



# PTC MATHCAD ROADMAP

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Product Manager

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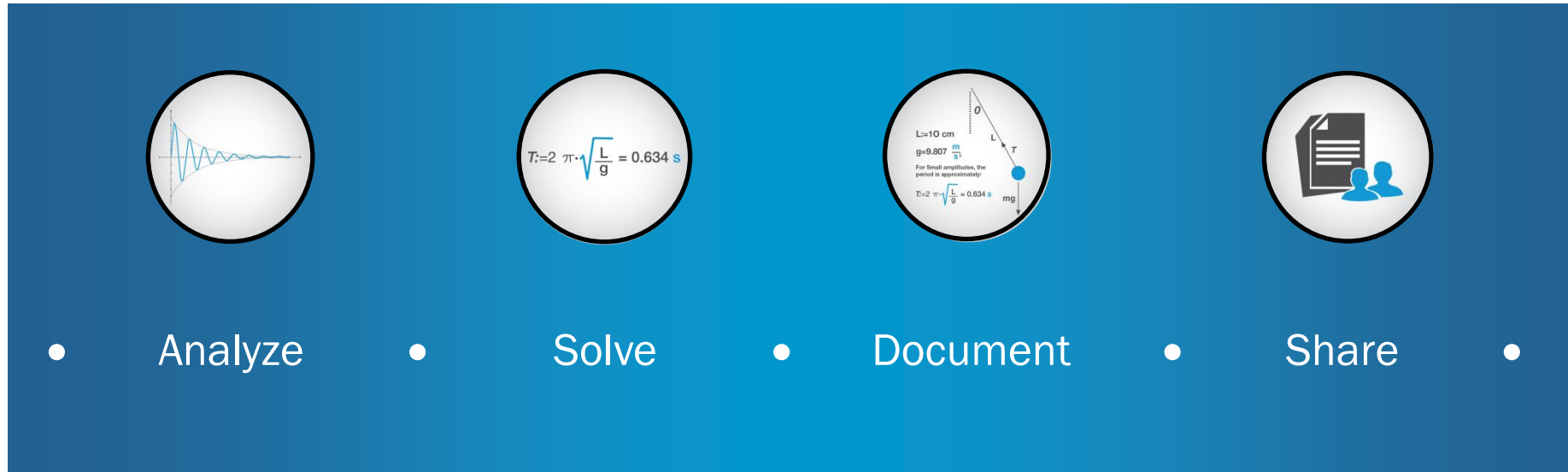


# WHAT IS PTC MATHCAD?

# WHAT IS PTC MATHCAD?



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

**PTC<sup>×</sup> Mathcad<sup>×</sup> Solving Systems of Equations**

**Example of Differential Equations: Damped Vibrations**

**Given:**

Mass:  $m_1 := 10 \text{ kg}$        $m_2 := 5 \text{ kg}$

Force:  $F_1(t) := 5 e^{-0.5 t} \text{ N}$        $F_2(t) := 0 \text{ N}$

Spring constants:  $k_1 := 100 \frac{\text{N}}{\text{m}}$        $k_2 := 75 \frac{\text{N}}{\text{m}}$        $k_3 := 100 \frac{\text{N}}{\text{m}}$

Damping coefficients:  $c_1 := 5 \frac{\text{N}\cdot\text{s}}{\text{m}}$        $c_2 := 25 \frac{\text{N}\cdot\text{s}}{\text{m}}$        $c_3 := 25 \frac{\text{N}\cdot\text{s}}{\text{m}}$

**Guest Values**

No Guess Values are necessary for solving ODEs. We only need the Constraints and the Solver.

**Constraints**

$$m_1 \cdot d_1''(t) = -c_1 \cdot d_1'(t) + c_2 \cdot (d_2'(t) - d_1'(t)) - k_1 \cdot d_1(t) + k_2 \cdot (d_2(t) - d_1(t)) + F_1(t)$$

$$m_2 \cdot d_2''(t) = -c_3 \cdot d_2'(t) + c_2 \cdot (d_1'(t) - d_2'(t)) - k_3 \cdot d_2(t) + k_2 \cdot (d_1(t) - d_2(t)) + F_2(t)$$

$d_1(0 \text{ s}) = 0 \text{ mm}$        $d_1'(0 \text{ s}) = 1 \frac{\text{m}}{\text{s}}$

$d_2(0 \text{ s}) = 0 \text{ mm}$        $d_2'(0 \text{ s}) = -1.5 \frac{\text{m}}{\text{s}}$

**Solver**

$$\begin{bmatrix} d_1 \\ d_2 \end{bmatrix} := \text{odesolve} \left( \begin{bmatrix} d_1(t) \\ d_2(t) \end{bmatrix}, 7 \text{ s} \right)$$

$t := 0 \text{ s}, 0.01 \text{ s}.. 7 \text{ s}$

System Response: Position vs. Time

$\frac{d_1(t) \text{ (cm)}}{d_2(t) \text{ (cm)}}$

$t \text{ (s)}$

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# WHAT IS PTC MATHCAD?

## This is PTC Mathcad

**Analysis of Axial Flow Machines**

Create a cambered airfoil using two 2-D Bezier curves, each defined by the four vectors, B and T. (See Rogers & Adams, "Mathematical Elements for Computer Graphics", McGraw-Hill, 1990, p.293). Define the two polygons so that the 2D airfoil can be defined in a CVT manner starting from the trailing edge. See also program V-10 in this Fluids course and program VII mod in Applied Graphics and Geometry, Vol 1.

$\alpha := \frac{9 \cdot \pi}{150}$  Angle of attack

$n := 8$   $i := 0, 1, \dots, 8$   $G_i := \frac{n!}{i! \cdot (n-i)!}$  Build the blending matrix. The polygons B and T must be defined to satisfy thin airfoil theory.

$Bx := \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$   $By := \begin{bmatrix} 0.2 \\ -0.4 \\ -0.6 \end{bmatrix}$

The parameter  $t$  goes from 0 to 1 for all Bezier curves, giving 21 points on the curve.

