MathCAD Quick Start Guide: v a.0.1

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Crosshair Cursor:

By clicking anywhere on a blank portion of the document, a red crosshair cursor will appear. If you then proceed to type, MathCAD will enter into either formula editing mode, or text mode. The default mode will be formula editing mode. In this mode you can perform **Assignment of Constants** and **Assignment of Functions**. To enter **Text Mode**, type some letter, say "a" and then hit the space bar.

Text Mode: (")

In MathCAD, you can type text as well as formulas. There are two ways to enter into text mode. First, one may use the hot-key to enter the text-mode by typing ("). Or, one may just type some letter, say "a" and then hit the space bar. Once text mode has been entered, you may do normal text editing functions inside the text box which appears.

Editing a Text Box:

1) Activate the text box
   a) by clicking inside the text area.
   b) clicking and dragging a box arround the text area
2) Move the cursor with the mouse or arrow keys to navigate to the place that you want to edit, and then edit like normal
3) HINT: like all decent text editors:
   CTRL+ARROW: skips over words
   CTRL+SHIFT+ARROW: highlights words

Moving a Text Box:

1) Activate the text box
2) Move the cursor to the outline of the text area until the cursor turns into a hand.
3) Click, and then drag the text area to the location that you desire
4) ***WARNING***, before moving large groups of text save your document. MathCAD has a habit of crashing when large groups of text and/or formulas are moved

Moving Up and Down:

1) To move a text box down (i.e. place more blank space above it) simply place the crosshair above the text box and hit "enter".
2) To move a text box up (i.e. delete more blank space above it) simply place the crosshair above the text box and hit "backspace".

Copying a Text Box:

1) Activate the text box
2) Press CTRL+C (no need to highlight the text)
3) Click on the page where you want the copy to appear,
4) Press CTRL+V

Resizing the Text Box:

1) Activate the text box
2) Click on the lower right black square in the text box
3) Drag that square to re-size the text box to make it the desired size.

Constants:

To assign a value to a constant, simply put the cursor where you want the assignment statement to appear, type the constant name, and then ":". The value of the constant may then be displayed by typing the variable name and then " = ".

Assignment of Constants: (:)
Example: assignment of the value "5" to the variable "a": **(a : 5 <ENTER>)**

$a := 5$

Displaying Constant's value: (=)
Example: reading the value of a constant "a": **(a = <ENTER>)**

$a = 5$

Functions:

Functions are used when you want an expression to accept some parameter, perform some mathematical operation, and then output the result. These functions may be then later included in other functions.

Assignment of Functions: (:)
Example: assigning the function "f" to some expression f(x): **(f(x) : 2*x-a <ENTER>)**

$f(x) := 2 \cdot x - a$

notes:
1) Everything which is not predefined MUST be in the parameter list. The parameter list is the list of *variables* between the parentheses.
2) We have already defined the *constant* "a" above, and thus the value of "a" will be automatically substituted into this expression.
3) The *variable* "x" is not defined above, and thus it must appear in the parameter list.
4) As the numeral "2" is defined by MathCAD itself, you do not need to define it or other special constants, such as "π", "e", etc...
5) If you fail to define all unknowns either in the paramiter list as *variables* or in the preceeding sections as *constants*, then MathCAD will give you an error message saying "this variable or function not defined above"

Example: assigning the function "g" as some function of "f": **(g(x) : 2*f(x)+ 4 <ENTER>)**

$g(x) := 2 \cdot f(x) + 4$

Displaying Functions' value: (=)
Example: Returning the value of a function "f" when "x=2": **(f(2) = <ENTER>)**

