

MS Mathematics

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Agenda

■ MDCS

■ Math Projects

- Math engine
- Word & OneNote Add-Ins
- Mathematics v4 – standalone app

■ Future

■ Questions?



MDCS



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

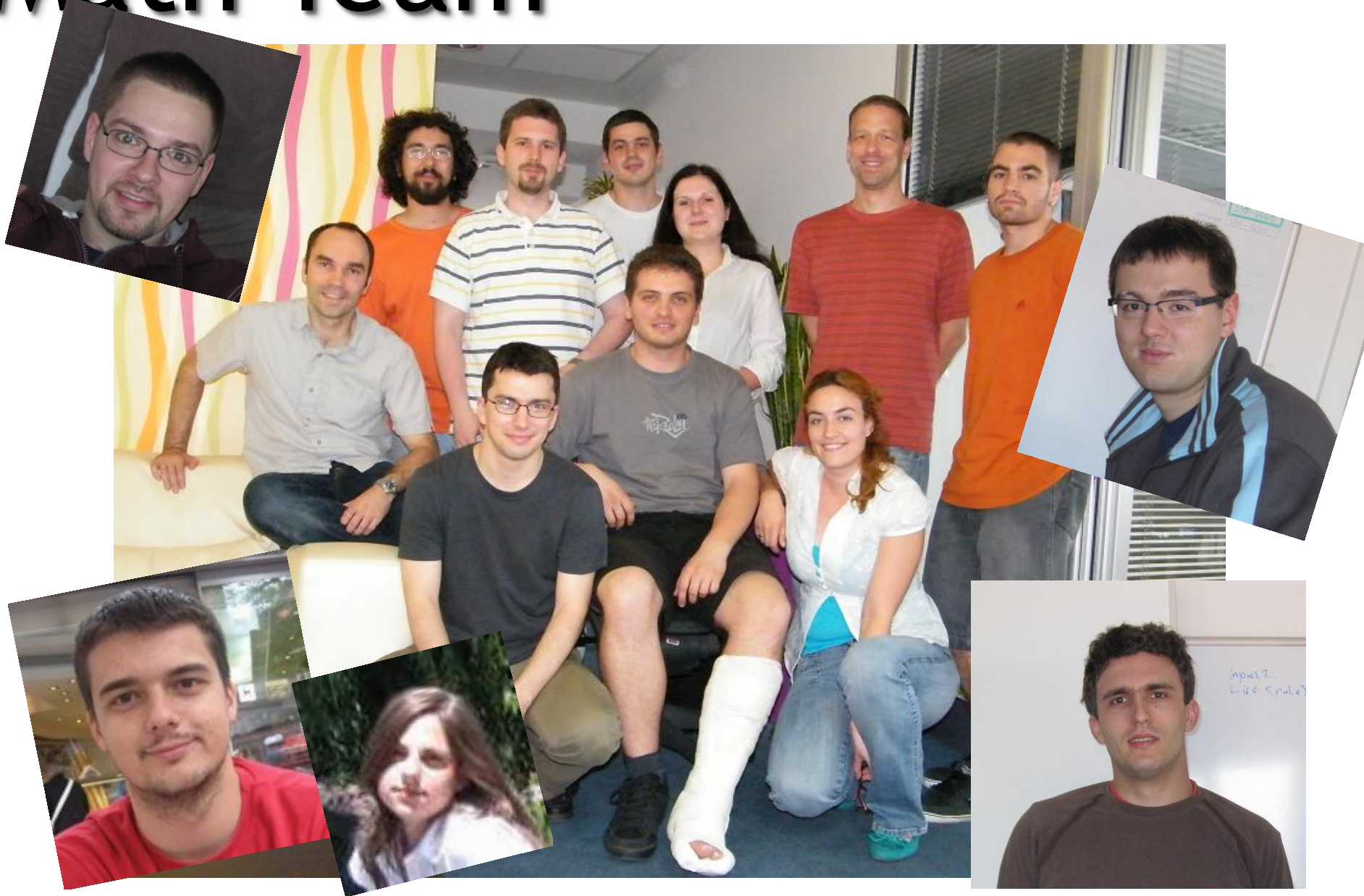
■ Ongoing contributions

- Many SQL engagements
- Office – Education (Math, SP Integration)
- Bing – Mobile Search (OCR)