$j := 0, 1, \dots, 20$   $t_j := \frac{j}{20}$

$J_{i,j} := G_i \cdot (t_j)^i \cdot (1-t_j)^{n-i}$

$XL_j := \sum_i (Bx_i \cdot J_{i,j})$   $YL_j := \sum_i (By_i \cdot J_{i,j})$   $XU_j := \sum_i (Tx_i \cdot J_{i,j})$   $YU_j := \sum_i (Ty_i \cdot J_{i,j})$

$NFL_{i,j} := XL_{i,j}$   $YFL_{i,j} := YL_{i,j} \cdot \cos(\beta(rh - 0.03 \cdot j)) - ZL_{i,j} \cdot \sin(\beta(rh + 0.03 \cdot j))$

$XFU_{i,j} := XU_{i,j}$   $ZFL_{i,j} := YL_{i,j} \cdot \sin(\beta(rh + 0.03 \cdot j)) + ZL_{i,j} \cdot \cos(\beta(rh - 0.03 \cdot j))$

```
// Load an image
src = imread("lena.jpg", CV_LOAD_IMAGE_GRAYSCALE);
dst = src.clone();
if( !src.data )
{ return -1; }

for(int y = 0; y < src.rows; y++)
for(int x = 0; x < src.cols; x++)
dst.at<uchar>(y,x) = 0.0;

pm = phaseStart;

% convert am and pm to i and q and scal
q = am .* sin( pm );
i = am .* cos( pm );
iqwave = [i + (j * q)];

onTime = [zeros(1,(offPts/2)) iqwave(1:(onP
marker = [ones(2,(onPts+edgePts+edgePts)) z
iqwave_size = size (onTime)

=($B$1*$D$1/2)*((PI)*$F$1*$D$1-$H$1)(PI)*$D$1+$F$1*$H$1)+$B$1*$F$2*$D$2/2
```

These are NOT

“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

The screenshot shows the PTC Mathcad Prime 3.1 interface with a document titled 'symbolic\_DEQ\_solution\_p3\_landscape'. The document content includes:

- Initial conditions:  $[a_0 \ a_1] = [x_0] = [A]$  solve,  $a_0, a_1$
- Equation: 
$$A \cdot b - A \cdot \sqrt{b^2 - 4 \cdot k \cdot m} + 2 \cdot V \cdot m \quad A \cdot \sqrt{b^2 - 4 \cdot k \cdot m} + A \cdot b + 2 \cdot V \cdot m$$
- For a velocity of  $V := 0$  and an initial amplitude  $A := 1$
- Section: **Symbolically derived function for displacement**
- Equation: 
$$x(m, b, k, t) \rightarrow e^{-\frac{t \cdot (b - \sqrt{b^2 - 4 \cdot k \cdot m})}{2 \cdot m}} \cdot (b + \sqrt{b^2 - 4 \cdot k \cdot m}) - e^{-\frac{t \cdot (b + \sqrt{b^2 - 4 \cdot k \cdot m})}{2 \cdot m}} \cdot (b - \sqrt{b^2 - 4 \cdot k \cdot m})$$
- Section: **3. Compare the solutions from ODEsolve (numeric) with the symbolically derived solution**
- Time range:  $t := 0, 0.2..20$
- Graph: A plot comparing 'Numerically solved solution' (blue dashed line) and 'Symbolically derived solution' (orange solid line) for  $x(m, b, k, t)$  over time  $t$ .
- Diagram: A schematic of a mass-spring-damper system with mass  $m$ , spring constant  $k$ , and damper coefficient  $b$ .
- Parameters:  $m \equiv 2$ ,  $b \equiv 1$ ,  $k \equiv 3$

Callout boxes highlight the following features:

- 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
- Symbolic operations, and solving combined with numerics
- Enhanced documentation with math-in-text support
- Superior Mathematical formatting options
- 64-bit support, multi-threaded calculations
- WYSIWYG Page-view, or draft view for extra whiteboard space
- Spec tables and embedded Excel allow organization and calculation
- Global definition support
- 2D and 3D plots allow direct manipulation - no repetitive dialogs!
- Custom functions that allow re-use of legacy code as functions
- Graph-paper interface keeps content organized with clear calculation order
- Collapsible areas help streamline presentation
- Intuitive function toolbar allows rapid discovery and use

# 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<sup>©</sup> physical properties, CoolProp<sup>©</sup> 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





Spring variable definitions:

Number of Active Coils:  $N_{coil} := 18$

Diameter of the wire:  $d_{wire} := 7 \text{ mm}$

Coil diameter:  $D_{coil} := 28 \text{ mm}$


Outer diameter:  $D_{outer} := D_{coil} + d_{wire} = 35 \text{ mm}$

Shear modulus:  $G := 77.2 \text{ GPa} = (1.12 \cdot 10^7) \text{ psi}$

Force on the spring:  $F_{spring} := \frac{1}{2} (250 \text{ kg} \cdot g) = 1.226 \text{ kN}$

Shear Stress:  $\tau := \frac{8 \cdot F_{spring} \cdot D_{coil}}{\pi \cdot d_{wire}^3} + \frac{4 \cdot F_{spring}}{\pi \cdot d_{wire}^2} = 286.673 \text{ MPa}$

Spring Constant:  $k_{front\_suspension} = \frac{d_{wire}^4 \cdot G}{8 \cdot D_{coil}^3 \cdot N_{coil}} = 58.637 \frac{\text{kN}}{\text{m}}$



Document Design Intent

Coil diameter:  $D_{coil} := 28 \text{ mm}$

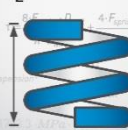
Outer diameter:  $D_{outer} := D_{coil} + d_{wire} = 35 \text{ mm}$

