Chapter 6
Vectors and Differential Equations: A Visual Approach using Autograph

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ABSTRACT

This chapter is inspired by a session the author gave at the 10th EMAC Conference (Engineering, Mathematics, and Applications) at the University of Technology, Sydney, in December 2011. The audience was university teachers, but the software, Autograph, was designed for use in High Schools. The author was able to show how a simple, pedagogically focused interface could be used to create a highly visual approach to the teaching of two favourite topics: Vectors (in 2D and 3D) and Differential Equations (1st and 2nd Order).

INTRODUCTION

Teachers of University mathematics are generally used to using one of the software giants, such as Maple, Mathcad, or Mathematica. These tools can be tamed to perform almost any mathematical task, but each requires a detailed knowledge of syntax; furthermore, the presentation is generally in “notebook” style, which is perfect for research use, but can appear confusing when used as visualizer in the

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classroom. Autograph on the other hand is designed with teaching in mind: the screen is uncluttered, and all operations are easily found by the judicious use of “select” and “right-click”.

The University teachers in Sydney were somewhat surprised that software created for high school use could bring so many new insights into the teaching of vectors and differential equations (See Figure 1).

**BACKGROUND**

Autograph was conceived in the secondary classroom, covering topics right up to University entrance in the UK. This included many topics that have long since risen above school curriculums in the general rush to consolidate, together with the laudable aim of trying to encourage more students to study mathematics. The two topics of this chapter, vectors and differential equations, used to be well inside the school envelope, but they now occupy the overlapping space between the top end of high school and the first year of university mathematics.

In the design of Autograph, there was an overriding determination to make the creation of dynamic objects as straightforward as possible. This has led to an environment where it is possible to study concepts from the “bottom up”. The logical addition of dependent objects and variable parameters can help students to build firm foundations based on a creative mix of dynamic visualisations and solid bookwork.

The get the most out of this article, you are invited to download and install Autograph (PC or Mac) from www.autograph-maths.com/download and to email the author for a serial number (otherwise your installation will run out after 30 days).

Please also refer to the online dynamic full colour version of this chapter on the Web: www.tsm-resources.com/dynamic.
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