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Subject No. PH39209 (Computational Physics Lab)

Lab Sheet - 3

§1. The differential equation is given by $y' = (x + y)\,\sin(x)$ with $y(x = 0) = 5$.

Find the solution, using the following methods, in the interval $[0, 6]$ using step size $h = 0.1$.

(i) RK-2 method and (ii) RK-4 method. Plot the behavior of y as a function of x.

§2. The 2^{nd} order differential equation $y'' + 5y' + 6y = 10\sin x$ with $y(x = 0) = 0$ and $y'(x = 0) = 5$.

Solve this equation using Eulers and RK-4 method with the step size $h = 0.1$ in the interval $[0, 3]$.

Compare the solutions with the analytical solution $y(x) = -6e^{-3x} + 7e^{-2x} + \sin x - \cos x$.

§3. Using the graphical method, identify the roots of the following transcendental equation correct to three decimal positions.

$$x^3 - \frac{132}{32}x^2 + \frac{28}{32}x + \frac{147}{32} = 5\,\sin(x)$$