**Applied
Math!**

Math Projects

Math Team

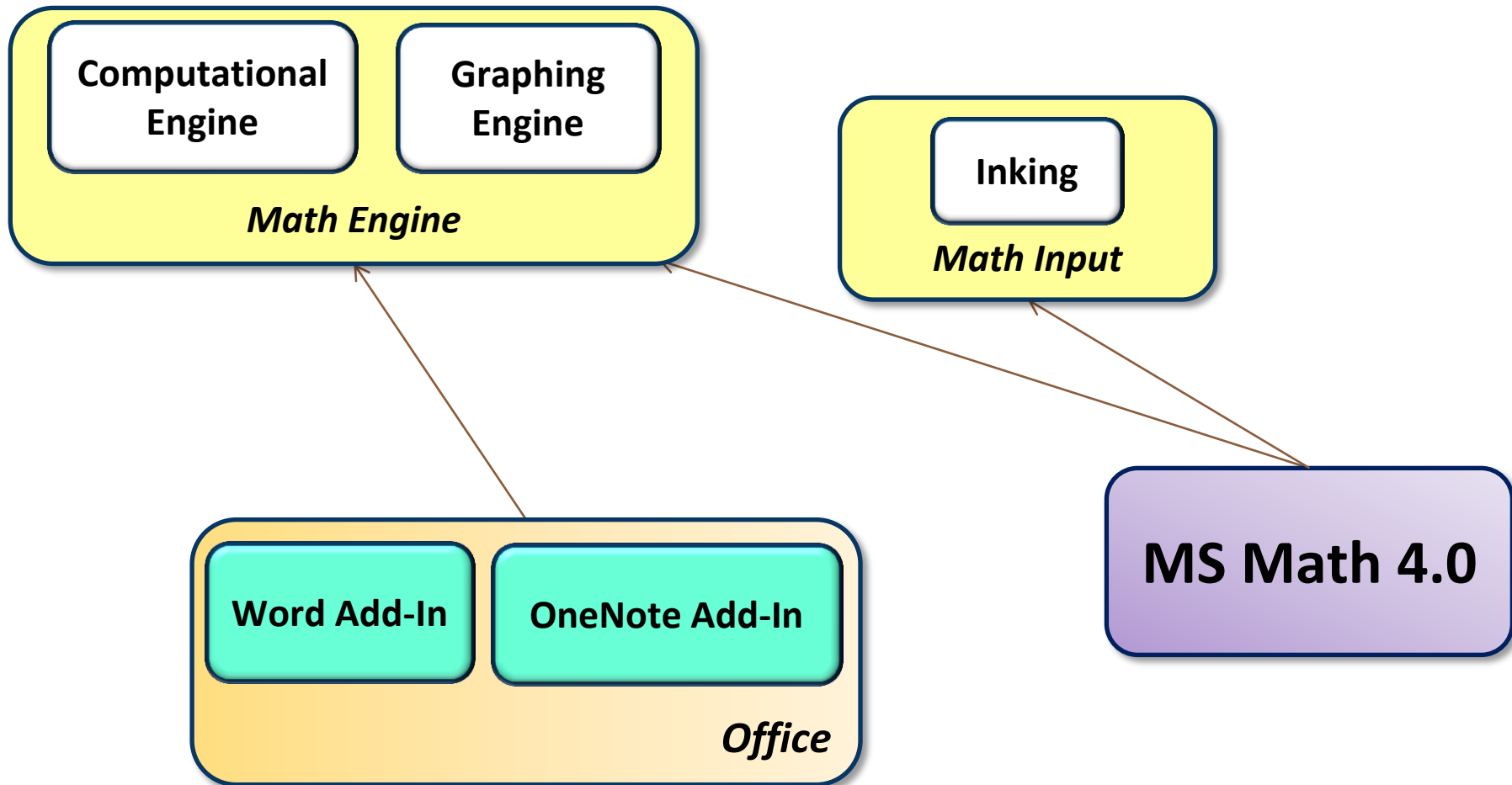


Microsoft Mathematics

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



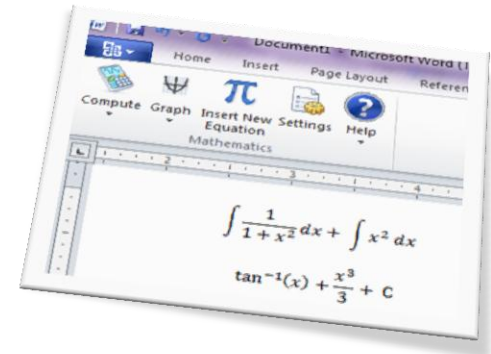
Math Scenarios



■ Solving math problems

Jill needs to solve some integrals for her science project:

