PTC MATHCAD ROADMAP

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Product Manager

June 2016

WHAT IS PTC MATHCAD?

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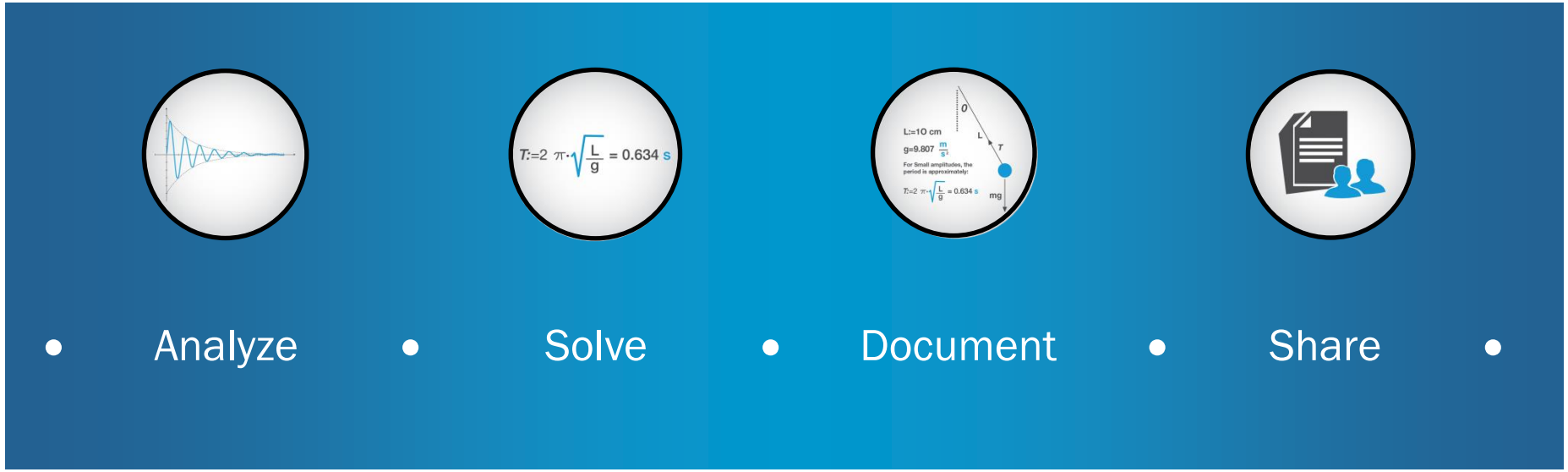
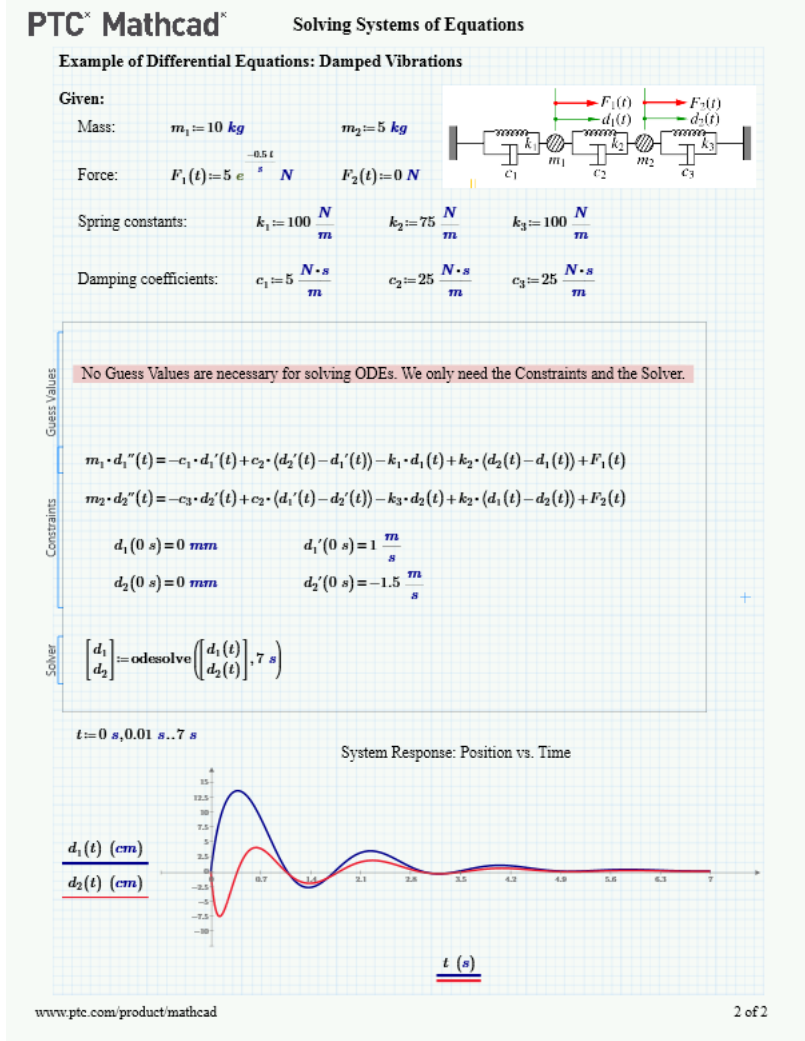
A **digital engineering notebook** to perform your engineering calculations and manage your design intent



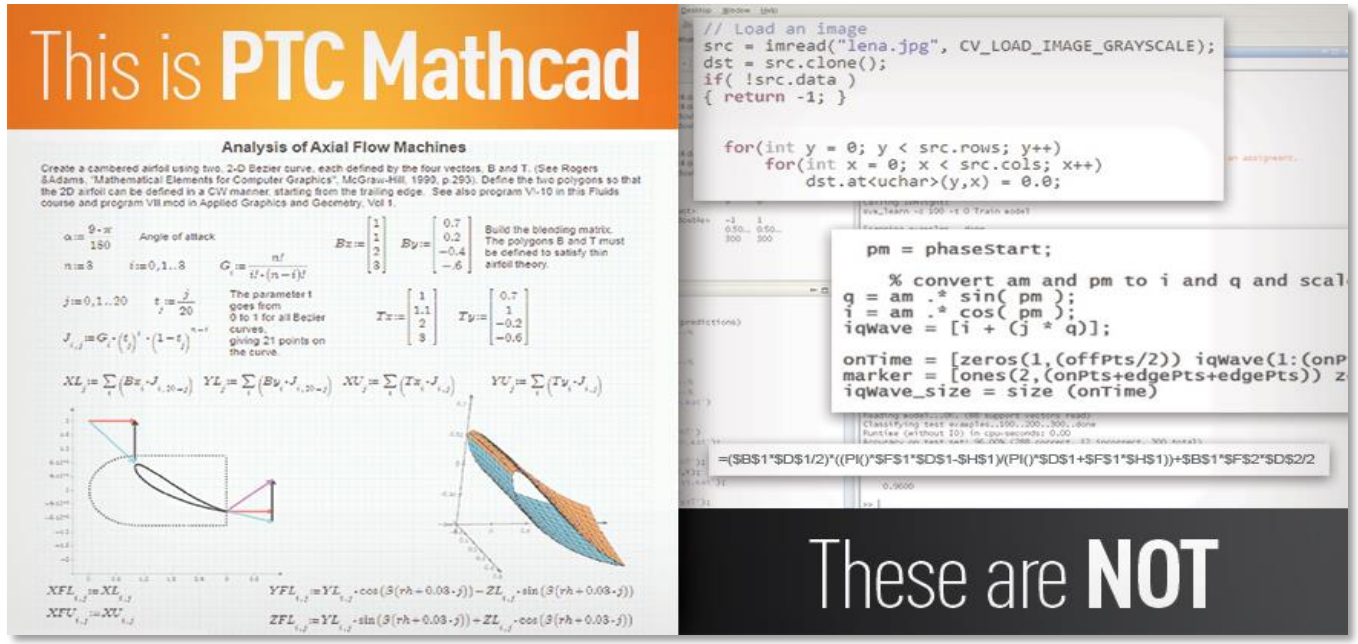
PTC Mathcad combines the ease and familiarity of an ***engineering notebook*** with a powerful ***mathematical engine***

WHAT IS PTC MATHCAD?

- Standard mathematical notation
  - Don't need to know Mathcad to understand Mathcad documents
- Comprehensive support for units
  - Explicit units reduce unit assumption errors across cultural boundaries, and prevents disparate unit calculation mistakes
- Document-oriented approach
  - Mathcad worksheet calculates results and communicates ideas at the same time
- Visual presentation features
  - Use of integrated text, images, plots, and areas help annotate the calculations



WHAT IS PTC MATHCAD?



"Talented engineers are using Excel and getting serious errors of which they're simply not aware. And errors build up more rapidly than you might expect."

Dr. Alan Stevens
Specialist, Mathematical Modeling & Simulation
Rolls-Royce

"Using PTC Mathcad, we can draw up calculation notes twice as fast, but the real value is in proofing and verification. On average, this stage takes three times less time using PTC Mathcad compared with Microsoft Excel, representing a clear gain in productivity."

