Agenda

- MDCS
- Math Projects
  - Math engine
  - Word & OneNote Add-Ins
  - Mathematics v4 – standalone app
- Future
- Questions?
MDCS History

- Founded in 2005
  - At the time, 5th Dev center in the world!
  - In Belgrade, Serbia
  - By Bodin Drešević (20 year MSFT veteran)

- Number of completed releases
  - Windows 7
  - Office 2010
  - SQL Server 2008

- Staff
  - III 2009: ~ 40 people, XI 2009: ~28 people
  - II 2011: ~ 45 people
MDCS Projects

History
- Windows 7:
  - Handwriting recognizers for Tablet PC (7 Languages incl. Serbian)
  - Math Equation Recognizer & Math Input UI
  - Windows OCR
- Live Book Search: Document Layout Analysis Engines
- Office 2010:
  - Inking and diagraming support
  - Mathematics add-in
- SQL 2008: Spatial Extensibility
- Education: Microsoft Mathematics 4.0

Ongoing contributions
- Many SQL engagements
- Office – Education (Math, SP Integration)
- Bing – Mobile Search (OCR)
Math Projects
Math Team
Microsoft Mathematics helps bring complex mathematics concepts to life.

It can be used to solve advanced mathematical problems – from algebra to calculus to physics and statistics – through dynamic 3D graphs, making math more engaging and easier to grasp.
Math Architecture

Math Engine

- Computational Engine
- Graphing Engine

Math Input

- Inking

Office

- Word Add-In
- OneNote Add-In

MS Math 4.0
Math Scenarios

**Solving math problems**

Jill needs to solve some integrals for her science project:
- Uses **MS Mathematics** Office add-in
- Inputs the integrals
- Calculates results and shares with the team

**Plotting function graphs**

Jack needs to verify a graph of a trigonometric function:
- Uses **MS Mathematic 4.0**
- Easily Inks the function
- Plots the graph and analyzes it
Math Engine
Math Coverage

Calculus
- Continuity checking
- Limits
- Sum of series
- Product of series
- Derivatives
- Definite Integrals
- Indefinite Integrals
- Multiple Integrals

Algebra
- Equalities
- Inequalities
- System of equalities
- Number factorization
- Polynomial factorization
- Algebra of Rational Expressions
- Expanding
- Matrices

Basic Statistics
- Calculator
- Equalities
- System of equalities

Trigonometry
- Real numbers (R)
- Complex numbers (C)
- Gradians
- Radians
- Degrees

Numeric Math
- Working Modes
## Graphing Engine

### Plotting in 2D
- x, y Cartesian coordinates
- Polar coordinates

Ability to:
- Save/Edit graphs
- Change plotting range
- Change plotting surface
- Resize the graph
- Animate
Graphing Engine

**Plotting in 3D**
- x, y & z Cartesian coordinates
- Cylindrical & spherical representations

Ability to:
- Resize
- Change plotting range
- Change plotting surface
- Rotate around each axes
- Update already existing graph
- Animate if there are any parameters
Word & OneNote Add-In
Add-Ins

- Word 12 Add-In
- Word & OneNote 14 Add-Ins
- x86 & x64 Add-Ins
- One setup for different user platforms
- Live from 8/13/2010
- In 5 months ~150k downloads
  - Among top Office downloaded bits
[Word/OneNote Math Add-In Demo]
Mathematics v4
Past & Present

History

- **MS Student 2005 and 2006**
  - MS Math 1.0 and 2.0 shipped as a component of MS Student
  - Marketed as a “2-D and 3-D Graphing Calculator”

- **MS Math 3.0 shipped as a standalone product in 2007**
  - Scaled down version in MS Student 2008, 2009 (no ink reco or calculus)
  - Step-by-Step Equation Solver; Graphing Calculator; Formulas and Equations Library, Triangle Solver, Unit Conversion Tool; Ink Handwriting Support

- **MS Math Add-in for Word 2007 shipped 11/2007**
  - Link for up-sell to full packaged product - e.g. for step-by-step
  - ~ 215,000 downloads in 2009

- **August, 2010:** MS Math 4.0 BETA
- **October, 2010:** MS Math 4.0 RTM
- **January, 2011:** MS Math 4.0 Public Release
  - In 2 weeks 200k downloads
Description

- **Standalone & Free product**
- **K3-K12 Math coverage**
- **Computational operations**
  - Symbolic & Numeric
  - Real & Complex number field
- **Graphing**
  - 2D & 3D
  - Cartesian, Polar, Spherical, Cylindrical coordinate systems
- **Additional tools/features**
  - Triangle tool
  - Equation & Formula library
  - Unit conversion tool
  - Step-by-step solving
- **Keyboard, Touch-like & Handwriting Input**
Architecture

Microsoft Mathematics 4.0

Math Engine

Math Engine Wrapper

Graphing Engine

Computational Engine

Unit Conversion Tool

Triangle Tool

Step-by-Step Engine

graphing ?

yes

no
solve\(x^2 + 2x + 1 = 0, x\)

Solution steps using the quadratic formula
Solution steps for completing the square
Output \(x = -1\) or \(x = -1\)

This equation was solved for \(x\). Would you like to plot both sides of this expression in 2D or plot?
Software development
Engineering Process Overview

- **Product development**
  - Functional, Development & Test design specifications
  - Project tracking on weekly level
  - Primary & secondary component owners
    - Code reviews for all changes
  - Daily work item & bug reports

- **Quality assurance**
  - Daily official builds
  - Daily functional and performance reports
  - **100 000** test cases divided into categories
Test Coverage

- **Computational & Graphing engine**
  - ~100,000 test cases
  - Latest vs. previous
  - Latest vs. initial

- **BVT**
  - ~35 test cases
  - Simulated UI actions
  - Different combinations of OS x Office

- **Computational stability & performance**
  - 40,000 test cases

- **Regular MSFT Release Compliance tools & tests**
Challenges

- Education software – not Mathematica or Matlab
- Simple, but correct
- Are bugs ok?

- Parametric equations/inequalities
  - $ax = 1 \rightarrow x = \frac{1}{a}$
  - $x^2 = a \rightarrow x = \sqrt{a}$
  - How to present correct solution?
UX experience

- **UI changes**
  - Easy access to specific functionality
  - Graphing and Computational actions separated
  - Math preferences pulled to the top level – Ribbon

- **UX study**

- **UI experience that reveals most of Math capabilities**
UX experience

Visible actions
Questions?
THANK YOU! 😊