

19.1: Introduction

Development of classical mechanics has involved a close and synergistic interweaving of physics and mathematics, that continues to play a key role in these fields. The concepts of scalar and vector fields play a pivotal role in describing the force fields and particle motion in both the Newtonian formulation of classical mechanics and electromagnetism. Thus it is imperative that you be familiar with the sophisticated mathematical formalism used to treat multivariate scalar and vector fields in classical mechanics. Ordinary and partial differential equations up to second order, as well as integration of algebraic and trigonometric functions play a major role in classical mechanics. It is assumed that you already have a working knowledge of differential and integral calculus in sufficient depth to handle this material. Computer codes, such as Mathematica, MatLab, and Maple, or symbolic calculators, can be used to obtain mathematical solutions for complicated cases.

The following 9 appendices provide brief summaries of matrix algebra, vector algebra, orthogonal coordinate systems, coordinate transformations, tensor algebra, multivariate calculus, vector differential plus integral calculus, Fourier analysis and time-sampled waveform analysis. The manipulation of scalar and vector fields is greatly facilitated by transforming to orthogonal curvilinear coordinate systems that match the symmetries of the problem. These appendices discuss how to account for the time dependence of the orthogonal unit vectors for curvilinear coordinate systems. It is assumed that, except for coordinate transformations and tensor algebra, you have been introduced to these topics in linear algebra and other physics courses, and thus the purpose of these appendices is to serve as a reference plus brief review.

This page titled [19.1: Introduction](#) is shared under a [CC BY-NC-SA 4.0](#) license and was authored, remixed, and/or curated by [Douglas Cline](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.