$f(2) = -1$

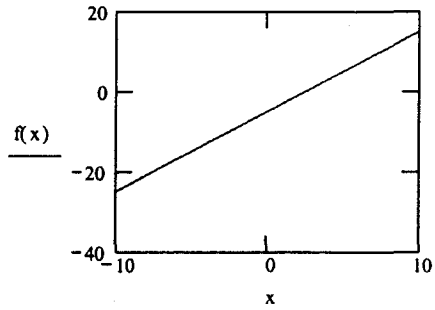
$g(2) = 2$

Annother function Example: (no real meaning, just for illustration purposes only)

$$w(x) := 2 \quad h(x) := 2 \cdot x^2 \quad I(x) := \frac{1}{12} \cdot w(x) \cdot h(x) \quad SomeFunction(x, y) := I(x) \cdot h(y) \cdot \int_0^x h(\xi) \cdot w(\xi) \, d\xi$$

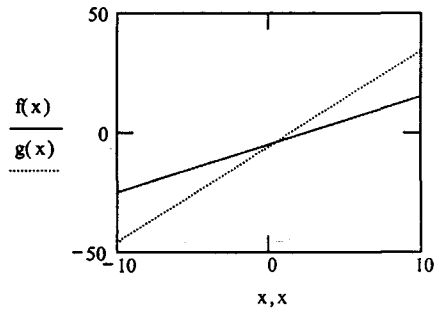
Graphing:

Graphing a Function: (SHIFT+2)
Example: Graphing the function "f": **(@ <TAB> f(x) <ENTER>)**

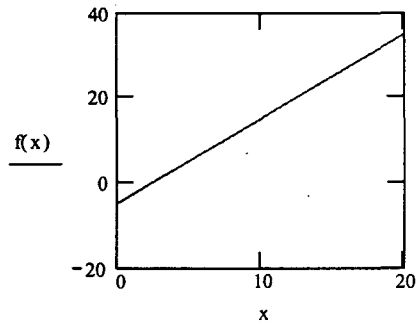


notes:
1) By pressing <TAB>, you skip defining the domain variable. When you skip defining the domain variable, MathCAD automatically fills in the variable at the bottom of the graph as the variable in the function's parameter list that you are graphing.
2) When you do not define the domain, then MathCAD automatically sets the domain to be "x ε {-10, 10}"
   a) You can later define the domain to be different than the default.

Example: Graphing Multiple functions, "f" & "g": **(@ <TAB> f(x),g(x) <ENTER>)**



Example: Defining a Domain while Graphing:
(@ x SHIFT+<TAB> 0 <TAB> 20 <TAB> f(x) <ENTER>)



notes:
1) You can manually assign the range of the graph by tabbing over to the appropriate fields.
2) Although they are often faster, you do not need to use the keyboard shortcuts. After activating the plot, you may position the mouse over the black squares and fill in the values of the specific fields
3) You can resize the graph in the same way as a text-box by clicking and dragging on the black square in the lower right of the plot after activating the plot.

Expression Navigation:

Expression navigation may be somewhat tricky at first, but after some use you will get use to it. It is actually quite straight-forward.

If you type up the following expressions, you will begin to see how to navigate formulas.
1) The key is to always look at the blue underline.
2) Whatever the blue underline is under, the next mathematical operation will be performed on that group.
3) By pressing the space bar, you can enarge the scope on which the operation will be performed

$f(x) := 2 \cdot x^2$ **(f(x) : 2 * x ^ 2 <ENTER>)**

$f(x) := 2 \cdot x^{\frac{2}{3}}$ **(f(x) : 2 * x ^ 2 / 3 <ENTER>)**

$f(x) := 2 \cdot \frac{x^2}{3}$ **(f(x) : 2 * x ^ 2 <SPACE> / 3 <ENTER>)**

$f(x) := \frac{2 \cdot x^2}{3}$ **(f(x) : 2 * x ^ 2 <SPACE> <SPACE> / 3 <ENTER>)**

Calculus Functions:

Differentiation: **(SHIFT+/)**
Example: Find the derivative of "f": **(g(x) : SHIFT+/ f(x) ALT+<TAB> x <ENTER>)**

