



- [Home](#)
- [Mathcad Products](#)
- [PlanetPTC Community](#)
- [Meet the Bloggers](#)

PTC's Mathcad Engineering Blog

[Current Articles](#) | [RSS Feed](#)

On a Mile High Mathcad Mission at ICTCM

Posted by [Chris Hartmann](#) on [Tue, Mar 29, 2011 @ 01:27 PM](#)

I recently returned to Needham from the [International Conference on Technology in Collegiate Mathematics \(ICTCM\)](#) in Denver, CO. [ICTCM](#) is a modest-sized conference for mathematics educators. The attendees are all passionate about teaching collegiate mathematics and curious about the ways that their colleagues employ technology to increase student achievement in the early years of collegiate mathematics.



This year, the PTC Academic Program made its first visit to the conference, bringing Mathcad back to the conference after an absence of several years. Our **PTC: The Product Development Company** booth drew lots of attention. Some attendees walked by with puzzled looks on their faces while others approached and asked, "Just out of curiosity, why are you here?"

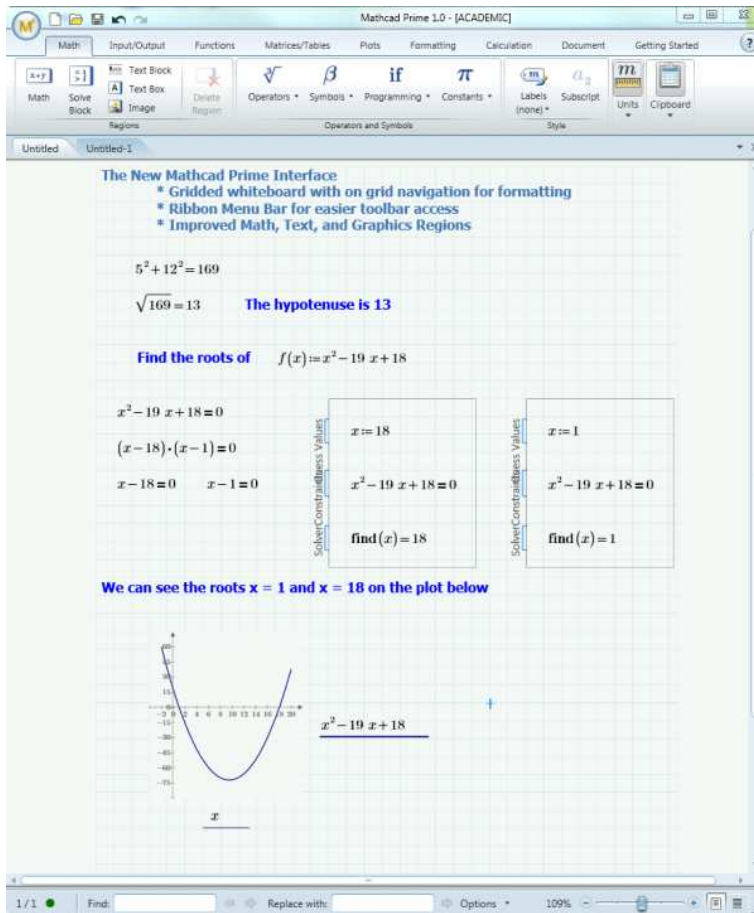
Why we visit ICTCM

A goal of PTC's Academic Program is to inspire the next generation of engineers and product designers. Working in the education vertical for the world's leading Product Development Company, we know that world class product development requires hard work, creating thinking, and effective collaboration, as well as science, technology, engineering, and math (STEM) skills. Our Academic Program is steeped in first-hand knowledge of how tools like [Creo](#), [Windchill](#) and [Mathcad](#) enable our customers to turn effort, creativity, knowledge and skill into outstanding products that help them grow revenue.

We also believe that there is a bidirectional relationship between high quality STEM education and a strong American manufacturing sector. At [ICTCM](#) and other meeting venues, we leverage our expertise as a software and service provider to great Global companies. Our goal: to build relationships with educators who believe that learning STEM concepts in a way that connects students to real world projects and tools helps to optimize all stakeholders' investments in higher education.

Encountering Mathcad Prime

Mathcad has a long history of use in both world class engineering calculations and high quality STEM education. Many educators value and take advantage of Mathcad's WYSIWIG (what you see is what you get) to provide their students with a platform for transparent, professional quality mathematical communication.



With the launch of [Mathcad Prime 1.0](#) in January 2011, Mathcad is better positioned than ever to play this role in high quality STEM education at the University level. We brought Mathcad back to [ICTCM](#) this year to demonstrate these capabilities for a critical audience, the 750 or so [ICTCM](#) attendees who gather each year to showcase their own work and evaluate the next generation of solutions offered by the education publishing and educational technology industries.

The Reaction at ICTCM

At [ICTCM](#) about 1-in-3 visitors to our booth were already familiar with Mathcad. These legacy users wanted to see if [Mathcad Prime 1.0](#) was a big step in the right direction. YES. The most positive response came from mathematics educators who currently use Mathcad to write tests, lectures, or answer keys. The new interface Jakov and company have developed for Prime is elegant and inviting, especially to younger users who are less familiar with notational conventions established in Mathcad's early years.

For many who were unfamiliar with Mathcad, it took a moment to form an accurate impression of Mathcad's unique capabilities as a communication tool. Several asked, "What is different about this when I can already use the equation editor capabilities of my favorite word processor?" Readers of this blog will surely know my answer: "When you use Mathcad the mathematics is dynamic and interactive! Changes to variable assignments or equations update the entire worksheet." For many, this was an "aha!" moment. Mathcad enables curriculum developers to express symbolic and numeric mathematics in a high quality multimedia document using standard mathematics notation. And, Mathcad allows students and teachers to interact with the mathematics in the documents by changing values, observing changes, and recording observations, questions, and conclusions.

