Daily Prep Assignment for March 4th

Overview

We start by generalizing what we did in 10.4 to the case of functions from $\mathbb{R}^m$ to $\mathbb{R}^n$. Linear algebra will be key in this process. In Section 10.5 we learn how to generalize the chain rule to functions of several variables. In the extra material we once again generalize to $f : \mathbb{R}^m \to \mathbb{R}^n$.

Basic learning objectives

These are the tasks you should be able to perform with reasonable fluency **when you arrive at our next class meeting**. Important new vocabulary words are indicated *in italics*.

- Understand the equation for the tangent plane for a function of two variables.
- Recall the chain rule from single variable calculus.

Advanced learning objectives

In addition to mastering the basic objectives, here are the tasks you should be able to perform **after class, with practice**.

- Compute the total derivative of a function from $\mathbb{R}^m$ to $\mathbb{R}^n$.
- Use the total derivative to write the linearization of a function from $\mathbb{R}^m$ to $\mathbb{R}^n$.
- Compute the chain rule of a function of several variables.
- Use the total derivative to express the chain rule.

To prepare for class

Preview activities: Read the example preview activity solution on the course website then,

- Preview activity 10.5.1

Reading:

- Skim section 10.4 extra
- Read section 10.5
- Skim section 10.5 extra

Watching: Watch these additional resources if you need support reading the text.

1. Overview of extra 10.4: `https://youtu.be/Bi0m_Q_SflY`
2. Overview of 10.5: `https://youtu.be/jznjxA7qK60`
3. Overview of extra 10.5: `https://youtu.be/Qy3PZiPqw24`

During and after class

- Activity 10.5.2
- Activity 10.5.3
- Calculate $D(\mathbf{f} \circ \mathbf{g})$ in two ways: (a) by first evaluating $\mathbf{f} \circ \mathbf{g}$ and (b) by using the chain rule and the derivative matrices $D\mathbf{f}$ and $D\mathbf{g}$.

$$f(x,y) = \left(xy - \frac{y}{x}, \frac{x}{y} + y^3 \right), g(s,t) = \left(\frac{s}{t}, s^2 t \right)$$