$f(x) := (20 \cdot x)$

$g(x) := \frac{d}{dx} f(x)$

$g(3) = 20$

Caveat:

Using the calculus functions can sometimes be tricky due to the way that MathCAD parses functions. On several occations, a function that looked correct to me, was comming up with the wrong result, so I retyped the function, and then it worked. Although it looked EXACTLY the same as the previous function, MathCAD had parsed it in it's own special way which made it evaluate the expression differently than I wanted it evaluated as. So the moral of the story is, although you may think an equation is correct, it is best to have parentheses around the pertinant portions of the equations to force MathCAD to parse it how you want it to be parsed. I am sorry that I could not find the example of where this happened... but if weird stuff happens like this, try putting parenthesis around the trouble expressions.

Programming:

Like the vector assignments, programming in MathCAD is a little quirky. The most confusing portion is the navigation through the equations. However, if you remember the scope of the operations and that when you want to add a new line, the blue underline must be under the entire portion that you want to underline, then it should not be too hard.

Only the basic, often used programming flow structures are shown in this guide, for more information, please consult the MathCAD online help, or borrow the MathCAD manual from the lab assistant in the computer lab. You may borrow the manuals for most software packages installed in the computer lab, but the manuals may not be taken from the computer lab.

Example: Vector Functions and differentiating them.

$$A(x) := \left| \begin{array}{l} \text{for } n \in i \\ \quad a_n \leftarrow x^n \\ A \leftarrow a \end{array} \right.$$

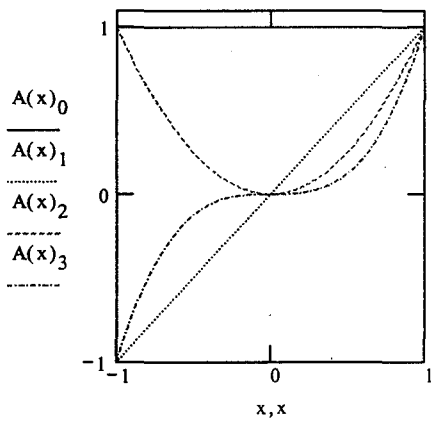
$$B(x) := \left| \begin{array}{l} \text{for } n \in i \\ \quad a_n \leftarrow \frac{d}{dx} A(x)_n \\ B \leftarrow a \end{array} \right.$$

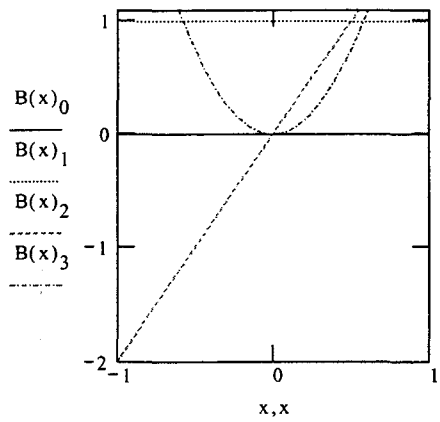
notes: this second assignment is for speed only, I just copied the value of the evaluated "B" vector and then pasted the results into the assignment of "B". This way MathCAD does not need to differentiate each time "B(x)" is evaluated

$$A(x)^T \rightarrow \begin{bmatrix} 1 & x & x^2 & x^3 \end{bmatrix}$$

$$B(x)^T \rightarrow \begin{bmatrix} 0 & 1 & 2 \cdot x & 3 \cdot x^2 \end{bmatrix}$$

