



COMPARISON SHOPPING?

6 Pitfalls of Choosing the Wrong Math Software.

Engineers, scientists, and mathematicians all require specialized calculation software. The alternatives are just too time-consuming and error-prone to risk using in today's hyper-competitive environment.

Take care in your decision for what kind of application to choose.

This **self-demonstrative*** eBook will show you the six aspects that you must holistically consider to choose the right math software.

Ctrl+Click the text below to jump to that part of this eBook.



*This eBook was made using PTC Mathcad Prime. Be sure to select "Yes" on the opening pop-up to evaluate scriptable controls.

CHANGE LOG

2022:

- Created eBook using PTC Mathcad Prime 8

2023:

- Updated eBook to a PTC Mathcad Prime 9 worksheet and updated text to reflect product updates
- Created Change Log page
- Changed eBook's color schemes using PTC Mathcad Prime 9's "More Color" custom color picker, in accordance to PTC color palette brand guidelines
- Defined several text styles using PTC Mathcad Prime 9's Text Styles feature
- Added internal hyperlinks on second and second-to-last page to different sections
- Changed or added to some of the PTC Mathcad examples

2024:

- Updated eBook to a PTC Mathcad Prime 10 worksheet and updated text to reflect product updates
- Changed footer to X instead of Twitter
- Added Advanced Controls on the Programming page, as well as a **secret message** at the end if you **check all six of the checkboxes found throughout the worksheet**
- New 3D CAD Integration image & YouTube links added to learn more

2025:

- Updated eBook to a PTC Mathcad Prime 11 worksheet; edited text to reflect product updates or hyperlinked resources
- Changed page number format
- Added region borders various items, including the scavenger hunt checkbox controls, this change log, final results in examples, and more
 - The checkboxes now all have different messages depending on if they are checked or not
- Set a custom unit system
- Moved Advanced Controls to their own page ("Controls & Python"), within the Integrations chapter

I'm one of the checkboxes. Check me and the other five!

EASE OF USE: **LEARNING CURVE**

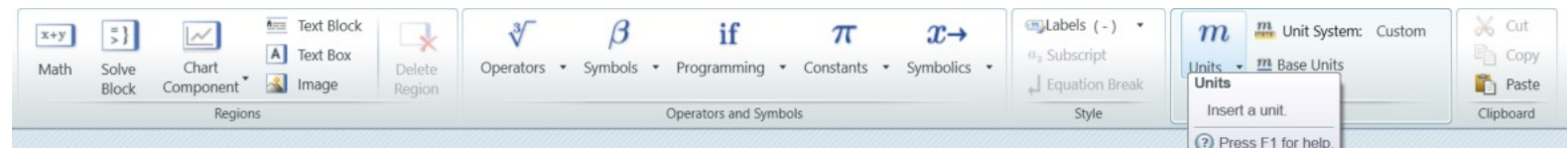
Competitors

- Users of other math software must spend a lot of time searching for what they need
- Steep learning curve

PTC Mathcad

- PTC Mathcad sorts all features by their domain, displayed in an intuitive way for you to learn it
- Press F1 while selecting a feature to visit that feature's in-context help page
- Mathcad Prime is designed so you can learn how to use the software within 15 minutes.
 - Your math needs may be complicated, but using your math software shouldn't be

I'll keep reading to learn more about how Mathcad is easy to learn!



EASE OF USE: EQUATION EDITOR

Competitors

- Formulas may be difficult to troubleshoot
- Math formulas may get displayed and further calculated after a prior structure
- Large formulas may not fit nicely in the document

PTC Mathcad

- Mathcad offers natural math notation to save you time in creating calculations
- Math formulas are introduced either by using the operators and symbols from the Math tab or by typing them or using keyboard shortcuts
- Equation Wrapping is used to split large formulas to multiple rows and keep the font size

Same formula written twice; version below the black bar has an equation break.

