

PTC MATHCAD PRIME 7

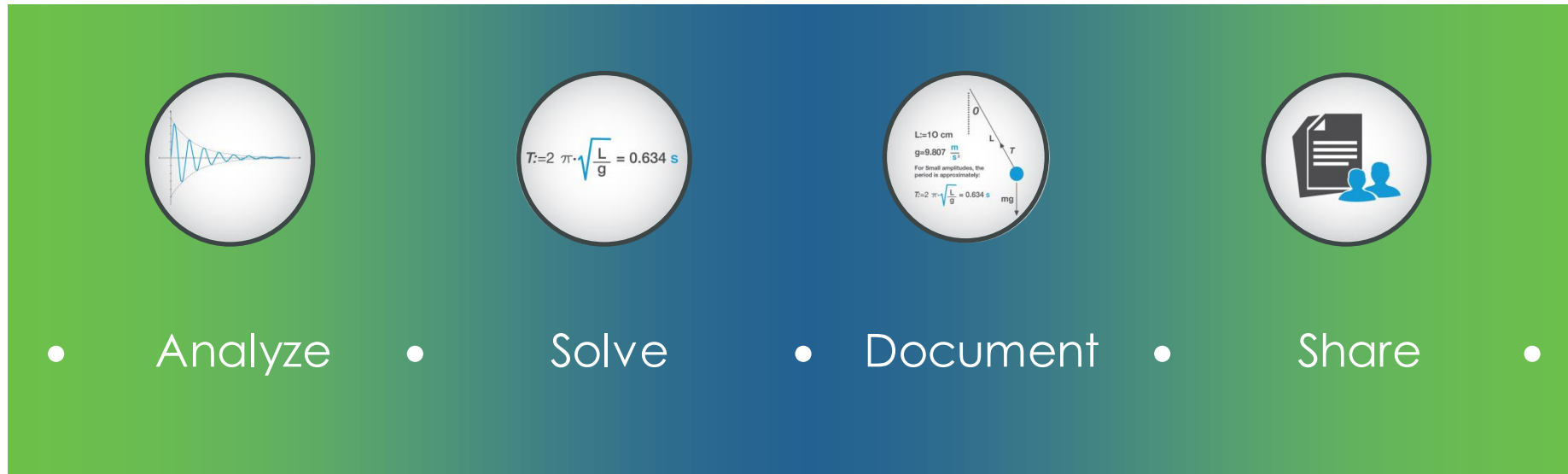


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March 2021

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?

- **Engineering calculation software** that integrates multiple content types into a **comprehensive engineering document**
 - Mathcad worksheets are live math documents that calculate results and communicate ideas at the same time
 - Standard mathematical notation for transparency and readability
- **Powerful math engine**
 - Numeric and Symbolic calculations
 - Rich function library
 - Comprehensive support for units
- **Visual presentation features**
 - Fully formatted text and math
 - 2D, 3D, polar, and contour plots
 - Full control over display content

PTC[×] Mathcad[×] Solving Systems of Equations

Example of Differential Equations: Damped Vibrations

Given:

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

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

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

Guess 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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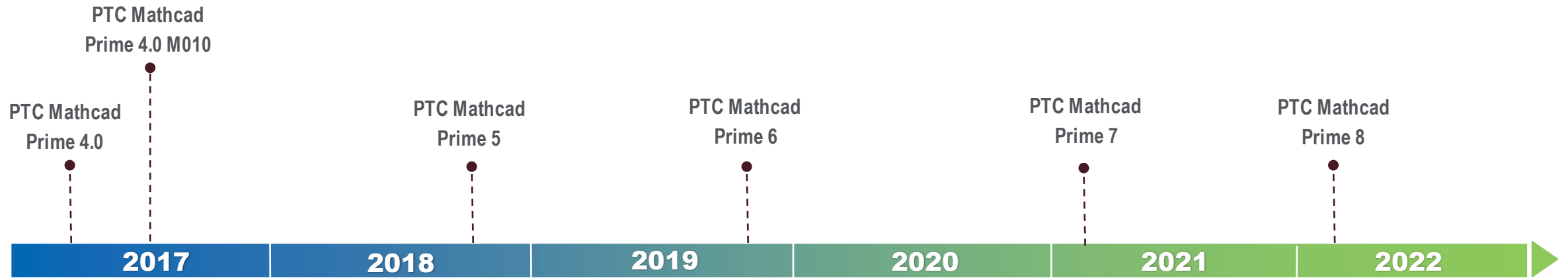
MATHCAD PRIME: RELEASE SUMMARY