$$B(x) := \begin{bmatrix} 0 & 1 & 2 \cdot x & 3 \cdot x^2 \end{bmatrix}^T$$





Example: Piece-wise functions

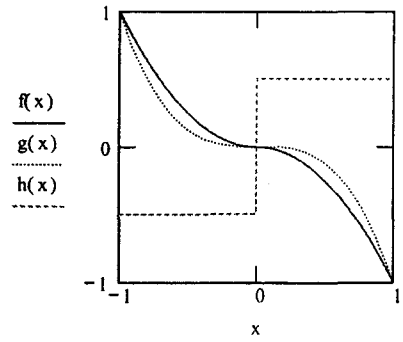
$f(x) := 0$

$Xdomain := -1, -0.5 .. 1$

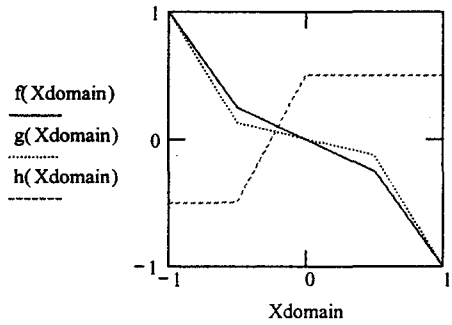
$$f(x) := \begin{cases} x^2 & \text{if } x < 0 \\ -x^2 & \text{otherwise} \end{cases}$$

$$g(x) := (-x)^3$$

$$h(x) := \begin{cases} -0.5 & \text{if } x < 0 \\ 0.5 & \text{otherwise} \end{cases}$$



notes: the solid graph is f(x) and note that it is NOT a cubic equation, but a piece-wise function of two parabolas. The dashed line, h(x) is a piece-wise step function



notes: As long as you have not assigned "x" to some value, you may use x as the default domain variable, and MathCAD will automatically calculate the values of the functions for MANY points over the domain. If you do not want to wait that long, you may define your own domain by using the range operator in much the same way as the indices were defined. However, unlike the indices' range variable, it is not necessary to have all elements of the domain integer values.

MathCAD and Excel:

As MathCAD is a windows application, it works well with other applications. As such, you can insert an excel document into a MathCAD document.

$a := 2$

$b :=$

2	4
	6

a

$b = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$

1) ALT+i
2) C
3) Select the Excel option
4) <NEXT>
5) Select the Empty Excel Worksheet
   a) note, you can also include an existing worksheet to insert.
6) <NEXT>
7) Choose which excel cells you want to input into and output from.
   a) Choose 1 input at cell A1
   b) Choose 1 output with cell range B1:B2
8) Finish

notes: if you choose the "display as icon" checkbox, the worksheet will not be displayed in mathcad, only the input and output variables will be displayed. This is useful if you include and existing excel document which can be quite large, and then want to use excel to perform lots of operations. All of these operations may done in excel, saved, and then MathCAD will operate on this saved file.

notes: by doing this, you may also link MathCAD and MATLAB together. and do what MATLAB does well in MATLAB and what MathCAD does well in MathCAD and link them via this insert components.

MathCAD and Word:

Like MathCAD and Excel, MathCAD and Microsoft Word work well together as well. However it works in the opposite direction as with MathCAD and Excel. You may easily paste MathCAD pieces into Microsoft word.

notes: However, be careful because if you have a large MathCAD document and you copy and paste one equation into Microsoft Word, then, although only the highlighted equation is visible, the ENTIRE MathCAD document will be pasted into Microsoft Word. This can result in unwieldy file-sizes. The entire MathCAD document may be accessed by double clicking on the MathCAD-pasted area and you will notice that the toolbar changes to MathCAD's tool bar and you are able to edit the MathCAD file while within Microsoft Word. However, it should be noted that this MathCAD file bears no connection to the original. It is a separate entity existing inside Microsoft Word. One way to get around this is to do a paste special while in Microsoft Word (**ALT+E S**) and then selecting it to be pasted as a picture instead of a MathCAD document. This may or may not save space in the Microsoft Word document, and you will not be able to edit the file while in Microsoft Word, to edit it, you must return to MathCAD.

Solving Systems of Equations:

Example: Using a Solve Block

$x := 1 \qquad y := 1$

notes: As MathCAD performs a Newton-Cotes iteration to find the desired solution, some initial guess values must be given for the variables.

Given

notes: The word "given" must be typed in equation mode.