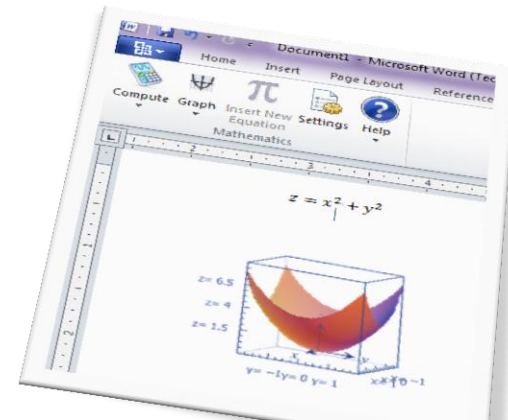
- Uses **MS Mathematics** Office add-in
- Inputs the integrals
- Calculates results and shares with the team



■ Plotting function graphs

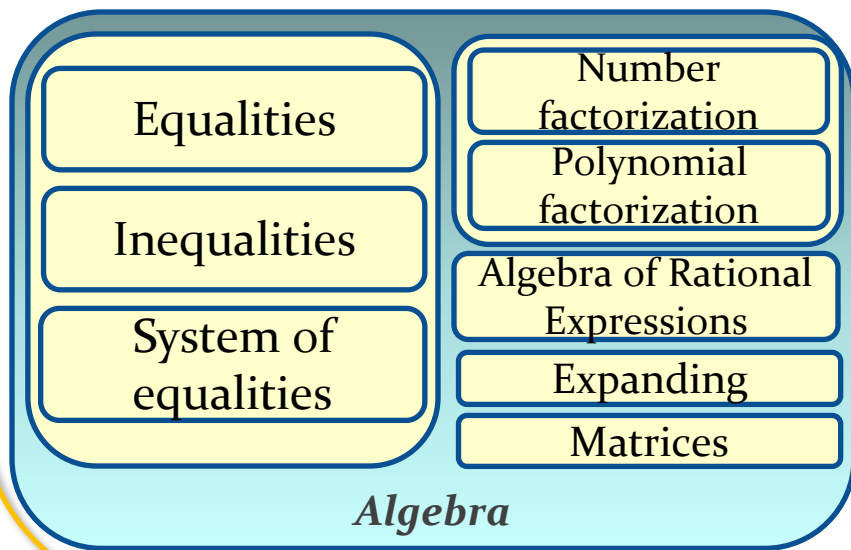
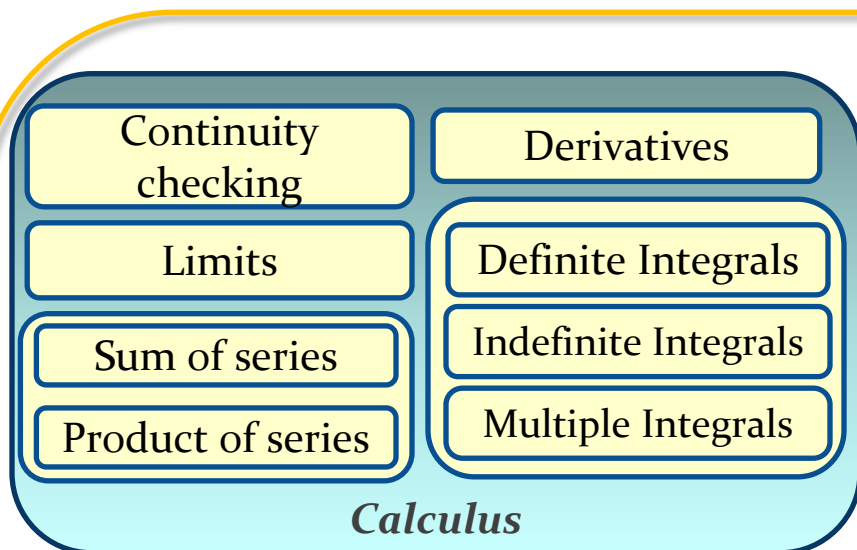
Jack needs to verify a graph of a trigonometric function:

- Uses **MS Mathematic 4.0**
- Easily Inks the function
- Plots the graph and analyzes it



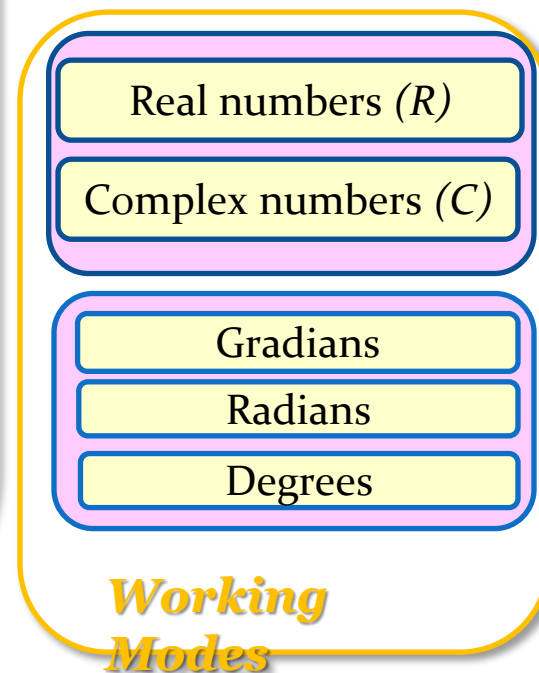
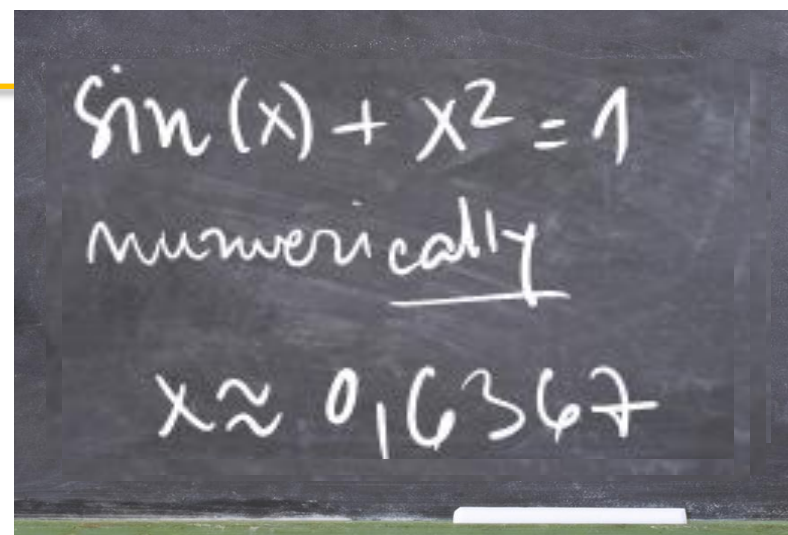
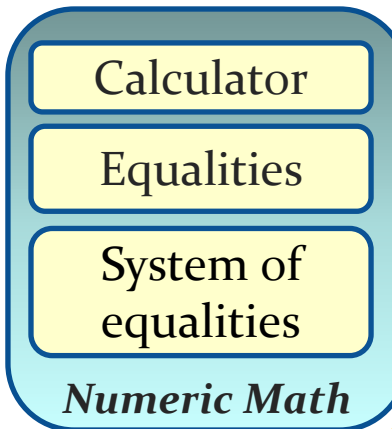
Math Engine

