

Mathcad Prime 3.0

Curriculum Guide



Live Classroom Curriculum Guide

- Mathcad Prime 3.0 Essentials



Mathcad Prime 3.0 Essentials

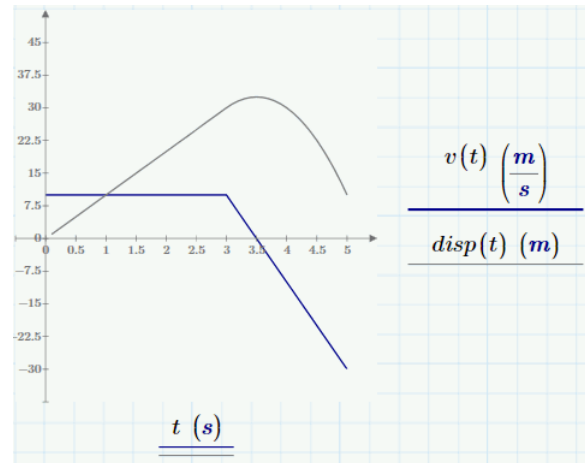
Overview

Course Code TRN-4010-T

Course Length 2 Days

In this course, you will learn the basics of Mathcad Prime. You will learn about Mathcad Prime's extensive functionality, such as opening and working with Mathcad files, navigating workspaces, defining variables and expressions, and solving equations. In addition, you will learn how to plot graphs, solve for roots, and manipulate data.

At the end of each module, you will complete a set of review questions to reinforce critical topics from that module. At the end of the course, you will complete a course assessment in Pro/FICIENCY intended to evaluate your understanding of the course as a whole.



Course Objectives

- Open and save Mathcad files
- Navigate the Mathcad workspace
- Develop Mathcad templates
- Identify and format math and text regions
- Develop and edit math expressions
- Define, evaluate, and use variables
- Assign an expression retroactively
- Define and evaluate user-defined and built-in functions
- Define, evaluate, and use range variables
- Use units in calculations
- Plot 2-D and 3-D graphs
- Solve for the roots of a function with a single independent variable
- Symbolically solve equations
- Numerically solve a system of linear and nonlinear equations
- Solve unconstrained and constrained optimization problems
- Solve ordinary differential equations
- Create a program within the Mathcad worksheet using Mathcad's programming features
- Import and export data
- Smooth, interpolate, and regress data

$$v(t) := 10 \cdot \frac{m}{s} + \left(-20 \cdot \frac{m}{s^2}\right) \cdot (t - 3 \cdot s) \cdot (t > 3 \cdot s)$$

Prerequisites

- None

Audience

- This class is intended for novice and intermediate Mathcad users. People in related roles will also benefit from taking this course.
-

Agenda

Day 1

Module	1	Getting Started
Module	2	Documenting and Formatting
Module	3	Entering and Editing Math
Module	4	Variables
Module	5	Functions
Module	6	Range Variables
Module	7	Controlling Calculations
Module	8	Vectors and Matrices
Module	9	Units
Module	10	2-D Plotting
Module	11	Project – Day 1

Day 2

Module	12	3-D Plotting
Module	13	Boolean Conditions
Module	14	Symbolics
Module	15	Solving
Module	16	Optimization
Module	17	Differential Equations
Module	18	Programming
Module	19	Data Exchange
Module	20	Data Analysis
Module	21	Project – Day 2

Course Content

Module 1. Getting Started

- i. Opening Mathcad
- ii. The Mathcad Workspace
- iii. Mathcad Worksheets
- iv. Saving Mathcad Files

Knowledge Check Questions

Module 2. Documenting and Formatting

- i. Text Regions
- ii. Embedding Math in a Text Region
- iii. Options for Formatting Worksheets
- iv. Understanding Mathcad Templates

Knowledge Check Questions

Module 3. Entering and Editing Math

- i. Using Operators
- ii. Entering and Evaluating a Mathematical Expression
- iii. Formatting Math Regions
- iv. Formatting Mathematical Results
- v. Implied Multiplication

Knowledge Check Questions

Module 4. Variables

- i. Defining a Variable
- ii. Numerically Evaluating a Variable
- iii. Defining a Global Variable
- iv. Assigning an Expression Retroactively
- v. Using Literal Subscripts