PTC MATHCAD PRODUCT TIMELINE



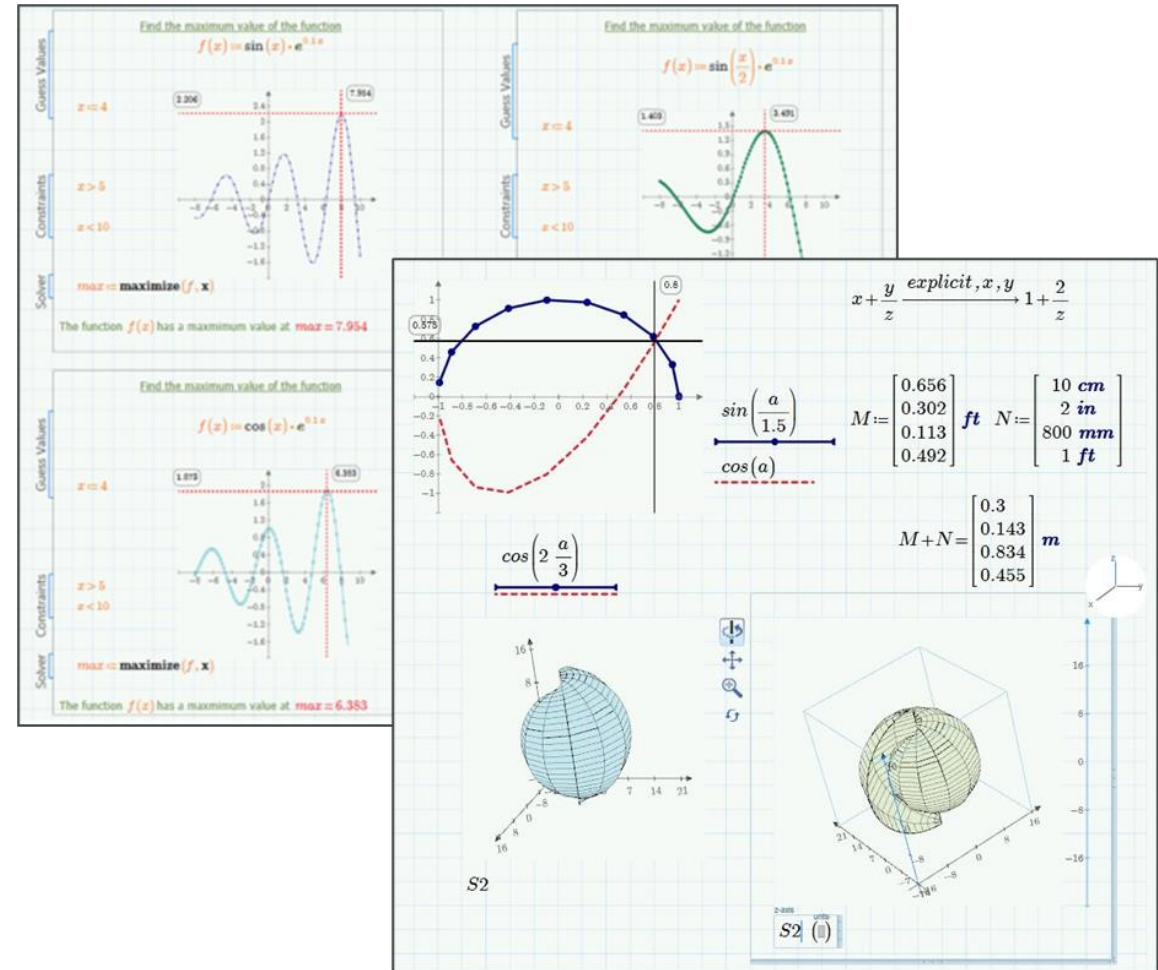
PTC Mathcad Prime x.0

- Major releases with new functionality
- From 2016, yearly frequency to match subscription period
- Prime 7 release shift to better align with Creo yearly release



