VECTOR CALCULUS — Lesson 03/26
DR. PAUL L. BAILEY — Wednesday, March 25, 2020

The next section gives an overview of path independence, which is critical for your understanding of Stoke's Theorem. A similar phenomenon occurs for analytic functions in the complex plane.

Today, I wish for you to *carefully* read Section 16.3, pages 1160 through 1162, up to Line Integrals. Think carefully about what it means for a nonempty subset of $\mathbb{R}$, $\mathbb{R}^2$, or $\mathbb{R}^3$ to be "connected" and/or "simply connected".

In each case, visualize the set given, and ask yourself if it is connected and/or simply connected:

Subsets of the Real Line

(a) $\mathbb{R} \setminus 0$

(b) $[0, 2] \cup (1, 3)$

(c) $([-1, 1] \cap [0, 2]) \cup \{5\}$

Subsets of $\mathbb{R}^2$

(d) $\{(x, y) \in \mathbb{R}^2 \mid x^2 + y^2 = 1\}$

(e) $\{(x, y) \in \mathbb{R}^2 \mid x^2 + y^2 \leq 1\} \setminus \{(0, 0)\}$

(f) $\{(x, y) \in \mathbb{R}^2 \mid x^2 + y^2 \leq 1 \text{ and } x \neq 0\}$

(g) $\mathbb{R}^2 \setminus [-1, 1]$

Subsets of $\mathbb{R}^3$

(h) $([0, 1] \times [-2, 2] \times [3, 5]) \setminus \{(0, -2, 3)\}$

(i) $([0, 1] \times [-2, 2] \times [3, 5]) \setminus ((\frac{1}{3}, \frac{2}{3}) \times (-1, 1) \times (4, 4.5))$

(j) $\mathbb{R}^3 \setminus \{(0, 0, 0)\}$

(k) $\{(x, y, z) \in \mathbb{R}^3 \mid x^2 + y^2 + z^2 \leq 1\} \setminus \{(0, 0, 1)\}$

Acknowledge that you have completed this work in the following Google Forms checkin:

0326 Vector Calculus Checkin

I do not want to give you any extra stress, but ...
If you do not fill out these forms, I have to give your names to the dean.