Do you know an educator who is looking for a new way to make their STEM courses more relevant, more exciting, more interactive? Do them a favor and forward this blog post to them. Encourage them to check out your favorite tool for mathematical communication: www.ptc.com/go/trymathcadprime/

Tags: [User Conference](#), [education](#), [calculation](#), [communication](#)

Mathcad A-Z: E is for Excel

Posted by [Mona Zeflet](#) on [Mon, Mar 28, 2011 @ 09:56 PM](#)

Did you know that there are many different ways to import data from Excel to Mathcad? In Mathcad 15 and earlier versions, you can use the **Excel Component** or **Data Import Wizard** to import data.

The data can then be embedded in your worksheet, so that you can edit the data directly in Mathcad.

data :=

0	0
1	2.6
3	23.16
4	27.67
5	...

Use Mathcad to analyze and visualize the data.

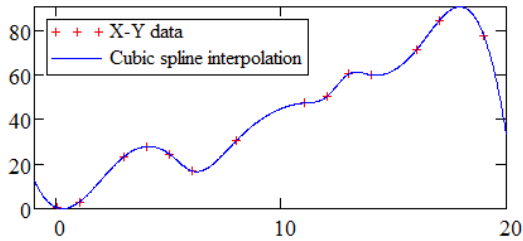
$data := csort(data, 0) \quad X := data^{(0)} \quad Y := data^{(1)}$

Spline coefficients:

$S := cspline(X, Y)$

Fitting function:

$fit(x) := interp(S, X, Y, x)$

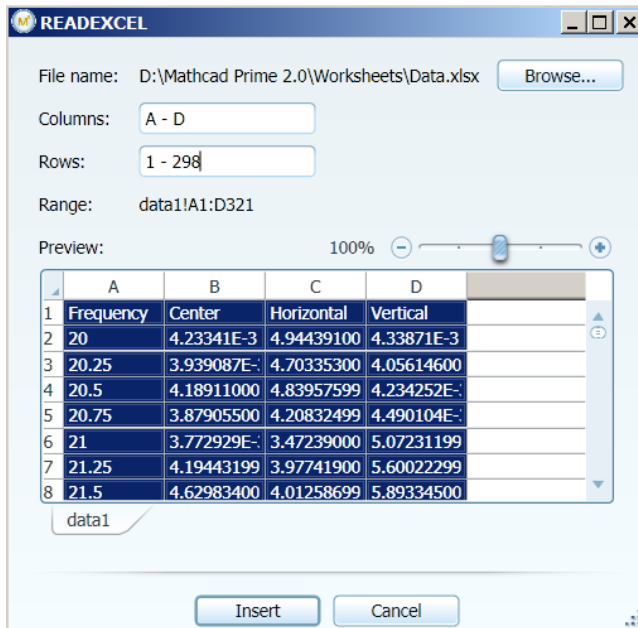


The Mathcad Add-In for Excel lets you add Mathcad calculations and plots to your Excel worksheets with full access to worksheet data.

Mathcad 15 also offers a number of functions for bringing in data from Excel.

Mathcad Prime 1.0

In Mathcad Prime 1.0, the new **READEXCEL** function combines the preview and selection capabilities of the Data Import Wizard with the batch facilities of a function.



The function can be edited for batch processing a number of data files.

$$M := \text{READEXCEL}(\text{".\Data.xlsx"}, \text{"data1!A1:D299"})$$

	"Frequency"	"Center"	"Horizontal"	"Vertical"
M =	20	0.004	0.005	0.004
	20.25	0.004	0.005	0.004
	20.5	0.004	0.005	0.004
	20.75	0.004	0.004	0.004
	21	0.004	0.003	0.005
	21.25	0.004	0.004	0.006
	21.5	0.005	0.004	0.006
	21.75	0.005	0.004	0.005
	22	0.005	0.005	0.004
	22.25	0.006	0.005	0.006
	22.5	0.025	0.018	0.02
				⋮

Tags: [Excel](#), [Mathcad Prime](#), [Mathcad 15](#), [data analysis](#), [READEXCEL](#)

Show your calculation skills with Mathcad – and win!

Posted by Bettina Giemsa on Fri, Mar 25, 2011 @ 02:08 AM

Today is Friday and thus time to use Mathcad for some less serious problems than calculating open channel flow, voltage drops across circuits, or the transmission gear ratio for a geared drive.

Less serious? Well, some of the insects coming to life in springtime and summer may turn into a serious problem to some of us. Believe me, I have a huge garden and hedge trimming is best done with long sleeves and some repellent spray :-)

Nonetheless, I guess those of us who live in the Northern hemisphere are looking forward to the warmer time of year. Here is a little puzzle for you to match the season...



Also, I am donating five (5) of our brand new "[Think – Hear – Share](#)" t-shirts to the users who send in the coolest worksheets with the solution.

Here is the problem:

A fly is sitting at a distance of h from a man with a fly swatter. At time $t=0$ the fly is pursued by the man who has a constant acceleration of 1 . The fly flies in a straight line away from the man with an acceleration of $0.6t$. What is the largest initial separation, h , for which the man can intercept the fly?