Knowledge Check Questions

Module 5. Functions

- i. Defining a User-Defined Function
- ii. Inserting a Built-In Function
- iii. Design of Experiments Functions
- iv. Using Deprecated Functions

Knowledge Check Questions

Module 6. Range Variables

- i. Defining a Range Variable
- ii. Using a Range Variable

Knowledge Check Questions

Module 7. Controlling Calculations

- i. Controlling Calculations
- ii. Using Calculation Options
- iii. Using Areas

Knowledge Check Questions

Module 8. Vectors and Matrices

- i. Vectors and Matrices
- ii. Defining Vectors and Matrices
- iii. Extracting Elements from an Array
- iv. Nested Arrays
- v. Using Array Operators and Functions

Knowledge Check Questions

Module 9. Units

- i. Selecting a Unit System
- ii. Using Units
- iii. Adding Units to Arrays and Range Variables
- iv. Using Angular Units
- v. Using Temperature Units

Knowledge Check Questions

Module 10. 2-D Plotting

- i. Plotting Data in 2-D
- ii. Plotting Functions in 2-D
- iii. 2-D Plot Formatting
- iv. 2-D Trace Formatting
- v. 2-D Axes Formatting
- vi. Using Units with 2-D Plots

Knowledge Check Questions

Module 11. Project – Day 1

- i. Structural Engineering Project – Day 1
- ii. Mechanical Engineering Project – Day 1

Module 12. 3-D Plotting

- i. Plotting Functions in 3-D
- ii. Formatting a 3-D Plot
- iii. Plotting Data in 3-D
- iv. Plotting Multiple Traces

Knowledge Check Questions

Module 13. Boolean Conditions

- i. Using Boolean Operators
 - ii. Writing Equations Using Boolean Operators
-

- iii. Creating Conditional Statements
- iv. Using Piecewise Continuous Functions

Knowledge Check Questions

Module 14. Symbolics

- i. Symbolics
- ii. Symbolic Calculation
- iii. Symbolic Algebra

Knowledge Check Questions

Module 15. Solving

- i. Solving for Roots of Equations
- ii. Numerically Solving Systems of Linear Equations
- iii. Numerically Solving Systems of Nonlinear Equations
- iv. Symbolically Solving Systems of Equations
- v. Modifying the Convergence and Constraint Tolerance

Knowledge Check Questions

Module 16. Optimization

- i. Constrained Optimization
- ii. Unconstrained Optimization

Knowledge Check Questions

Module 17. Differential Equations

- i. Ordinary Differential Equations

Knowledge Check Questions

Module 18. Programming

- i. Creating a Program
- ii. Conditional Statements
- iii. Looping Constructs

Knowledge Check Questions

Module 19. Data Exchange

- i. Importing Data
- ii. Exporting Data
- iii. Using the Excel Component

Knowledge Check Questions

Module 20. Data Analysis

- i. Data Analysis
- ii. Smoothing Data
- iii. Interpolating Data
- iv. Regressing Data

Knowledge Check Questions

Module 21. Project – Day 2

- i. Structural Engineering Project – Day 2
 - ii. Mechanical Engineering Project – Day 2
-

Web Based Curriculum Guide

- Mathcad Prime 3.0 - Application Orientation
 - Mathcad Prime 3.0 - Working With Units
 - Mathcad Prime 3.0 – Plotting
 - Mathcad Prime 3.0 - Symbolics and Solving
 - Mathcad Prime 3.0 - Programming Mathematical Expressions
 - Mathcad Prime 3.0 - Data Exchange and Analysis
 - Design of Experiments Using Mathcad Prime 3.0
 - Mathcad Prime 3.0 Integration with Creo Parametric 2.0
-

Mathcad Prime 3.0 - Application Orientation

Overview

Course Code WBT-4010-A

Course Length 7 Pours

$$a = b = 2 \cdot \sqrt{10}$$

$$\theta = 30 \cdot deg = 0.524 \cdot rad$$

In this course, you will learn the essentials of Mathcad Prime and understand how it reinforces Mathcad Prime's extensive functionality using clear, straightforward instruction and examples. This course will familiarize you with many of Mathcad Prime's critical features to ensure immediate application of the product.

You will complete Pro/FICIENCY skills assessment questions for each topic. These questions are used to help reinforce your understanding of the course topics.