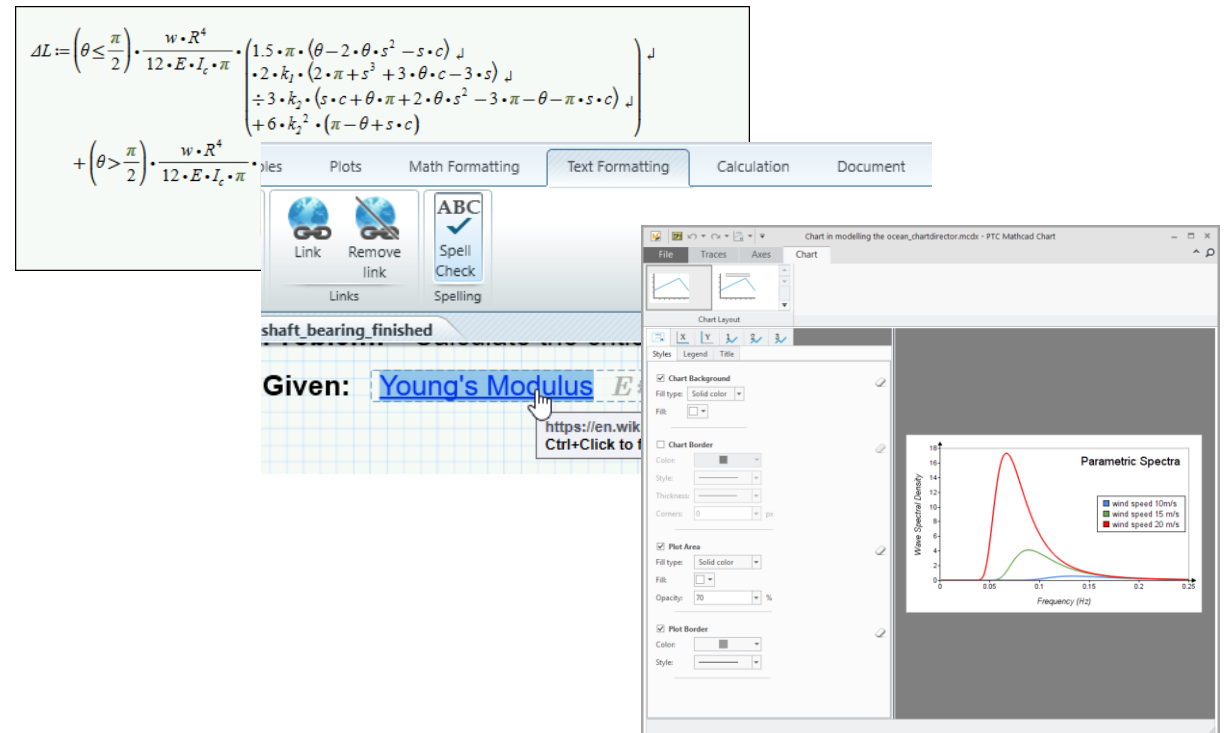
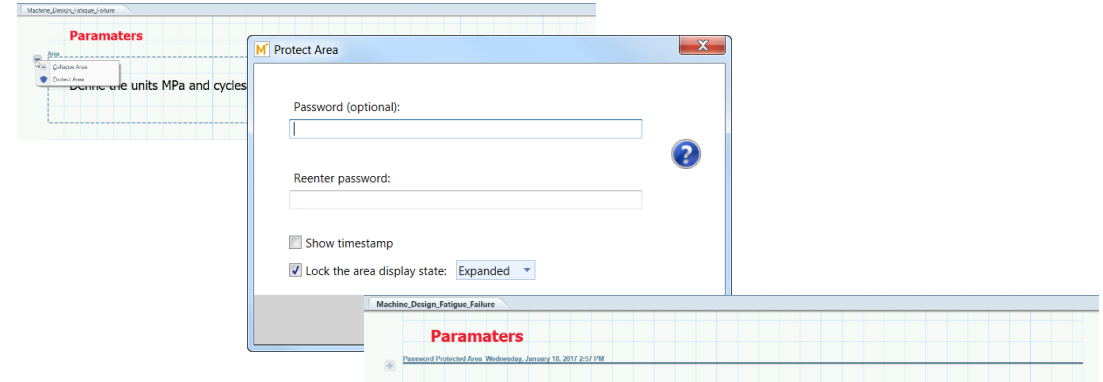
PTC MATHCAD PRIME EARLY VERSIONS