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Analysis Driven Design

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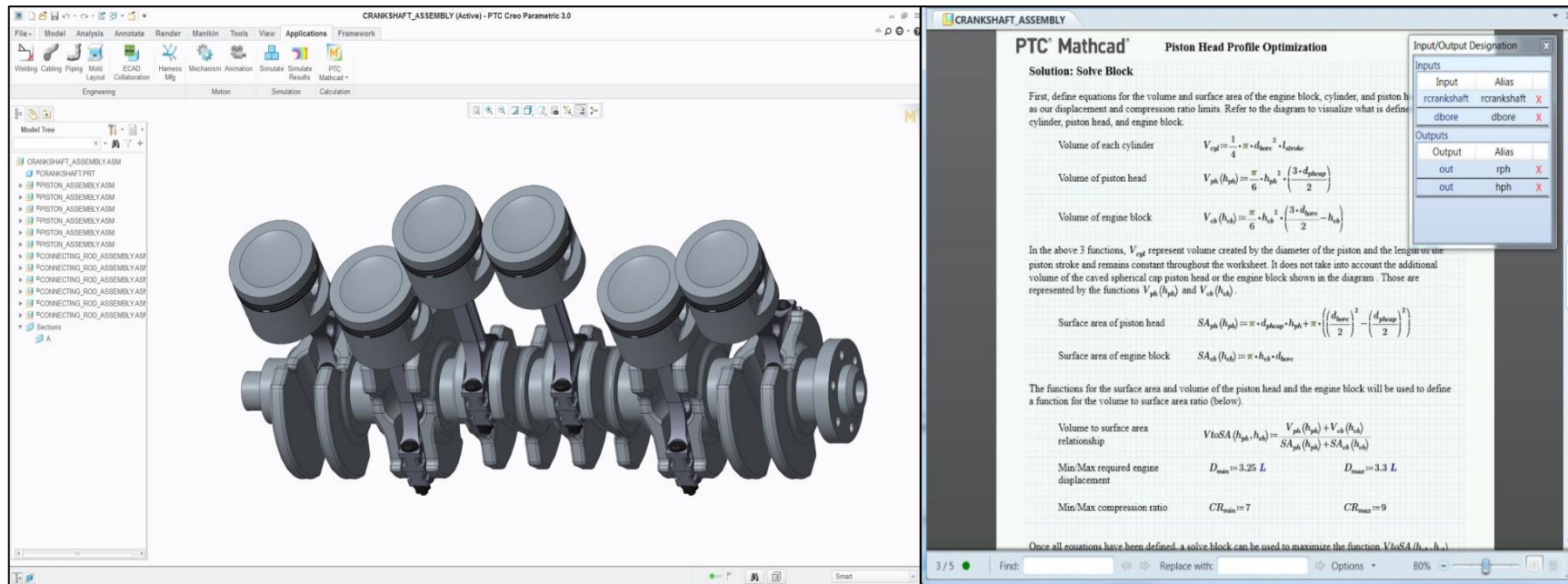
Verification and Validation

# 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

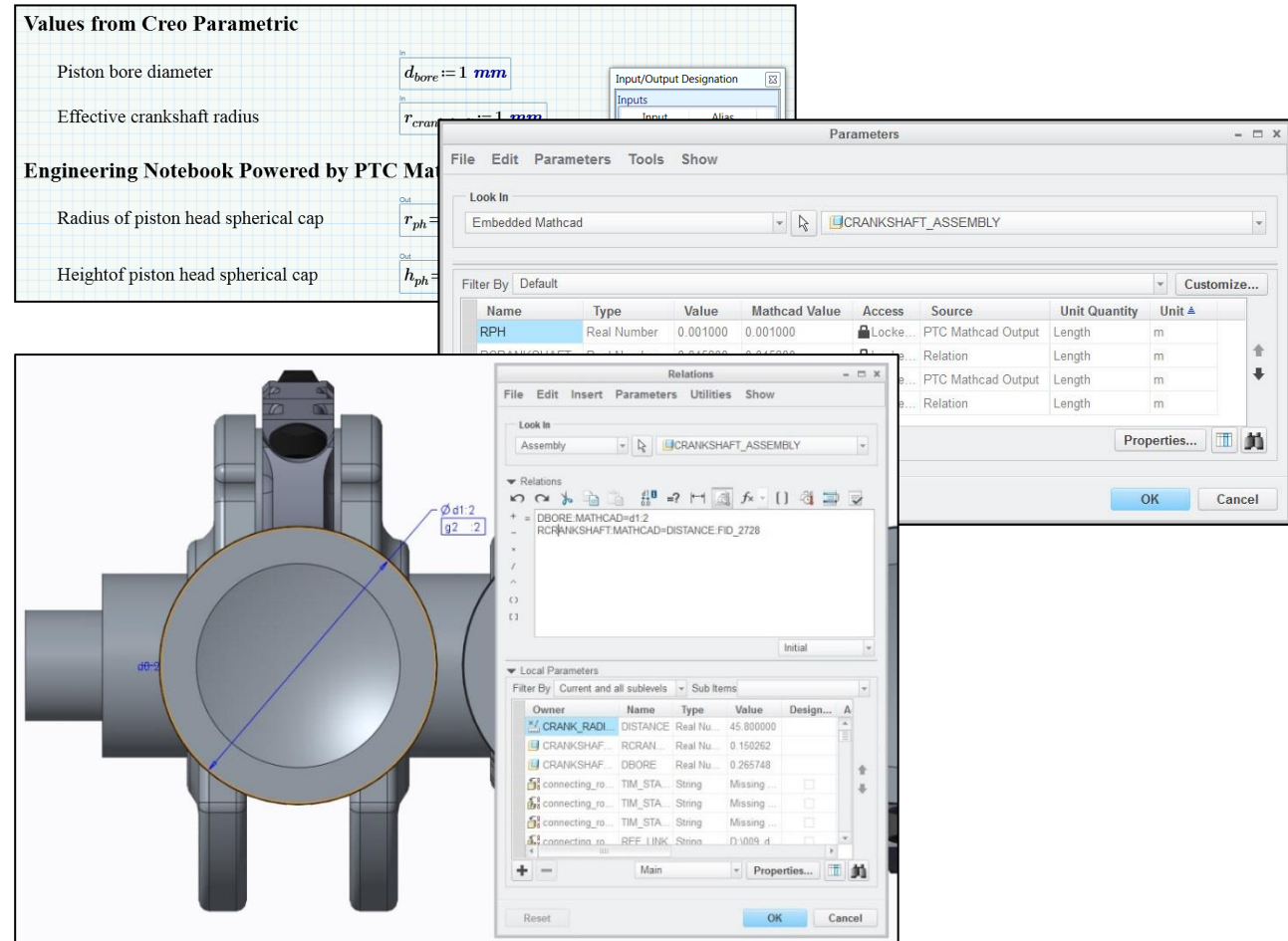


# ENGINEERING NOTEBOOK, POWERED BY PTC MATHCAD



## 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 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.

## Mathcad Calculation Server

Beam Deflection

Drill Verification

### ODE Example: Spring Mass System

Find the displacement over time,  $x(t)$ , of a mass,  $M$ , with a dampening weight constant,  $C$ , attached to a spring constant,  $k$ , that has a horizontal force,  $F(t)$ .

