Part I: Read and Respond (prepare for class Wednesday, April 23)

Finish reading Section 5.2, taking notes for yourself and answering the following questions to turn in as part of your Part I assignment. Review the syllabus for parts (a)–(c) that should be included in this assignment.

Reading Questions

1. Do you see how the "finesse" in the proof of the Chain Rule is solving the problem Abbott points out in the earlier string of equations above the Chain Rule? Explain.
2. In your own words, what is Darboux's Theorem telling us?

Part II: Exercises (prepare for class for Wednesday, April 23)

1. Exercise 5.2.3a
2. Let $s\colon \mathbb{R} \to \mathbb{R}$ and $c\colon \mathbb{R} \to \mathbb{R}$ be functions satisfying the following conditions.
   (a) $s(x+y) = s(x)c(y) + s(y)c(x)$ for all $x, y \in \mathbb{R}$
   (b) $c(x+y) = c(x)c(y) - s(x)s(y)$ for all $x, y \in \mathbb{R}$
   (c) $\lim_{x\to 0} \frac{s(x)}{x} = 1$ and $\lim_{x\to 0} \frac{c(x)-1}{x} = 0$.

   Show that $s'(x) = c(x)$ and $c'(x) = -s(x)$ for all $x \in \mathbb{R}$.

   Note: for this problem, you will likely want to use the following version of the definition of the derivative, which gives the derivative function, not just the derivative at a point:

$$\lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$$

3. In Calculus I, we prove that the derivative of a constant function is 0 (as you did in your Part I). Then I often give the following as a bonus problem: "True or False: If $f'(x) = 0$ for all x in the domain of f, then f is constant." What say you to this question?

Part III: Problems (due FRIday, April 25 at the beginning of class)

Nothing new; feel free to turn in an extra revision if you'd like!