- PTC Mathcad Prime 1.0
 - Multi-document, task-oriented, WYSIWYG UI
 - Comprehensive support for units
 - Rich numeric function library
 - X-Y, polar, and contour plots
- PTC Mathcad Prime 2.0
 - Symbolic calculations
 - 3D Plots
 - Excel Component
 - Collapsible Areas
- PTC Mathcad Prime 3.0
 - Math Styles
 - Templates
 - Math in Text
 - Custom Functions
 - Global Definition
- PTC Mathcad Prime 3.1
 - Engineering Notebook, powered by PTC Mathcad
 - API



PTC MATHCAD PRIME EARLY VERSIONS

- PTC Mathcad Prime 4.0
 - Area protection and locking
 - Interoperability with Third Party Applications
 - Embedded objects
 - Export to MS Word
 - Equation wrapping
 - Windows 10 support
- PTC Mathcad Prime 5.0
 - 2D Plot Enhancements, including
 - Axis expression formatting
 - Legend
 - 2nd Y Axis
 - Plot title
- PTC Mathcad Prime 6.0
 - Custom Margins, headers and footers
 - Spellcheck
 - Hyperlinks in Text
 - New Symbolic Engine



- New functionality
 - Combo-box input control
 - Standalone Converter
 - Symbolics Enhancements
 - UI Enhancements
 - API Guide
 - Bug fixes

Material: Steel ▾

Material: Steel

Material: Iron

Material: Copper

$$G := \text{Material} = 79.4 \text{ GPa}$$

$$\gamma := \text{Material} \cdot \frac{\text{kg}}{\text{m}^3} \cdot g \quad \gamma = 76.982 \frac{\text{kN}}{\text{m}^3}$$

Legacy Symbolic Engine:

$$\ln(x) = a \cdot \text{li} \xrightarrow{\text{solve, } x, \text{fully, assume, } a = \text{real}} \begin{cases} \text{if } -\pi \leq a < \pi \\ e^{a \cdot \text{li}} \\ \text{else if } a \in \text{union}(\text{Interval}(-\infty, \infty), \text{Interval}(\pi, \infty)) \\ \text{undefined} \end{cases}$$

New Symbolic Engine:

$$\ln(x) = a \cdot \text{li} \xrightarrow{\text{solve, } x, \text{fully, assume, } a = \text{real}} \begin{cases} \text{if } -\pi < a \leq \pi \\ e^{a \cdot \text{li}} \\ \text{else} \\ \text{undefined} \end{cases}$$

Material :=

	units	units
Material	()	()
Steel	7850	79.4
Iron	8250	52.5
Copper	8960	44.7

$$G := \text{Material} = 79.4 \text{ GPa}$$

$$\gamma := \text{Material} \cdot \frac{\text{kN}}{\text{m}^3} = 76.982 \frac{\text{kN}}{\text{m}^3}$$

PTC Mathcad Prime 7.0.0.0 XMCD, MCD Converter

Add Worksheets
 Remove Worksheets
 Add References
 Convert
 Pause

Source Worksheet	Version	Status	Retrials Left
C:\worksheets\moving_filter_1.xmcd	14/15		0

