Limits and Continuity

- **Definition:** $\lim_{x\to a} f(x) = L$
- **L'Hôpital's Rule:** If $\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$, then

$$\lim_{x\to a}\frac{f(x)}{g(x)} = \lim_{x\to a}\frac{f'(x)}{g'(x)}$$

Derivatives

- **Power Rule:** $\frac{d}{dx}[x^n] = nx^{n-1}$
- **Product Rule:** $(fg)' = f'g + fg'$
- **Quotient Rule:** $\left(\frac{f}{g}\right)' = \frac{f'g-fg'}{g^2}$
- **Chain Rule:** $\frac{d}{dx}[f(g(x))] = f'(g(x))\cdot g'(x)$

Common Derivatives

$$\frac{d}{dx}[\sin x] = \cos x \qquad \frac{d}{dx}[e^x] = e^x$$
$$\frac{d}{dx}[\cos x] = -\sin x \qquad \frac{d}{dx}[\ln x] = \frac{1}{x}$$

Integrals

- **Power Rule:** $\int x^n dx = \frac{x^{n+1}}{n+1} + C \quad (n \neq -1)$
- **Integration by Parts:**

$$\int u\,dv = uv - \int v\,du$$

Common Integrals

$$\int \sin x\,dx = -\cos x + C$$
$$\int \cos x\,dx = \sin x + C$$
$$\int \frac{1}{x}\,dx = \ln|x| + C$$
$$\int e^x\,dx = e^x + C$$

Series and Sequences

- **Geometric Series:** $\sum_{n=0}^{\infty} ar^n = \frac{a}{1-r} \quad (|r| < 1)$
- **Taylor Series:**

$$f(x) = \sum_{n=0}^{\infty}\frac{f^{(n)}(a)}{n!}(x-a)^n$$