$x + (3 \cdot y \cdot 2) = 3$

notes: The constraint equations follow

$3 \cdot x - 5\ y = 2$

(3 * x - 5 * y CTRL+= 2)

$$\text{Find}(x, y) = \begin{bmatrix} 1.174 \\ 0.304 \end{bmatrix}$$

notes: The function "find" solves the system.

Example: Using a matrix and row reduction to solve for a linear system of equations

$$\begin{bmatrix} 2 & 6 & 4 \\ 2 & 3 & 1 \\ 5 & 4 & 7 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -3 \\ 2 \\ -1 \end{bmatrix}$$

To solve this system of equations, remember linear algebra. All you need to do is to create an augmented matrix with the coefficients on the left and the solution on the right. Then row reduce it, and the solution will appear in the right hand column.

$$\text{rref}\left(\begin{bmatrix} 2 & 6 & 4 & -3 \\ 2 & 3 & 1 & 2 \\ 5 & 4 & 7 & -1 \end{bmatrix}\right) = \begin{bmatrix} 1 & 0 & 0 & 2.021 \\ 0 & 1 & 0 & -0.187 \\ 0 & 0 & 1 & -1.479 \end{bmatrix}$$

notes: The function "rref" transforms the matrix into "Row Reduced Echelon Form"

Thus the solution to the above system of equations is:

x = 2.021
y = -0.187
z = -1.479

Vectors: (1D, 2D, and multidimensional Arrays)

Vectors can be very useful in storing data. Vectors (or arrays) in MathCAD may be of any arbitrary dimension, but MathCAD is fairly quirky about how you access data in arrays. However, if all you are wanting to do is to store one dimensional and two dimensional arrays, then MathCAD is very well behaved. But note that it will probably be convenient (hint hint for those of you going on into 625) to make a vector of several arrays or even matrices. So this section may be of more use to you than you think. Previously, we talked about the *constant* "a" and assigning a value to it. In error messages, MathCAD terms these as *scalars* and *vectors* and multidimensional *vectors* as matrices.

Basic Array Assignments:

Example: Assigning by creation of a vector and then displaying the contents

$$m := \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$ **(m : CTRL+m 3 <TAB> 1 <ENTER> 1 <TAB> 2 <TAB> 3 <ENTER>)**

$$m = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$ **(m =)**

$m := 0$ ***notes:*** this clears the data in the vector.

Example: Assigning by creation of a row vector, transpose it and then displaying the contents. The transpose may be found in the Matrix Control Panel if you do not want to use the keyboard short-cut.

$m := (1 \quad 2 \quad 3)^T$ **(m : CTRL+m 1 <TAB> 3 <ENTER> 1 <TAB> 2 <TAB> 3 <RIGHT ARROW> CRTL+1 <ENTER>)**

$$m = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

notes: MathCAD likes column vectors and if you are going to be performing matrix and vector operations, make sure that the vectors are column vectors or else MathCAD will give you an error that the rows and columns don't match

$m := 0$

Example: Assigning by referencing indices. (note these two methods are logically IDENTICAL)

$m_0 := 1$ **(m [0 : 1)** $m_0 = 1$ **(m [0 =)**

$m_1 := 2$ **(m [1 : 2)** $m_1 = 2$ **(m [1 =)**

$m_2 := 3$ **(m [2 : 3)** $m_2 = 3$ **(m [2 =)**

$$m = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

notes: here we see that the base index of the vector is zero and that we increment the subscript to create new values. This base index numeral can be changed to any integer that you want by going into options under the math menu (ALT+m O #) where # is the desired starting index. This can be very useful when you are doing lots of itterating and matrix operations (hint hint for people enrolled in 625)

Example: Subscript VS. Index: **(.) VS. ([ )**

Subscripting a constant or function:

$m_1 := 3$	**(m . : 3)**
$m_1 = 3$	**(m . =)**
$m_1 = 2$	**(m [=)**

notes: **VERY IMPORTANT!!!!** note that the two expressions of m_1 are seemingly identical, however, the first form refers to the *constant* "m *subscript* 1", while the second form refers to the *constant* "m *index* 1". Note how "m *index* 1" has retained the value of "2" that we assigned to it above. The *subscript* is a purely cosmetic feature, and in actuality, MathCAD stores your *constant* name with a period in it, but it displays it as a subscript for ease of viewing.
notes: while in a Text Box, typing a period results in a period showing up, if you want a subscript in the text box, then you need to create it as described under the text editing section through the format menu.

