Contents

Homework 0

Due: Friday, Jan 21 (no need to turn in)

1. Calculating Limits Using the Limit Laws
   - $\lim_{x \to 2} \dfrac{x^2 + x - 6}{x - 2}$
   - $\lim_{h \to 0} \dfrac{(x+h)^2 - x^2}{h}$
   - $\lim_{x \to 0} \dfrac{1}{t} - \dfrac{1}{t^2 + t}$
2. The Chain Rule:
   - Compute $\dfrac{\mathrm{d}}{\mathrm{d}x} \ln(x + \sin x)$
   - Compute $\dfrac{\mathrm{d}}{\mathrm{d}x} \cos(x^2 e^x)$
3. Implicit Differentiation: Solve for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ for the following implicit function.
   - $x^2 + y^2 = r^2$
   - $\dfrac{x+y}{x-y} = x$
4. Linear Approximations and Differentials: Find the Taylor polynomials of degree two approximating the given function centered at the given point.
   - $f(x) = \sin(2x)$ at $a = \frac{\pi}{2}$
   - $f(x) = e^x$ at $a = 1$
5. Mean Value Theorem: Determine if the Mean Value Theorem can be applied to the following function on the the given closed interval.
   - $f(x) = 3 + \sqrt{x}, x \in [0, 4]$
   - $f(x) = \dfrac{x}{1+x}, x \in [1, 3]$

6. L'Hospital's Rule
   - $\lim_{x \to 2} \dfrac{x^3 - 7x^2 + 10x}{x^2 + x - 6}$
   - $\lim_{x \to \infty} (e^x + x)^{\frac{1}{x}}$
   - $\lim_{x \to \infty} x \ln\left(1 + \dfrac{3}{x}\right)$
7. Integration by parts
   - $\int \dfrac{\ln(x)}{x^2}\,\mathrm{d}x$
   - $\int e^x x\,\mathrm{d}x$
8. The Fundamental Theorem of Calculus: Find the derivative of the following
   - $\int_1^x \dfrac{1}{t^3 + 1}\,\mathrm{d}t$
   - $\int_1^{\sqrt{x}} \sin t\,\mathrm{d}t$
   - $\int_x^{2x} t^3\,\mathrm{d}t$