Notice the equation-break multiplication →

$$(R_x \geq a) \cdot \left(2 \cdot R_x \cdot \alpha - (2 \cdot a \cdot \sin(\alpha)) + -2 \cdot \sqrt{R_x^2 - a^2} \cdot \left(\frac{\pi}{2} - \text{asin} \left(\frac{a + R_x \cdot \cos(\alpha)}{R_x + a \cdot \cos(\alpha)} \right) \right) \right) (R_x < a) \cdot \left(2 \cdot R_x \cdot \alpha - (2 \cdot a \cdot \sin(\alpha)) + 2 \sqrt{a^2 - R_x^2} \cdot \ln \left(\frac{\sqrt{a^2 - R_x^2} \cdot \sin(\alpha) + a + R_x \cdot \cos(\alpha)}{R_x + a \cdot \cos(\alpha)} \right) \right)$$

Notice the equation-break multiplication ↓

$$(R_x \geq a) \cdot \left(2 \cdot R_x \cdot \alpha - (2 \cdot a \cdot \sin(\alpha)) + -2 \cdot \sqrt{R_x^2 - a^2} \cdot \left(\frac{\pi}{2} - \text{asin} \left(\frac{a + R_x \cdot \cos(\alpha)}{R_x + a \cdot \cos(\alpha)} \right) \right) \right) \downarrow = 0 \text{ m}^2$$

$$\cdot (R_x < a) \cdot \left(2 \cdot R_x \cdot \alpha - (2 \cdot a \cdot \sin(\alpha)) + 2 \sqrt{a^2 - R_x^2} \cdot \ln \left(\frac{\sqrt{a^2 - R_x^2} \cdot \sin(\alpha) + a + R_x \cdot \cos(\alpha)}{R_x + a \cdot \cos(\alpha)} \right) \right)$$

EASE OF USE: CLARITY AND ERROR PREVENTION

Competitors

- In typical math software, a user must add a computation or programming block and then run/compile it to see the results' errors

PTC Mathcad

- Mathcad Prime is continuously interpreting your information, and you are constantly notified about information that you might want to use
- Mathcad helps you in advance through error messages that point you to missing details or steps

$$f(x) := \frac{3}{x}$$

$$g(x) := f(x) - 10$$

$$g(0) = ?$$

You cannot divide by zero, so Mathcad returns this when you click the red box:

This expression is divided by zero. It cannot be computed.

EASE OF USE: PROGRAMMING

Competitors

- In many applications, math formulas are introduced and/or calculated through programming syntax, even for simple things



PTC Mathcad

- Writing simple to advanced math formulas does not require you to have a programming skill set
- Mathcad has programming functionality in advanced cases where you need it, such as leveraging loops or conditionals. [Watch more!](#)

$$SumOddNums(n) := \left\| \begin{array}{l} sum \leftarrow 0 \\ \text{for } i \in 1, 3 \dots n \\ \quad \left\| sum \leftarrow sum + i \right. \\ \left. sum \right. \end{array} \right\|$$

$$SumOddNums(10) = 25$$

$$fib(n) := \left\| \begin{array}{l} \text{if } n > 1 \\ \quad \left\| fib(n-1) + fib(n-2) \right. \\ \text{else} \\ \quad \left\| 1 \right. \end{array} \right\| \quad k := 0 \dots 12$$