Course Objectives

- Open and save Mathcad files
- Navigate the Mathcad workspace
- Identify and format math and text regions
- Develop and edit math expressions
- Define, evaluate, and use variables
- Assign an expression retroactively
- Define and evaluate user-defined and built-in functions
- Define, evaluate, and use range variables
- Define and use vectors and matrices

$$CP := \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Prerequisites

- None

Audience

- This class is intended for the novice or intermediate user of Mathcad.

Table of Contents

Module	1	Getting Started
Module	2	Documenting and Formatting
Module	3	Entering and Editing Math
Module	4	Variables
Module	5	Functions
Module	6	Range Variables
Module	7	Controlling Calculations
Module	8	Vectors and Matrices
Module	9	Boolean Conditions
Module	10	Differential Equations

Mathcad Prime 3.0 - Working With Units

Overview

Course Code WBT-4010-B

Course Length 1 Hour

$mass := 40 \cdot kg$

In this course, you will learn the essentials of working with units using Mathcad Prime. You will understand how it reinforces Mathcad Prime's units functionality using clear, straightforward instruction and examples.

At the end of the course, you will complete a course assessment in Pro/FICIENCY intended to evaluate your understanding of the course as a whole.

Course Objectives

- Use units in calculations

$10 \text{ } ^\circ F - 10 \text{ } \Delta^\circ F = 0 \text{ } ^\circ F$

Prerequisites

- WBT-4010-A Mathcad Prime 3.0 – Application Orientation

Audience

- This class is intended for the novice or intermediate user of Mathcad.

Table of Contents

Module 1 Units

Mathcad Prime 3.0 - Plotting

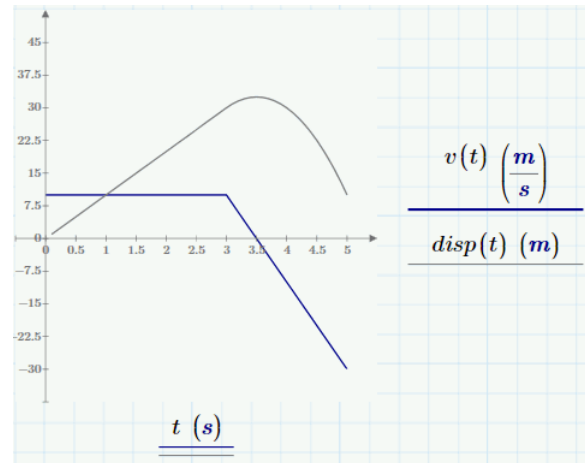
Overview

Course Code WBT-4010-C

Course Length 2 Hours

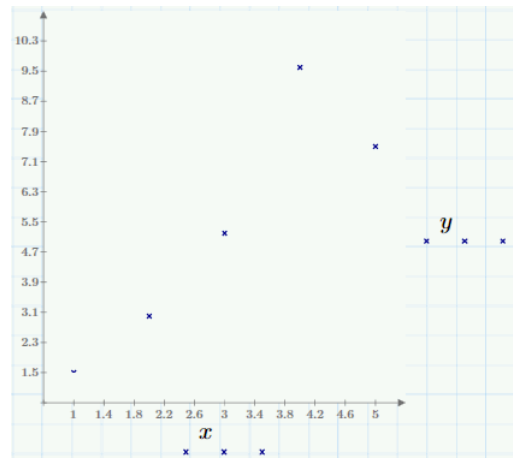
In this course, you will learn the essentials of 2-D and 3-D plotting using Mathcad Prime. You will understand how it reinforces Mathcad Prime's plotting functionality using clear, straightforward instruction and examples.

You will complete Pro/FICIENCY skills assessment questions for each topic. These questions are used to help reinforce your understanding of the course topics.



Course Objectives

- Plot 2-D and 3-D graphs
- Format 2-D and 3-D graphs



Prerequisites

- Mathcad Prime 3.0 – Application Orientation

Audience

- This course is intended for the novice or intermediate Mathcad user.

Table of Contents

Module	1	2-D Plotting
Module	2	3-D Plotting

Mathcad Prime 3.0 - Symbolics and Solving

Overview

Course Code	WBT-4010-D
Course Length	2 Pours

$$\begin{bmatrix} x - \pi \cdot y = a \\ 2 \cdot x + \sin(B) \cdot y = b \end{bmatrix} \xrightarrow{\text{solve}, x, y} \begin{bmatrix} \frac{\pi \cdot b + a \cdot \sin(B)}{2 \cdot \pi + \sin(B)} & \frac{b - 2 \cdot a}{2 \cdot \pi + \sin(B)} \end{bmatrix}$$

In this course, you will be introduced to the essentials of symbolics and solving equations using Mathcad Prime. You will understand how it reinforces Mathcad Prime’s symbolics and solving functionality using clear, straightforward instruction and examples.

