Differentiation Notes

28 April 2024

1 Basics

1. Power Rule
$$\frac{d}{dx}[x^n] = nx^{n-1}$$

2. Constant Rule
$$\frac{d}{dx}[a] = 0$$

3. Sum and Difference Rule
$$\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$$

4. Product Rule
$$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$$

2 Trigonometric Derivatives

1. Sine Rule
$$\frac{d}{dx}[\sin(x)] = \cos(x)$$

2. Cosine Rule
$$\frac{d}{dx}[\cos(x)] = -\sin(x)$$

3. Tangent Rule
$$\frac{d}{dx}[\tan(x)] = \sec^2(x)$$

4. Cosecant Rule
$$\frac{d}{dx}[\csc(x)] = -\csc(x)\cot(x)$$

5. Secant Rule
$$\frac{d}{dx}[\sec(x)] = \sec(x)\tan(x)$$

3 Exponential and Logarithmic Derivatives

1. Exponential Rule
$$\frac{d}{dx}[e^x] = e^x$$

2. Natural Logarithm Rule
$$\frac{d}{dx}[\ln(x)] = \frac{1}{x}$$

3. General Logarithm Rule
$$\frac{d}{dx}[\log_a(x)] = \frac{1}{x \ln(a)}$$

4. Exponential Function Rule
$$\frac{d}{dx}[a^x] = a^x \ln(a)$$

5. Logarithmic Function Rule
$$\frac{d}{dx}[\log_a(x)] = \frac{1}{x \ln(a)}$$

4 Chain Rule and Implicit Differentiation