Here are the rules:

- Anybody can submit a response, but the solutions must be calculated and submitted in a Mathcad worksheet
 - To do so, [you can download the Mathcad Prime 1.0 free trial here](#)
 - The best worksheets will be published and publicly shared in [PlanetPTC Community](#); by sending in your worksheet, you agree that we publish your worksheet.
 - Our team of Mathcad product experts will select the best submissions. The judges' decision will be final.
 - You can use any version of Mathcad for creating your worksheet
- All Mathcad worksheets must be emailed to MathcadEngage@ptc.com by Friday, April 8, 12:00 noon EDT. Please use the subject "Fly swatting with Mathcad" in your email message.

If you have any questions, leave a comment below. Good luck everyone, I look forward to receiving your beautiful worksheets!

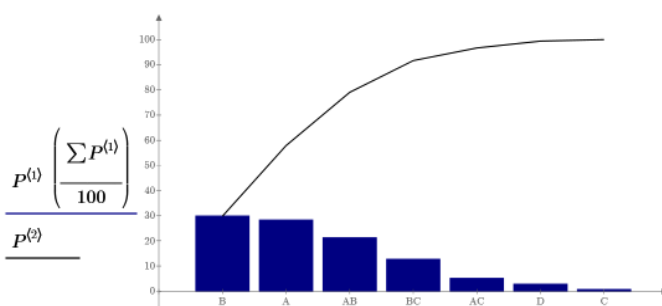
Bettina

Tags: [mathcad](#), [worksheet](#), [engineering calculations](#), [puzzle](#), [win](#), [calculation](#)

Mathcad A to Z: D is for Design of Experiments

Posted by Mona Zeflet on Mon, Mar 21, 2011 @ 12:51 PM

Design of Experiments (DOE) also known as experimental design is a method of investigation, used when there are a number of factors and variations. The DOE functions allow you to sort which among a large group of factors have the most influence on the result.



New DOE Functions

We've added 28 new Design of Experiments (DOE) functions to Mathcad 15 and Mathcad Prime 1.0. We've also added 3 new graph types including box plots, pareto plots, and effects plots.

The design of experiment (DOE) functions and plots in Mathcad can be used for constructing experimental design matrices, for analyzing and screening factors, for developing statistical models, and for performing Monte Carlo simulations.

Design Matrices

You can create design matrices, then with the DOE utility functions, analyze the properties of fractional factorial design matrices.

Factor Screening

To screen factors, you can calculate the effects or the level effects of factors, interactions, or of the design blocking. Then you can display the experimental results in a box plot, an effects plot, or a Pareto plot. An analysis of variance (ANOVA) function tests if factors are significant.

Regression Analysis

Use these functions to quickly map a multivariate polynomial regression surface or work with regression coefficients. Functions can return model parameters, an ANOVA for regression, and a detailed analysis for each run or data point used to create the multivariate polynomial regression surface.

Monte Carlo Simulation

Monte Carlo methods build up, over many iterations, the statistical behavior of a complex system made of components with unique variances.

Tags: [Design of Experiments](#), [DOE](#), [box plot](#), [regression analysis](#), [Monte Carlo simulation](#), [ANOVA](#), [design matrices](#), [factor screening](#), [Pareto plot](#), [effects plot](#)

Creating eUnits (or eBooks) for your Course (or Lab) with Mathcad

Posted by Chris Hartmann on Thu, Mar 17, 2011 @ 06:00 AM

From time to time I play around with ideas for using Mathcad as a curriculum development tool. Mathcad has and continues to have many capabilities for writing lessons, generating quizzes, and completing homework assignments. For both teachers and students Mathcad's standard mathematics notation, plotting tools, word processing capabilities, and data management with units offer a powerful toolkit for math, science, and engineering course work.

Recently I was speaking with Marc Artzrouni of the [University of Pau](#) in France. Prof. Artzrouni uses Mathcad to prepare lectures in mathematics.

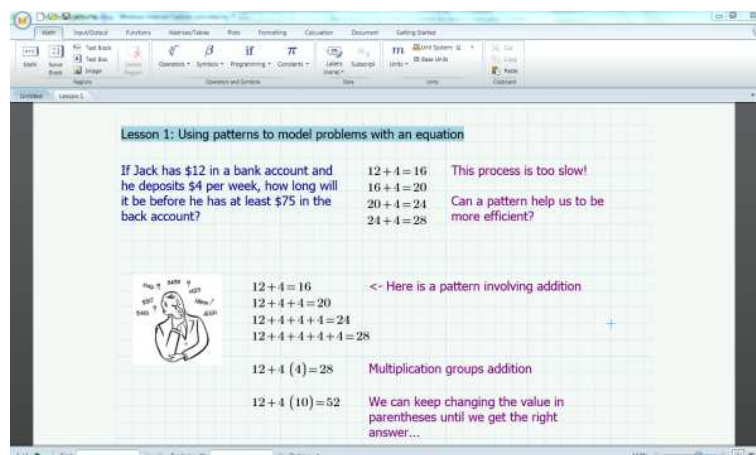
His pedagogy is interesting:

- write a complete lecture using Mathcad,
- delete key sections of the lecture to prepare note-template handouts for the students,
- deliver the lecture while the students take notes on the template.

The students at Pau are very satisfied with the value that Mathcad adds to their mathematics courses.

After speaking with Prof. Artzrouni I was thinking about ways to make this process entirely electronic – remove both the traditional textbooks and notebooks from the lecture class.

While it is possible to take notes in Mathcad 15.0 or [Mathcad Prime 1.0](#), file management would quickly become an issue. Then, it hit me! What about [Microsoft OneNote](#)?