You will complete Pro/FICIENCY skills assessment questions for each topic. These questions are used to help reinforce your understanding of the course topics.

Course Objectives

- Solve for the roots of a function with a single independent variable
- Numerically and symbolically solve a system of linear and nonlinear equations
- Solve unconstrained and constrained optimization problems
- Solve ordinary differential equations

The screenshot shows a Mathcad Prime solver block. On the left, there are three labels: 'Guess Values', 'Constraints', and 'Solver'. The 'Guess Values' section contains two equations: $a := 1$ and $b := 1$. The 'Constraints' section contains the matrix equation $M \cdot \begin{bmatrix} a \\ b \end{bmatrix} = v$. The 'Solver' section contains the command $\begin{bmatrix} a \\ b \end{bmatrix} := \text{find}(a, b)$.

Prerequisites

- Mathcad Prime 3.0 – Application Orientation

Audience

- This course is intended for the novice or intermediate Mathcad user.

Table of Contents

Module	1	Symbolics
--------	---	-----------

Module	2	Solving
--------	---	---------

Mathcad Prime 3.0 - Programming Mathematical Expressions

Overview

Course Code WBT-4010-E

Course Length 1 Hour

In this course, you will learn the essentials of programming using Mathcad Prime. You will understand how it reinforces Mathcad Prime's units functionality using clear, straightforward instruction and examples.

You will complete Pro/FICIENCY skills assessment questions for each topic. These questions are used to help reinforce your understanding of the course topics.

```

Newton(x, tol) :=
  r ← x/2
  rnew ← r + x/(2*r)
  while |rnew - r| > tol
    r ← rnew
    rnew ← r + x/(2*r)

```

Course Objectives

- Create a program within the Mathcad worksheet using Mathcad's programming features

```

IsOdd(x) :=
  if |mod(x, 2) = 1|
    word ← "True"
  else
    word ← "False"

```

Prerequisites

- Mathcad Prime 3.0 – Application Orientation

Audience

- This course is intended for the novice or intermediate Mathcad user.

Table of Contents

Module 1 Programming

Mathcad Prime 3.0 - Data Exchange and Analysis

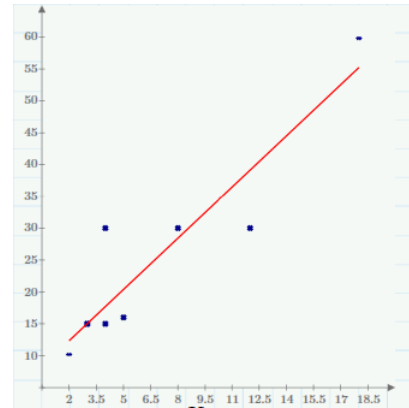
Overview

Course Code WBT-4010-F

Course Length 2 Hours

In this course, you will learn the essentials of importing and exporting data and data analysis using Mathcad Prime. You will understand how it reinforces Mathcad Prime's data exchange and analysis functionality using clear, straightforward instruction and examples.

You will complete Pro/FICIENCY skills assessment questions for each topic. These questions are used to help reinforce your understanding of the course topics.



Course Objectives

- Import and export data
- Smooth, interpolate, and regress data

```
EX:=READEXCEL("..\student\MC Prime Data Files\datastep_07.xlsx", "datastep!A1:B4")
```

$$EX = \begin{bmatrix} -10 & 7.04 \\ -9 & 19.78 \\ -8 & 43.39 \\ -7 & 45.55 \end{bmatrix}$$

Prerequisites

- Mathcad Prime 3.0 – Application Orientation
- Mathcad Prime 3.0 – Plotting

Audience

- This course is intended for the novice or intermediate Mathcad user.