M

C

k

Home

**Worksheets inputs**

M 4

C 5

K 4

**Worksheets Outputs**

0	0.5
0.5	0.450
1	0.341
1.5	0.221
2	0.116
2.5	0.039
3	-0.009
3.5	-0.034
4	-0.040
4.5	-0.037
5	-0.028
5.5	-0.018
6	-0.010

**ODE computing displacement**

POWERED BY

# PTC<sup>®</sup> Mathcad<sup>®</sup>

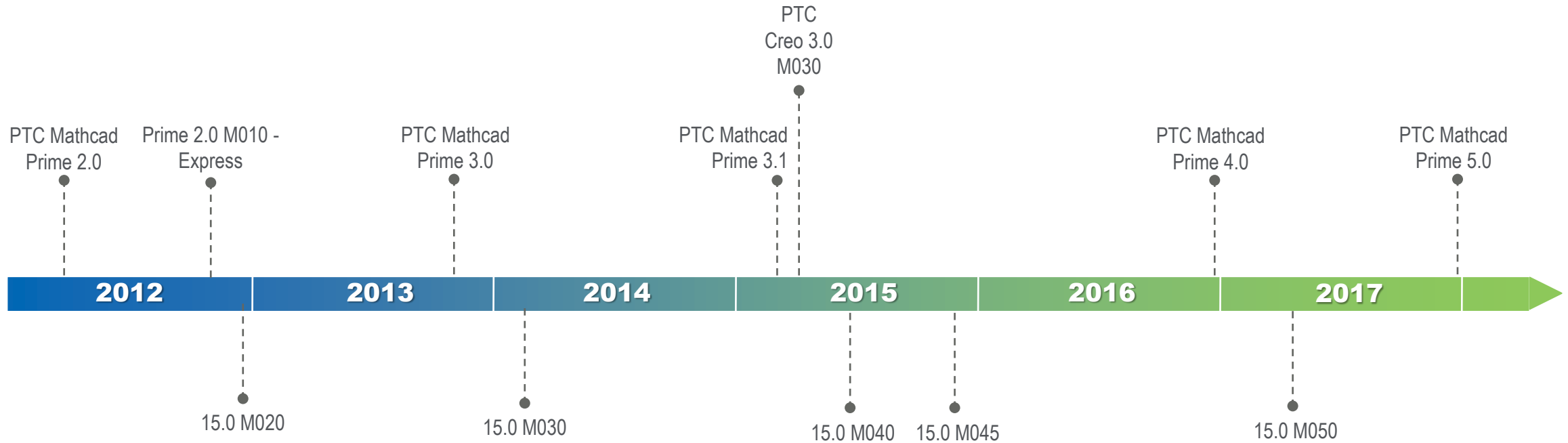
# PTC MATHCAD ROADMAP

# 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

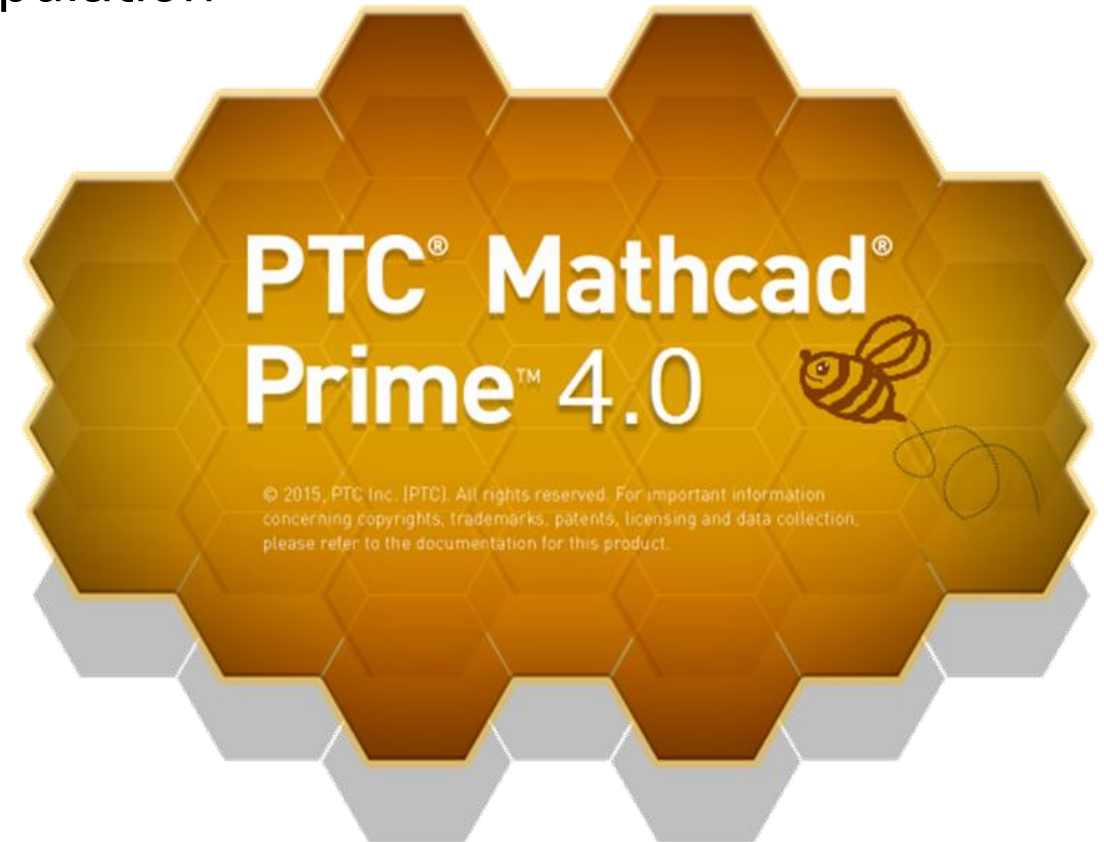


- **PTC Mathcad 15.0**

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

