

# Homework Assignments

MATH231

Spring 2022

**1 Homework 0**

**2**

## Homework 0

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

1. Calculating Limits

- $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x - 2}$
- $\lim_{h \rightarrow 0} \frac{(x + h)^2 - x^2}{h}$
- $\lim_{x \rightarrow 0} \frac{1}{t} - \frac{1}{t^2 + t}$

2. The Chain Rule

- $\frac{d}{dx} \ln(x + \sin x)$
- $\frac{d}{dx} \cos(x^2 e^x)$

3. Implicit Differentiation: Solve for  $\frac{dy}{dx}$  for the following implicit function.

- $x^2 + y^2 = r^2$
- $\frac{x + y}{x - y} = x$

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.

- $f(x) = 3 + \sqrt{x}, x \in [0, 4]$
- $f(x) = \frac{x}{1 + x}, x \in [1, 3]$

6. L'Hospital's Rule

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

- $\lim_{x \rightarrow \infty} (e^x + x)^{\frac{1}{x}}$

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

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

- $\int_1^x \frac{1}{t^3 + 1} dt$

- $\int_1^{\sqrt{x}} \sin t dt$

- $\int_x^{2x} t^3 dt$

8. Substitution Rule

- $\int_0^1 \frac{x}{\sqrt{1 - 4x^2}} dx$

- $\int_{\frac{1}{4}}^{\frac{1}{2}} \frac{\cos(\pi t)}{\sin^2(\pi t)} dx$

- $\int_0^1 x e^{4x^2 + 3} dx$