$fib(k) =$	1
	1
	2
	3
	5
	8
	13
	21
	34
	55
	89
	144
	233

EASE OF USE: FUNCTIONS

Competitors

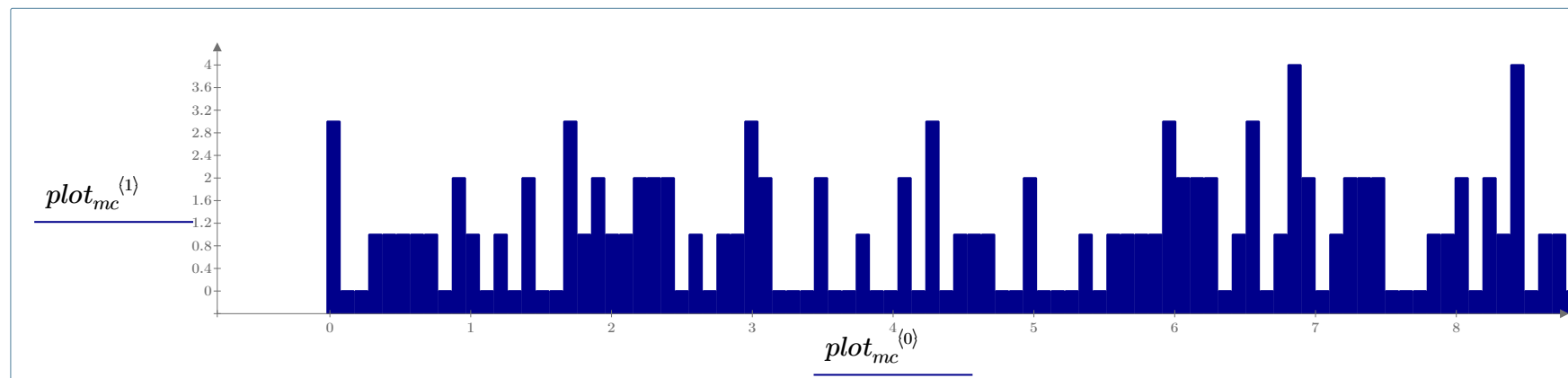
- It may be easy to mistake functions; locating them in math software and trying to find the best one to apply on a certain model can be a cumbersome and difficult process

PTC Mathcad

- A wide range of predefined functions is available, from built-in functions to user-defined functions, including user-created .dll files
- For the built-in functions (accessible via the Functions tab) and user-defined functions, Mathcad's state-of-the-art algorithms will do all the work—again, you don't need to program anything

$$M := \text{montecarlo}(f, n, Rvals, dist, lim)$$

$$plot_{mc} := \text{histogram}(100, Y1)$$



MATH ENGINE: UNITS

Competitors

- Some applications have units, others work without their implementation
- The performance of units and unit systems in other applications may be insufficient

$$G := 40 \text{ GPa}$$

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

$$G + \gamma = ?$$

Mathcad Prime flags an error that these units are incompatible. Unit compatibility is a way to check for logic errors.

These units are not compatible.

PTC Mathcad

- Mathcad continues to be the leader in unit intelligence, above and beyond what other applications can do:
 - Mathcad provides complete unit sets in International System (SI), United States Customary System (USCS) and Centimeter-Gram-Second (CGS). You may also create a Custom Unit System.
 - Mathcad carries units through calculations, converts units, and flags errors
 - You can specify values using these built-in units or using your own user-defined units
 - Tables, plots, and matrices take units

$$\text{customunit} := 5 \text{ in}$$

$$10 \text{ customunit} + 20 \text{ customunit} = 30 \text{ customunit}$$

$$10 \text{ customunit} + 20 \text{ yd} + 30 \text{ m} = 29.121 \text{ Smoot}$$

You can define your own units and use those in conjunction with Mathcad's built-in units.

MATH ENGINE: SYMBOLICS

Symbolics are used for evaluating expressions without assigning values to variables and are immune to the round-off errors that are inherent in numerical calculations. [Watch about it here.](#)

Competitors

- Some applications do not provide a symbolic calculation engine
- If they do provide symbolic calculation, the function implementations are not easy to use or are limited in scope

PTC Mathcad

- Solve equations symbolically
- Specify your operations with robust set of keywords and modifiers
- PTC continuously enhances the symbolic engine with every Mathcad Prime release based on customer feedback

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

$$\left[\begin{array}{l} \frac{d^2}{dx^2} y(x) + y(x) = 1 \\ y(0) = 2 \\ y'(0) = 3 \end{array} \right] \xrightarrow{\text{solve, } y} 3 \cdot \sin(x) + \cos(x) + 1$$

SUPERIOR DOCUMENT: CONSOLIDATED INFORMATION

Users need software where they can include multiple content types, with a free, flexible layout and no predefined structure.