## 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



## Performance improvements in document manipulation

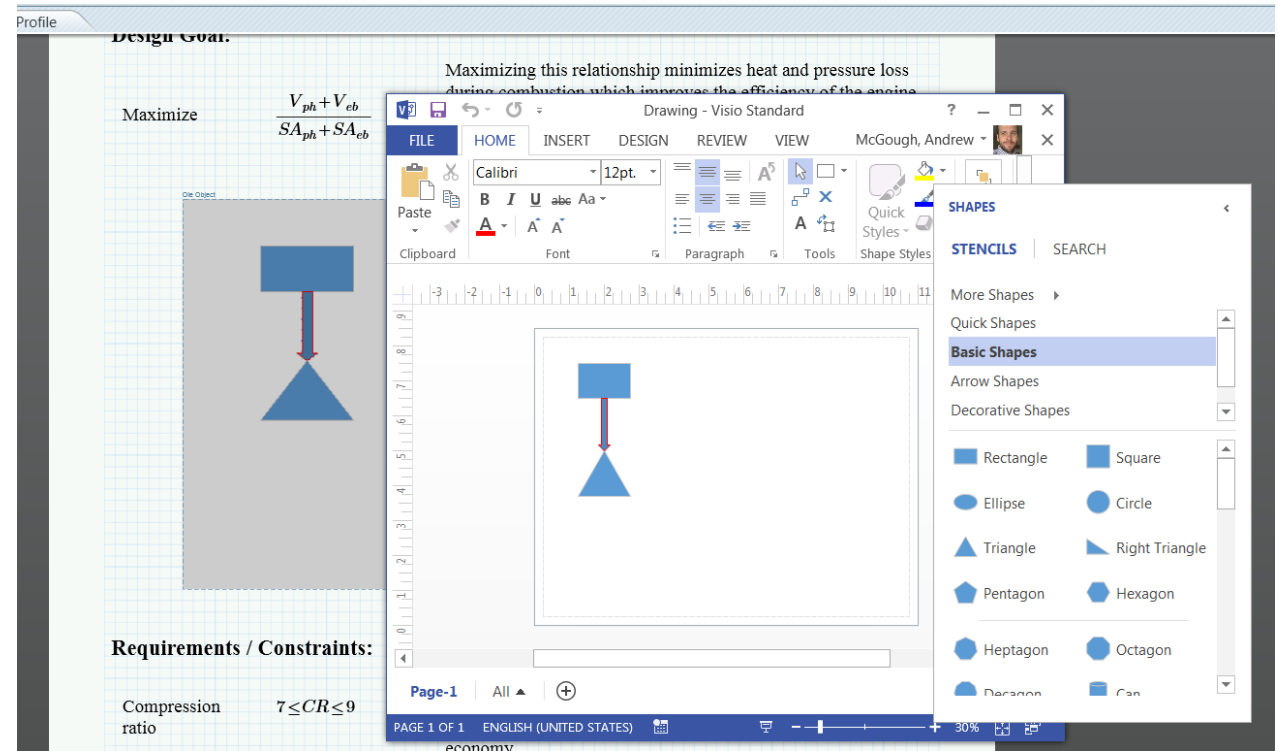
- Performance improvement of worksheet-level operations (e.g. adding/removing whitespace)
- Performance improvement of region-level operations (e.g. text editing) that can result in worksheet layout change

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



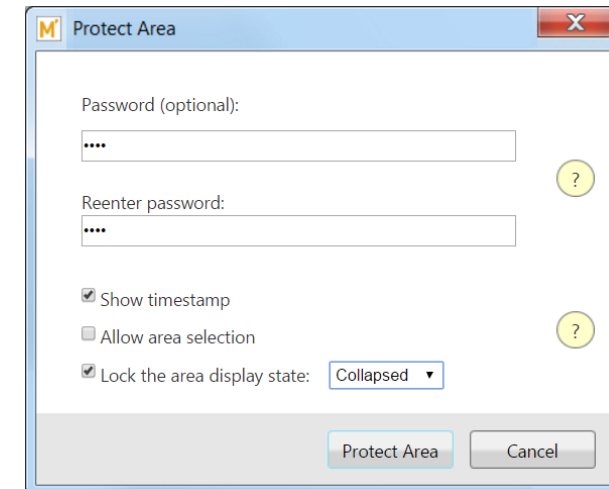
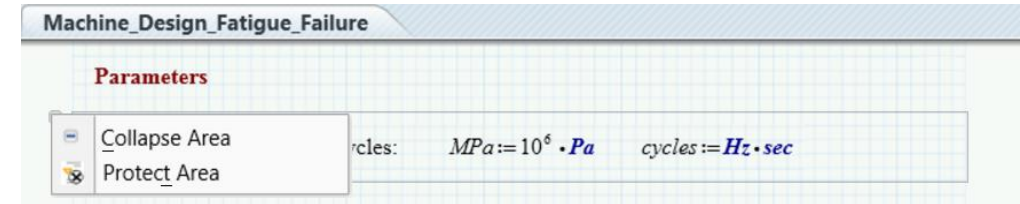
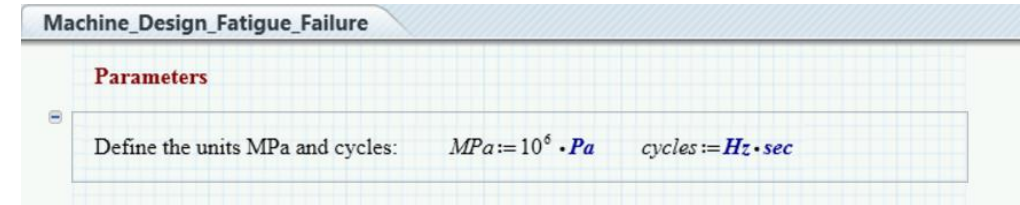
## Mathcad as an OLE container

