

# Linear combinations of solutions

An important definition that pops up throughout mathematics is that of a *linear combination*. At the moment, we are interested in linear combinations of function.

## Definition

A **linear combination** of the function  $y_1, y_2, \dots, y_n$  is an expression  $c_1 y_1 + c_2 y_2 + \dots + c_n y_n$ , where  $c_1, c_2, \dots, c_n$  are real numbers.

In other words, a linear combination of functions is a function created from constant *multiples* and *sums* of the functions. What we learn is that the linear combination of solutions for a homogeneous linear differential equation, is again a solution!

## Theorem

Suppose  $y_1, y_2, \dots, y_n$  are solutions to a homogeneous linear differentiation equation (on an interval  $I$ ). Then  $c_1 y_1 + c_2 y_2 + \dots + c_n y_n$  is also a solution for the differential equation on  $I$ .

## Discussion, comments, and examples:



Math45-Module-09-Video-01

## WeBWorK module 09 exercises:

- Problems 1

## Relevant Wikipedia articles:

- [Linear combination](https://en.wikipedia.org/wiki/Linear_combination) [.\(https://en.wikipedia.org/wiki/Linear\\_combination\)](https://en.wikipedia.org/wiki/Linear_combination)