Sylvain Routeau
Department Head Subsea Structures
Technip

CURRENT CAPABILITIES

PTC MATHCAD

Templates to promote re-use and adoption of approved methods

Multiple document environment

Task-based UI organizes workflows in an intuitive manner

Integrated headers and footers – just double-click to edit

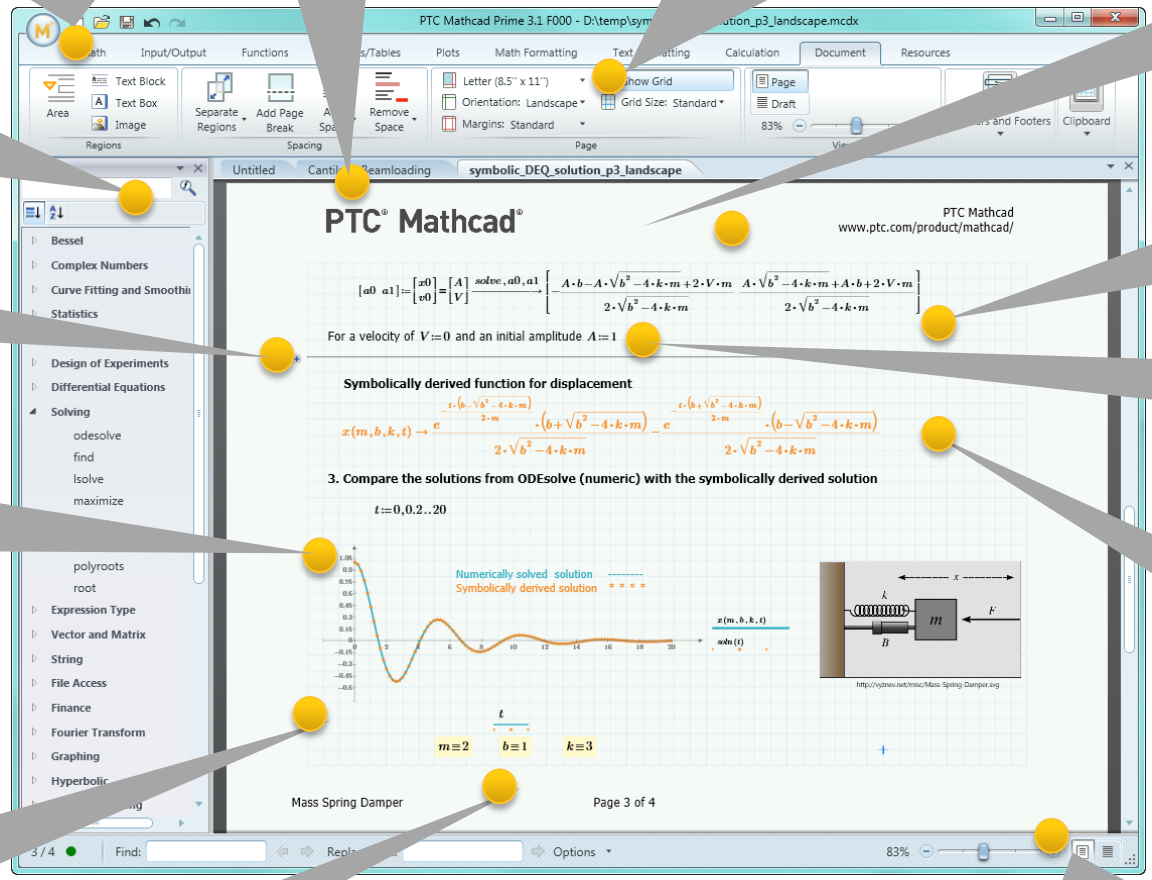
Intuitive function toolbar allows rapid discovery and use

Collapsible areas help streamline presentation

Graph-paper interface keeps content organized with clear calculation order

Custom functions that allow re-use of legacy code as functions

2D and 3D plots allow direct manipulation - no repetitive dialogs!



Symbolic operations, and solving combined with numerics

Enhanced documentation with math-in-text support

Superior Mathematical formatting options

64-bit support, multi-threaded calculations

Global definition support

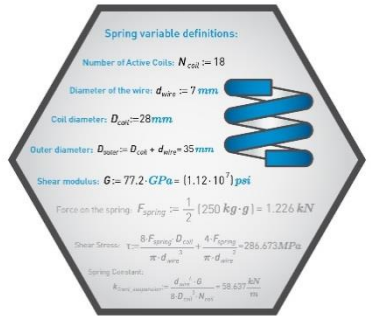
Spec tables and embedded Excel allow organization and calculation

WYSIWYG Page-view, or draft view for extra whiteboard space

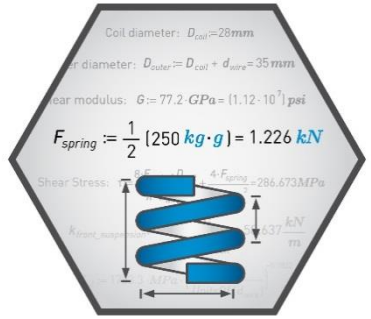
PTC MATHCAD PRIME 3.1

- Functionality
  - New PTC Creo integration
    - 3 use cases for CAD engineer
      - Document design intent
      - Analysis driven design
      - Verification and validation
  - API
    - Re-written to be cleaner and more efficient
    - Extensive SDK with a dozen code examples including source code to SolidWorks integration
  - Large data handling
    - For 64-bit architectures, data set sizes are no longer limited to 2 gigabyte ceiling
  - Windows 8.1 support
  - Connectivity with third party tools
    - Prode© physical properties, CoolProp © fluid properties, ODBC-compliant databases
    - Export algorithms to drive CAD surfaces though STL, DXF or IBL formats
    - Read and write in HDF5 file format
    - Export matrices to C++ code
  - PTC Mathcad Worksheet Libraries
    - Over 1,500 pre-built worksheets across:
      - Mechanical, Electrical, Civil & Structural, Chemical, Applied Math and Education
  - Scripts to convert legacy e-books & create HTML TOCs

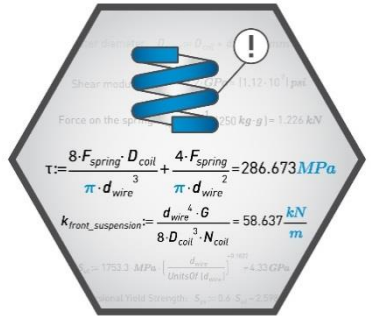
ENGINEERING NOTEBOOK, POWERED BY PTC MATHCAD



Document Design Intent



Analysis Driven Design

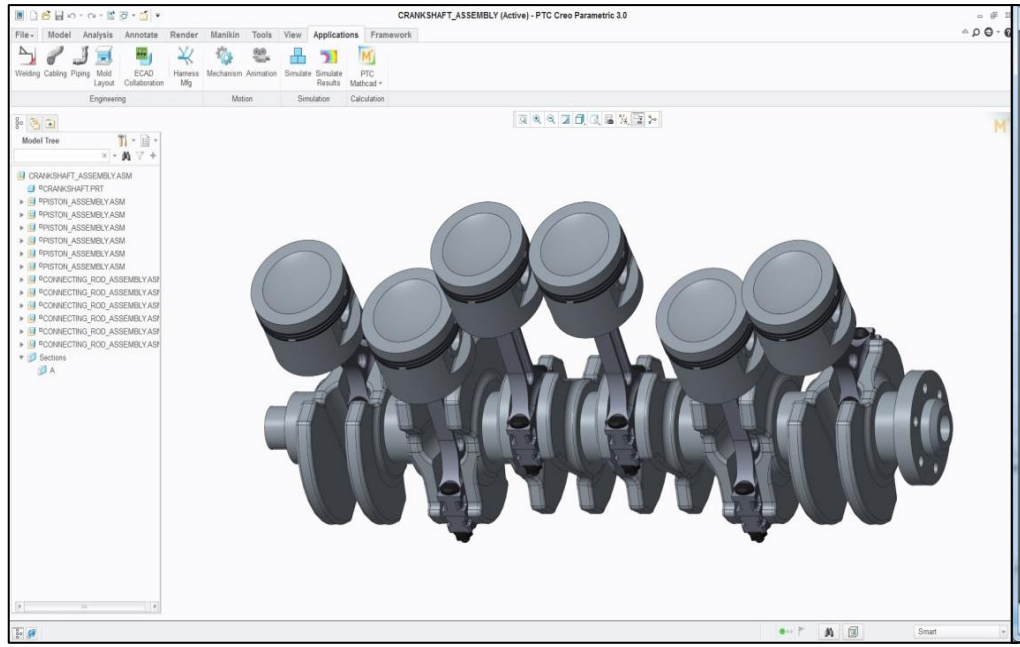


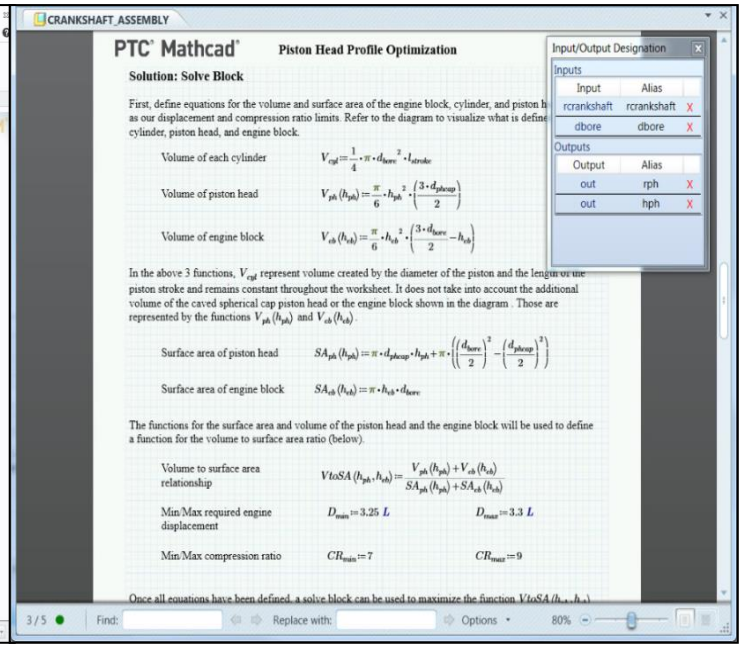
Verification and Validation

ENGINEERING NOTEBOOK, POWERED BY PTC MATHCAD

Document Design Intent

- **Embed** a Mathcad worksheet directly **within** the Creo model
- Embedded worksheet can be opened, edited and saved within the Creo model
- All design details in the worksheet automatically travel with the Creo model

