

Calculus II Reference Table

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1 Trigonometric Formulas

- $\sin^2(\theta) + \cos^2(\theta) = 1$
- $1 + \tan^2(\theta) = \sec^2(\theta)$
- $1 + \cot^2(\theta) = \csc^2(\theta)$
- $\sin(-\theta) = -\sin(\theta)$
- $\cos(-\theta) = \cos(\theta)$
- $\tan(-\theta) = -\tan(\theta)$
- $\sin(A \pm B) = \sin(A)\cos(B) \pm \cos(A)\sin(B)$
- $\cos(A \pm B) = \cos(A)\cos(B) \mp \sin(A)\sin(B)$
- $\sin(2\theta) = 2\sin(\theta)\cos(\theta)$
- $\cos(2\theta) = \cos^2(\theta) - \sin^2(\theta) = 2\cos^2(\theta) - 1 = 1 - 2\sin^2(\theta)$
- $\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} = \frac{1}{\cot(\theta)}$
- $\cot(\theta) = \frac{\cos(\theta)}{\sin(\theta)} = \frac{1}{\tan(\theta)}$
- $\sec(\theta) = \frac{1}{\cos(\theta)}$
- $\csc(\theta) = \frac{1}{\sin(\theta)}$
- $\cos\left(\frac{\pi}{2} - \theta\right) = \sin(\theta)$
- $\sin\left(\frac{\pi}{2} - \theta\right) = \cos(\theta)$

2 Differentiation Formulas

- $\frac{d}{dx}(x^n) = nx^{n-1}$
- $\frac{d}{dx}(fg) = fg' + gf'$
- $\frac{d}{dx}\left(\frac{f}{g}\right) = \frac{gf' - fg'}{g^2}$
- $\frac{d}{dx}(f(g(x))) = f'(g(x))g'(x)$
- $\frac{d}{dx}(\sin(x)) = \cos(x)$
- $\frac{d}{dx}(\cos(x)) = -\sin(x)$
- $\frac{d}{dx}(\tan(x)) = \sec^2(x)$
- $\frac{d}{dx}(\cot(x)) = -\csc^2(x)$
- $\frac{d}{dx}(\sec(x)) = \sec(x)\tan(x)$
- $\frac{d}{dx}(\csc(x)) = -\csc(x)\cot(x)$
- $\frac{d}{dx}(e^x) = e^x$
- $\frac{d}{dx}(a^x) = a^x \ln(a)$
- $\frac{d}{dx}(\ln(x)) = \frac{1}{x}$
- $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}(\cos^{-1} x) = \frac{-1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
- $\frac{d}{dx}(\cot^{-1} x) = \frac{-1}{1+x^2}$
- $\frac{d}{dx}(\sec^{-1} x) = \frac{1}{|x|\sqrt{x^2-1}}$
- $\frac{d}{dx}(\csc^{-1} x) = \frac{-1}{|x|\sqrt{x^2-1}}$

3 Integration Formulas

- $\int a dx = ax + C$
- $\int x^n dx = \frac{x^{n+1}}{n+1}$
- $\int \frac{1}{x} dx = \ln |x| + C$
- $\int e^x dx = e^x + C$
- $\int a^x dx = \frac{a^x}{\ln(a)} + C$
- $\int \ln(x) dx = x \ln(x) - x + C$
- $\int \sin(x) dx = -\cos(x) + C$
- $\int \cos(x) dx = \sin(x) + C$
- $\int \tan(x) dx = \ln |\sec(x)| + C = -\ln |\cos(x)| + C$
- $\int \cot(x) dx = \ln |\sin(x)| + C$
- $\int \sec(x) dx = \ln |\sec(x) + \tan(x)| + C$
- $\int \csc(x) dx = \ln |\csc(x) - \cot(x)| + C$
- $\int \sec^2(x) dx = \tan(x) + C$
- $\int \sec(x) \tan(x) dx = \sec(x) + C$
- $\int \csc^2(x) dx = -\cot(x) + C$
- $\int \csc(x) \cot(x) dx = -\csc(x) + C$
- $\int \tan^2(x) dx = \tan(x) - x + C$
- $\int \frac{dx}{a^2+x^2} = \frac{1}{a} \tan^{-1} \frac{x}{a} + C$
- $\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}(\frac{x}{a}) + C$

4 Fundamental Theorem of Calculus

$$\int_a^b f'(x) dx = f(b) - f(a)$$

Convergence and Divergence Tests for Series

| Test | Series | Convergence or Divergence | Comments |
|------------------|-------------------------------------|--|--|
| Divergence | $\sum a_n$ | Diverges if $\lim_{n \rightarrow \infty} a_n \neq 0$ | Inconclusive if $\lim_{n \rightarrow \infty} a_n = 0$ |
| Geometric Series | $\sum_{n=1}^{\infty} ar^{n-1}$ | Converges if $ r < 1$, diverges if $ r \geq 1$ | Useful for the comparison tests if the n th term a_n of a series is similar to ar^{n-1} |
| p -series | $\sum_{n=1}^{\infty} \frac{1}{n^p}$ | Converges if $p > 1$, diverges if $p \leq 1$ | Useful for the comparison tests if the n th term a_n of a series is similar to $\frac{1}{n^p}$ |

If any errors are found, please contact me at alvin.lin.dev@gmail.com