- 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



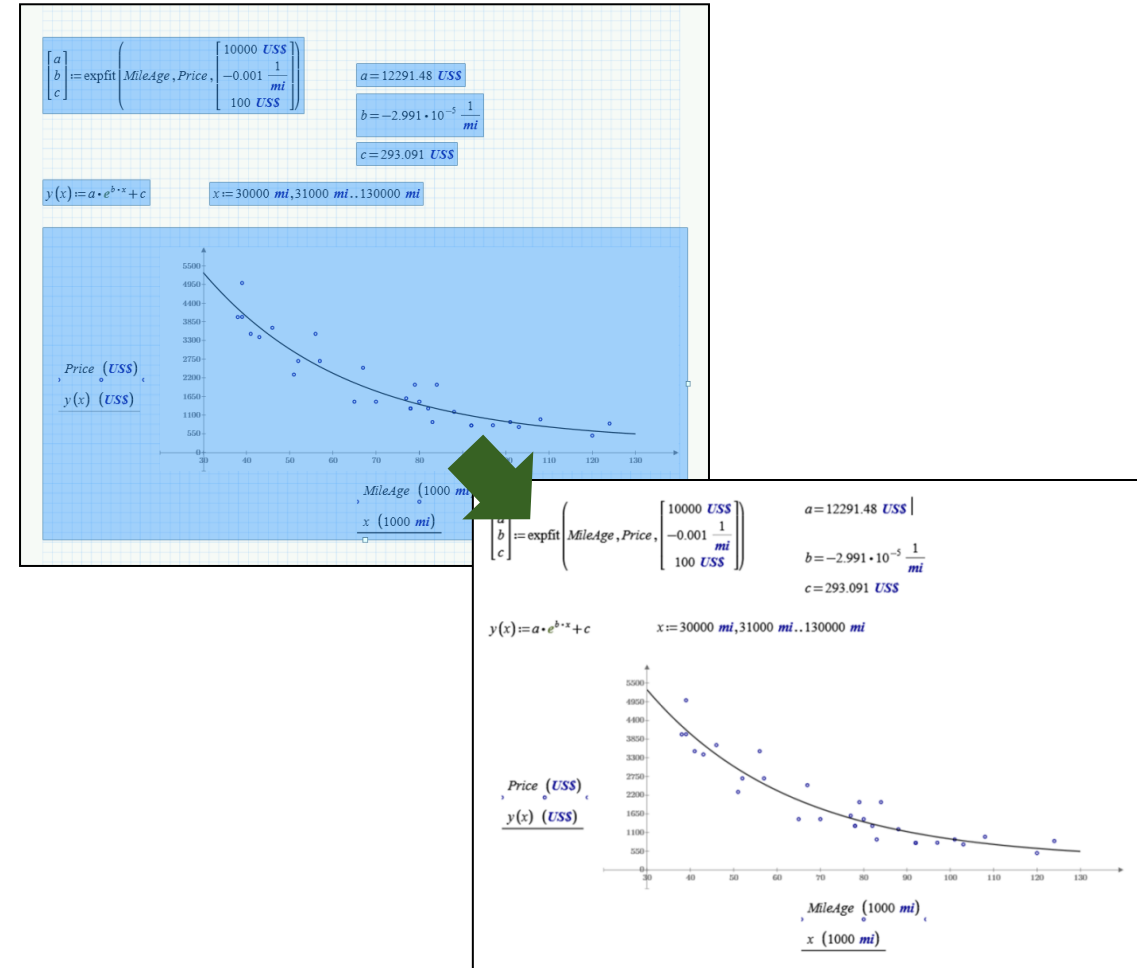
## Content Protection – Area Protection/Locking

- 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



## Improved external app interoperability – copy multiple regions to Word

- Select/copy multiple regions and paste in Word (3<sup>rd</sup> 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):

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

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

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

Change in vertical diameter (an increase is positive):

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

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

# PTC MATHCAD ROADMAP



- Subsequent Release Themes

- Yearly releases

- Prime 5.0 December 2017
  - Plot Enhancements - Embed 3<sup>rd</sup> 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 3<sup>rd</sup> party integrations

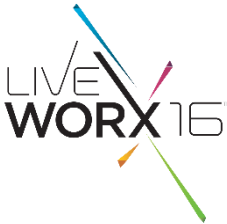
The collage illustrates several key features from the PTC MathCAD roadmap:

- Function Maximization:** Three screenshots show the 'Solve' and 'Plot' panes for finding the maximum of functions like  $f(x) = \sin(x) \cdot e^{0.1x}$  and  $f(x) = \cos(x) \cdot e^{0.1x}$ . The solver results are displayed as `max:=maximize(f, x)` and the maximum value is highlighted in red.
- Trigonometric Functions:** A plot shows  $\sin\left(\frac{a}{1.5}\right)$  and  $\cos(a)$  with a value of 0.8. Below it, a 3D sphere is shown with a value of  $\cos\left(2 \frac{a}{3}\right)$ .
- Engineering Calculations:** A complex calculation involving units is shown:
 
$$x + \frac{y}{z} \xrightarrow{\text{explicit, } x, y} 1 + \frac{2}{z}$$

$$M := \begin{bmatrix} 0.656 \\ 0.302 \\ 0.113 \\ 0.492 \end{bmatrix} \text{ft} \quad N := \begin{bmatrix} 10 \text{ cm} \\ 2 \text{ in} \\ 800 \text{ mm} \\ 1 \text{ ft} \end{bmatrix}$$

$$M + N = \begin{bmatrix} 0.3 \\ 0.143 \\ 0.834 \\ 0.455 \end{bmatrix} \text{m}$$
- 3D Plotting:** A 3D sphere is shown in a coordinate system, with a value of  $S2$  displayed below it.

# PRIME 5.0 PLOT ENHANCEMENTS



## PTC Mathcad 15.0 X-Y Plots

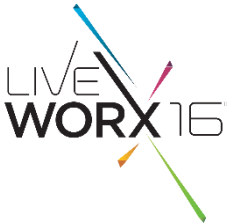
The image displays four screenshots of the 'Formatting Currently Selected X-Y Plot' dialog box, illustrating various configuration options:

- Top Left Screenshot (X-Y Axes Tab):** Shows options for enabling a secondary Y-axis, X-axis and Y-axis settings (Log scale, Grid lines, Numbered, Auto scale, Show markers, Auto grid, Number of grids), and Axis Style (Boxed, Crossed, None, Equal scales).
- Top Right Screenshot (Traces Tab):** Shows a table for configuring multiple traces and legend placement options.
- Bottom Left Screenshot (Number Format Tab):** Shows format options (General, Decimal, Scientific, Engineering, Fraction), Number of decimal places, Show trailing zeros, Show exponents in engineering format, and Exponential threshold.
- Bottom Right Screenshot (Labels Tab):** Shows Title placement (Above, Below, Show Title) and Axis labels (X-Axis, Y-Axis, Y2-Axis).

