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Calculus Methods (Quickstudy: Academic)

Review of Basic Calculus for Business, Biology & Psychology Majors

CALCULUS METHODS

LIMITS & CONTINUITY

- $\lim_{x \rightarrow a} f(x) = L$ if $f(x)$ is close to L for all x sufficiently close (but not equal) to a .
- $f(x)$ is continuous at $x = a$ if:
 - $f(a)$ is defined,
 - $\lim_{x \rightarrow a} f(x) = L$ exists, and
 - $L = f(a)$

INTEGRALS

THE DEFINITE INTEGRAL

- Let $f(x)$ be continuous on $[a, b]$.
- Riemann Sum Definition of Definite Integral
 - Divide $[a, b]$ into n equal subintervals of width $\Delta x = \frac{b-a}{n}$.
 - Let $x_0, x_1, x_2, \dots, x_n$ be the endpoints of the subintervals. They are found by: $x_0 = a$, $x_1 = a + \Delta x$, $x_2 = a + 2\Delta x$, $x_3 = a + 3\Delta x$, \dots , $x_n = a + (n-1)\Delta x$.
 - Let m_1, m_2, \dots, m_n denote the midpoints of the subintervals. They are found by: $m_1 = 0.5(x_0 + x_1)$, $m_2 = 0.5(x_1 + x_2)$, $m_3 = 0.5(x_2 + x_3)$, \dots , $m_n = 0.5(x_{n-1} + x_n)$.
 - $\int_a^b f(x) dx = \lim_{n \rightarrow \infty} \sum_{i=1}^n f(m_i) \Delta x$.
- Midpoint Rule: $\int_a^b f(x) dx \approx \lim_{n \rightarrow \infty} f(m_i) \Delta x = \Delta x [f(x_1) + f(x_2) + \dots + f(x_n)]$.
- Trapezoid Rule: $\int_a^b f(x) dx \approx \frac{1}{2} [f(x_0) + 2f(x_1) + f(x_2) + \dots + 2f(x_{n-1}) + f(x_n)] \Delta x$.
- Simpson's Rule: $\int_a^b f(x) dx \approx \frac{1}{3} [f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + \dots + 2f(x_{n-2}) + 4f(x_{n-1}) + f(x_n)] \Delta x$.

THE INDEFINITE INTEGRAL

- $F(x)$ is called an antiderivative of $f(x)$, if $F'(x) = f(x)$.
- The most general antiderivative is denoted $\int f(x) dx$.
- $\int f(x) dx$ is also called the indefinite integral of $f(x)$.
- Fundamental Theorem of Calculus**
 - If $F(x) = \int f(x) dx$ is continuous on $[a, b]$, then $\int_a^b f(x) dx = F(b) - F(a)$.

INTEGRATION FORMULAS

- $\int [f(x) + g(x)] dx = \int f(x) dx + \int g(x) dx$
- $\int kf(x) dx = k \int f(x) dx$ if k is a constant
- $\int [f(x)]^n dx = \frac{f(x)^{n+1}}{n+1} + C$
- $\int x^n dx = x^{n+1} + C$
- $\int e^x dx = e^x + C$
- If $f(x) \geq 0$ on $[a, b]$, $\int_a^b f(x) dx$ gives the area under the curve.
- $\int_a^b [f(x) - g(x)] dx$ gives the area between the two curves $y = f(x)$ and $y = g(x)$.
- Average value of $f(x)$ on $[a, b]$ is $\frac{1}{b-a} \int_a^b f(x) dx$.

INTEGRATION BY PARTS

- Factor the integrand into two parts u and dv .
- Find $u = g(x)$ and $dv = f(x) dx$.
- Find du .
- Set $u v = \int f(x) g(x) dx$.

INTEGRATION BY SUBSTITUTION

TO SOLVE $\int f(g(x)) g'(x) dx$

- Set $u = g(x)$, where $g(x)$ is chosen so as to simplify the integrand.
- Substitute $u = g(x)$ and $du = g'(x) dx$ into the integrand.
- This step usually requires multiplying or dividing by a constant.
- Solve $\int f(u) du = F(u) + C$.
- Substitute $u = g(x)$ to get the answer $F(g(x)) + C$.

IMPROPER INTEGRALS

INFINITE LIMITS OF INTEGRATION

- $\int_a^b f(x) dx = \lim_{t \rightarrow b^-} \int_a^t f(x) dx$
- $\int_a^b f(x) dx = \lim_{t \rightarrow a^+} \int_t^b f(x) dx$

IMPROPER AT THE LEFT OR RIGHT ENDPOINTS

- If $f(x)$ is discontinuous at $x = b$, $\int_a^b f(x) dx = \lim_{t \rightarrow b^-} \int_a^t f(x) dx$.
- If $f(x)$ is discontinuous at $x = a$, $\int_a^b f(x) dx = \lim_{t \rightarrow a^+} \int_t^b f(x) dx$.

DERIVATIVES & THEIR APPLICATIONS

DERIVATIVE BASICS

- DEFINITION OF DERIVATIVE**

$$f'(a) = \lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$$
- If $y = f(x)$, the derivative $f'(x)$ is also denoted $\frac{dy}{dx}$.

FORMULAS:

- Power Rule: $\frac{d}{dx} (x^n) = nx^{n-1}$
- $\frac{d}{dx} (e^{ax}) = ae^{ax}$
- $\frac{d}{dx} (\ln x) = \frac{1}{x}$
- General Power Rule: $\frac{d}{dx} (f(x)^n) = n f(x)^{n-1} f'(x)$
- $\frac{d}{dx} [e^{f(x)}] = e^{f(x)} f'(x)$
- $\frac{d}{dx} [\ln f(x)] = \frac{f'(x)}{f(x)}$
- Sum or Difference Rule: $\frac{d}{dx} [f(x) + g(x)] = f'(x) + g'(x)$
- Constant Multiple Rule: $\frac{d}{dx} [af(x)] = af'(x)$
- Product Rule: $\frac{d}{dx} [f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$
- Quotient Rule:
$$\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$
- Chain Rule:
$$\frac{d}{dx} [f(g(x))] = f'(g(x))g'(x)$$
,

$$\text{or } \frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$
- Derivative of an inverse function:
$$\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$$

IMPLICIT DIFFERENTIATION

GIVEN AN EQUATION INVOLVING FUNCTION OF x AND y , TO FIND: $\frac{dy}{dx}$

- Differentiate both sides of the equation with respect to x , treating y as a function of x and applying the chain rule to each term involving y (i.e. $\frac{d}{dx} [f(y)] = f'(y) \frac{dy}{dx}$).
- Move all terms with $\frac{dy}{dx}$ to left side and all other terms to the right.
- Solve for $\frac{dy}{dx}$.



Synopsis

Calculus analysis, functions and equations. For business, biology and psychology majors.

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I tutor high school and college students in various areas of mathematics - from algebra through calculus. I purchased this study guide for one of my present students whose textbook does not have all of the rules for derivatives and integrals in one place. This is a great reference to find the most commonly used calculus methods for a student to use when doing homework problems.

Excellent summary of the main topics covered in calculus. But you have to go beyond this to really master the concepts.

great

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Good for you refresh knowledge, practical, manageable and economic . Easy to understand, reason concepts of calculus methods applications. Must sell by related topics and the right price rather than

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Delivered as advertised

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