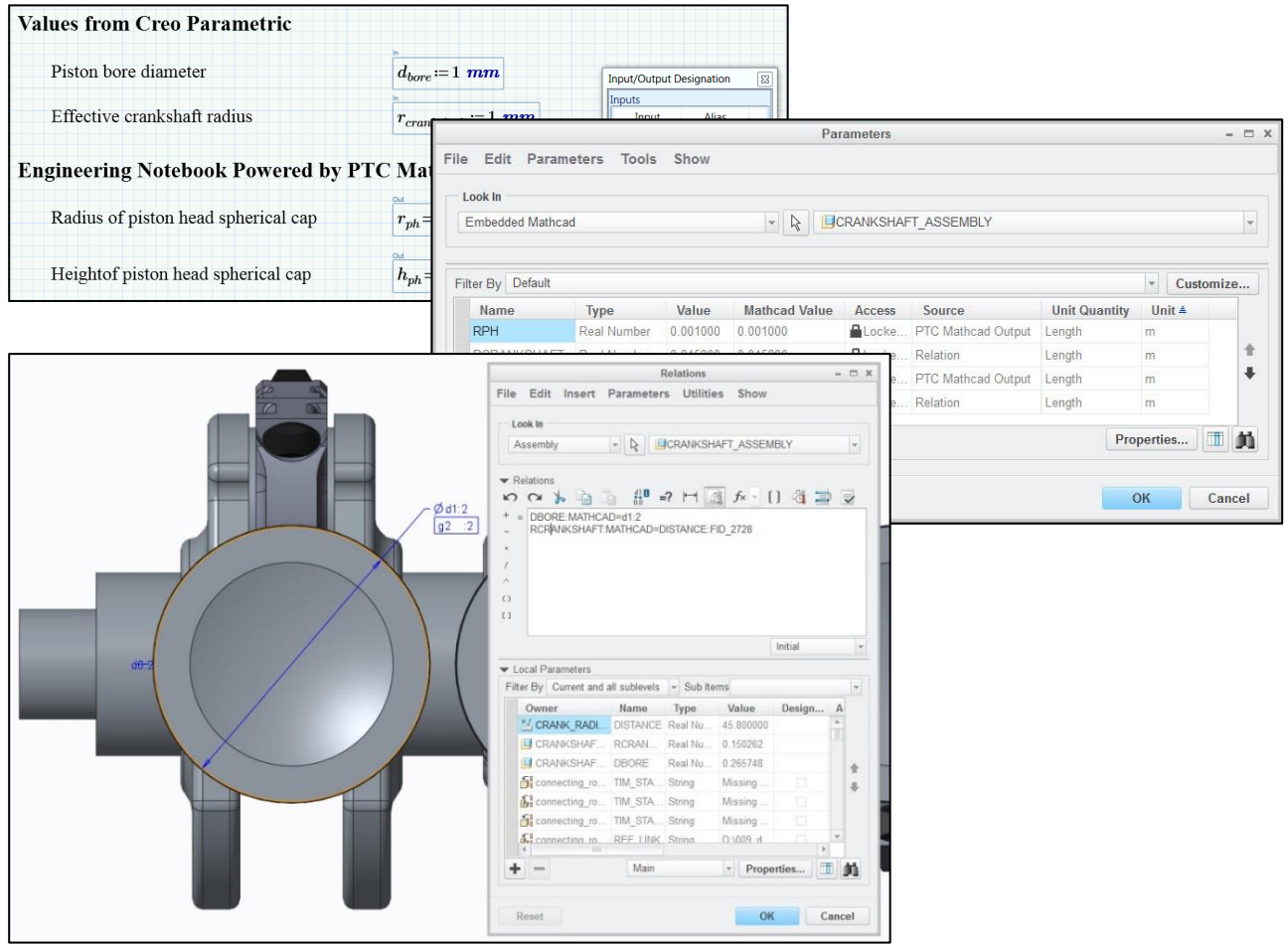




ENGINEERING NOTEBOOK, POWERED BY PTC MATHCAD

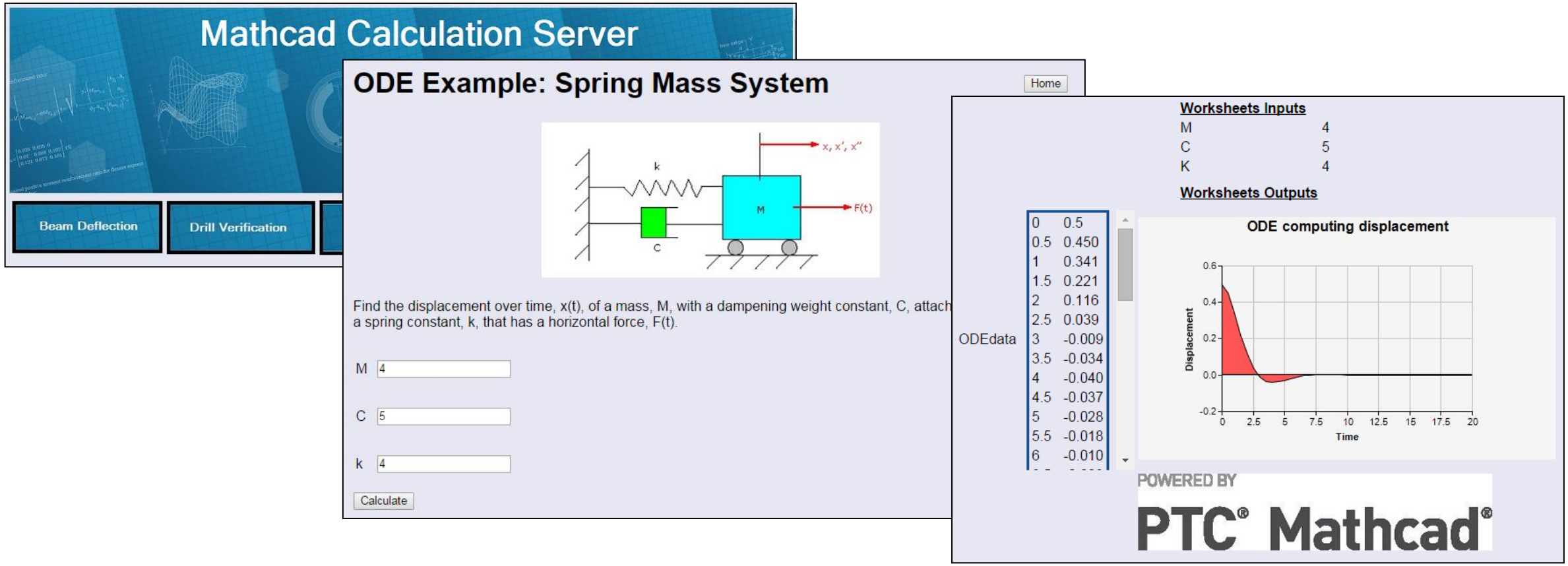
Analysis Driven Design and Verification and Validation

- Analysis Driven Design
  - Solve calculations and use the results as dimensions within the Creo model - relate Mathcad outputs to parameters in Creo to use Mathcad values in Creo
- Verification and Validation
  - Creo parameters further analyzed with Mathcad's extensive array of math tools - relate Mathcad inputs to parameters in Creo to use Creo values in Mathcad
- Tag parameters in the embedded Mathcad worksheet
  - Inputs – values from Creo to Mathcad
  - Outputs – values from Mathcad to Creo
- Mathcad input definitions and output evaluations become available in Creo Parameters Table



PTC MATHCAD GATEWAY

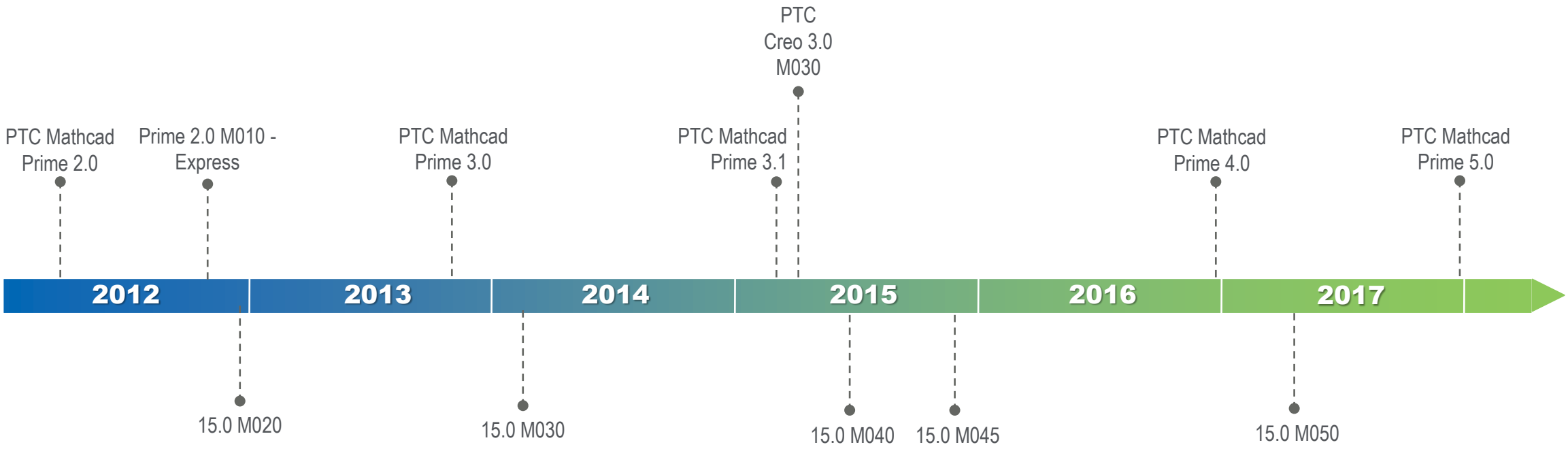
- PTC Mathcad Gateway is a calculation server that provides access to your company's certified engineering calculations for any user, anytime, on any device. Users can obtain quick calculation results for their specific scenarios without exposing valuable company IP.