Combining Subscripting with Indexing:

$m_{\alpha_0} := 1$	**(m . a CTRL+G [0 : 1)**
$m_{\alpha_1} := 2$	**(m . a CTRL+G [1 : 2)**
$m_{\alpha_2} := 3$	**(m . a CTRL+G [2 : 3)**
$m_\alpha = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	**(m . a CTRL+G =)**

notes: we have the *constant* m subscript α, index 0, 1, & 2

<u>Iterative Vector Assignments & Range Constants:</u> (;)

Example: Basic Iterative Assignment

$m := 0$	**(m : 0)**
$i := 1 .. 3$	**(i : 1 ; 3)**
$m_i := i$	**(m [i : i)**

notes: Here we assign a range *constant*. When this *constant* "i" is used as an *index*, then MathCAD automatically does a for-loop over the index.

$m^T = (0 \quad 1 \quad 2 \quad 3)$	**(m CTRL+1 =)**

notes: I transposed the vector to save space, sometimes this is helpful, especially if you have large vectors.

$m_0 = 0$	**(m [0 =)**
$m_1 = 1$	**(m [1 =)**
$m_2 = 2$	**(m [2 =)**
$m_3 = 3$	**(m [3 =)**

notes: Notice that the first element in the vector m is "0" This is because the index range that we have told MathCAD to iterate over is only from "1" to "3" and MathCAD still has the default array origin set to zero. So the "0"th index of vector "m" defaults to zero.

Example: Index Constant with modifications 1

$m := 0$

$m_{i+1} := i \cdot 2$ **(m [i + 1: i * 2)**

$m^T = (0\ 0\ 2\ 4\ 6)$

notes: you can place arithmetic functions in the index definition. Helpful in 525, critical in 625.

IMPORTANT!!!: if you have some expression in the index, this expression MUST evaluate to a valid integer index of the array, or else an error will occur.

Example: Index Constant with modifications 2

$m := 0$

$f(x) := 2 \cdot x$

$m_{f(i)} := 3 \cdot i$ **(m [f(i) : 3 * i)**

$m^T = (0\ 0\ 3\ 0\ 6\ 0\ 9)$

IMPORTANT!!!: just like above, the expression in the index, must evaluate to an integer value... in this case, you must be ensured that f(i) will ALWAYS evaluate to an integer value.

Example: Skipping Indices

$m := 0$

$i := 1, 3 .. 7$ **(i : 1, 3 ; 5)**

$m_i := i$ **(m [i : i)**

$m^T = (0\ 1\ 0\ 3\ 0\ 5\ 0\ 7)$

Example: 2-Dimensional Arrays

$m := 0$

$i := 0 .. 10$ **(i : 0 ; 10)**

$j := 0 .. 10$ **(j : 0 ; 10)**

$m_{i,j} := i \cdot j$ **(m [i , j <SPACE> <SPACE> : i * j)**

$m =$

	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

Example: 3-Dimensional Arrays (THIS METHOD DOES NOT WORK)

$m := 0$

$i := 0..3$ **(i : 0 ; 3)**

$j := 0..3$ **(j : 0 ; 3)**

$k := 0..3$ **(k : 0 ; 3)**

$l := 0..3$ **(l : 0 ; 3)**

$m_{i,j,k} := i \cdot j \cdot k$ **(m [i , j , k <SPACE> <SPACE> <SPACE> : i * j * k)**

$$m = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 3 & 6 & 9 \\ 0 & 6 & 12 & 18 \\ 0 & 9 & 18 & 27 \end{bmatrix}$$

notes: this does not do what you expect it to. MathCAD is a little quirky when it comes to higher order arrays. However, if you just remember that MathCAD only likes 1 and 2 dimensional arrays, then you can put as many 1 and 2 dimensional arrays inside each other that you want.