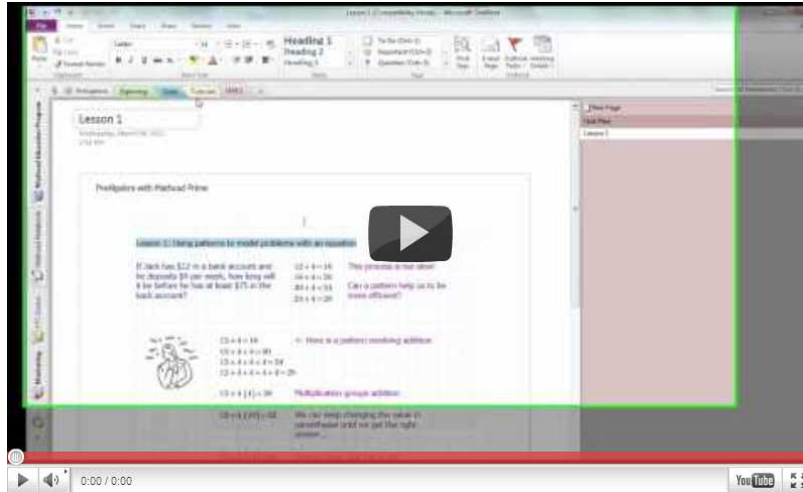
I recently upgraded to OneNote 2010 so I have been trying to leverage its tools to improve my own productivity. In doing so I discovered that it was possible to print from Mathcad directly to OneNote.

For example, if I employ Prof. Artzrouni's pedagogical strategy with Mathcad and OneNote, I could print the lecture notes directly to OneNote and distribute them electronically. If my students are working on a laptop or a tablet, then they can take notes directly onto the page using OneNote or in the original Mathcad file. Or, they can print them out and take notes with a pen.

A substantial benefit that I see in this approach is the way that OneNote organizes content like an electronic 3-ring binder. It is extremely easy to organize and manipulate notebook sections for different types of instructional materials; organize pages by content; tag pages for easy searching; or share notebooks electronically with colleagues, students, or peers. It is also extremely easy to revise pages from a unit or book from one year to the next by editing, adding, or deleting content.

A couple of days of initial trials has really sparked my interest in exploring this idea further. The teacher in me sees great possibilities in combining Mathcad's live, standard mathematics with OneNote's flexible page handling capabilities (I am quite sure the same approach would work well in documenting the work of an engineering unit or a research lab).

In order to illustrate the ease and power of this idea, I created the following video sketch. In the video I demonstrate how I might have used Mathcad Prime 1.0 and Microsoft OneNote to develop a lesson for a middle school mathematics class (my former position). If I have piqued your interest, enjoy this brief demonstration:



What do you think? If you try this idea in your work or studies, I would love to hear from you at MathcadEducation@ptc.com.

Tags: [Mathcad Prime](#), [prealgebra](#), [electronic textbooks](#), [mathematics education](#), [middle school](#), [OneNote](#)

I stumbled upon some math today...

[Posted by Bettina Giemsa on Tue, Mar 15, 2011 @ 03:20 AM](#)

... and I recently stumbled upon a blog with this very tagline -- the [Math Encounters Blog](#) by Mark Biegert.

It's full of stories of everyday math – such as "[Magic Number Analysis – 'Money Factor' in Auto Leasing](#)" or "[Designing a stairway for my cabin](#)" – and many of them involve Mathcad.

Of course, I immediately thought of pulling him into my own blogging plans. So I left a comment on his blog asking him to contact me and we arranged a phone call. The call turned out to be rather short, but not because he didn't have much to say... on the contrary, he came up with so much good storytelling, I actually had to cut him short or this blog post would have turned too long to be pleasant for the readers.

So, where to start? Of course, with Mathcad ;-)

Mark is an electrical engineer working in the telecommunications industry. He has been using Mathcad since 1993. He was then working in the defense sector, and using a different calculation software.



His project was giving him a hard time and he was struggling with his calculations until a colleague introduced him to Mathcad, which turned out to be so comfortable to use that he finally managed to successfully complete his project.

Mark tells me he has been using other software products all along in his career, but Mathcad quickly turned out to be his favorite and has stayed it ever since for its strong documentation capabilities.

He says "doing your calculations is one thing, but they are worth nothing when you can't convey your results to others. With Mathcad, I can document everything and easily print out a PDF – this is awesome."

From reading his blog, you instantly learn that he loves math. I asked him if he was good at it at school:

"I actually wasn't a good student and mathematics was my worst subject. I even failed math once. But when I was a kid we had a neighbor who came over to our house quite often to visit my father. He was a professor of electrical engineering who had a contract with NASA to analyze Earth resources from space. He had those great photographs of the Earth from space – which was really something special back in the 60s. He told me that when I wanted to achieve something in life and be able to do the same work as he was doing, I would need to be a good student. It worked!"

Mark told me that his own children are grown up now, and so he has started tutoring kids and volunteers to help them with their homework. My question then was "Do you introduce them to Mathcad, too?"

"Yes I do. One of the reasons I did not like math as a kid was because of the tedium of routine calculation. Even drawing a graph is painful by hand. I use Mathcad for everything. I speak at local schools about engineering to math and science classes, and many kids think that engineers spend all day grinding through routine calculations. I am able to show them that I never do that."

The other question I asked him was how he gets the ideas for his blog. He says he actually has drawers filled with all these stories and the blog is his way of getting it all organized – a digital file cabinet, so to speak. He says he and the guys he works with spend their breaks together -- they discuss their stories over lunch and he writes them down.

As he mentioned he has a ton of stories yet to be written down. I asked of course for one to share with us here today.

