



## Subject No. PH39209 (Computational Physics Lab)

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§1. Consider two linear equations,  $ax + by = c$  and  $px + qy = r$ . Write a simple code to calculate  $x$  and  $y$  by considering the other quantities as inputs.

§2. Consider the Taylor expansion for  $\sin(x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1}$ .

Compute  $\sin(x)$  considering  $x$  as a variable in the range  $[0, \pi]$  for  $n = 10$ . Take the step size  $h = \pi/20$  and  $h = \pi/3$ , and plot  $\sin(x)$  vs.  $x$  for both the values of  $h$  in the same graph.

§3. Arrange the following number both in the ascending and descending order.

124, 45, 89, 67, 30, 200, 145, 765, 18, 0, 11

§4. Find the value of  $N!$ , where  $N$  is a arbitrary real number.

§5. Write a code to solve the first order differential equation,

$$\frac{dx}{dt} = 10$$

with the initial condition  $x(t = 0) = 2$ . Plot the graph.

§6. Write a code to solve the first order differential equation,

$$\frac{dx}{dt} = 2x + 10$$

with the initial condition  $x(t = 0) = 0$ . Plot the graph.

§7. Write a code to solve the first order differential equation,

$$\frac{df(x)}{dx} = x$$

where  $f(x) = \alpha + x^2/2$ . Take the initial condition  $f(x = 0) = \alpha$ . Plot the graph.

§8. A particle is obeying the force balance equation

$$m \ddot{x} = -k x.$$

Write a code to solve the above equation using the initial conditions,  $x(t=0) = 1$  and  $\dot{x} = 0$ .  
(Take  $k = 2$ )

§9. A particle is obeying the force balance equation

$$m \ddot{x} = -k x - \gamma \dot{x}.$$

Write a code to solve the above equation using the initial conditions,  $x(t=0) = 0$  and  $\dot{x} = 1$ .  
(Take  $k = 2$  and  $\gamma = 1$ )

§10. Generate 100 random numbers between  $[0,100]$  and plot their distribution.