PTC MATHCAD ROADMAP

PTC MATHCAD PRODUCT ROADMAP

- **PTC Mathcad Prime x.0**
  - Major releases with new functionality
  - From 2016, yearly frequency to match subscription period
  - Maintenance releases to address customer-reported issues when necessary



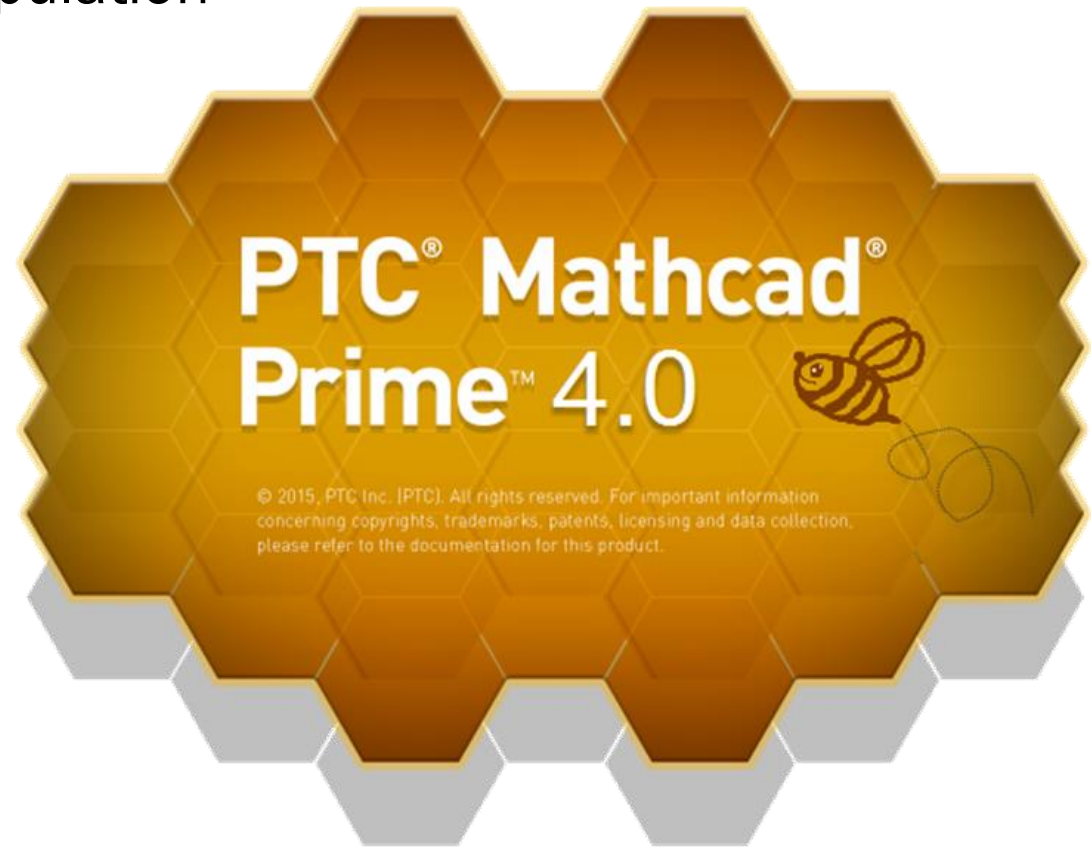
- **PTC Mathcad 15.0**
  - Maintenance releases to address customer-reported issues, platform and/or technology changes
  - No new features

Forward looking information, subject to change without notice

PTC MATHCAD PRIME 4.0

New functionality:

- Performance improvements in document manipulation
- Mathcad as an OLE container
- Content protection
- Improved copy/paste to other applications
- Equation wrapping
- Windows 10 support
- Computational enhancements



PTC MATHCAD PRIME 4.0

Performance improvements in document manipulation

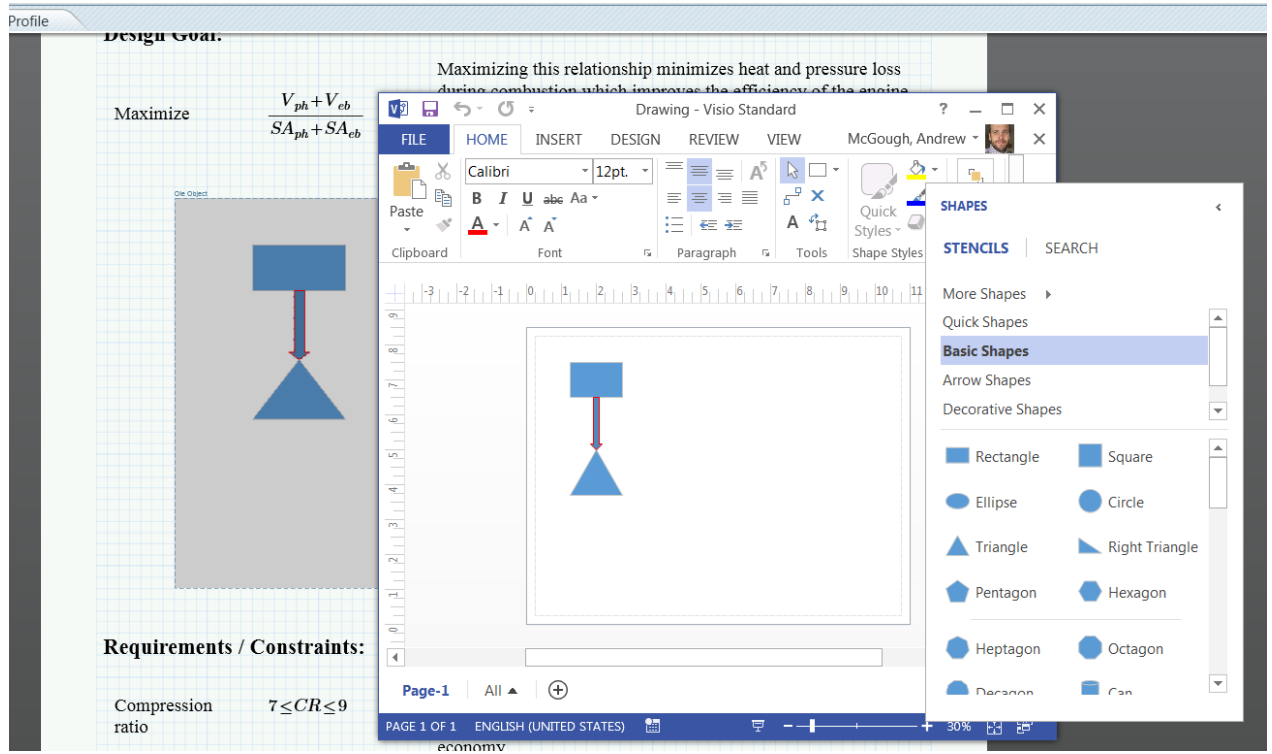
- Performance improvement of worksheet-level operations (e.g. adding/removing whitespace)
- Performance improvement of region-level operations (e.g. text editing) that can result in worksheet layout change

Main Improvements	Improvement (Worksheet dependent)
Switching between Page/Draft mode	Improved 10 – 30 times
"Orientation" - Page Orientation change (Portrait/Landscape)	Improved 10 – 100 times
"Letter" - Page size change (change page formats A3, A4, ...)	Improved 10 – 40 times
"Margin" – Margin switch between Standard, Narrow and Wide	Improved 10 – 40 times
"Grid Size" – Grid size switch between Fine and Standard.	Improved 10 – 15 times
"Show Grid"	Improved 5 – 10 times
"Add Space"	Improved 5 – 10 times
"Remove Space"	Improved 5 – 10 times
"Add Page Break"	Improved 1.5 – 2 times
"Separate Regions"	Some improvement
Select All	Improved 10 – 40 times
Un-Select All	Improved 10 – 40 times
Math format changes on selected items	Some improvement
Text format changes on selected items	Some improvement
Collapse Area	Some improvement

PTC MATHCAD PRIME 4.0

Mathcad as an OLE container

- Ability to embed applications as OLE objects within the worksheet
  - Any OLE object available on the system
  - Can embed new or from file
  - Can link to file

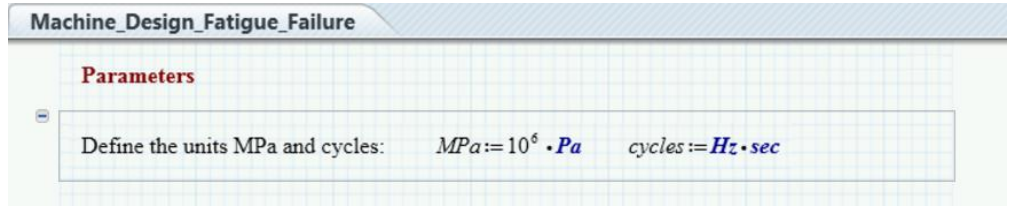


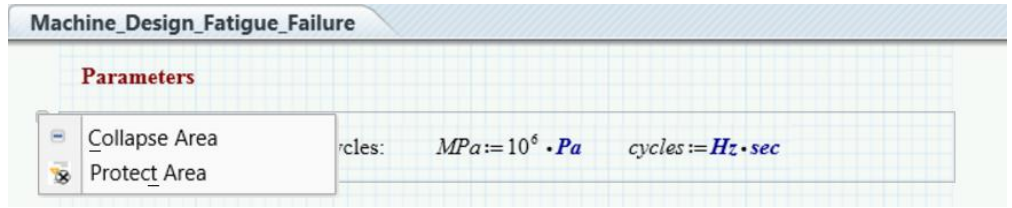
PTC MATHCAD PRIME 4.0

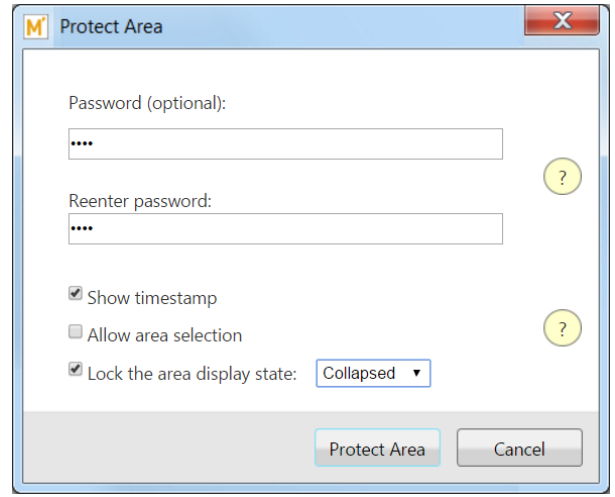
Content Protection – Area Protection/Locking

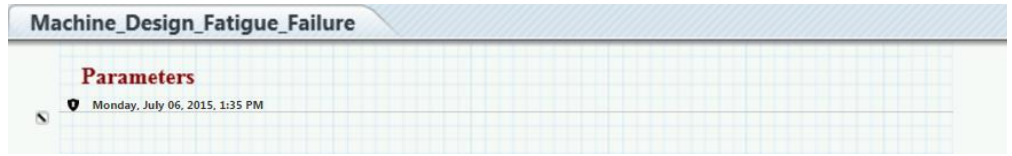
- Protect/Lock an Area from Edit
  - Protect content from edit (password/no password)
  - Lock area display state (open, closed, no lock)