Here it is!

"As an engineer, I frequently find dimensional analysis a useful tool. [John Barrow](#) of Gresham College has put together a excellent 'Everyday Math' [lecture on dimensional analysis](#) that used Olympic rowing as an example.

Using dimensional arguments, he has argued that the speed of a coxed rowboat was proportional to the 9th root of the number of rowers, as shown by the following equation.

$$v = k \cdot n^{\frac{1}{9}}$$

where v is the velocity of the coxless rowboat, k is the constant of proportionality and n is the number of rowers.

Professor Barrow used the 1980 Olympic results as his example. I decided to use Mathcad to fit his equation to results from the 1976, 1980, and 1984 Olympic Games to verify his results for myself.

The Mathcad calculations are shown below.

Results from 1976, 1984, and 1988 Olympic Games

$$\begin{pmatrix} \text{Year} \\ \text{velocity} \\ n_{\text{Coxless}} \end{pmatrix} :=$$

Coxless Rowing Times				
Year	# of Rowers	Time (HMS)	Sec	Vel(m/s)
1976	1	07:29.0	449.0	4.45
1976	2	07:23.3	443.3	4.51
1976	4	06:37.4	397.4	5.03
1980	1	07:09.6	429.6	4.66
1980	2	06:48.0	408.0	4.90
1980	4	06:08.2	368.2	5.43
1984	1	07:00.2	420.2	4.76
1984	2	06:45.4	405.4	4.93
1984	4	06:03.5	363.5	5.50

guess values

$$\text{guess} := \begin{pmatrix} 470 \\ 0.1 \end{pmatrix}$$

Date from Database Olympics: <http://www.databaseolympics.com/index.htm>

Coxless := augment(Year, velocity) *Creating one array allows me to use vlookup to filter data.*

$$s(n, A, b) := \left(A \cdot n^b - A \cdot n^b \cdot \ln(n) \right)^T$$

$$\text{cd} := \text{genfit}(n_{\text{Coxless}}, \text{vlookup}(1976, \text{Coxless}, 1), \text{guess}, s)$$

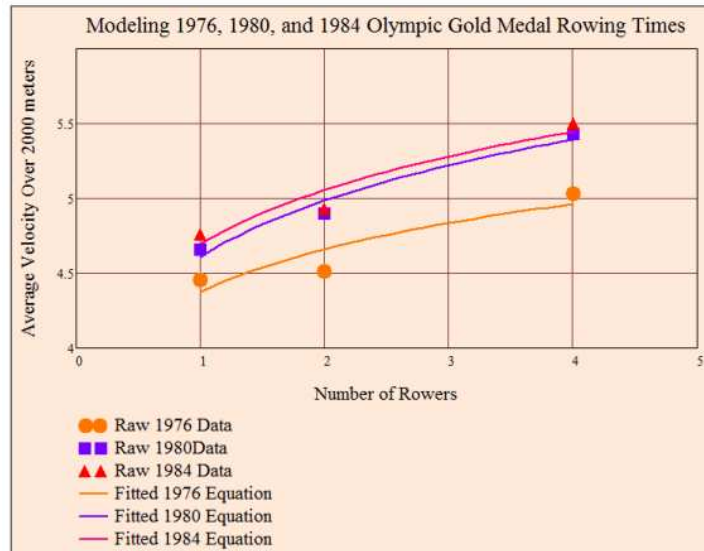
$$\text{cd} := \text{augment}(\text{cd}, \text{genfit}(n_{\text{Coxless}}, \text{vlookup}(1980, \text{Coxless}, 1), \text{guess}, s)) \quad \text{Results in columns}$$

$$\text{cd} := \text{augment}(\text{cd}, \text{genfit}(n_{\text{Coxless}}, \text{vlookup}(1984, \text{Coxless}, 1), \text{guess}, s)) \quad \text{cd} = \begin{pmatrix} 4.375 & 4.610 & 4.693 \\ 0.091 & 0.113 & 0.107 \end{pmatrix}$$

$$h(n, \text{cd}) := \text{cd}_0 n^{\text{cd}_1} \quad \text{Model function}$$

The graphical results are shown below. The 9th root curve fit comes reasonably close to the fitting the real data."

$$n := 1, 1.1..4$$



Thanks to Mark Biegert for taking the time to share "his" Mathcad story – I enjoyed working with you a lot.

To our readers: If you liked this story, let us know and leave a comment below. Also, I recommend you to take a [look at his blog](#) - this is "real math" for everyone!

Thanks!

Bettina

Tags: [math](#), [mathcad](#), [electrical engineer](#), [electrical engineering](#), [calculations](#), [equation](#), [dimensional arguments](#), [Mathcad calculation](#)

Mathcad A-Z: C is for Curve Fitting

Posted by Mona Zefel on Mon, Mar 14, 2011 @ 07:54 AM

Curve fitting means finding a mathematical function or plot curve that best fits a set of data. By doing so, you can see patterns in a data set, predict future data points, and understand the relationship between different factors.

Mathcad has a number of specialized curve-fitting functions.

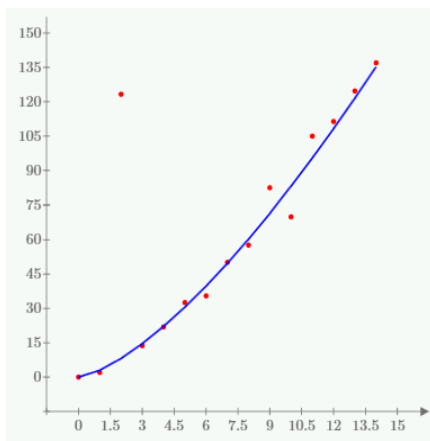
A least squares fit is the method most commonly used to find the line that best fits a set of data. "Least squares" refers to the sum of the squares of the distances from the individual data points to the line itself. A least squares fit finds the smallest possible sum, or closest fit.

