Section 14.1

Vector-valued functions

What are functions?

Then a vector-valued function is...

Example 14.1.1. Find a vector function $\vec{r}(t)$ for the ellipse centered at the origin with major radius of length 4 parallel to the y-axis and minor radius of length 2 parallel to the x-axis.

Example 14.1.2. Find a vector function $\vec{r}(t)$ for the ellipse centered at the origin with major radius of length 4 parallel to the y-axis and minor radius of length 2 parallel to the vector $\langle 1, 0, 1 \rangle$.

Example 14.1.3. Find a vector function $\vec{r}(t)$ for the curve of intersection between the two quadrics $S : z = 3x^2 + y^2 + 1, R : z = 5 - x^2 - 3y^2$.

Definition: Limit of a Vector-Valued Function
A vector-valued function $\vec{r}$ approaches the limit $\vec{L}$ as t approaches a, written $\lim_{t \to a} \vec{r}(t) = \vec{L}$, provided $\lim_{t \to a} |\vec{r}(t) - \vec{L}| = 0$.

Example 14.1.4. Let $\vec{r}(t) = \cos(\pi t)\vec{\imath} + \sin(\pi t)\vec{\jmath} + e^{-t}\vec{k}$.

1. Evaluate $\lim_{t \to 2} \vec{r}(t)$

2. Evaluate $\lim_{t \to \infty} \vec{r}(t)$

3. At what points is $\vec{r}$ continuous?