- Details:
  - Protect from edit and optional lock Area state
  - Password or no Password
  - New RMB option and new RMB on expand icon
  - Default no timestamp, no Area state lock







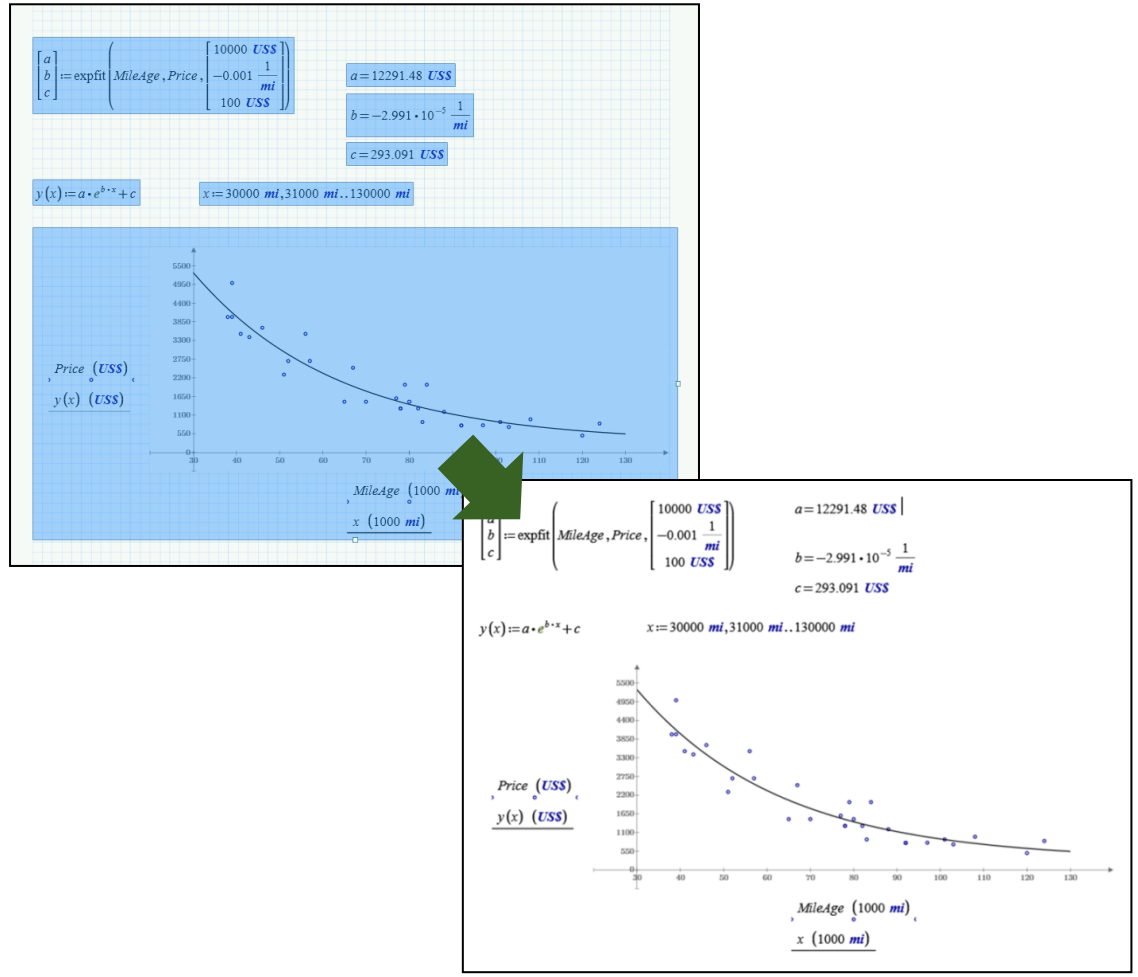


PTC MATHCAD PRIME 4.0

Improved external app interoperability – copy multiple regions to Word

- Select/copy multiple regions and paste in Word (3rd party apps)

- Details:
  - User can select multiple regions (contiguous or non-contiguous) and ‘copy’
    - Makes available on the clipboard for paste into third party applications
  - All regions paste as images (.png) except text, which pastes as text
  - Text pasted with Mathcad formatting, except:
    - Keep Text Only – apply normal formatting for Word
    - Merge Formatting – keep features such as bullets, maintain some target formatting



Equation Wrapping

- Two ways to enter equation break:
  - Editing an equation
    - ctrl+shift+enter toggles wrap on addition, subtraction, multiplication and inline division operators
  - As you type
    - Four keyboard shortcuts to insert wrapped addition, subtraction, multiplication and inline division operators

For solid cross section Change in horizontal diameter (an increase is positive):

$$D_H := \left(\theta \le \frac{\pi}{2}\right) \cdot \frac{-w \cdot R^4}{6 \cdot E \cdot I_c \cdot \pi} \cdot \left(\pi \cdot k_1 \cdot \left(s^3 + 3 \cdot \theta \cdot c + 4 - 3 \cdot s\right) + 3 \cdot k_2 \cdot \left(\pi - \theta + 2 \cdot \theta \cdot c^2 - s \cdot c\right) - 6 \cdot k_2^2 \cdot (\pi - \theta + s \cdot c)\right) + \left(\theta > \frac{\pi}{2}\right) \cdot \frac{-w \cdot R}{2 \cdot E \cdot I_c}$$

For solid cross section Change in horizontal diameter (an increase is positive):

$$D_H := \left(\theta \le \frac{\pi}{2}\right) \cdot \frac{-w \cdot R^4}{6 \cdot E \cdot I_c \cdot \pi} \cdot \left(\pi \cdot k_1 \cdot \left(s^3 + 3 \cdot \theta \cdot c + 4 - 3 \cdot s\right) + 3 \cdot k_2 \cdot \left(\pi - \theta + 2 \cdot \theta \cdot c^2 - s \cdot c\right) - 6 \cdot k_2^2 \cdot (\pi - \theta + s \cdot c)\right) \dots$$
$$+ \left(\theta > \frac{\pi}{2}\right) \cdot \frac{-w \cdot R^4}{2 \cdot E \cdot I_c \cdot \pi} \cdot \left(\pi \cdot k_1 \cdot \left(c \cdot (\pi - \theta) + s - \frac{s^3}{3}\right) + k_2 \cdot \left((\pi - \theta) \cdot \left(2 \cdot s^2 - 1\right) - s \cdot c\right) + 2 \cdot k_2^2 \cdot (\pi - \theta + s \cdot c)\right)$$

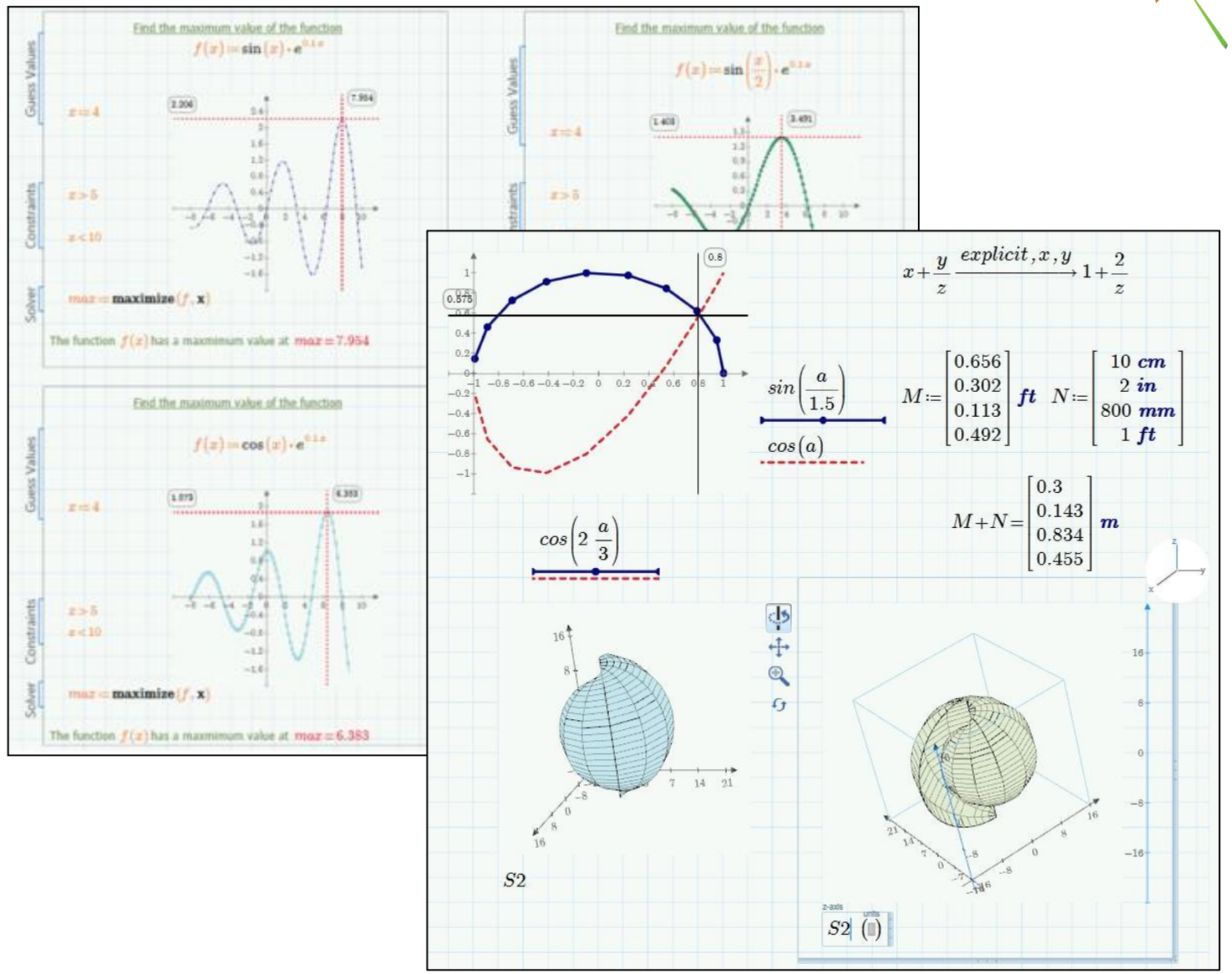
Change in vertical diameter (an increase is positive):