Table of Contents

Module	1	Data Exchange
--------	---	---------------

Module	2	Data Analysis
--------	---	---------------

Design of Experiments Using Mathcad Prime 3.0

Overview

Course Code WBT-4011-0

Course Length 2 Hours

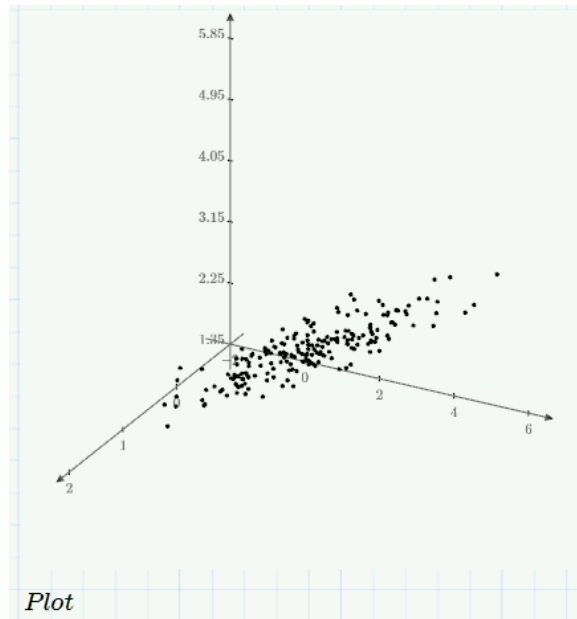
In this course, you will learn how to use several design functions found within Mathcad. This course is designed for users who want to use Mathcad to analyze data resulting from experiments designed to understand the relationship between input variables and response variables in a system or process.

You will complete Pro/FICIENCY skills assessment questions for this course. These questions are used to help reinforce your understanding of the course topics and form the basis for daily review sessions.

$$Real := \begin{bmatrix} "Run" & "Block" & "A" & "B" \\ 1 & 1 & 10 & "high" \\ 2 & 1 & 20 & "low" \\ 3 & 2 & 10 & "low" \\ 4 & 2 & 20 & "high" \end{bmatrix}$$

Course Objectives

- Understand the basics of experimental design
- Create design matrices
- Create screen factors
- Perform a regression analysis
- Perform a Monte Carlo simulation



Prerequisites

- Mathcad Prime 3.0 Essentials

Audience

- This course is intended for intermediate or advanced users of Mathcad.

Table of Contents

Module	1	Design of Experiments
--------	---	-----------------------

Mathcad Prime 3.0 Integration with Creo Parametric 2.0

Overview

Course Code WBT-4012-0

Course Length 2 Hours

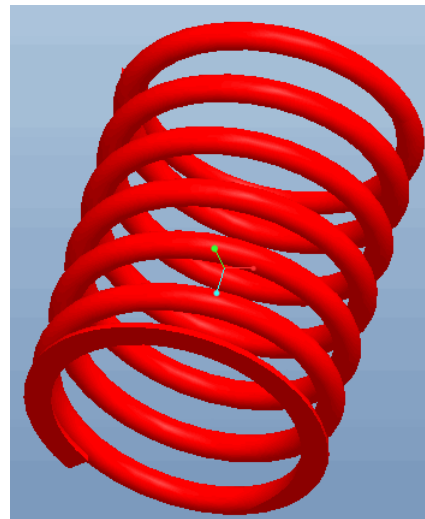
In this course, you will learn how to use Mathcad Prime and Creo Parametric in conjunction with one another. This course is designed for users who are already familiar with both Mathcad Prime and Creo Parametric.

You will complete Pro/FICIENCY skills assessment questions for each topic. These questions are used to help reinforce your understanding of the course topics.

Number of Active Coils:	$N_c := 1$
Diameter of the wire:	$d_w := 1 \cdot \text{mm} = 0.039 \text{ in}$
Force on the spring:	$F := 1 \cdot N = 0.225 \text{ lbf}$
Coil diameter:	$D_c := 10 \cdot \text{mm}$
Shear modulus:	$G := 77.2 \cdot \text{GPa} = (1.12 \cdot 10^7) \text{ psi}$

Course Objectives

- Understand license and software requirements
- Map variables in Mathcad Prime to receive information from Creo Parametric
- Map variables in Mathcad Prime to return information to Creo Parametric
- Perform a Mathcad analysis in Creo Parametric



Prerequisites

- Mathcad Prime 3.0 Essentials or equivalent experience
- Introduction to Creo Parametric or equivalent experience

Audience

- This course is intended for design engineers and mechanical designers. People in related roles will also benefit from taking this course.

Table of Contents

Module	1	Mathcad Prime Integration with Creo Parametric
--------	---	--
