In the physics that we know for the last few hundred years, the general procedure is as follows: Laws of physics are expressed in the form of differential equations whose solution under appropriate conditions leads to the solution of the physical problem. Solving of differential equations has thus become a central problem in physics. In this respect various branches of physics can be divided into two categories, one in which the differential equations are linear, like Newtonian mechanics, classical electrodynamics, ordinary quantum mechanics, etc. and the other in which the differential equations are non-linear, like general relativity, quantum field theory, certain cases of fluid mechanics, etc. Linear differential equations have the advantage that by adding two or more solutions, one always gets a new solution, and the general solution can be expressed as linear combination of particular solutions. Since this does not hold for non-linear differential equations, to obtain general exact solutions for non-linear differential equations becomes more complicated.

In the present work we shall be mainly concerned with the solving of some of the non-linear differential equations that arise in physics. In Part I we deal with differential
equations for Einstein's gravitational field and in Part II when the gravitational field is coupled with some other field. In Part III we consider non-linear differential equations arising out of quantum field theory and fluid mechanics.

Although present day physicists frequently deal with non-linear partial differential equations and more sophisticated mathematical tools, sometimes study of a simple algebraic inequality can lead to a result of considerable physical interest. An example of this kind will be given in Part IV.