Superposition Principle

Define the differential operator L by

$$L = \frac{d^n}{dx^n} + a_{n-1}(x)\frac{d^{n-1}}{dx^{n-1}} + \ldots + a_0(x)$$

Notice that L is a linear operator, i.e.

$$L(c_1 y_1 + c_2 y_2) = c_1 L(y_1) + c_2 L(y_2)$$

Theorem: (principle of superposition) If y_1 and y_2 are two different solutions of $L(y) = 0$, then so is $c_1 y_1 + c_2 y_2$ for *any* two constants c_1 and c_2.