General and particular solutions

We turn to how we can handle the fact that we often have more than one solution and need to describe and write these all.

For example, it make be that simply changing one constant in a solution produces another solution. In this case we have an infinite many solutions for the infinite many constants, but in many ways there is only one solution, up to the constant. We would call such a family of solutions a **1-parameter family of** solutions.

Definition:

Suppose a DE $F(x, y', \ldots, y^{(n)}) = 0$ has a set of solutions such that every solution in this set of solutions can be realized by ranging over n-many constants. We call such a set of solutions an n-**parameter family of solutions** for the DE.

Sometimes there are no parameters, *or*, we simply want to look at one particular solution from a family.

Definition:

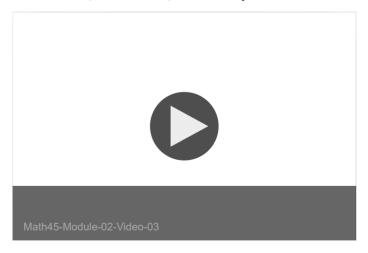A solution for a DE that has no parameters is called a **particular solution**.

Meanwhile, it is also possible that an n-parameter family of solutions actually provides EVERY solution for a DE.

Definition:

An n-parameter family of solutions which gives rise to all solutions of a DE (by ranging over all parameters, i.e., constants) is called a **general solution** for the DE.

An ultimate goal throughout this class is to find a general solution for a given DE.

Discussion, comments, and examples:

Math45-Module-02-Video-03

WeBWorK module 02 exercises:

- Problem 8

Relevant Wikipedia articles:

- **Parametric family of functions**   **(https://en.wikipedia.org/wiki/Parametric_family)**