$$

with boundary conditions B.C  $y(1) = 1/3$  and  $y(2) = 1/12$ . Note: the exact solution is  $y(t) = 1/(3t^2)$ .

Plot your numerical solution against the exact solution. Show the numerical and exact solutions as solid curve and open circles, respectively. Label the solutions using Matlab legend.

**Question 2**

Consider the BVP:

$$y'' = y - x$$

with boundary conditions  $y(0) = 1$  and  $y(1) = 1 + \cosh(1)$ . Note: the exact solutions is  $y(x) = \cosh(x) + x$ .

- (a) Confirm the exact solution satisfies the BVP.
- (b) Use a finite difference method to obtain a numerical solution to the problem.
- (c) Write a Matlab code and plot your numerical solution (for every  $N = 4, 8$ , and  $16$  intervals) along with the exact solution. Show the numerical and exact solutions as solid curve and open circles, respectively. Label the solutions using Matlab legend.
- (d) Make a table of the error at the mid-point of the domain and confirm that it follows the theoretical estimate.