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Differentiation formulas are essential in calculus for solving problems related to rates of change and slopes of curves. Here is a concise list of commonly used differentiation formulas:

Basic Derivatives:

1. $\frac{d}{dx}[c] = 0$ (where c is a constant)
2. $\frac{d}{dx}[x^n] = n \cdot x^{n-1}$
3. $\frac{d}{dx}[e^x] = e^x$
4. $\frac{d}{dx}[a^x] = a^x \ln(a)$ (where $a > 0$)
5. $\frac{d}{dx}[\ln(x)] = \frac{1}{x}$ (for $x > 0$)
6. $\frac{d}{dx}[\log_a(x)] = \frac{1}{x \ln(a)}$

Trigonometric Functions:

1. $\frac{d}{dx}[\sin(x)] = \cos(x)$
2. $\frac{d}{dx}[\cos(x)] = -\sin(x)$
3. $\frac{d}{dx}[\tan(x)] = \sec^2(x)$ (for $x \neq \frac{\pi}{2} + n\pi$)
4. $\frac{d}{dx}[\cot(x)] = -\csc^2(x)$ (for $x \neq n\pi$)
5. $\frac{d}{dx}[\sec(x)] = \sec(x)\tan(x)$
6. $\frac{d}{dx}[\csc(x)] = -\csc(x)\cot(x)$

Inverse Trigonometric Functions:

1. $\frac{d}{dx}[\sin^{-1}(x)] = \frac{1}{\sqrt{1-x^2}}$ (for $|x| < 1$)
2. $\frac{d}{dx}[\cos^{-1}(x)] = -\frac{1}{\sqrt{1-x^2}}$ (for $|x| < 1$)
3. $\frac{d}{dx}[\tan^{-1}(x)] = \frac{1}{1+x^2}$
4. $\frac{d}{dx}[\cot^{-1}(x)] = -\frac{1}{1+x^2}$
5. $\frac{d}{dx}[\sec^{-1}(x)] = \frac{1}{|x|\sqrt{x^2-1}}$ (for $|x| > 1$)
6. $\frac{d}{dx}[\csc^{-1}(x)] = -\frac{1}{|x|\sqrt{x^2-1}}$ (for $|x| > 1$)

Hyperbolic Functions:

1. $\frac{d}{dx}[\sinh(x)] = \cosh(x)$
2. $\frac{d}{dx}[\cosh(x)] = \sinh(x)$
3. $\frac{d}{dx}[\tanh(x)] = \operatorname{sech}^2(x)$
4. $\frac{d}{dx}[\coth(x)] = -\operatorname{csch}^2(x)$
5. $\frac{d}{dx}[\operatorname{sech}(x)] = -\operatorname{sech}(x)\tanh(x)$
6. $\frac{d}{dx}[\operatorname{csch}(x)] = -\operatorname{csch}(x)\coth(x)$

Inverse Hyperbolic Functions:

1. $\frac{d}{dx}[\sinh^{-1}(x)] = \frac{1}{\sqrt{x^2+1}}$

2. $\frac{d}{dx}[\cosh^{-1}(x)] = \frac{1}{\sqrt{x^2-1}}$ (for $x > 1$)
3. $\frac{d}{dx}[\tanh^{-1}(x)] = \frac{1}{1-x^2}$ (for $|x| < 1$)
4. $\frac{d}{dx}[\coth^{-1}(x)] = \frac{1}{1-x^2}$ (for $|x| > 1$)
5. $\frac{d}{dx}[\operatorname{sech}^{-1}(x)] = -\frac{1}{x\sqrt{1-x^2}}$ (for $0 < x < 1$)
6. $\frac{d}{dx}[\operatorname{csch}^{-1}(x)] = -\frac{1}{|x|\sqrt{x^2+1}}$

Product, Quotient, and Chain Rules:

1. Product Rule: $\frac{d}{dx}[u \cdot v] = u'v + uv'$
2. Quotient Rule: $\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{u'v - uv'}{v^2}$
3. Chain Rule: $\frac{d}{dx}[f(g(x))] = f'(g(x)) \cdot g'(x)$