Limits

$\lim_{x \to a} f(x) = L$

It's read as x approaches a, $f(x)$ approaches L.

Basic formulas

$\lim_{x \to a} x = a \quad \lim_{x \to \infty} \frac{1}{x} = 0$

$\lim_{x \to a} c = c$ where c is a constant

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

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

$\lim_{x \to a} \frac{f(x)}{g(x)} = \frac{\lim_{x \to a} f(x)}{\lim_{x \to a} g(x)}$ provided $\lim_{x \to a} g(x) \neq 0$

Advanced formulas

L'Hopital's Rule: $\lim_{x \to a} \frac{f(x)}{g(x)} = \frac{\lim_{x \to a} f'(x)}{\lim_{x \to a} g'(x)}$

$\lim_{x \to a} \frac{f(x)}{g(x)} = +\infty \cdot \text{sign}(f(x))$ if $g(x) \to 0^+$

$\lim_{x \to a} \frac{f(x)}{g(x)} = -\infty \cdot \text{sign}(f(x))$ if $g(x) \to 0^-$

$$f'(x) = \lim_{h \to 0} \left(\frac{f(x+h) - f(x)}{h} \right)$$

Derivatives

- Lagrange's notation: $f'(x)$
- Leibniz's notation: $\frac{\mathrm{d}}{\mathrm{d}(x)} f(x)$

Basic formulas

$(e^x)' = e^x$

$x^{n\prime} = nx^{n-1} \quad a^{x\prime} = a^x \ln(a)$ where $a > 0$

$\ln(x)' = \frac{1}{x} \quad \log_a x' = \frac{1}{x \ln(a)}$

$(f(x) \cdot g(x))' = f'(x) \cdot g(x) + f(x) \cdot g'(x)$

$\left(\frac{f(x)}{g(x)} \right)' = \frac{f'(x) \cdot g(x) + f(x) \cdot g'(x)}{g^2(x)}$

$(f(g(x)))' = f'(g(x)) \cdot g'(x)$

$\sin(x)' = \cos(x) \quad \cos(x)' = -\sin(x)$

Common derivatives:

- TBA

Integrals

- TBA

Common integrals:

- TBA

Fundamental Theorem of Calculus

- TBA

where

$$F(x)$$

is the antiderivative of

$$f(x)$$

.

Multivariable Calculus

Partial Derivatives

- TBA

Gradient

- TBA

Divergence

- TBA

Curl

- TBA

Green's Theorem

- TBA

Stokes' Theorem

- TBA

Linear Algebra

Vectors and Matrices

- **Vector**: TBA
- **Matrix**: TBA

Determinants

- TBA

Eigenvalues and Eigenvectors

- TBA

Inverse of a Matrix

- TBA

Ordinary Differential Equations

First-Order ODEs

Separable Equations

- TBA

Integrating Factor

- TBA

- TBA

Second-Order ODEs

Homogeneous Equations

- TBA

Characteristic Equation

- TBA

Systems of ODEs

- TBA

Laplace Transform

- TBA

Feel free to expand and customize this cheat sheet according to your needs.