$$D_V := \frac{w \cdot R^4}{6 \cdot E \cdot I_c \cdot \pi} \cdot \left(\pi \cdot k_1 \cdot \begin{pmatrix} 2 - c^3 \dots \\ +3 \cdot c \end{pmatrix} + 3 \cdot k_2 \cdot \begin{pmatrix} 2 \cdot \theta \cdot s^2 - \theta + s \cdot c \dots \\ -\pi \cdot \left(1 + 2 \cdot c + s^2\right) \end{pmatrix} + 6 \cdot k_2^2 \cdot \begin{pmatrix} \pi - \theta \dots \\ +s \cdot c \end{pmatrix}\right)$$

$$\Delta L := \left(\theta \le \frac{\pi}{2}\right) \cdot \frac{w \cdot R^4}{12 \cdot E \cdot I_c \cdot \pi} \cdot \begin{pmatrix} 1.5 \cdot \pi \cdot \left(\theta - 2 \cdot \theta \cdot s^2 - s \cdot c\right) \dots \\ \cdot 2 \cdot k_1 \cdot \left(2 \cdot \pi + s^3 + 3 \cdot \theta \cdot c - 3 \cdot s\right) \dots \\ \div 3 \cdot k_2 \cdot \left(s \cdot c + \theta \cdot \pi + 2 \cdot \theta \cdot s^2 - 3 \cdot \pi - \theta - \pi \cdot s \cdot c\right) \dots \\ +6 \cdot k_2^2 \cdot (\pi - \theta + s \cdot c) \end{pmatrix} \dots$$
$$+ \left(\theta > \frac{\pi}{2}\right) \cdot \frac{w \cdot R^4}{12 \cdot E \cdot I_c \cdot \pi} \cdot \begin{pmatrix} 1.5 \cdot \pi \cdot \left((\pi - \theta) \cdot \left(1 - 2 \cdot s^2\right) + s \cdot c\right) \dots \\ +2 \cdot k_1 \cdot \left(2 \cdot \pi + s^3 + 3 \cdot \theta \cdot c - 3 \cdot s - \pi \cdot c^3\right) \dots \\ +3 \cdot k_2 \cdot \left((\pi + 1) \cdot (\pi - \theta + s \cdot c) + 2 \cdot \theta \cdot s^2 - 4 \cdot \pi \cdot (1 + c)\right) \dots \\ +6 \cdot k_2^2 \cdot (\pi - \theta + s \cdot c) \end{pmatrix}$$

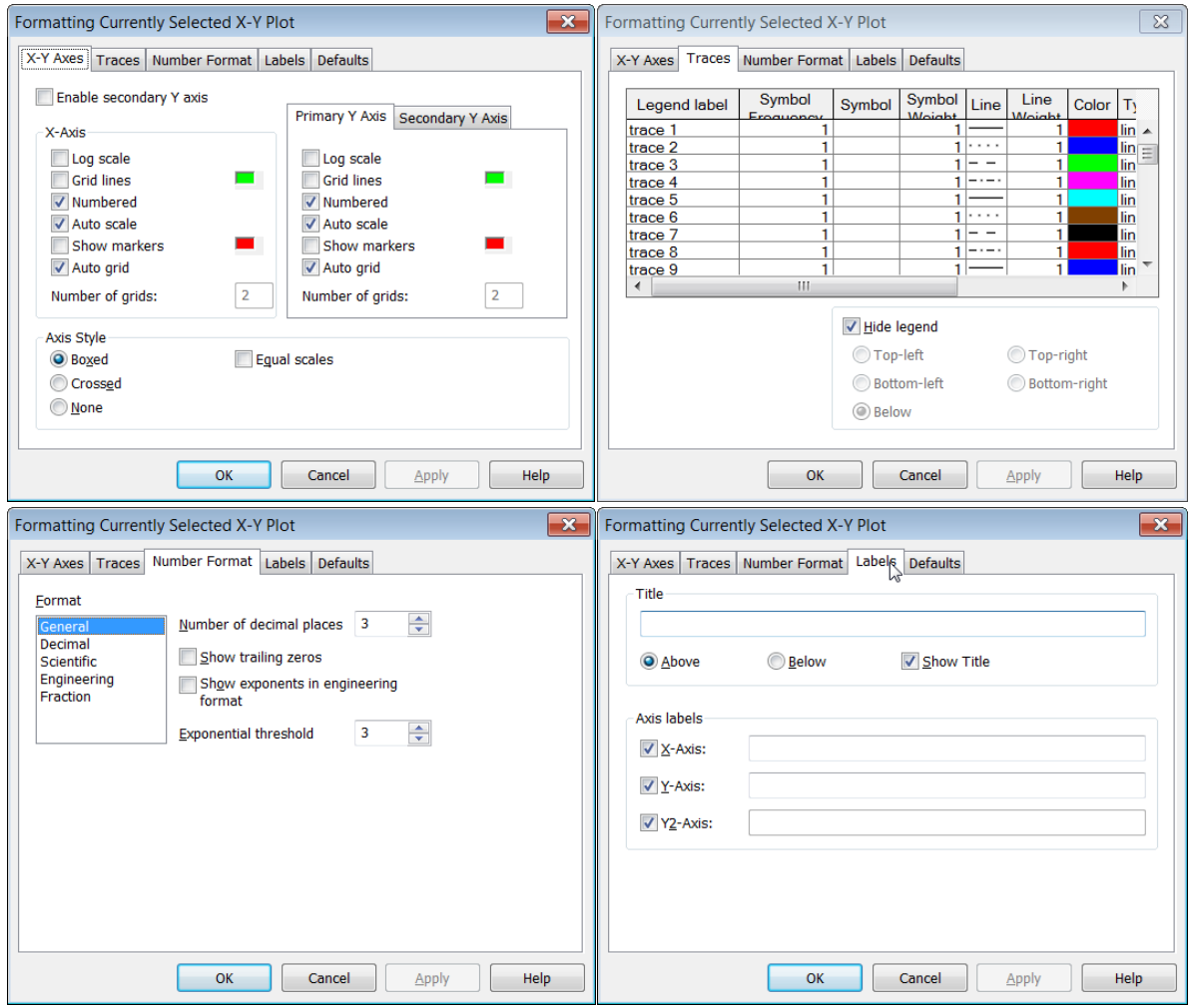
PTC MATHCAD ROADMAP

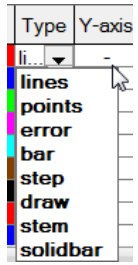
- Subsequent Release Themes
- Yearly releases
  - Prime 5.0 December 2017
    - **Plot Enhancements** - Embed 3rd party tool to match Mathcad 15.0 plots on first release
    - Math engine refactoring
    - TBD
  - Prime 6.0 December 2018
    - Content TBD
  - Prime 7.0 December 2019
    - Content TBD
- Candidate functionality examples
  - Constrained inputs (input controls)
  - Picture operator
  - Scripted controls
  - Gradient operator
  - Hyperlinks
  - Redefinition warnings
  - Text styles
  - Custom margins
  - PTC Creo integration phase II
  - API enhancements
  - Additional 3rd party integrations