Mathcad has three built-in functions to fit data to a line: line, slope, and intercept.

Beyond that Mathcad has many built-in curve fitting functions for the most common model functions: exponential, logistic, logarithmic, sinusoidal, and power.

In addition, you can use one of the generalized curve fitting functions to specify your own model function.

Further, you can analyze your data to evaluate the quality of the fit, using other data analysis functions. The goal of all the curve fitting functions is to enable you to best understand your data and to control factors that influence the data.



Tags: [Mathcad](#), [Mathcad Prime](#), [curve fitting](#), [least squares fit](#), [data analysis](#)

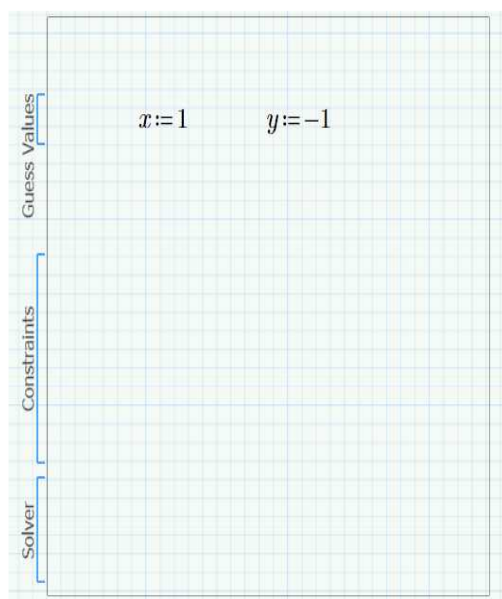
Solving Systems of Equations through Mathcad Solve Blocks, part 2

Posted by Mona Zefel on Fri, Mar 11, 2011 @ 02:08 PM

Sometimes solve blocks cannot find a solution. Read on to see how to resolve some issues.

Errors and Problems with No Solutions

Sometimes there might be no solution, or Mathcad might not find a solution. In either case, Find displays the error message "No solution was found."



The problem asks for numbers u and v that add to both 2 and 3, which is impossible.

Find also returns an error message if there is a solution, but the solver cannot find it. One example is

Guess Values	$u := 1 \quad v := 1$
Constraints	$u + v = 2$ $u + v = 3$
Solver	$\text{Find}(u, v) = ?$

The problem here is that the only solutions to the given equation are complex numbers. (Graph the two expressions above, and you'll see the curves do not intersect.) The real guess value of $z := 1$ sets the solver off in the wrong direction. In this case, just as with the root function, trying a complex guess may help.

Guess Values	$z := 1$
Constraints	$\sin(z) = z^2 + 1$
Solver	$\text{Find}(z) = ?$

Find also returns an error if there are any missing guess values.

Guess Values	$z := 1 + 1i$
Constraints	$\sin(z) = z^2 + 1$
Solver	$\text{Find}(z) = 0.488 + 0.785i$

Try solving again by adding a guess value for p .

Guess Values	
--------------	--

Find also returns an error if any of the functions in the solve block is undefined at a guess value:

$x := -3$ $y := 4$
 $\Gamma(x) = y + 1$
 $x + y = 7$
 $\text{Find}(x, y) = ?$

To find the source of the error, click the region with the error and select Previous or First in the Error Tracing group from the Calculation tab. The cursor lands on the Gamma function, telling you that this is where the error occurs. The Gamma function is undefined at the value $x = -3$.

$\Gamma(-3) = ?$

Changing the value of x solves the problem.

Complex Solutions

Solve blocks sometimes return complex solutions even when the guess values are real.

$u := 1$ $v := 2$
 $|u| = 2$ $\frac{\sin(v)}{v \cdot 1i} = \frac{\cos(u)}{u}$
 $\begin{bmatrix} us \\ vs \end{bmatrix} := \text{Find}(u, v)$

$us = 1.82 + 0.829i$ $vs = 2.156 + 0.641i$
 $|us| = 2$

Try changing the guess values for this solve block from real to complex and to different values to see how the results change.

When solve blocks begin solving a problem, they evaluate the constraints at the guess values as a check to see if the problem is real or complex. If the values of the constraints are complex at the guesses, the solve block can produce complex solutions even if the guess values themselves are real.

In other cases, where the constraints are only complex over a portion of their domain, you might be surprised by a complex result. This can occur if the solver, in the course of calculating its iterations, wanders into a complex region of solutions as it refines the guesses into solutions. Check the constraints in the regions of the guess value if you get real answers when you expect complex ones, or vice versa.

A future article will discuss using built-in constants TOL and CTOL to help resolve solve block issues when the tolerance needs to be adjusted.

Visit the [Mathcad Community](#) website for the Mathcad Prime 1.0 and Mathcad 15 worksheets.

