University of Dhaka
Department of Mathematics
2nd Year B.S. Honors, Session 2023-24
Subject: Mathematics
Course Code: MTH 250 Course Title: Math Lab - II
Assignment 2: Calculus II, Deadline: 2 lab classes
Name: Roll:

1. (a) Sketch the graphs of the following parametric curves.

i. $x(t) = A\sin(at + \delta)$, $y(t) = B\cos(bt)$, where A, B, a, b, δ are constants.
ii. $x(t) = \cos t$, $y(t) = \sin t$. Also, plot the tangent vector at specific points.

Commands you will need: *fplot, plot, subplot, axis, quiver.*

(b) Sketch the graphs of the following parametric curves in space.

i. $x(t) = \cos t$, $y(t) = \sin t$, $z(t) = t$.
ii. $x(t) = e^{-0.1t}\cos t$, $y(t) = e^{-0.1t}\sin t$, $z(t) = t$.
iii. $x(t) = t$, $y(t) = t^2$, $z(t) = t^3$.
iv. $x(t) = \sin 3t$, $y(t) = \sin 2t$, $z(t) = \cos 5t$.
v. $x(t) = t\cos t$, $y(t) = t\sin t$, $z(t) = t$.

Commands you will need: *fplot3, plot3.*

(c) Sketch each of the following surfaces along with some level curves.

i. $z = x^2 + y^2$.
ii. $\frac{x^2}{9} + \frac{y^2}{4} + \frac{z^2}{16} = 1$.
iii. $z = \sqrt{x^2 + y^2 + 1}$.

Commands you will need: *fsurf, fmesh, surf, mesh, contour, fcontour, mesh-grid.*

2. Use the Second Derivatives Test to find the local extrema and saddle points. Create a 'quiver' plot to show the gradient vector field and label the critical points on the plot.

i. $f(x, y) = x^3 - 3xy + y^3$.
ii. $f(x, y) = x^4 - 4xy + y^4$.

Commands you will need: *clabel, gradient, hessian, alpha, solve, quiver, scatter3.*

3. (b) Find the area of the region enclosed by the ellipses $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and $\frac{x^2}{16} + \frac{y^2}{9} = 1$.

(a) Find the area of the region enclosed by the hyperbolas $\frac{x^2}{16} - \frac{y^2}{9} = 1$ and $\frac{x^2}{9} - \frac{y^2}{16} = 1$.