Competitors

- In many other programs, results fall below the row where the computation is initially written, and the information is scattered

PTC Mathcad

- In Mathcad, all kinds of content can be included anywhere in the worksheet—math, text, pictures, plots, diagrams, and tables to create comprehensive engineering documents and presentation-ready reports
- This very eBook was made in PTC Mathcad Prime

SUPERIOR DOCUMENT: DRAFT VIEW

Competitors

- In typical math software, you need to type and then modify or erase your "try outs" in the same location

PTC Mathcad

- Mathcad has a special space called "Draft View" – an active zone where additional calculations and checks can be done; here you can test any Mathcad functionality or add comments for approval or validations
- Draft View appears on the right-hand side and you can toggle Mathcad between Page View and Draft View. Try it out on this page if you're viewing from the Mathcad worksheet version

$$5 \text{ mph} + \text{DraftViewVariable} = 9 \text{ mph}$$

INTEGRATION: MICROSOFT EXCEL

Competitors

- Microsoft Excel integration exists in other software, but it's not so smooth

PTC Mathcad

- Mathcad seamlessly drives data back and forth with Excel, and can import Excel data or embed an Excel spreadsheet inside Mathcad with the Excel Component
- Mathcad can also write into Excel worksheets

With WRITEEXCEL, Mathcad created a new Excel document in the same file directory as this Mathcad worksheet with the results of Page 7's Monte Carlo function.

Matrix := WRITEEXCEL (“.\montecarlo.xlsx”, *M*)

READEXCEL will insert the data of that Excel worksheet back to Mathcad.

READEXCEL (“.\montecarlo.xlsx”, “Sheet1!A1:C10”) =

“X”	“Y”	“Output”
5.998	1.356	12.674
7.363	2.991	16.222
8.149	9.883	21.24
10.387	7.777	24.663
8.124	5.677	19.085
6.548	4.926	15.559
7.879	8.011	19.764
7.519	4.493	17.285
6.957	7.323	17.576

INTEGRATION: CONTROLS & PYTHON

Competitors

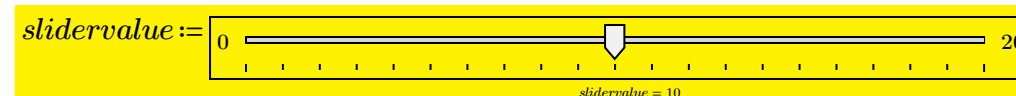
- Implementing lists of items or controls is significantly more complicated and could require additional toolboxes or a special programming background

$$\text{thrust}(t) := \begin{cases} \text{if } 0 \leq t < 5 \\ \quad \parallel 100 \text{ N} \\ \text{else if } 5 \leq t < 20 \\ \quad \parallel 80 \text{ N} \\ \text{else} \\ \quad \parallel 0 \text{ N} \end{cases}$$

PTC Mathcad

- Supplement your worksheets with scriptable advanced controls, giving you VBScript/JScript/Python coding for use cases like conditionally formatting text boxes, rapidly selecting different input values, or nested configuration management. [Watch more use cases here.](#)

Play with the slider to change the conditionally formatted design check on thrust! Try for 100 newtons!



$$\text{thrust}(\text{slidervalue}) = 80 \text{ N}$$

$$\text{DesignCheck} := \text{thrust}(\text{slidervalue})$$

COULD BE BETTER!

Pass the Design Check!

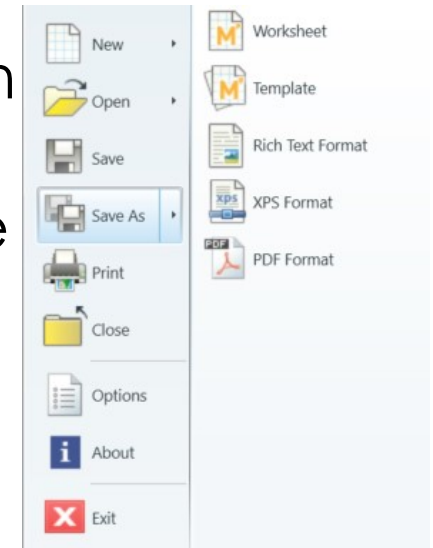
INTEGRATION: MICROSOFT WORD & ADOBE PDF

Competitors

- Converting data or driving it from one software to another can be time consuming since it is unintuitive or there is not an automated process

PTC Mathcad

- Using PTC Mathcad's different export options directly to Word (RTF) and PDF gives you flexibility in how to share your work
- This eBook's PDF version was made with export to PDF
- You can also copy-paste Mathcad expressions and charts into Word or PowerPoint presentations