Tags: [Mathcad Prime](#), [Mathcad 15](#), [solving systems of equations](#), [solve blocks](#)

How to Solve Systems of Equations through Solve Blocks in Mathcad

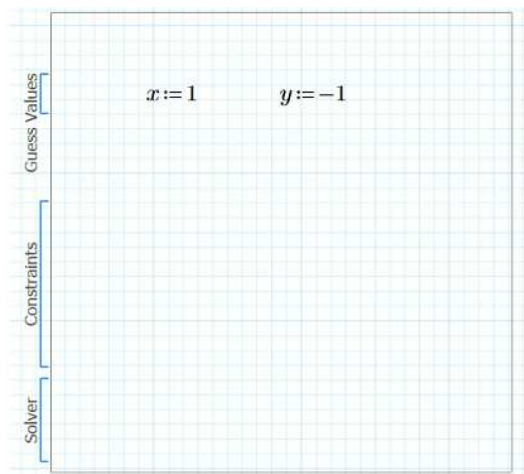
Posted by Mona Zefel on Tue, Mar 08, 2011 @ 04:59 PM

Solve blocks are a Mathcad construct that lets you solve any number of equations and unknown variables.

The function Find returns a solution to a system of equations given by a solve block. You can use Find to solve a linear system or nonlinear systems.

How to Use Mathcad Prime Solve Blocks

1. Insert a Solve Block from the Math tab and add two guess values.



Note that the Guess Values label moves to bracket that section. The algorithm for Find starts at these values and moves toward a solution.

The solve block box allows you to reposition the solve block on the page, without worrying about losing any of the pieces. Definitions inside the solve block are local to the solve block.

2. Next add your constraints. You must have the same number of constraints as variables you are solving. You do not need the word Given, unlike earlier versions of Mathcad.
3. For the equals sign, use the Boolean Equals operator, Ctrl+=

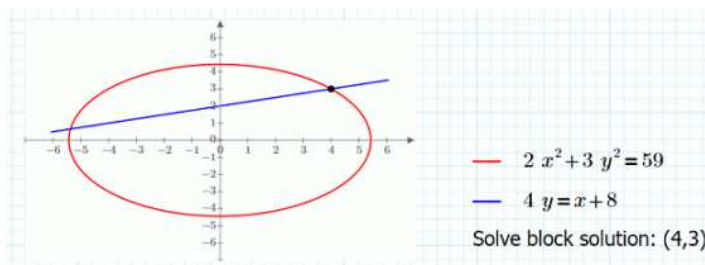
Note: The entries of the solution vector correspond to the variables in the same order that the variables appear after Find. Type in Find(y, x) to return the entries in reverse order.

Evaluate the left-hand sides of the system with the found results to confirm that the solution is correct.

Multiple Solutions

Take a look at the solve block below.

The first equation represents an ellipse, while the second represents a straight line. These are plotted below, along with the solution point.



As the graph shows, the solution corresponds to the point in the first quadrant where the curve and the line intersect. However, there is another solution to the system, corresponding to the point of intersection in the second quadrant. How can you get Find to return this second solution?

Change the Guess Value

Changing the guess values reveals other solutions. Keep in mind that the result returned by the function Find (as well as by the functions Minerr, Minimize, and Maximize) is directly related to the guess values for the unknown variables, and at most one solution is returned for a given set of guess values.

So changing the guess values might lead to a different solution.

Looking at the graph above, you can see that the second solution lies in the second quadrant. So it seems reasonable to try guess values corresponding to a point - the guess point - that also lies in the second quadrant. Try the guess point (-3, 3).

Guess Values	$x := -3 \quad y := 3$
Constraints	$2 \cdot x^2 + 3 \cdot y^2 = 59$ $4 \cdot y = x + 8$
Solver	$\text{Find}(x, y) = \begin{bmatrix} -5.371 \\ 0.657 \end{bmatrix}$

This time Find returns the second solution.

Usually, if you choose a guess point close to a solution, Find returns that solution. However, as with the root function, Find does not always return the solution that is closest to the given guess point.

You can see the relationship between guess points and their corresponding solutions graphically by defining a function that takes a guess point to the resulting solution.

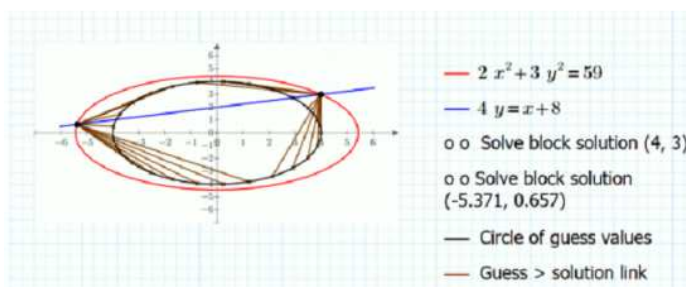
Guess Values	
Constraints	$2 \cdot x^2 + 3 \cdot y^2 = 59$ $4 \cdot y = x + 8$
Solver	$Pt(x, y) := \text{Find}(x, y)$

For any guess point (x, y), the function Pt(x,y) returns one of the two solutions. For example:

$$Pt(-3, 3) = \begin{bmatrix} -5.371 \\ 0.657 \end{bmatrix}$$

Now, see what happens when you apply the Pt function to 25 guess points, equally spaced on a circle of radius 4 with center at the origin. Draw a line from each guess point to the solution produced by the Pt function for that guess. The resulting plot is quite interesting.

$R := 4$	$N := 25$
$i := 0 .. N - 1$	
$\begin{bmatrix} X_{0,i} \\ Y_{0,i} \end{bmatrix} := R \cdot \begin{bmatrix} \cos\left(i \cdot \frac{2 \cdot \pi}{N}\right) \\ \sin\left(i \cdot \frac{2 \cdot \pi}{N}\right) \end{bmatrix}$	$\begin{bmatrix} X_{1,i} \\ Y_{1,i} \end{bmatrix} := Pt(X_{0,i}, Y_{0,i})$



Notice that most guess points in the right half-plane ($x > 0$) lead to the solution (4,3). However, some points in the right half-plane lead to the solution (-3.71, 0.657). Try changing R to 6 in the example above to see what happens when the guess points lie on a circle of radius 6.