PRIME 5.0 PLOT ENHANCEMENTS

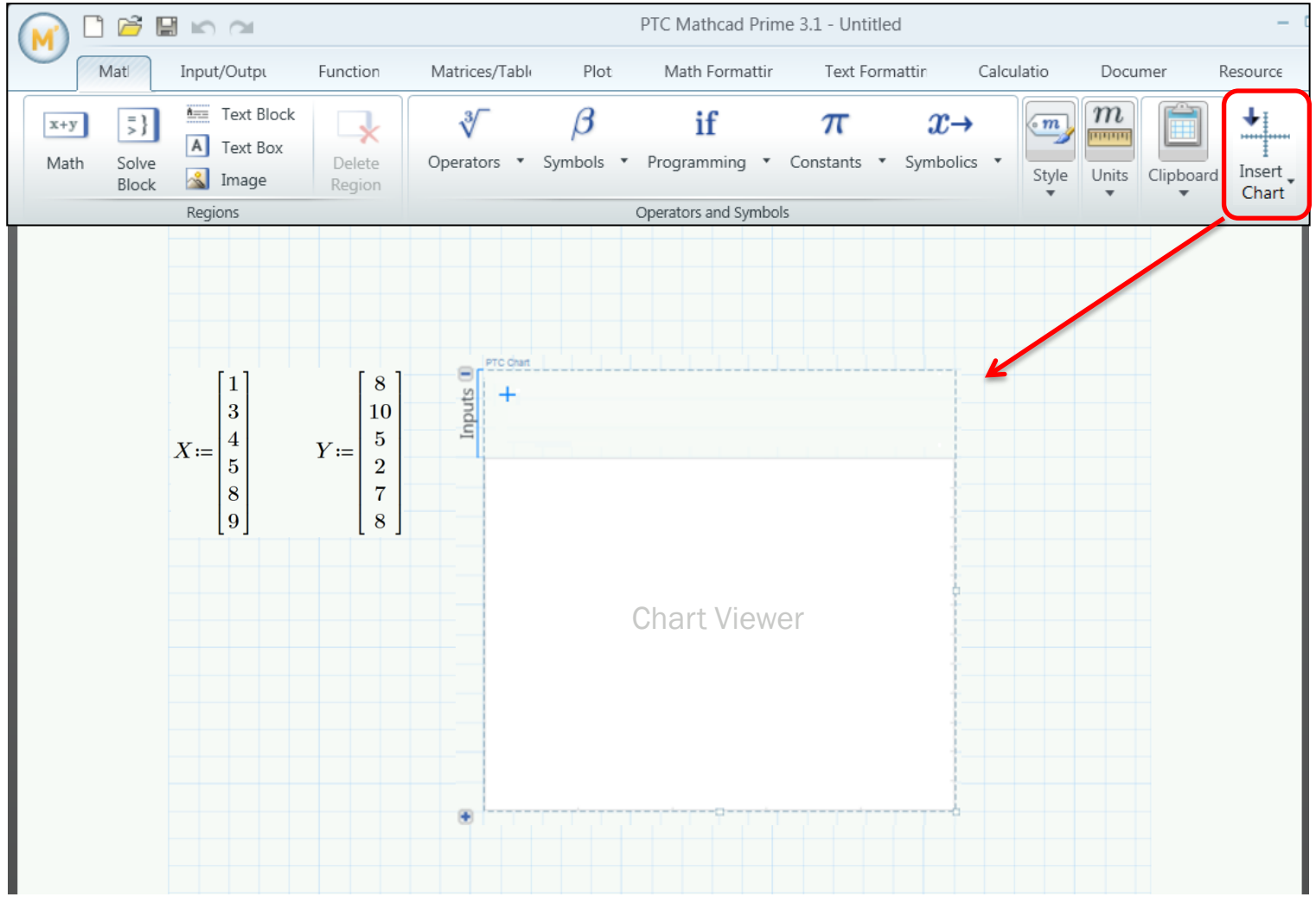
PTC Mathcad 15.0 X-Y Plots





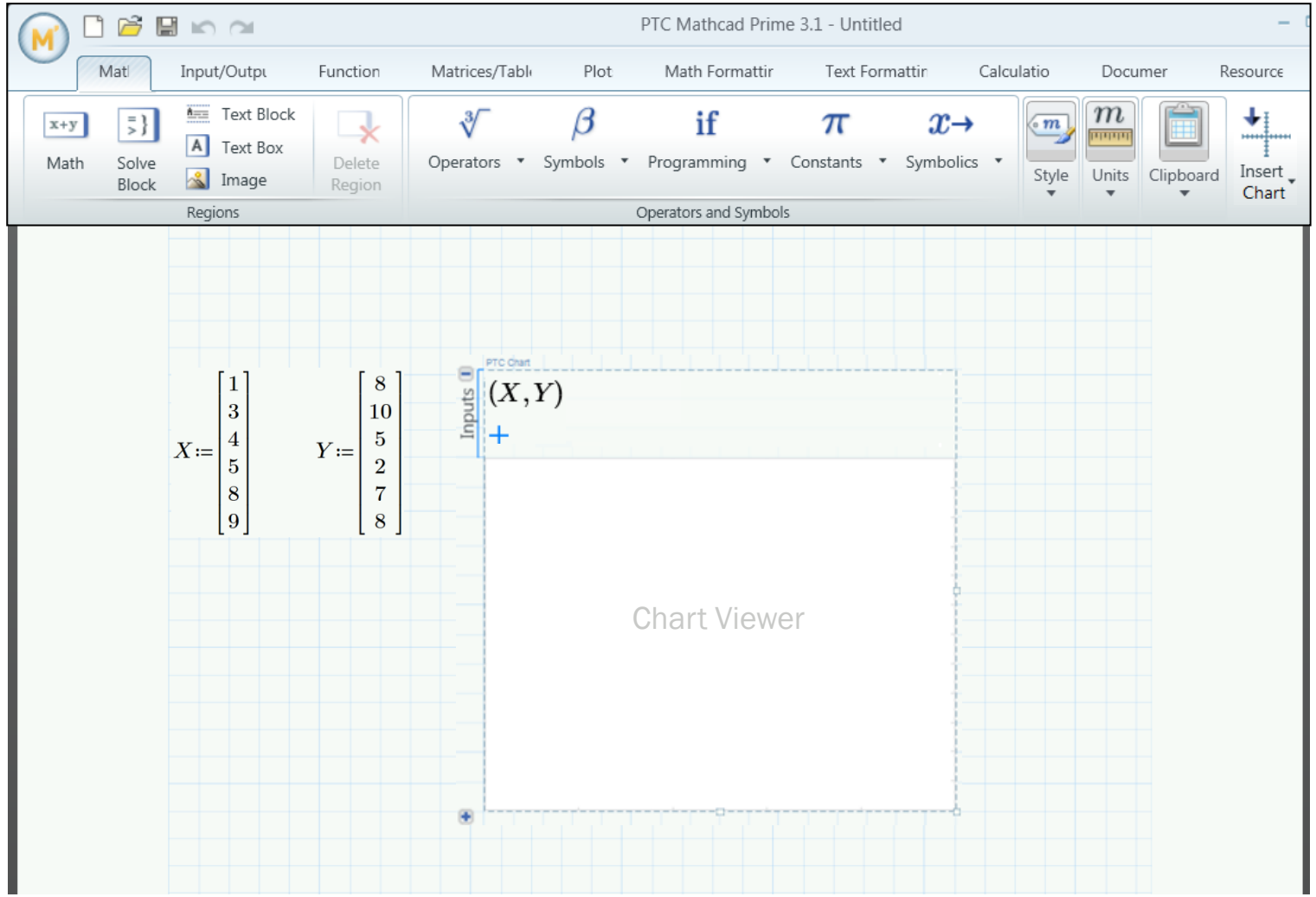
PRIME 5.0 PLOT ENHANCEMENTS

- Insert Chart object



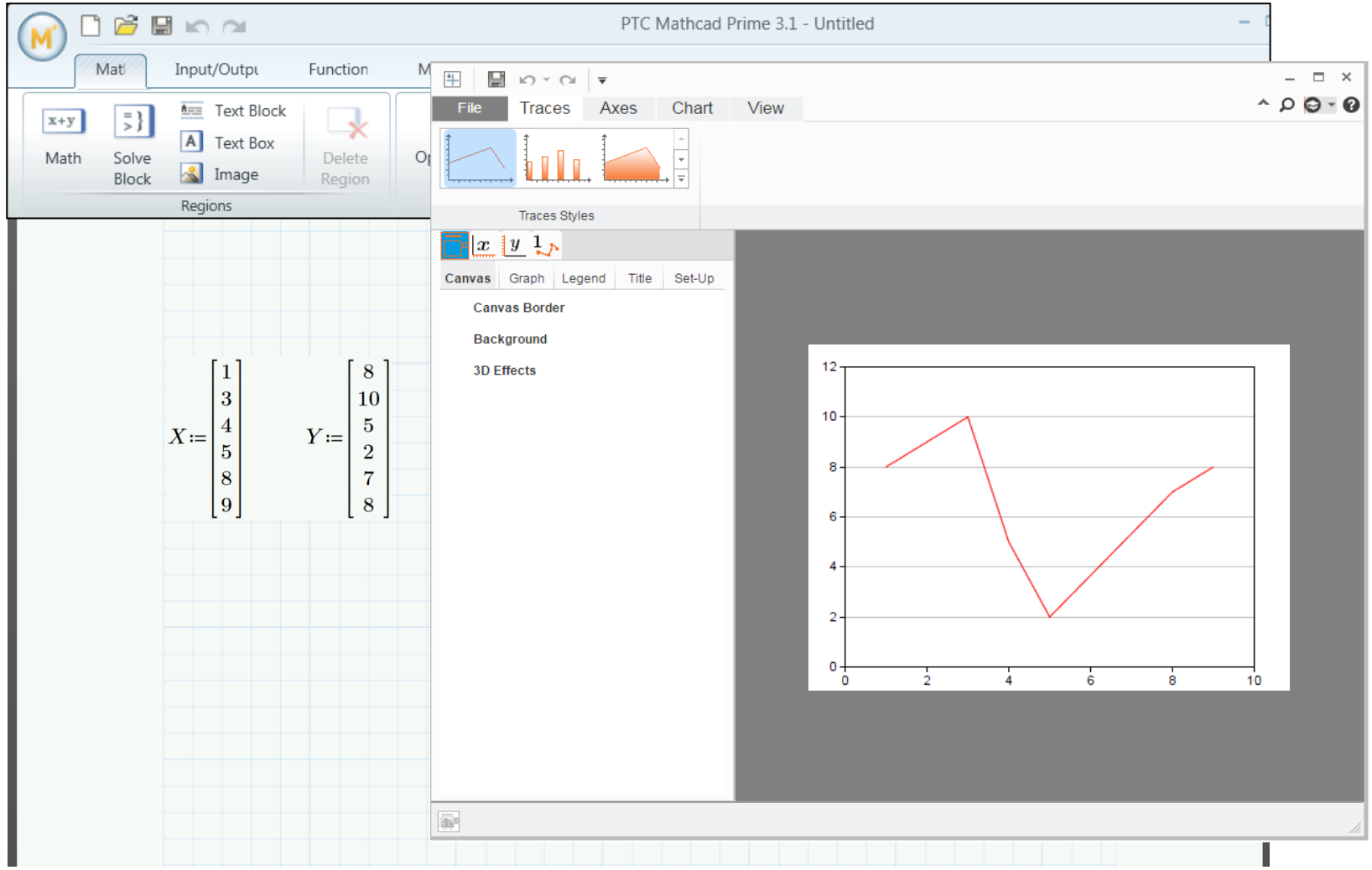
PRIME 5.0 PLOT ENHANCEMENTS

- Type data series



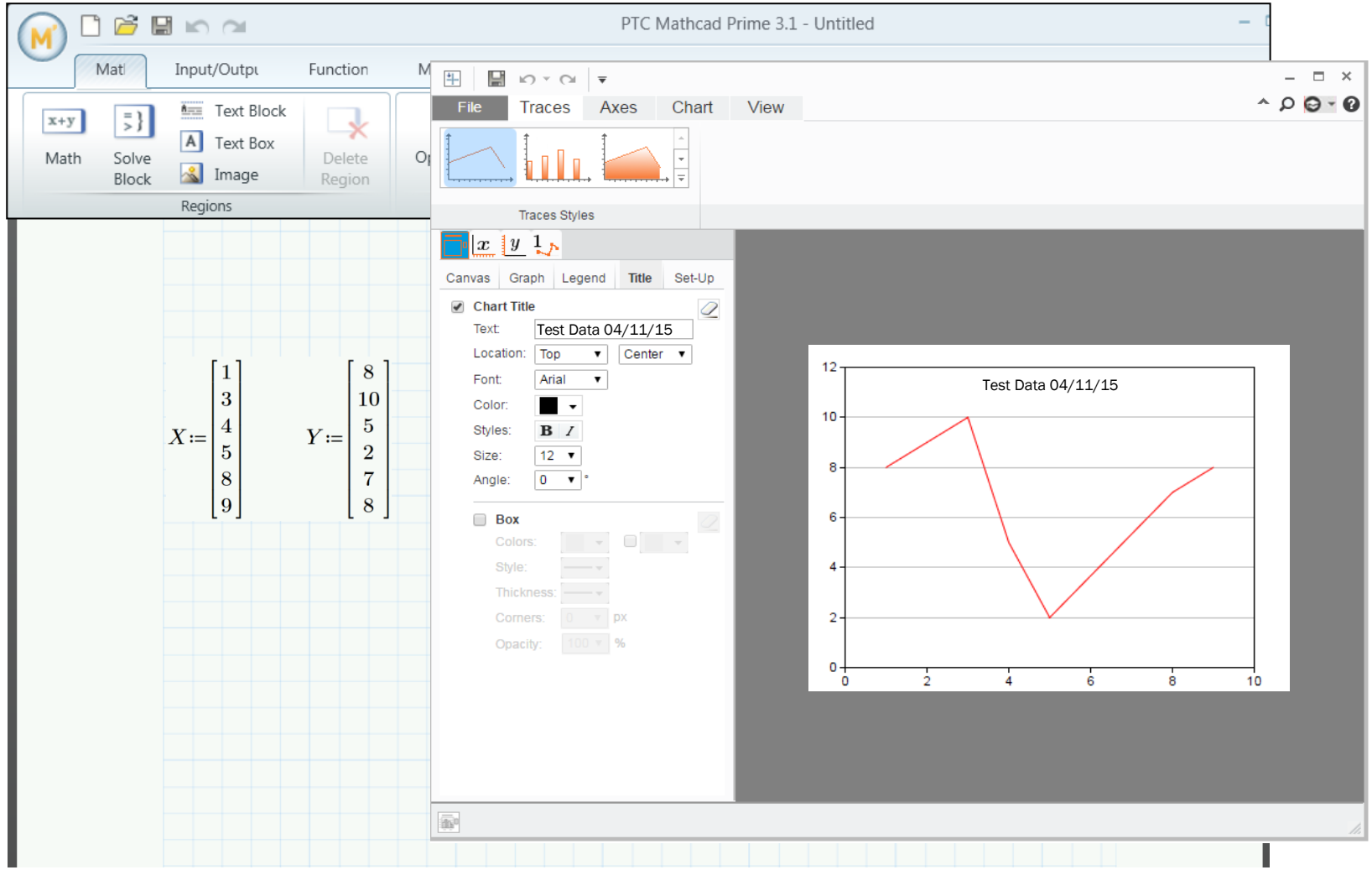
PRIME 5.0 PLOT ENHANCEMENTS

- Double-click chart area to activate chart + its associated Ribbon UI