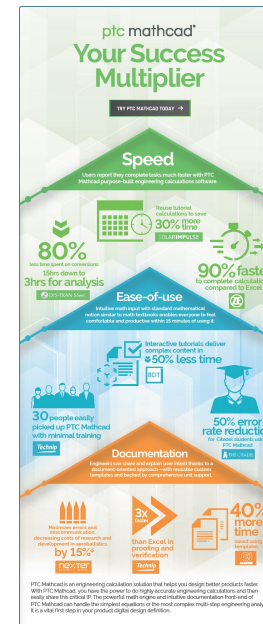
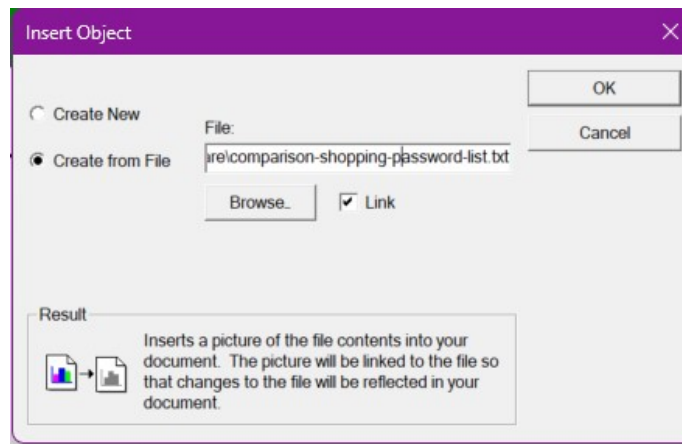
INTEGRATION: EMBEDDING DIFFERENT FILE TYPES

Competitors

- Some math applications lack the ability to embed content from various other applications

PTC Mathcad

- Mathcad Prime allows you to insert Object Linking and Embedding (OLE) objects into your worksheet. You can use this capability to embed new or existing content from other applications into your worksheet



This infographic showcasing how successful customers have benefitted from PTC Mathcad, [PTC Mathcad: Your Success Multiplier](#), is embedded into this Mathcad worksheet. If you double-click it from the worksheet, it'll open the infographic in your PDF reader!

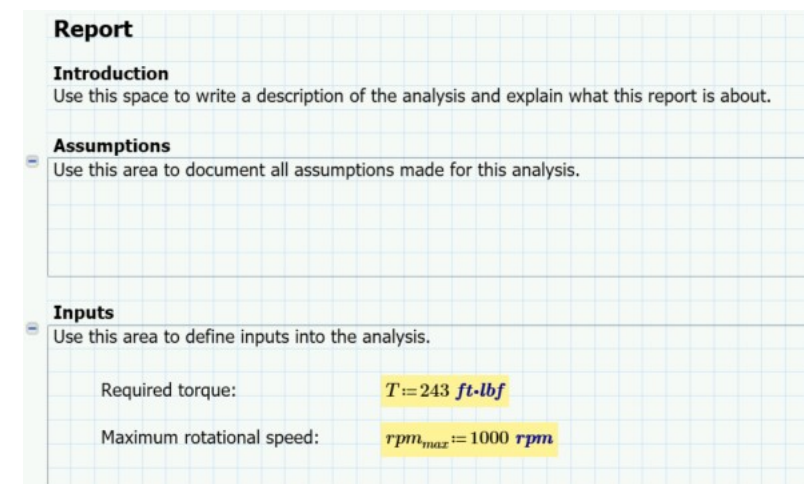
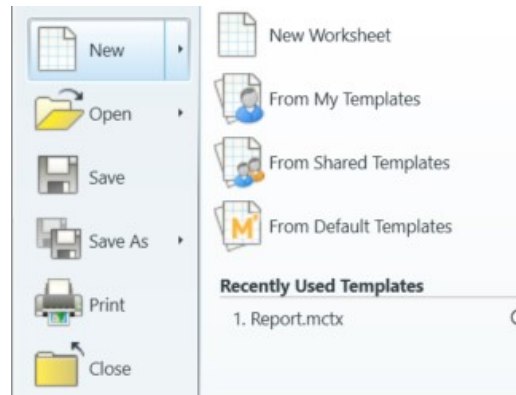
INTEGRATION: PREDEFINED AND NEW TEMPLATES

