Math 181 Honors Quiz 4 Version A

1. Use the δ-ϵ definition of limit to show that $\lim_{x \to 1}(x^2 + 13x) = 14$.

2. Let $w(x) = f(x)g(x)$. Assuming f and g are continuous functions with derivatives f' and g', show $w'(x) = f'(x)g(x) + f(x)g'(x)$ by using the limit laws to compute

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

3. Use the derivative rules

$$\frac{d}{dx}(x^n) = nx^{n-1}, \quad \frac{d}{dx}(x^{-n}) = -nx^{-n-1} \quad \text{and} \quad \frac{d}{dx}(x^{1/n}) = \frac{1}{n}x^{1/n-1}$$

for $n = 1, 2, 3, \ldots$ along with the general derivative rules

$$\frac{d}{dx}\big(cf(x)\big) = cf'(x) \quad \text{and} \quad \frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$$

to compute the following derivatives.

(i) $\dfrac{d}{dx}(x^4)$

(ii) $\dfrac{d}{dx}(3x^5 + x)$

(iii) $\dfrac{d}{dx}\left(x^2 + \dfrac{5}{x^2}\right)$

(iv) $\dfrac{d}{dx}\big(3\sqrt{x} + \sqrt[5]{x}\big)$