Higher-Order Preliminary Theory

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February 3, 2018

Abstract

Abstract goes here...

1 Declarations

I; Interval of valid differential equation solution; $variable \quad domain \quad and \quad range, \quad if \quad applicable$

2 Rule

2.1 Linear Independence with Wronskian Determinant

3 Pre-Derivation

3.1 Homogeneous and Non-Homogeneous Differential Equations

General n^{th} order differential equation:

$$a_n\, y^{(n)} + a_{n-1}\, y^{(n-1)} + \cdots + a_2\, y'' + a_1\, y' + a_0\, y = g(x)$$
$$\text{Where } \{a_n, a_{n-1}, \ldots, a_1, a_0\} \in k$$

If $g(x) = 0$, differential equation is homogeneous
If $g(x) \neq 0$, differential equation is non-homogeneous

3.2 The General Solution

An n^{th} order differential equation requires $n-1$ linearly independent solutions to form a general solution.

Let $\{y_n, y_{n-1}, \ldots, y_1, y_0\}$ be linearly independant

Let y be the general solution for the above n^{th} order differential equation.

Per linear combination: $y = c_1\, y_1 + c_2\, y_2 + \cdots + c_{n-1}\, y_{n-1} + c_n\, y_n$

3.3 Linear Dependence and Independence

Let $F = \{f_1, f_2, \ldots, f_n\}$ exist as functions of x.

The elements of F are said to be linearly independent on I, if there exists a set of constants $k_1, k_2, \ldots, k_n$, not all zero such that $\forall x(x \in I \implies k_1 f_1 + k_2 f_2 + \cdots + k_n f_n = 0)$.

4 Derivation

Derivation goes here

5 Exempli Gratia

Examples of important instances