Competitors

- Not all calculation applications include templates or template support

PTC Mathcad

- Standardized templates are provided. You can create documents that conform to documentation and engineering standards
- You can also create your own templates to conform to your company or department's specific standards and save time by reusing earlier work for similar projects



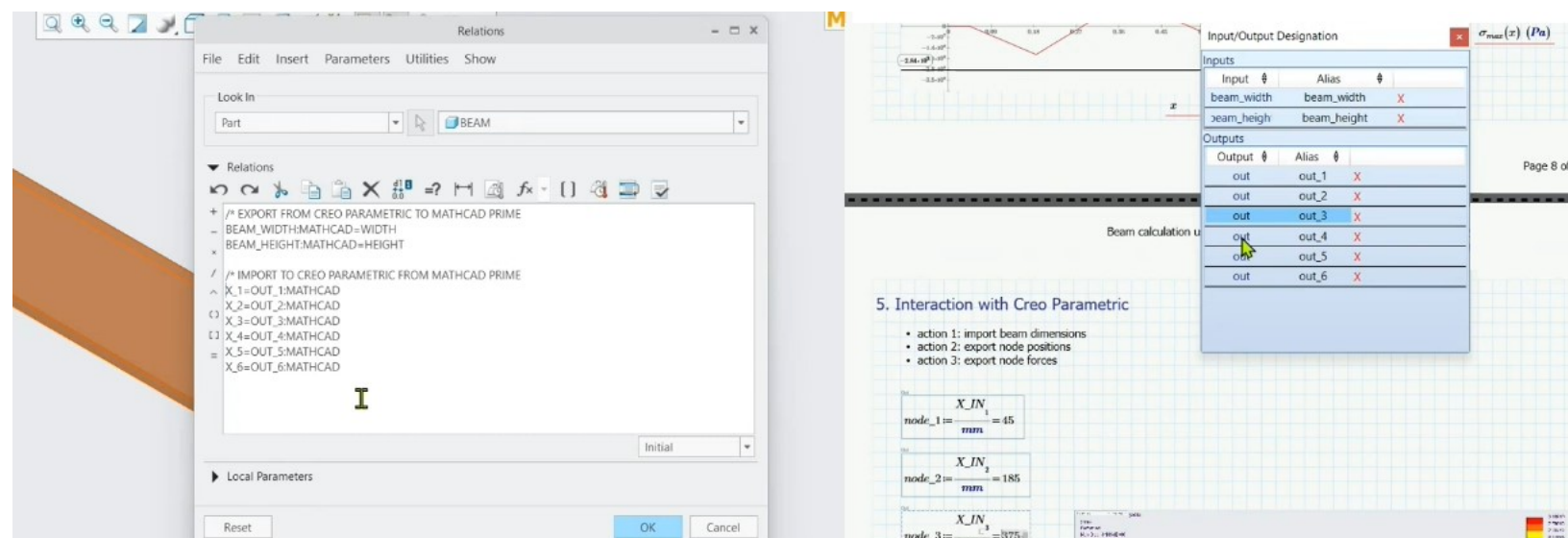
INTEGRATION: 3D CAD & PLM SOFTWARE

Competitors

- Computer-Aided Design data is a key component in product design, yet many math applications lack a CAD integration

PTC Mathcad

- Mathcad integrates seamlessly with PTC's Creo CAD & Windchill PLM systems to capture and document your engineering knowledge. This provides you the ability to update dimensions in your CAD model and regenerate geometry based on new parameters
- Use Mathcad's API to integrate with other programs



[Watch on YouTube: Using PTC Mathcad Prime and Creo Parametric to Apply Vertical Deflection Along a Metal Beam](https://www.youtube.com/watch?v=...)

RISKS: QUALITY ASSURANCE

Competitors

- Has other math software been rigorously tested?
- "Free" math software may not have followed industry QA standards and procedures

PTC Mathcad

- PTC Mathcad is committed to QA (quality assurance) process standards
- Mathcad protects you from compromising intellectual property
- [Mathcad Express](#) is a free-for-life Mathcad version with [reduced functionalities](#) that follows the same QA standards and procedures as the full version

RISKS: PROTECTING YOUR IP

Competitors

- Even proprietary software can occasionally be subjected to exposure



Password Protected Area

The information in the collapsed area above cannot be accessed in a printed or exported file. For demonstration purposes, the password to the above area is "MathcadPrime". Try right-clicking the area to unprotect it in the Mathcad worksheet version of this file. Then you can expand it and read what's inside.

