Teaching Assitant

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Office hours:

Wednesday / Friday 11:45 AM - 12:45 PM
McHenry Library Cafe

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Reflection

Take a moment to think about what was covered last class and what is due on upcomming assignments. Which concepts, techniques, etc. feel clear and doable? Which, if any, could use more explanation or practice?

Discuss the following with your groups

Give plain language definitions for the following terms:

- Vector-valued Function
- Tangent Line

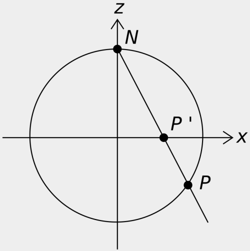
Write...

- the limit definition of a function of one variable.
- the derivatives of...
  - e^x.
  - $\cos(x)$.
  - x^n.
- the limit definition of a vector-valued function.
- the product rule.
- the quotient rule.
- the chain rule.

Problem 1

Let N denote the north pole $(0,1) \in S^1 \subseteq \mathbb{R}^2$. Define the "stereographic projection" $\sigma : S^1 \setminus \{N\} \to \mathbb{R}^1$ by

$$\sigma(x,y) = \frac{\langle x \rangle}{1-y}$$



For any $x \in S^1 \setminus \{N\}$, show that $\sigma(P) = P'$ where $(P', 0)$ is the point where the line through N and P intersects the linear subspace where $y = 0$.

Can you do this for $S^3 \subseteq \mathbb{R}^3$? What about $S^n \subseteq \mathbb{R}^{n+1}$?

Problems 2, 3 and 4 (Vector-Valued Functions)

Problem 2 (9.6.4)

Find a vector parametric eqution $\vec{r}(t)$ for the line through the points $P = (-4, -4, -4)$ and $Q = (-1, -1, -5)$ for each of the given conditions on the parameter t.

(a) $\vec{r}(0) = \langle -4, -4, -4 \rangle$ and $\vec{r}(8) = \langle -1, -1, -5 \rangle$.

(b) $\vec{r}(3) = P$ and $\vec{r}(7) = Q$.

(c) The points P and Q correspond to the parameter values $t = 0$ and $t = -3$ respectively.

Problem 3 (9.6.6)

Find a parameterization of the curve $x = -4z^2$ in the xz-plane.

Problem 4 (9.6.11)

A standard parameterization of the unit circle is $\langle \cos(t), \sin(t) \rangle$ for $0 \le t < 2\pi$.
Find a vector-valued function r that describes a point traveling along the unit circle so that at time $t = 0$ the point is at $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right)$ traveling clockwise (positive orientation).
What about traveling counter-clockwise (negative orientation)?

Probelms 5, 6, 7 and 8 (Derivatives and Integrals of Vector-Valued Functions)

Problem 5 (9.7.1)

If $r(t) = \cos(9t)\hat{i} + \sin(9t)\hat{j} + 3t\hat{k}$, compute:

(a) the velocity vector.

(b) the acceleration vector.

Problem 6 (9.7.3)

Evaluate $\int_0^2 t\hat{i} + t^2\hat{j} + t^3\hat{k}\,dt$.

Problem 7 (9.7.5)

Given $r(t) = \cos(-2t)\hat{i} + \sin(-2t)\hat{j} - 10t\hat{k}$, compute $r'(t)$ and $\int r(t)\,dt$.

Problem 8 (9.7.8)

If $r(t) = ta \times (b + tc)$, $a = \langle 4, 4, -1\rangle$, $b = \langle 1, 1, 4\rangle$, and $c = \langle -2, -3, -3\rangle$, compute $\frac{d}{dt}r(t)$.

Attendance