Math Coverage



Trigonometry

Basic Statistics



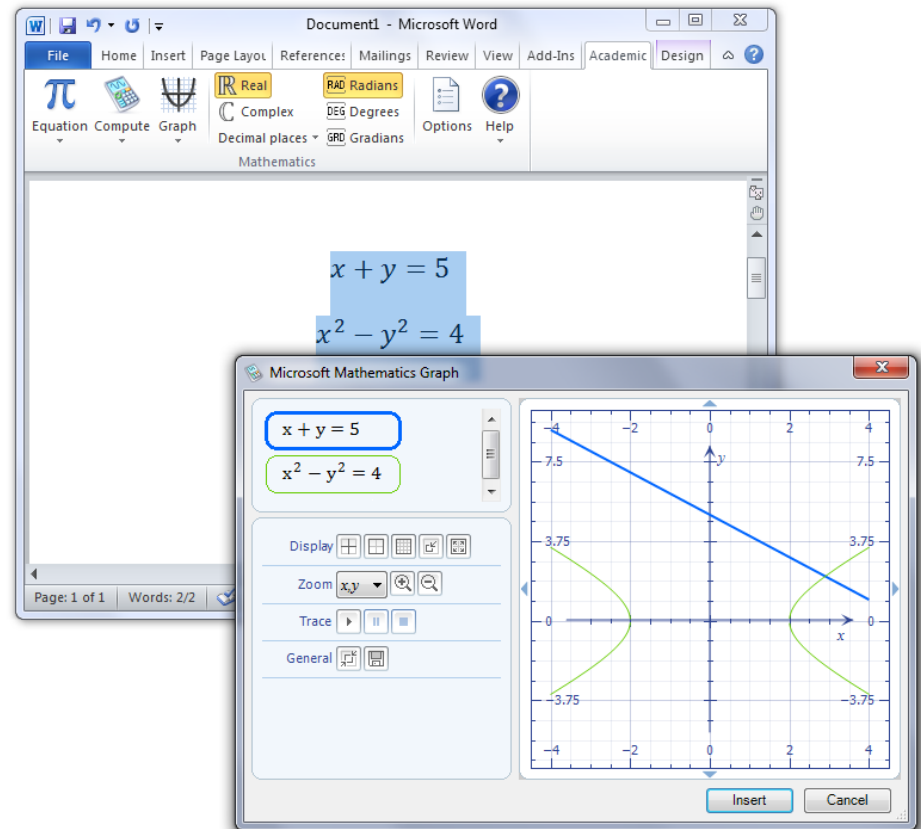
Graphing Engine

■ Plotting in 2D

- x, y Cartesian coordinates
- Polar coordinates

Ability to:

- Save/Edit graphs
- Change plotting range
- Change plotting surface
- Resize the graph
- Animate



