Math 199 CD2: Review and More on Derivative

Spetember 15, 2021

1 Review

1.1 Limit

For what value of k is the following a continuous function?

$$f(x) = \begin{cases} \frac{\sqrt{7x+2} - \sqrt{6x+4}}{x-2} & \text{if } x \geq -2/7 \text{ and } x \neq 2 \\ k & \text{if } x = 2 \end{cases}$$

1.2 ϵ-δ

1. Given $\epsilon = 1$, what can δ be for the following expression:

$$\lim_{x \to 1} 9x + 10 = 19$$

It's better if you start writing out the $\epsilon - \delta$ definition of this limit first

2. Given $\epsilon = 0.5$, what can δ be for the following expression:

$$\lim_{x \to 1/2} x + 10 = 21/2$$

3. Ask me if you still want more practice so I can give it to you

2 Product Rule

1. **More Products.** In this problem we will extend the product rule to apply to the product of two or more functions.

    (a) Write $\frac{d}{dx}(f(x)g(x))$ in terms of f, g, and their derivatives.

    (b) Write $\frac{d}{dx}(f(x)g(x)h(x))$ in terms of f, g, h and their derivatives.

    (c) Describe how to calculate $\frac{d}{dx}(f_1(x)f_2(x)\cdots f_n(x))$.

    (d) Using the rule above, calculate $\frac{d}{dx}(f(x)^n)$ for $n \geq 1$ (without using the chain rule!).

2. **More Derivatives.** In this problem, we will extend the product rule to more derivatives.

   (a) Write $\frac{d}{dx}(f(x)g(x))$ in terms of f, g, and their derivatives.

   (b) Write $\frac{d^2}{dx^2}(f(x)g(x))$ in terms of f, g, and their derivatives.

   (c) Expand $(x+y)^2$, $(x+y)^3$, and $(x+y)^4$ and compare to the above.

   (d) Let $f(x) = x^n e^x$. Find $f^{(n)}(0)$.