In the Cylindrical Differential Calculus, the integration of functions involving \( \lambda \) and \( \alpha \) follows certain protocols.

Let the integral of \( (\alpha x + \gamma) e^{\alpha x} \) with respect to \( x \) be evaluated.

\[
\int (\alpha x + \gamma) e^{\alpha x} \, dx = \frac{e^{\alpha x}}{\alpha} + C
\]

For the integral of \( (\lambda x - \gamma) e^{\lambda x} \) with respect to \( x \), we have:

\[
\int (\lambda x - \gamma) e^{\lambda x} \, dx = \frac{e^{\lambda x}}{\lambda^2} + C
\]

Integration by parts is also applicable:

\[
\int u \, dv = uv - \int v \, du
\]

For example, integrating \( (\alpha x + \gamma) e^{\alpha x} \) by parts, we get:

\[
\int (\alpha x + \gamma) e^{\alpha x} \, dx = (\alpha x + \gamma) e^{\alpha x} - \int e^{\alpha x} \, dx = e^{\alpha x} + C
\]

Similarly, for \( (\lambda x - \gamma) e^{\lambda x} \):

\[
\int (\lambda x - \gamma) e^{\lambda x} \, dx = (\lambda x - \gamma) e^{\lambda x} - \int e^{\lambda x} \, dx = e^{\lambda x} + C
\]

These integrals illustrate the application of integration formulas in the Cylindrical Differential Calculus.
Inverse Derivatives

A VOLUME OF MILLION

\( \int_{0}^{1} x^{2} \, dx = \left[ \frac{x^{3}}{3} \right]_{0}^{1} = \frac{1}{3} \)

The integral of \( x^{2} \) from 0 to 1 is \( \frac{1}{3} \).

\( \int_{a}^{b} f(x) \, dx = \lim_{n \to \infty} \sum_{i=1}^{n} f(x_{i}) \Delta x \)

The definite integral of \( f(x) \) from \( a \) to \( b \) is the limit of the sum of \( f(x_{i}) \) times \( \Delta x \) as \( n \) approaches infinity.

\( \int \frac{1}{x} \, dx = \ln |x| + C \)

The integral of \( \frac{1}{x} \) is equal to \( \ln |x| + C \).

\( \int e^{x} \, dx = e^{x} + C \)

The integral of \( e^{x} \) is equal to \( e^{x} + C \).

\( \int \cos x \, dx = \sin x + C \)

The integral of \( \cos x \) is equal to \( \sin x + C \).

\( \int \sin x \, dx = -\cos x + C \)

The integral of \( \sin x \) is equal to \( -\cos x + C \).

\( \int \frac{1}{\sqrt{1-x^{2}}} \, dx = \arcsin x + C \)

The integral of \( \frac{1}{\sqrt{1-x^{2}}} \) is equal to \( \arcsin x + C \).

\( \int a^{x} \, dx = \frac{a^{x}}{\ln a} + C, \quad a > 0, \quad a \neq 1 \)

The integral of \( a^{x} \) is equal to \( \frac{a^{x}}{\ln a} + C \), where \( a > 0 \) and \( a \neq 1 \).

\( \int \frac{1}{1+x^{2}} \, dx = \arctan x + C \)

The integral of \( \frac{1}{1+x^{2}} \) is equal to \( \arctan x + C \).

\( \int \frac{1}{\sqrt{a^{2} - x^{2}}} \, dx = \arcsin \left( \frac{x}{a} \right) + C \)

The integral of \( \frac{1}{\sqrt{a^{2} - x^{2}}} \) is equal to \( \arcsin \left( \frac{x}{a} \right) + C \).

\( \int \frac{1}{x^{2} - a^{2}} \, dx = \frac{1}{2a} \ln \left| \frac{x-a}{x+a} \right| + C \)

The integral of \( \frac{1}{x^{2} - a^{2}} \) is equal to \( \frac{1}{2a} \ln \left| \frac{x-a}{x+a} \right| + C \).

\( \int \frac{1}{x^{2} + a^{2}} \, dx = \frac{1}{a} \arctan \left( \frac{x}{a} \right) + C \)

The integral of \( \frac{1}{x^{2} + a^{2}} \) is equal to \( \frac{1}{a} \arctan \left( \frac{x}{a} \right) + C \).

\( \int \frac{1}{x^{2} - b^{2}} \, dx = \frac{1}{2b} \ln \left| \frac{x+b}{x-b} \right| + C \)

The integral of \( \frac{1}{x^{2} - b^{2}} \) is equal to \( \frac{1}{2b} \ln \left| \frac{x+b}{x-b} \right| + C \).

\( \int \frac{1}{x^{2} + b^{2}} \, dx = \frac{1}{b} \arctan \left( \frac{x}{b} \right) + C \)

The integral of \( \frac{1}{x^{2} + b^{2}} \) is equal to \( \frac{1}{b} \arctan \left( \frac{x}{b} \right) + C \).
INTEGRATION APPLICATIONS
Fundamental Theorem of Harm Reduction

\[ \frac{d}{dx} e^{ax} = ae^{ax} \]

\[ \int e^{ax} \, dx = \frac{1}{a} e^{ax} + C \]

\[ e^{ax} \text{ is the only function whose derivative is itself.} \]

CVDsAM DIFFERENTIALS

\[ \frac{d}{dx} \ln x = \frac{1}{x} \]

\[ \int \frac{1}{x} \, dx = \ln |x| + C \]

\[ \text{Natural logarithm is the inverse function of the exponential function.} \]

Integrate Alternating Harmonic Series

\[ \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} = \ln 2 \]

\[ \text{The series converges to the natural logarithm of 2.} \]

\[ \text{Calculation of series sum using integral representation.} \]

For a finite product, the alternating series can be expressed as

\[ \sum_{n=1}^{N} \frac{(-1)^{n+1}}{n} = \frac{1}{2} \ln(N) + O(1) \]

\[ \text{Approximation of finite series using the logarithmic function.} \]

Infinite Series

\[ \sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6} \]

\[ \text{The sum of the reciprocals of the squares of the natural numbers.} \]

\[ \text{The value of the zeta function at 2.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^3} = \frac{\pi^3}{36} \]

\[ \text{The sum of the reciprocals of the cubes of the natural numbers.} \]

\[ \text{The value of the zeta function at 3.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^4} = \frac{\pi^4}{90} \]

\[ \text{The sum of the reciprocals of the fourth powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 4.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^5} = \frac{\pi^5}{150} \]

\[ \text{The sum of the reciprocals of the fifth powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 5.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^6} = \frac{\pi^6}{945} \]

\[ \text{The sum of the reciprocals of the sixth powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 6.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^7} = \frac{\pi^7}{630} \]

\[ \text{The sum of the reciprocals of the seventh powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 7.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^8} = \frac{\pi^8}{3024} \]

\[ \text{The sum of the reciprocals of the eighth powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 8.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^9} = \frac{\pi^9}{15120} \]

\[ \text{The sum of the reciprocals of the ninth powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 9.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^{10}} = \frac{\pi^{10}}{362880} \]

\[ \text{The sum of the reciprocals of the tenth powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 10.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^{11}} = \frac{\pi^{11}}{524160} \]

\[ \text{The sum of the reciprocals of the eleventh powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 11.} \]

\[ \sum_{n=1}^{\infty} \frac{1}{n^{12}} = \frac{\pi^{12}}{3628800} \]

\[ \text{The sum of the reciprocals of the twelfth powers of the natural numbers.} \]

\[ \text{The value of the zeta function at 12.} \]