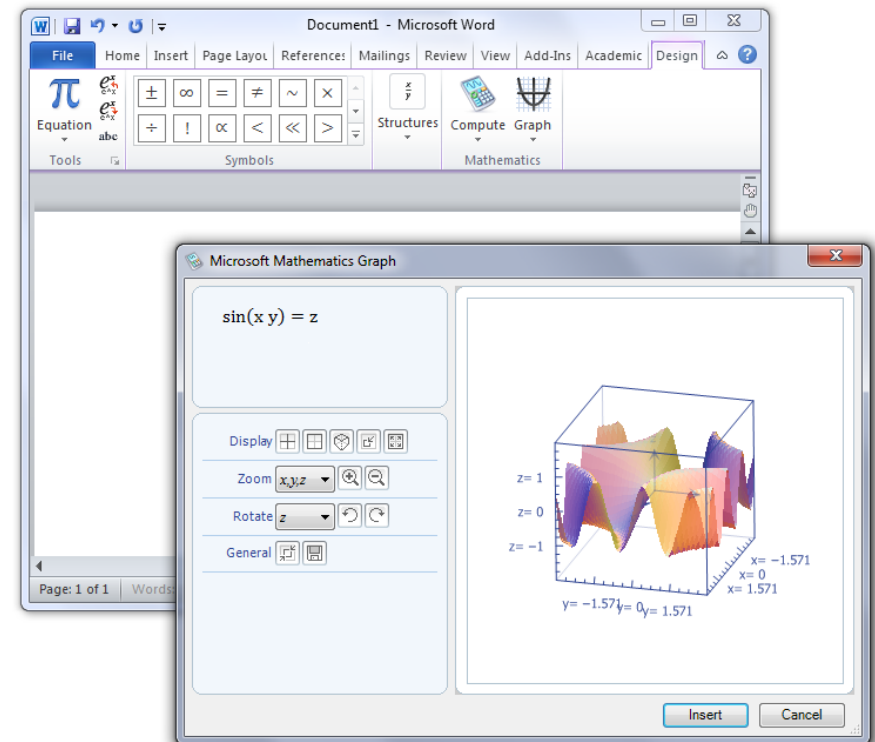
Graphing Engine

■ 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

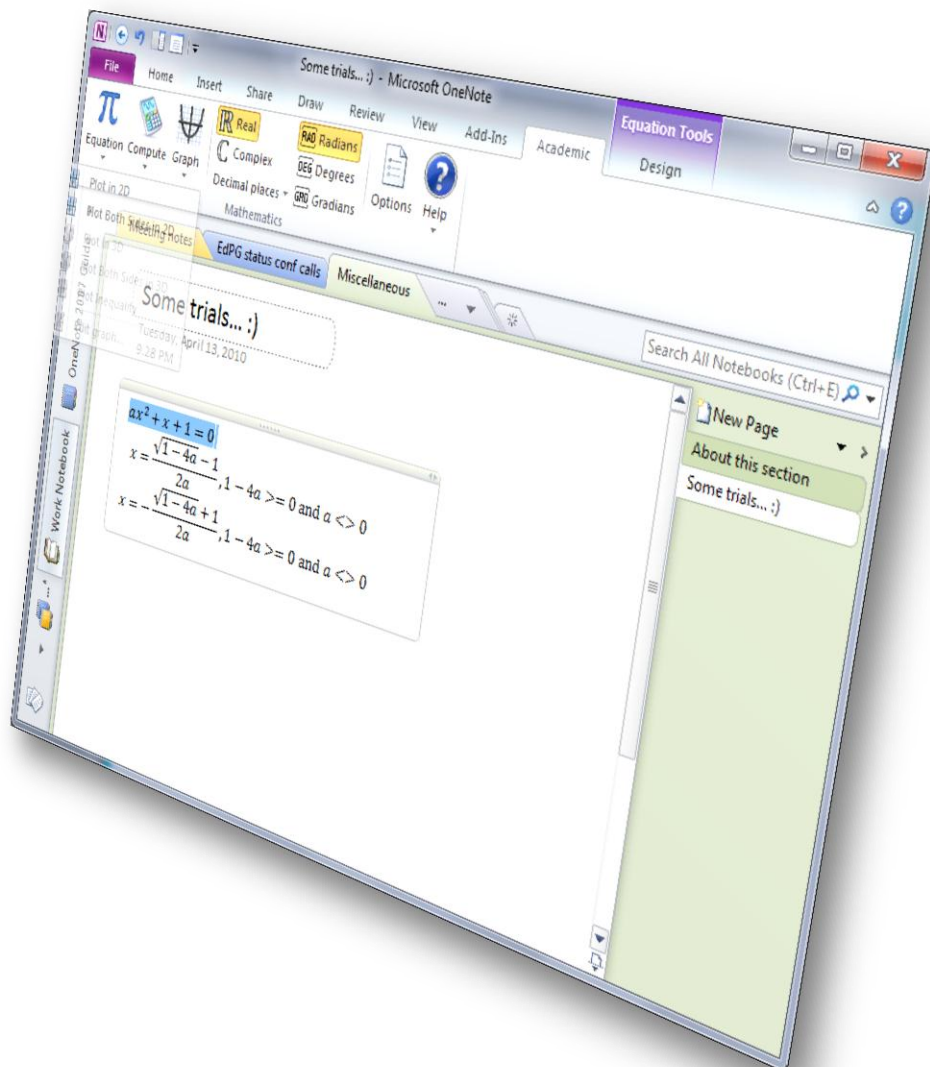


Word & OneNote Add-In

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

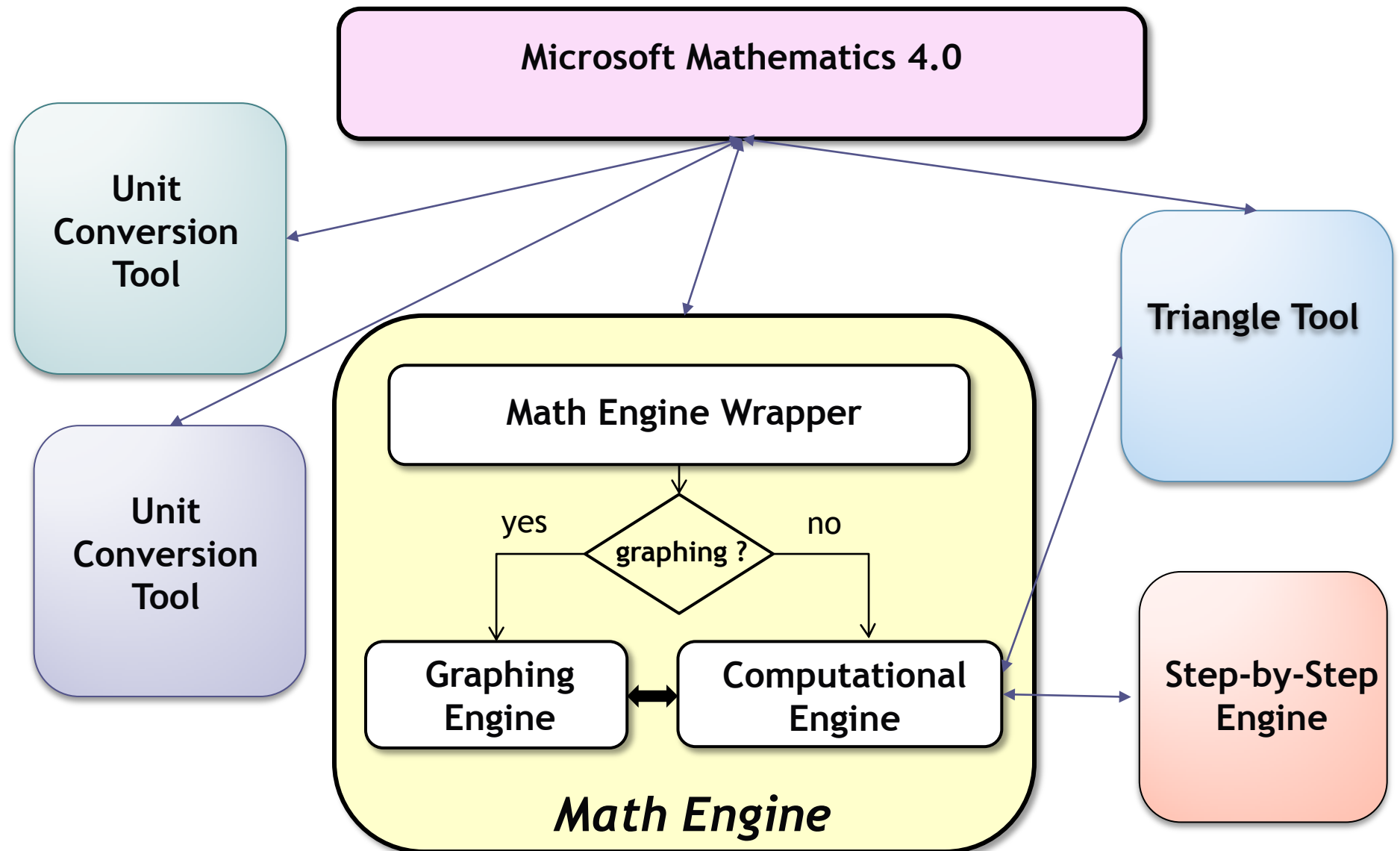
■ January, 2011: MS Math 4.0 Public Release

- 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



Mathematics v4

[Math 4.0 - Demo]

The image displays two overlapping windows from the Microsoft Mathematics Beta application. The background window is a 'Worksheet' titled 'Untitled - Microsoft Mathematics Beta'. It features a ribbon with 'File', 'Home', 'Insert', and 'View' tabs. The 'Home' tab is active, showing options for 'Clipboard' (Paste, Cut, Copy), 'Input' (Keyboard, Ink), and 'Numbers & Angles' (Real Numbers, Complex Numbers, Degrees, Radians, Gradians, Decimal Places, Not Fixed). The worksheet contains two rows. Row 1 shows an input $\text{solve}(x^2 + 2x + 1 = 0, x)$ and its output $x = -1 \text{ or } x = -1$. Row 2 is empty. The foreground window is a 'Graphing' window titled 'Graphin... Untitled - Microsoft Mathematics Beta'. It has a ribbon with 'File', 'Home', 'Insert', 'View', and 'Design' tabs. The 'Design' tab is active, showing options for 'Display' (Axes, Outer Frame, Grid Lines, Proportional Display, Wireframe/Color Surface) and 'Plotting Range' (Plotting Range, Restore Graph). The graphing area shows a coordinate plane with a blue parabola $y = x^2 + 2x + 1$ and a green line $y = 0$. The x-axis ranges from -2 to 2, and the y-axis ranges from -4.75 to 9.5. The graphing window also has a 'Worksheet' tab and a 'Graphing' tab, with the 'Graphing' tab selected. It includes a 'Functions' list on the left and a 'Graph Controls' section with 'Trace' buttons.

