MATH 104: WORKSHEET 3

1. Concepts

(1) Velocity and accelerations
(2) Unit tangent and unit normal vectors to curves
(3) Curvature and geometry of curves

2. Discussions

Question 1. If you move along a curve in 3D at a constant speed, what can you say about acceleration? Is it zero?

Question 2. Compute the velocity, acceleration, and arclength element of the curve with components $(\sin t, \cos 2t, t)$.

Question 3. Compute the length of a general helix in 3D with radius R and height C. What are the asymptotics for small R and C?

Question 4. Compute the arclength of the parametrized curve in 4D:

$$\gamma(t) = \begin{pmatrix} A\cos t \\ A\sin t \\ B\cos t \\ B\sin t \end{pmatrix}, 0 \leqslant t \leqslant 2\pi$$

Question 5. It was stated that the unit tangent $\hat{T}$ and the unit normal $\hat{N}$ to a curve are always orthogonal. Why?

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