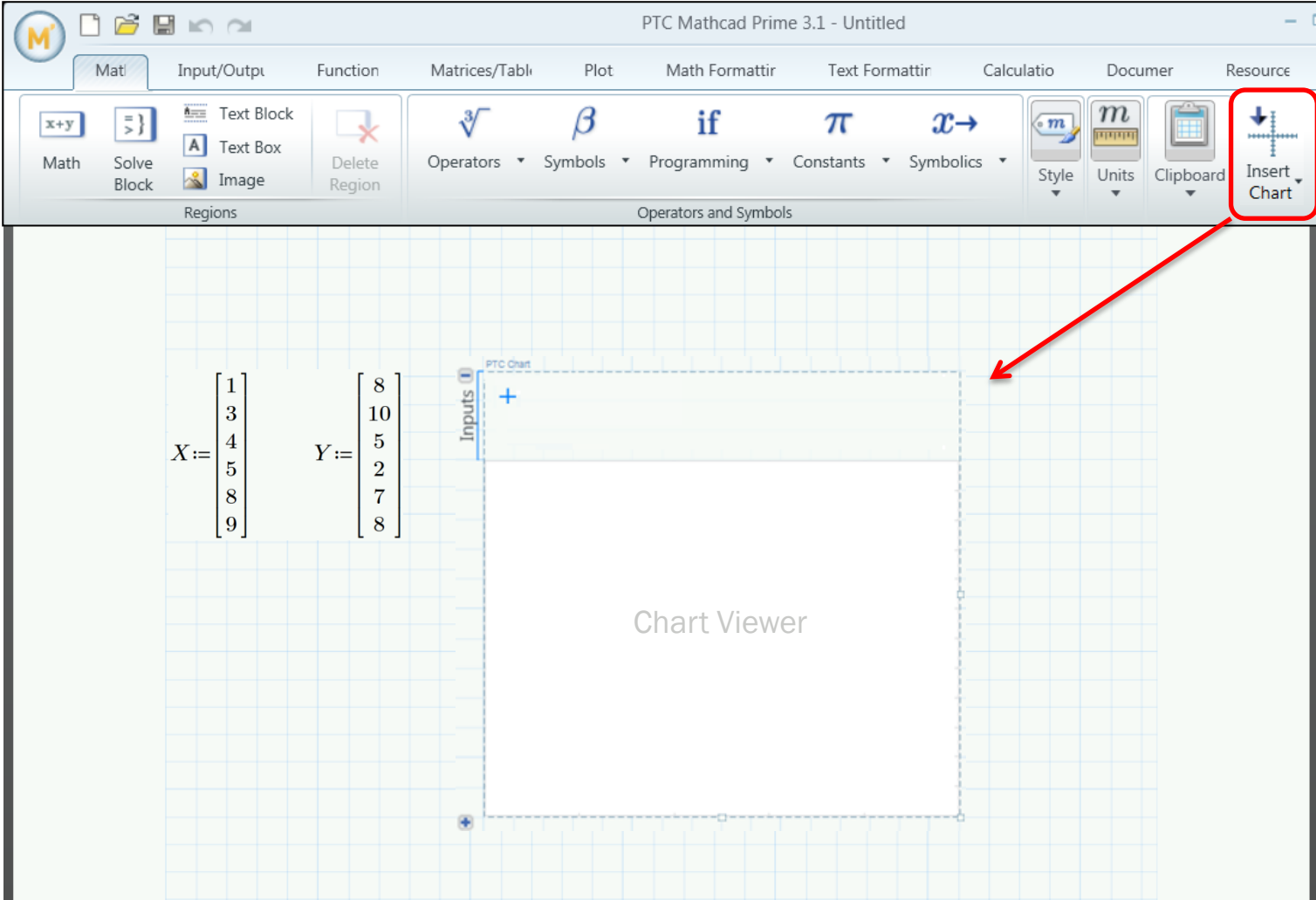
A legend for plot types with corresponding color-coded symbols:

- lines (red line)
- points (green square)
- error bar (magenta error bar)
- step (cyan step line)
- draw (brown line)
- stem (red stem)
- solidbar (blue bar)

