# Dev.MathOps System Design

# **Overview**

The MathOps system is designed as a unified ecosystem to support course delivery and management and document publishing (as a potential replacement for LaTeX), with support for interactive documents and web-based delivery, with an integrated online assessment tool with which to construct electronic textbooks for courses, or to attach assessments (formative and summative) to a textbook for self-study.

# **Modular Design**

The system is developed as a series of separate projects (IntelliJ IDEA modules). The individual modules include:

* **dev.mathops.commons**  
  This module contains central features that could be considered language extensions and utilities, and that are used throughout the system.
* **dev.mathops.text** (depends on **commons** module)  
  This module contains utilities for processing byte strings, UTF-16 Unicode strings, and USV Unicode+ strings (where Unicode+ is a specific assignment of private use areas to glyphs that are well-known and supported in fonts but are not defined within Unicode). This module also has utilities for building strings and generalized lexical parsing support, as well as encoding and URL processing utilities.
* **dev.mathops.persistence** (depends on **commons** and **text** modules)  
  This module provides a generalized database access and caching layer that unifies access to data from multiple databases and from a filesystem.
* **dev.mathops.math** (depends on **commons** and **text** modules)  
  This module implements mathematical functions, including support for interpolation, simplification of expressions, differentiation, and regression modeling. It includes support for variable sets and evaluation, including arrays of variables that operate like spreadsheets. It supports definition of sets and paths in the plane and in space that can be used by other modules and provides linear transformation operations on points and vectors.
* **dev.mathops** (depends on **commons**, **text**, **persistence**, and **math** modules)  
  This module provides web sites, course management and delivery, reporting, utilities, applications, and much more. This was the main (monolithic) module before the project was split into modules by function, and it still retains a lot of features that should be moved to separate modules.
* **dev.mathops.fx** (depends on **commons**, **text**, **persistence**, **math**, and **mathops** modules)  
  JavaFX applications within the MathOps ecpsystem.
* **dev.mathops.font** (depends on **commons**, **text**, and **math** modules)  
  This module contains utilities to parse and interpret font files and to generate glyph outlines, and to create virtual fonts by assigning glyphs from several source fonts to Unicode+ code points.
* **dev.mathops.graphics** (depends on **commons**, **text**, **math**, and **font** modules)  
  This module processes raster and vector graphics, and includes utilities for parsing, interpreting, and generating PDF files. It has rasterizers for primitives that can be used by other modules. This module also has 3D graphic support.
* **dev.mathops.document** (depends on **commons**, **text**, **math**, **font**, and **graphics** modules)  
  This module contains the document model for the publishing system, including analogs to HTML, SVG, MathML, and CSS, as well as tools for mathematical and data visualization and features of LaTeX and other document programs like Word and OpenOffice/LibreOffice.