PTC Mathcad

- Collapsible areas are available
- You can require a password to expand the area, as well as edit what's contained within
- You may also password-protect expanded areas so your viewers may see but not edit
- You can further customize these areas by hiding the area border or adding a timestamp of when the area was protected

RISKS: EASE OF ACCESS

Competitors

- For cloud-based or always-online math software, a spotty Internet connection will lose one's in-progress work
 - Without access to the Internet, software usage is impossible

PTC Mathcad

- Mathcad is available on your desktop and does not require a continuous Internet connection
- You can install the Help documentation locally on your desktop in addition to accessing it online

SUPPORT: ASSISTANCE

Competitors

- May have difficult-to-reach Customer Support

PTC Mathcad

- Rest assured that no one is there for you like the PTC Mathcad team is:
 - Technical Support and licensing help
 - Troubleshooting calculation errors and solving difficulties, while giving guidance and advice
 - Presenting customized demos and webinars

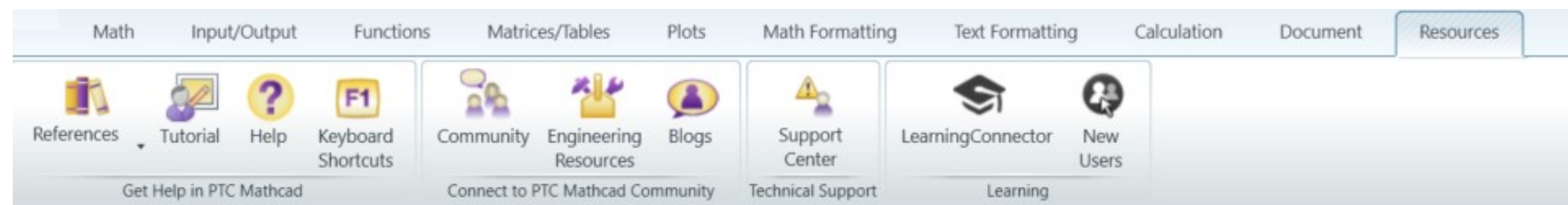
SUPPORT: RESOURCES

Competitors

- May have difficult to find detailed information and examples

PTC Mathcad

- Many learning resources are accessible, and from PTC Mathcad's Resources tab, such as:
 - [Mathcad's extensive Help documentation](#) with copy-pastable math expressions you can insert in your worksheet
 - Comprehensive [keyboard shortcuts](#)
 - An active [user community](#)
 - [Free example worksheets](#) across a wide variety of engineering disciplines and use cases
 - [Blog articles](#) written by subject-matter experts
 - Text and [video-based tutorials](#)



TOP 6 AREAS WHERE ptc® mathcad prime® IS THE BEST SOLUTION



Learning Curve
Equation Editor
Clarity & Error Prevention
Programming
Functions

Units
Symbolics

Check Me, the Final Box!

Consolidated Information
Draft View

Microsoft Excel
Controls & Python
Microsoft Word & Adobe PDF
Object Linking and Embedding
Templates
3D CAD software

Extensive Quality Assurance
Protecting Your Intellectual Property
Ease of Access

Assistance
Resources

Are you ready to try the latest version of PTC Mathcad Prime for yourself? We have a free 30-day trial for the full functionality of PTC Mathcad Prime. Make your own worksheets, open others', and explore for yourself how intuitive and powerful the software is.

[DOWNLOAD PTC MATHCAD PRIME TRIAL >>](#)

PTC Mathcad Prime empowers engineers to perform calculations and solve complex problems accurately, precisely, and transparently. With a document-based environment, Mathcad captures assumptions and decisions in-process so that calculation IP is preserved for traceability, communication, and reuse. Use Mathcad Prime to solve, analyze, document, and share engineering calculations clearly and effectively.

Password Protected Area

You haven't checked any boxes yet?
If you are viewing this on the PDF version
or you are using Mathcad Express (you'll notice a watermark),
you should click the link above and
download the full premium version of Mathcad Prime now!