A new model for the learning curve

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The 2005 MERLOT Editor’s Choice Award
Presented to the
Department of Applied Mathematics at the
University of Colorado at Boulder
For the
Mathematical Visualization Toolkit
Team MVT

- Faculty Sponsors: James H. Curry
  Anne Dougherty

- Current MVT developers: Jay Jones  Brandon Booth  Tom Josephson
  Luke  Ashely Gordon  Ian Her Many Horses

- J.R. WoodhullLogicon teaching professorship in Applied Mathematics

- Sun Microsystems

2005 Development Team
Past CU Student Developers

2004

2003

2002...
History

- MVT has been in development since 1998
- Sponsored by the Department of Applied Mathematics and SUN Microsystems
- Developed exclusively by University of Colorado at Boulder students
- All source code is platform-independent and written using web-based Java technologies
MVT Outline

- What is MVT?
  - Motivations
  - Solution
- Features
- Uses of MVT
- Where do I get it?
What is MVT?

• MVT is a set of visual and computational tools designed to help students better visualize the concepts of Calculus

• The program contains:
  • Scientific calculator
  • Plotting tools
  • Numerical tools
  • Linear algebra tools
  • Differential equations tools
  • Content-specific applets
  • Other Calculus visualization tools
Motivation: Problems with traditional mathematical software

- Educational obstacles
- Not targeted for lower division mathematics
- Large buy-in required: needs basic understanding of programming
Motivation:
Problems with traditional mathematical software

- Departmental obstacles
- Expensive licensing fees
- Not portable across platforms
- Lack of accessibility
The Solution: “Mathematical Visualization Toolkit”
MVT as the solution

- Addresses **educational obstacles** by focusing on student needs
- **Visualization tools**

3D Function Plotter
MVT as the solution

- Addresses **educational obstacles** by focusing on student needs
- **Visualization tools**
- **Topic-specific educational applications**

2D Function Integration
MVT as the solution - Visualization

- Users can manipulate curves, surfaces and vectors in a variety of coordinate systems
- Zooming, rotating, moving
MVT as the solution

- Addresses departmental obstacles
- Free
- Java-based
- Accessible via any web browser
- Platform independent
Feature Overview

- Numerical tools
- Graphical tools
- Topic-specific educational applets
- Tutorial-style help system
- What makes MVT unique?

Demo
Numerical Tools

- Calculator
- Linear Algebra tools
  - ODE solvers
  - Matrix tools
- Root Finding
- Differentiation and Integration
Graphing Tools

Robust set of plotting tools

- 2D & 3D
- Vector Fields
- Implicit
- Contour
- ODE
- Alternative coordinate systems

MVT tool menu
Educational applets

- Focus on specific topics covered in lower division mathematics

Riemann Sums applet

- Designed for the students
Help System

- Tutorial-style help page for every tool

Help Browser
Uniqueness!

- MVT is sticky
- Intuitive Graphical User Interface

Appearance Options

Tool Tips
Uses of MVT

- Presented in a two-week professional development course for high school and middle school teachers
- Used at Front Range Community College in Colorado
- Used in Calculus I, II, III and Differential Equations courses at CU Boulder
- All students are encouraged to use MVT for homework and labs
Uses of MVT

- High School
- Community College
- University

2D Function Plotting

Polar

Tangent Slider (derivatives)
Thank you for coming

- On behalf of the Department of Applied Mathematics at the University of Colorado, Boulder
- http://amath.colorado.edu/java

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