Find uses the Levenberg-Marquardt method, a very stable routine that is tolerant of poor guesses.

What these examples show is that choosing guess values is actually a guessing game. A picture can help you identify the guess points that return the solutions you are looking for.

There's lots more to learn about solve blocks, but this should get you going. Part two of this article will discuss what to do when the solve block does not find a solution.

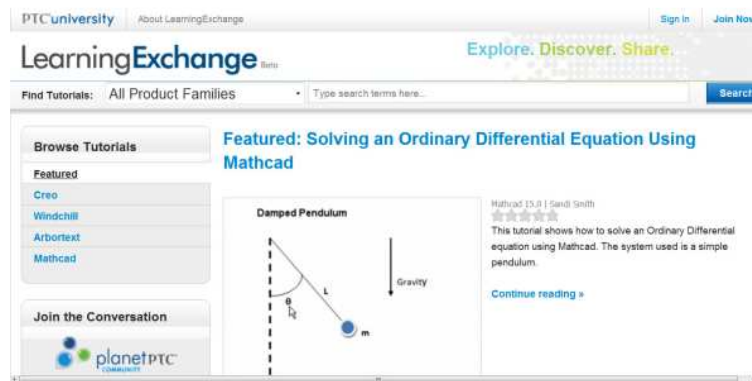
>> Visit the [Mathcad Community](#) website for the Mathcad Prime 1.0 and Mathcad 15 worksheets.

Tags: [Mathcad](#), [Solving](#), [solve block](#), [algebra](#), [Mathcad Prime](#), [Mathcad 15](#), [multiple unknowns](#), [guess values](#), [constraints](#), [find function](#), [solving systems of equations](#)

A Quick Introduction to PTC's new LearningExchange

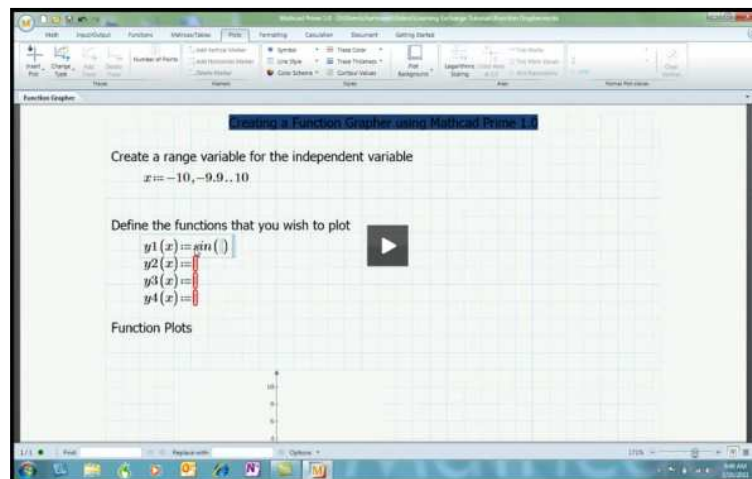
Posted by Chris Hartmann on Tue, Mar 08, 2011 @ 08:00 AM

A simple call to action welcomes users to PTC University's exciting new LearningExchange (<http://LearningExchange.PTC.com>): Explore, Discover, Share.



Explore

Learning Exchange (LEX) is a searchable database of quick tips and tricks videos featuring PTC's flagship products Creo Elements|Pro, Windchill, Arbortext, and Mathcad. For Mathcad users who are familiar with PTC's online training courses and integrated product tutorials, LearningExchange offers something new. It will be a collection of Just-in-Case and Just-in-Time tutorials designed to remind users of best practice engineering or showcase a new idea for using PTC's products.



A Just-in-Case Demo: [Creating a Simple Function Plotter using Mathcad Prime 1.0](#)

Discover

Longstanding Mathcad users may be unfamiliar with PTC products like Arbortext. Other Mathcad devotees may wonder why their colleagues in MCAD are so excited about Creo Elements Pro. LearningExchange provides an easy portal to keep pace with PTC's suite of innovative product development solutions. I encourage you to visit LearningExchange both to discover new ways of using Mathcad and new approaches to product development that combine Mathcad's capabilities with Creo, Windchill and Arbortext.

Featured: 60 Seconds on Sketcher



Creo Elements/Pro 5.0 | Steve Meyers



A few ideas to make your sketching more productive.

[Continue reading »](#)

Got a Minute? [Discover Creo's 2D Sketcher](#)

Share

Working at PTC, I am always reminded of the importance of professional community in a successful product development company. I see LearningExchange as a water cooler space for engineers and other Mathcad users -- here is a space to keep up with the latest tidbits and to recall past accomplishments. As LearningExchange grows it will serve two roles simultaneously -- suggesting new approaches and documenting best practices. I hope that a rich dialogue will arise around the Mathcad demos as users explore, discover and share the rich resources available to them on LearningExchange.

Once you have had a chance to check it out, let us know what you think. And, please don't hesitate to suggest topics you would like to see on PTC University's Learning Exchange (<http://LEX.PTC.com>).

Tags: [PTC](#), [collaboration](#), [education](#), [mathcad](#), [LearningExchange](#), [PTC University](#)

[All Posts](#)

[Next Page](#)

© 2011 Parametric Technology Corporation

[Copyright](#) © 2010, Parametric Technology Corporation

- [Legal Policies & Agreements](#)
- [Find a Reseller](#)
- [Contact PTC](#)