Homework Assignments

MATH231

Spring 2022

Homework 0

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

1. Calculating Limits Using the Limit Laws

   - $\lim\limits_{x \to 2} \dfrac{x^2 + x - 6}{x - 2}$

   - $\lim\limits_{h \to 0} \dfrac{(x + h)^2 - x^2}{h}$

   - $\lim\limits_{x \to 0} \dfrac{1}{t} - \dfrac{1}{t^2 + t}$

2. The Chain Rule:

   - Compute $\dfrac{d}{dx} \ln(x + \sin x)$

   - Compute $\dfrac{d}{dx} \cos(x^2 e^x)$

3. Implicit Differentiation: Solve for $\dfrac{dy}{dx}$ 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

- $\displaystyle\lim_{x\to 2} \frac{x^3 - 7x^2 + 10x}{x^2 + x - 6}$

- $\displaystyle\lim_{x\to\infty} \left(e^x + x\right)^{\frac{1}{x}}$

- $\displaystyle\lim_{x\to\infty} x\ln\left(1 + \frac{3}{x}\right)$

7. Integration by parts

- $\displaystyle\int \frac{\ln(x)}{x^2}\,\mathrm{d}x$

- $\displaystyle\int e^x x\,\mathrm{d}x$

8. The Fundamental Theorem of Calculus: Find the derivative of the following

- $\displaystyle\int_1^x \frac{1}{t^3 + 1}\,\mathrm{d}t$

- $\displaystyle\int_1^{\sqrt{x}} \sin t\,\mathrm{d}t$

- $\displaystyle\int_x^{2x} t^3\,\mathrm{d}t$