Conversion log for: C:\worksheets\moving_filter_1.xmcd

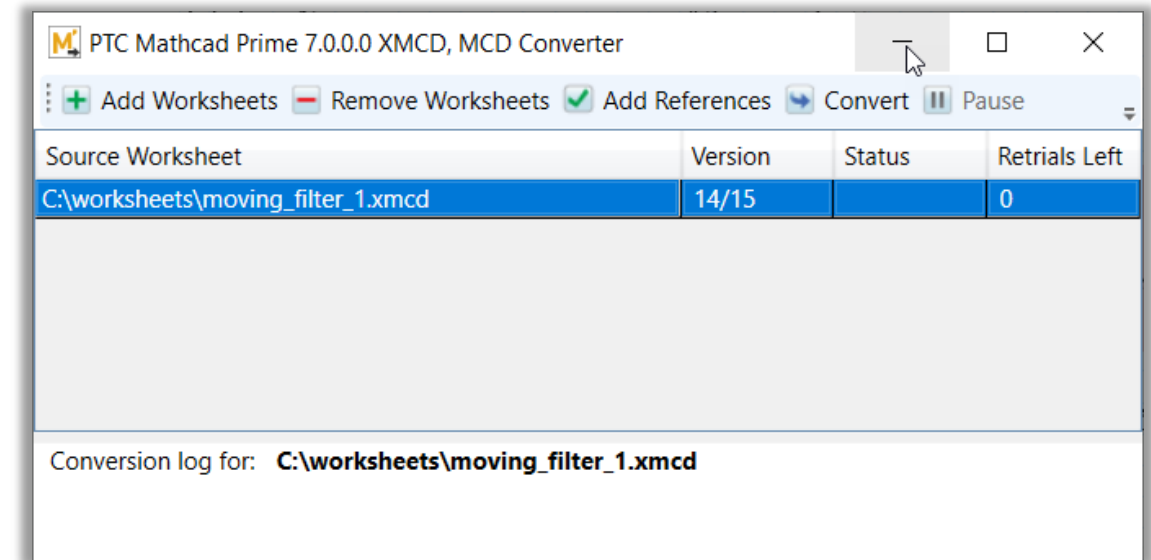
- Combo-box input control
 - Combo-box is part of the equation control
 - Multiple variables can be defined for each selected identifier
 - Option to hide variable assignment from combo-box selection
 - Supports conversion to new combo-box from radio button and check box web controls in legacy Mathcad 15 worksheets

The screenshot illustrates the material selection interface in Mathcad Prime 7.0. It shows two instances of the material selection control. The top instance has a dropdown menu open with 'Material: Iron' selected. The bottom instance has a table of material properties displayed.

Material	units	units
Steel	7850	79.4
Iron	8250	52.5
Copper	8960	44.7

*Combo-box input control has limited unit support

- Standalone converter
 - Created new conversion engine
 - Retained existing converter front-end
 - Converter now an opt-in option in the installer



Standalone converter does not require legacy Mathcad to be co-installed on the system

- Symbolics Enhancements
 - Improved, more precise error notifications
 - Enhanced and expanded functionality for faster, simplified results
 - Significant performance improvements for calculations and keywords

Legacy Symbolic Engine:

$$\int_0^1 \operatorname{dilog}(\sqrt[3]{x}) dx \rightarrow \int_0^1 \operatorname{dilog}(\sqrt[3]{x}) dx \xrightarrow{\text{float}} 0.28382295573711532536$$

New Symbolic Engine:

$$\int_0^1 \operatorname{dilog}(\sqrt[3]{x}) dx \rightarrow \frac{\pi^2}{6} - \frac{49}{36} \xrightarrow{\text{float}} 0.28382295573711532536$$

Legacy Symbolic Engine:

$$\ln(x) = a \cdot i \xrightarrow{\text{solve, x, fully, assume, a = real}} \begin{cases} \text{if } -\pi < a < \pi \\ e^{a \cdot i} \\ \text{else if } a \in \text{union}(\text{Interval}(-\infty, \infty), \text{Interval}(\pi, \infty)) \\ \text{undefined} \end{cases}$$

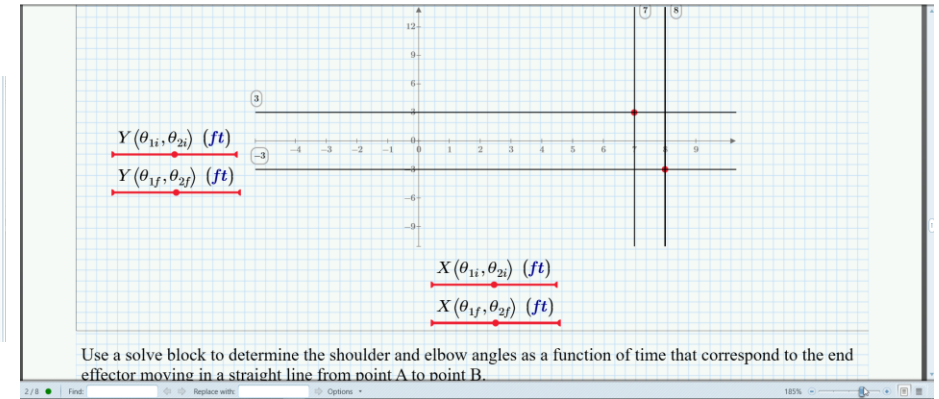
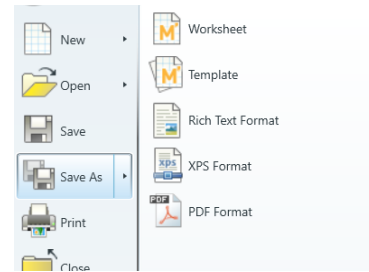
New Symbolic Engine:

