**MATH 104: WORKSHEET 5**

# 1. Concepts

- Distance formulas:
  (1) In $\mathbb{R}^2$, the distance between an point $P(x_1, y_1)$ and a line $ax + by + c = 0$ is
  $$D = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}.$$
  (2) In $\mathbb{R}^3$, the distance between an point $P(x_1, y_1, z_1)$ and a plane $ax + by + cz + d = 0$ is
  $$D = \frac{|ax_1 + by_1 + cz_1 + d|}{\sqrt{a^2 + b^2 + c^2}}.$$
  Remember, the dimension is very important! You can't have the first formula in $\mathbb{R}^3$ because $ax + by + c = 0$ is NOT an equation for a line in $\mathbb{R}^3$.
- Equations for Conic sections, Cylinders and Quadric Surfaces: read notes and books
- Vector functions
  $$\vec{r}(t) = \langle f(t), g(t), h(t)\rangle = f(t)\vec{i} + g(t)\vec{j} + h(t)\vec{k}.$$
- Limit and derivative of vector function

*Date*: 02/10/2025.

## 2. Questions

*Question* 1. Sketch the following functions:

(1)

$$\vec{r}(t) = \langle 1 + 2t, 2 + t, t \rangle$$

(2)

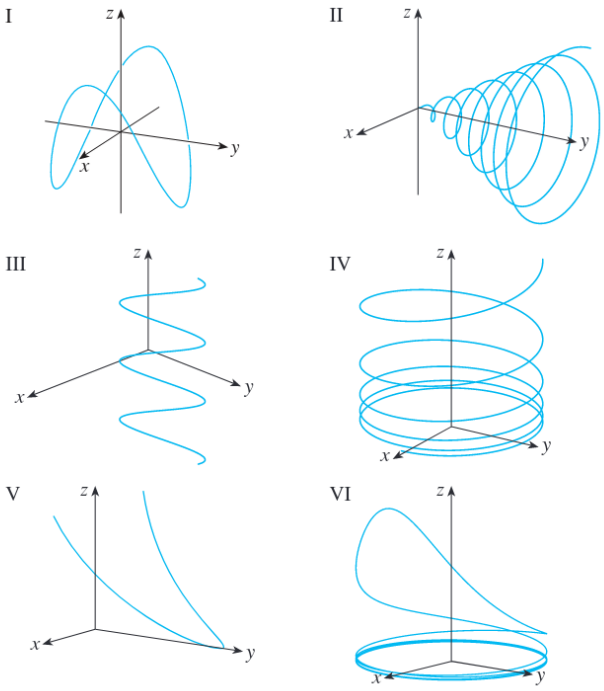
$$\vec{r}(t) = \langle t, \sin t, \cos t \rangle$$

(3)

$$\vec{r}(t) = \langle t, t, t^2 \rangle$$

*Question* 2. Do the foolowing

**21–26** Match the parametric equations with the graphs (labeled I–VI). Give reasons for your choices.




**21.** $x = t\cos t, \quad y = t, \quad z = t\sin t, \quad t \geqslant 0$

**22.** $x = \cos t, \quad y = \sin t, \quad z = 1/(1 + t^2)$

**23.** $x = t, \quad y = 1/(1 + t^2), \quad z = t^2$

**24.** $x = \cos t, \quad y = \sin t, \quad z = \cos 2t$

**25.** $x = \cos 8t, \quad y = \sin 8t, \quad z = e^{0.8t}, \quad t \geqslant 0$

**26.** $x = \cos^2 t, \quad y = \sin^2 t, \quad z = t$