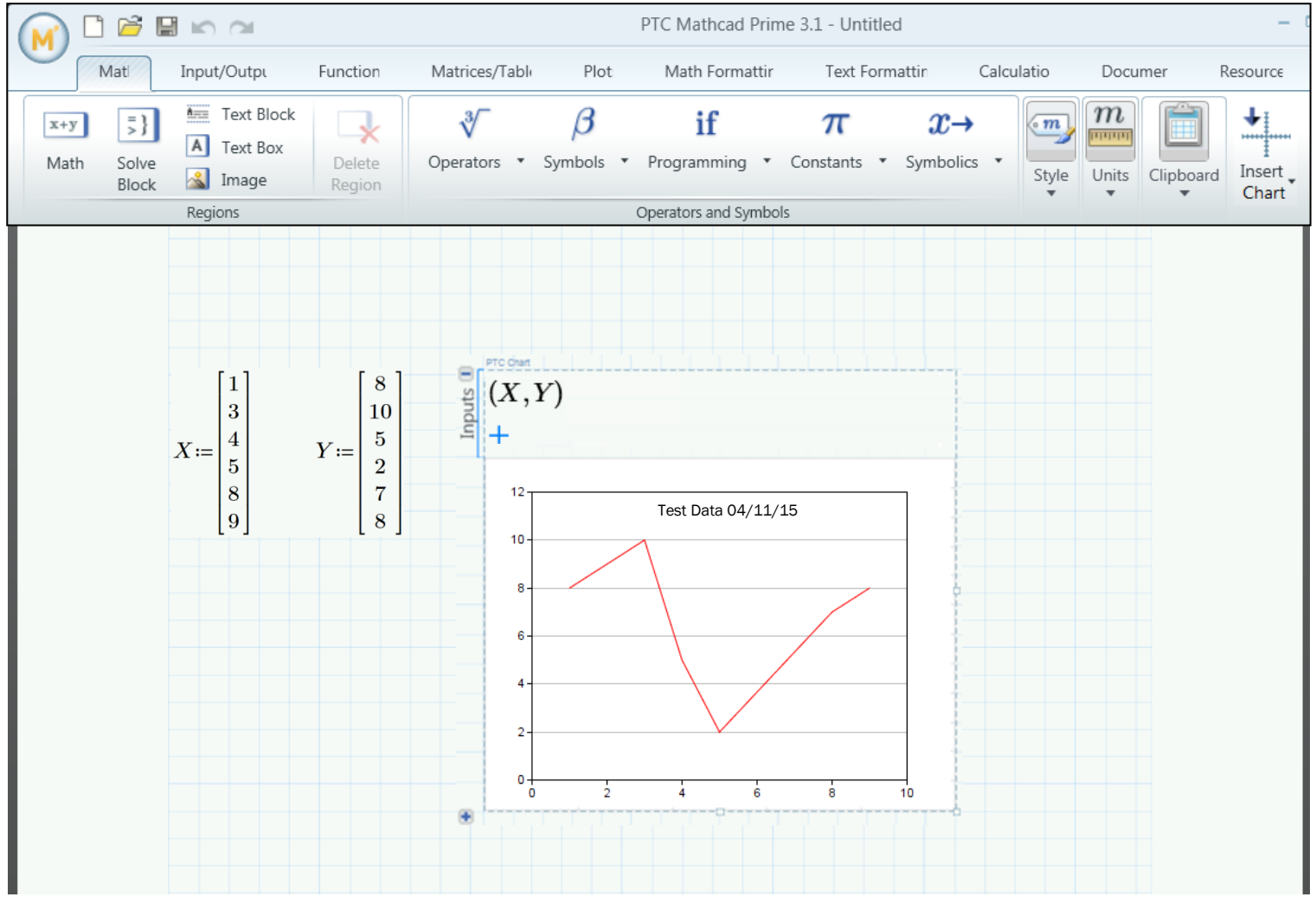
PRIME 5.0 PLOT ENHANCEMENTS

- On the relevant tab, select ‘Chart Title’ and fill in text



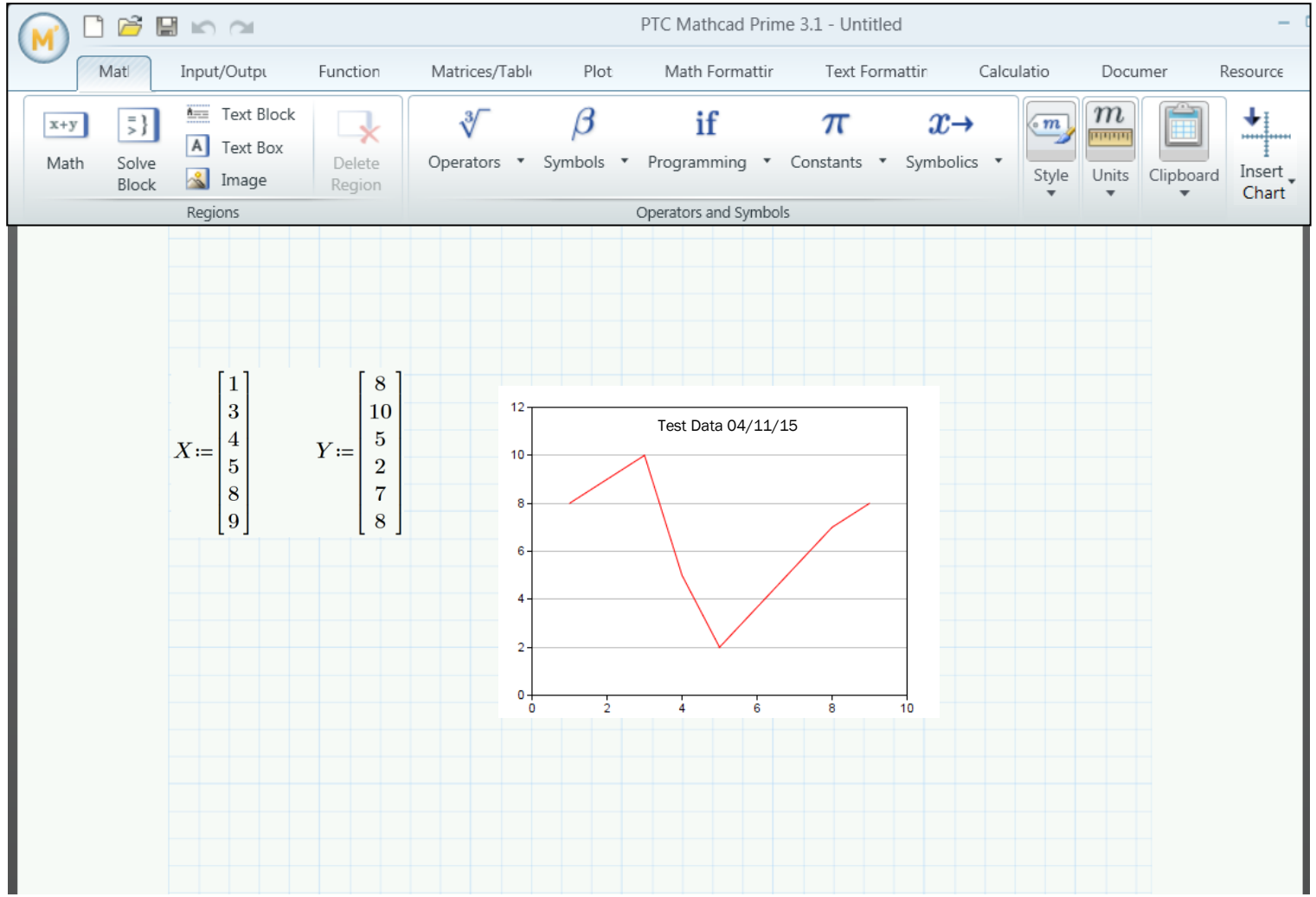
PRIME 5.0 PLOT ENHANCEMENTS

- Close external app to return to Mathcad



PRIME 5.0 PLOT ENHANCEMENTS

Minimize input area and de-select

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