# Solving Second Order ODEs, Two Non-analytical Methods Revisited

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## ABSTRACT

Mathematics can still be taught without using a CAS and this is probably the case in most schools and universities. Although CAS and technology are often used by instructors to demonstrate or illustrate mathematical concepts, they are rarely used by students. When we consider our mathematics curriculum, "Differential Equations" is one course that we firmly believe can and should benefit from the use of CAS. In this talk, we will report how our ODE course has evolved, as our engineering students have access to technology (Voyage 200 symbolic calculator) in the classroom at all times. This talk will show examples of what students still do by hand and what CAS allows us to do now to enrich the learning experience.

We will consider the series solutions of a second order equation with variable coefficients and numerical solution of the first order equivalent system. Many textbooks do not show the relation between these two subjects. With a CAS on every desk, we can ask students to compare results obtained with both methods. Of course, technology is a must to support this. As teachers, we still want our students to be able to do some specific computations manually. For example, they have to find the recurrence formula by hand for the coefficients of the series solution. However, we also want students to be able to compute, with some accuracy, the value of the solution at a certain point using partial sums or even graph this approximate solution. Then, converting the same equation into a first order system, they can plot the numerical generated curve obtained by the built-in RK method in the Voyage 200 or create a table of values for the approximate solution.

## Keywords

CAS, Second order differential equations, power series solutions, RK method.