Worksheet: Untitled - Microsoft Mathematics Beta

Input: $\text{solve}(x^2 + 2x + 1 = 0, x)$

Output: $x = -1 \text{ or } x = -1$

Graphing: Graphin... Untitled - Microsoft Mathematics Beta

Equations: $y = x^2 + 2x + 1$

Equations: $y = 0$

Graph Controls: Trace

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

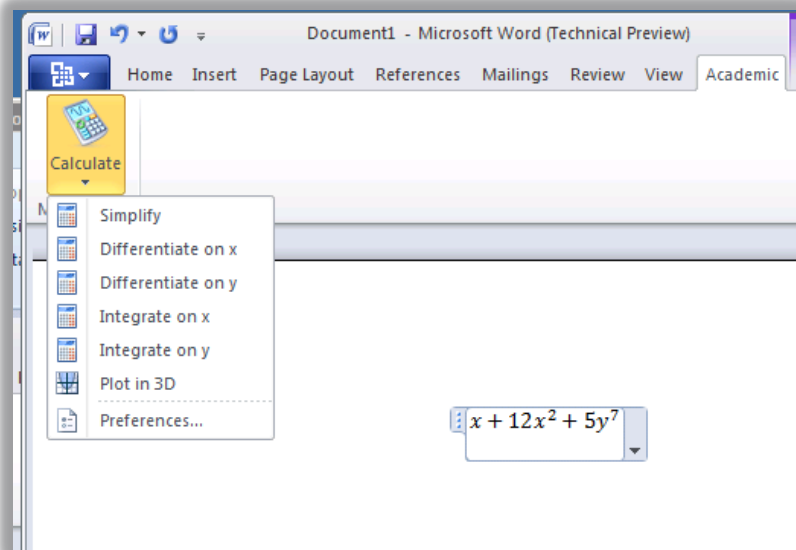
■ UI changes

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

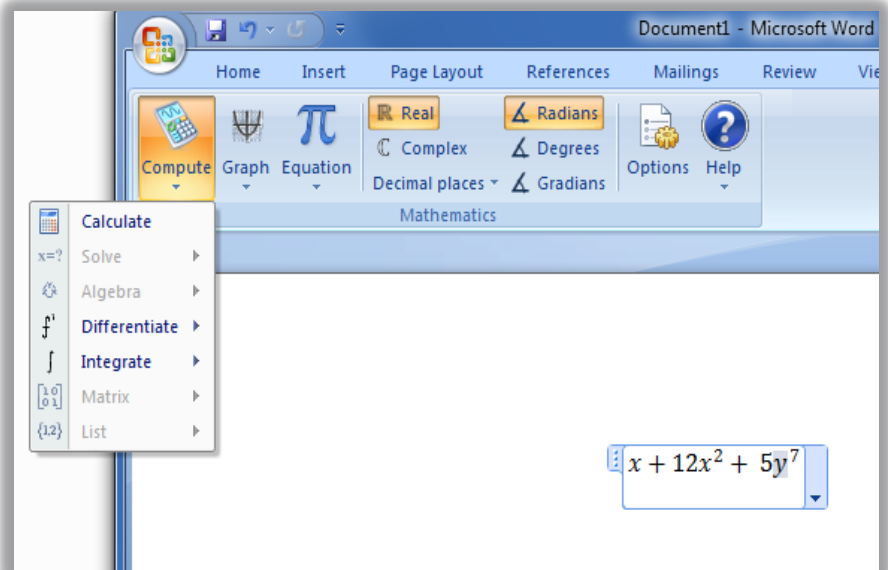
■ UX study

■ UI experience that reveals most of Math capabilities

UX experience



Visible actions





Questions?



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THANK YOU! ☺