
Preliminaries for differentiation

MthSc 206: Calculus of Several Variables

Basics

1. $\frac{d}{dx}c = 0$, where c is a constant.
2. $\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)] = cf'(x)$
3. $\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$
4. $\frac{d}{dx}[f(x) - g(x)] = f'(x) - g'(x)$
5. $\frac{d}{dx}[f(x) \cdot g(x)] = f'(x)g(x) + f(x)g'(x)$
6. $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$
(quotient rule)
7. $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$
(chain rule)
8. $\frac{d}{dx}f(g(h(x))) = f'(g(h(x)))g'(h(x))h'(x)$
9. $\frac{d}{dx}x^n = nx^{n-1}$

Exponential & log functions

1. $\frac{d}{dx}e^x = e^x$
2. $\frac{d}{dx}a^x = a^x \ln a$
3. $\frac{d}{dx} \ln |x| = \frac{1}{x}$
4. $\frac{d}{dx} \log_a x = \frac{1}{x \ln a}$

Note: $\log_a x = \frac{\ln x}{\ln a}$.

Trigonometric functions

1. $\frac{d}{dx} \sin x = \cos x$
2. $\frac{d}{dx} \cos x = -\sin x$
3. $\frac{d}{dx} \tan x = \sec^2 x$