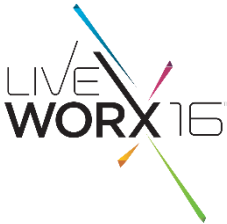
# PRIME 5.0 PLOT ENHANCEMENTS



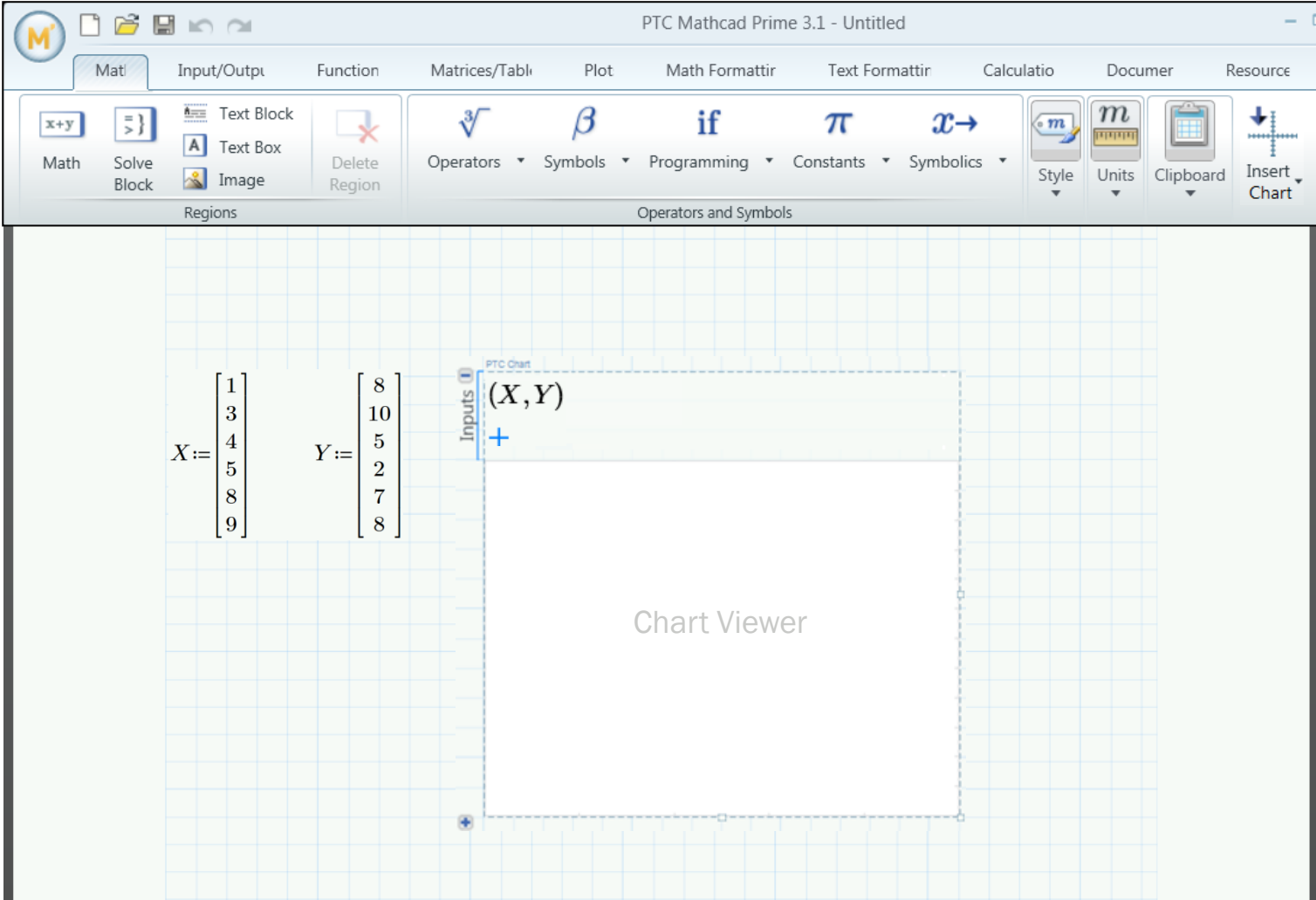
- Insert Chart object



# PRIME 5.0 PLOT ENHANCEMENTS

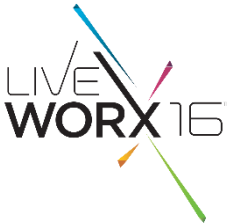


- Type data series





# PRIME 5.0 PLOT ENHANCEMENTS



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

The screenshot shows the PTC Mathcad Prime 3.1 interface. The main workspace contains two matrices:  $X := \begin{bmatrix} 1 \\ 3 \\ 4 \\ 5 \\ 8 \\ 9 \end{bmatrix}$  and  $Y := \begin{bmatrix} 8 \\ 10 \\ 5 \\ 2 \\ 7 \\ 8 \end{bmatrix}$ . A chart window is open, displaying a line graph with a red line. The chart's x-axis ranges from 0 to 10, and the y-axis ranges from 0 to 12. The ribbon UI for the chart is active, showing tabs for File, Traces, Axes, Chart, and View. The Chart tab is selected, and the ribbon includes sections for Canvas, Graph, Legend, Title, and Set-Up. The Canvas section is expanded, showing options for Canvas Border, Background, and 3D Effects.

# PRIME 5.0 PLOT ENHANCEMENTS



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

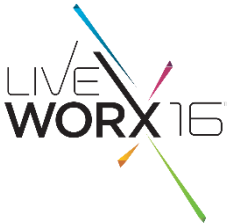
The screenshot displays the PTC Mathcad Prime 3.1 interface. On the left, two matrices are defined:

$$X := \begin{bmatrix} 1 \\ 3 \\ 4 \\ 5 \\ 8 \\ 9 \end{bmatrix} \quad Y := \begin{bmatrix} 8 \\ 10 \\ 5 \\ 2 \\ 7 \\ 8 \end{bmatrix}$$

The right side of the interface shows a chart window with the 'Title' tab selected. The 'Chart Title' checkbox is checked, and the text 'Test Data 04/11/15' is entered. The chart itself is a line plot with a red line, showing a peak at x=3 and a trough at x=5. The x-axis ranges from 0 to 10, and the y-axis ranges from 0 to 12.

x	y
1	8
3	10
4	5
5	2
8	7
9	8

# PRIME 5.0 PLOT ENHANCEMENTS



- Close external app to return to Mathcad

The screenshot shows the PTC Mathcad Prime 3.1 interface. The title bar reads "PTC Mathcad Prime 3.1 - Untitled". The ribbon includes tabs for "Mat", "Input/Output", "Function", "Matrices/Tables", "Plot", "Math Formatting", "Text Formatting", "Calculations", "Documents", and "Resources". The "Plot" tab is active, showing options for "Style", "Units", "Clipboard", and "Insert Chart".

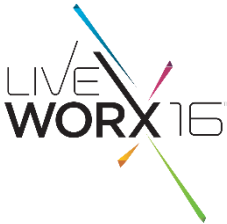
In the workspace, two vectors are defined:

$$X := \begin{bmatrix} 1 \\ 3 \\ 4 \\ 5 \\ 8 \\ 7 \\ 9 \end{bmatrix} \quad Y := \begin{bmatrix} 8 \\ 10 \\ 5 \\ 2 \\ 7 \\ 7 \\ 8 \end{bmatrix}$$

A "PTC Chart" is inserted, titled "Test Data 04/11/15". The chart has "Inputs (X, Y)" and a "+" sign. The plot shows a red line connecting the data points (X, Y) in the order they appear in the vectors. The x-axis ranges from 0 to 10, and the y-axis ranges from 0 to 12.

X	Y
1	8
3	10
4	5
5	2
8	7
7	7
9	8

# PRIME 5.0 PLOT ENHANCEMENTS



## Minimize input area and de-select

The screenshot shows the PTC Mathcad Prime 3.1 interface. The title bar reads "PTC Mathcad Prime 3.1 - Untitled". The ribbon includes tabs for "Mat", "Input/Output", "Function", "Matrices/Tables", "Plot", "Math Formatting", "Text Formatting", "Calculations", "Documents", and "Resources". The "Regions" group contains icons for Math, Solve Block, Text Block, Text Box, Image, and Delete Region. The "Operators and Symbols" group includes Operators, Symbols, Programming, Constants, and Symbolics. The "Style" group includes Style, Units, and Clipboard. The "Insert Chart" icon is also visible.

In the workspace, two matrices are defined:

$$X := \begin{bmatrix} 1 \\ 3 \\ 4 \\ 5 \\ 8 \\ 9 \end{bmatrix} \quad Y := \begin{bmatrix} 8 \\ 10 \\ 5 \\ 2 \\ 7 \\ 8 \end{bmatrix}$$

To the right, a plot titled "Test Data 04/11/15" is shown. The x-axis ranges from 0 to 10, and the y-axis ranges from 0 to 12. The plot displays a red line connecting the following data points:

X	Y
1	8
3	10
4	5
5	2
8	7
9	8

The image features several colorful geometric shapes, including triangles and lines in shades of blue, green, yellow, and purple, scattered across the background. A large, multi-colored geometric shape is prominent on the right side. The text 'LIVE WORX 16' is centered, with 'LIVE' in a thin, outlined font and 'WORX 16' in a bold, solid black font. A small 'TM' trademark symbol is positioned to the right of the '16'.

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