$$\ln(x) = a \cdot i \xrightarrow{\text{solve, x, fully, assume, a = real}} \begin{cases} \text{if } -\pi < a \leq \pi \\ e^{i \cdot a} \\ \text{else} \\ \text{undefined} \end{cases}$$

Mathcad Prime 7.0 fully embraces the new symbolic engine. The new engine provides a greater ability to make modifications and implement enhancements to symbolic calculations. Mathcad Prime 7.0 includes symbolic enhancements over the old symbolic engine and fixes several issues reported by customers. While Mathcad Prime 6.0 contains both symbolic engines, Mathcad Prime 7.0 contains the new symbolic engine only.

- Enhanced functionality
 - Calculations
 - Definite and indefinite **integrals**
 - **Limits**
 - **Polynomials, powers, and roots**
 - Keywords
 - **Solve**
 - Expanded problem set for **solve** and **solve** with modifier “**fully**”
 - system of equalities and inequalities
 - cubic equations
 - equations with symbolic functions
 - **Series**
 - Expanded to support **binominal series**
 - **Assume**
 - Expanded to include support for assumption with modifier “complex” when assuming complex values
- Performance Improvements
 - Calculations
 - Definite and indefinite **integrals**
 - **Limits**
 - *Large Powers* in **polynomials**
 - Keywords
 - **Solve**
 - Improved to solve more quickly
 - **Simplify**
 - Improved to provide better simplification of results
 - **Float**
 - Improved accuracy for some calculations (for ex. Bessel functions)
 - Improved rounding

- UI Enhancements
 - Zoom, focus, scroll refactoring
 - Save as PDF
 - Show/Hide major gridlines



- API Guide

Object: GetValueResult

This object represents the PTC Mathcad Prime GetValueResult

This

Ret	Pro
0	Introduction
1	What is New in PTC Mathcad Prime 7.0.0.0
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	Windchill Workgroup Manager
	Object Linking and Embedding (OLE)
	Opening a Worksheet from a Web Page
	Custom Functions

Object: Application

This object represents the PTC Mathcad Prime Application COM interface Ptc.MathcadPrime.Automation.IMathcadPrimeApplication.

The Application object is the only object that you must create (using new). You retrieve all other objects by assigning interfaces.

Refer to the following examples:

- Managed code: VB, C#, and C++ create an ApplicationCreator
- Scripting code: JavaScript and VBScript create through ActiveX an Application object.

Methods

- Activate() —Brings the PTC Mathcad Prime window to the foreground and activates it.
- CloseAll(Ptc.MathcadPrime.Automation.SaveOption) —Closes all open worksheets in PTC Mathcad Prime.
- The special behavior for any new and unmodified worksheet:
 - Worksheet is closed without prompting the user, even if the saveOption is spPromptToSaveChanges.
 - Worksheet is closed without saving, even if the saveOption is spSaveChanges.
- CreateWorksheetReadOnlyOptions—Creates the WorksheetReadOnlyOptions object.
- Use this method to create the WorksheetReadOnlyOptions object to pass it as an OpenEx(String, WorksheetReadOnlyOptions) argument.
- GetVersion() —Gets the version of PTC Mathcad Prime.

Returns:

String

- InitializeEvents2(MathcadPrimeEvents2, SubscribeAll as Boolean)
 - MathcadPrimeEvents2 is the object which is initialized on the COM Client side.
 - SubscribeAll
 - True—Subscribe to all events when initializing.
 - False—Do not subscribe to all events when initializing.



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