Lecture Notes
Math 2400 - Calculus III
Spring 2024

Name: _____

10.1 Vector Functions and Space Curves

Definition. What is a vector-valued function? What are the component functions of a vector-valued function?

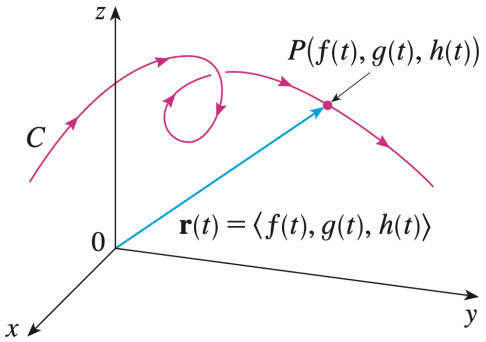
Example. Let $\vec{r}(t) = \langle t^3, \ln(3-t), \sqrt{t} \rangle$. What are the component functions? What is the domain of $\vec{r}(t)$?

Definition. How to take a limit of a vector-valued function?

Example. Find $\lim_{t\to 0} \vec{r}(t)$, where $\vec{r}(t) = (1+t^3)\vec{i} + te^{-t}\vec{j} + \dfrac{\sin t}{t}\vec{k}$.

Definition. What does it mean for a vector function $\vec{r}(t)$ to be continuous at a?

Definition. What is a space curve?



Example. Describe the curve defined by the vector function $\vec{r}(t) = \langle 1 + t, 2 + 5t, -1 + 6t \rangle$.

Remark. Plane curves can also be represented in vector notation. How would we write the curve given by the parametric equations $x = t^2 - 2t$ and $y = t + 1$ in vector notation?

Example. Sketch the curve whose vector equation is $\vec{r}(t) = \cos t\vec{i} + \sin t\vec{j} + t\vec{k}$.

Example. Find a vector equation for the line segment that joins the point $P(1, 3, -2)$ to the point $Q(2, -1, 3)$.

Example. Find a vector function that represents the curve of intersection of the cylinder $x^2 + y^2 = 1$ and the plane $y + z = 2$.