Example: 3-Dimensional Arrays (THIS METHOD DOES WORKS)

$m_{i,j} := i \cdot j$

$n_k := k \cdot m$

$o_l := n$

$p_{i,j} := n$

notes: the best way to learn how to use higher-dimension vectors is to mess around with it by yourself. It is actually quite simple once you figure out that MathCAD only likes to assign up to 2-dimensions in each nested assignment.

$$n = \begin{bmatrix} 0 \\ \{4,4\} \\ \{4,4\} \\ \{4,4\} \end{bmatrix} \quad n_1 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 2 & 3 \\ 0 & 2 & 4 & 6 \\ 0 & 3 & 6 & 9 \end{bmatrix} \quad n_2 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 2 & 4 & 6 \\ 0 & 4 & 8 & 12 \\ 0 & 6 & 12 & 18 \end{bmatrix} \quad n_3 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 3 & 6 & 9 \\ 0 & 6 & 12 & 18 \\ 0 & 9 & 18 & 27 \end{bmatrix}$$

$$o = \begin{bmatrix} \{4,1\} \\ \{4,1\} \\ \{4,1\} \\ \{4,1\} \end{bmatrix} \quad (o_1)_1 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 2 & 3 \\ 0 & 2 & 4 & 6 \\ 0 & 3 & 6 & 9 \end{bmatrix} \quad (o_2)_2 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 2 & 4 & 6 \\ 0 & 4 & 8 & 12 \\ 0 & 6 & 12 & 18 \end{bmatrix} \quad (o_2)_3 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 3 & 6 & 9 \\ 0 & 6 & 12 & 18 \\ 0 & 9 & 18 & 27 \end{bmatrix}$$

$$p = \begin{bmatrix} \{4,1\} & \{4,1\} & \{4,1\} & \{4,1\} \\ \{4,1\} & \{4,1\} & \{4,1\} & \{4,1\} \\ \{4,1\} & \{4,1\} & \{4,1\} & \{4,1\} \\ \{4,1\} & \{4,1\} & \{4,1\} & \{4,1\} \end{bmatrix} \quad (p_{1,1})_1 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 2 & 3 \\ 0 & 2 & 4 & 6 \\ 0 & 3 & 6 & 9 \end{bmatrix}$$

notes: these examples by no means exhausts the possibilities (in actuality the possibilities are infinite, limited only by the memory of the computer and windows propensity to unexpectantly crash). Higher order arrays are not necessary for anything you do in 525 or 625 or many other classes, however, they come in very handy when you want to save a set of arrays and then add them up later. Just stick each matrix in a vector and iterate over the vector at the end.

Vector Functions: (;)

Just as in the multidimensional vector assignment, MathCAD is quirky in its method of handling matrix functions:

$m(x,y) := \left[2 \cdot x \;\; 3 \cdot x^2 \;\; 6 \cdot x^2 \cdot y\right]^T$

$a := 1$

$b := 2$

$m(a,b)^T = (2 \;\; 3 \;\; 12)$

$m(a,b)_0 = 2$

$m(a,b)_1 = 3$

$m(a,b)_2 = 12$

notes: The function is first declared as a row vector for compact notation. Then it is transposed before it is assigned to the function because of how MathCAD requires vectors to be in a column if you are going to access their values by the *index*. The matrix is then re-transposed upon output to put it back into the nice row-format for ease of reading. You don't need to do it this way if you don't want to, you can just always declare stuff in column vectors, but it doesn't take up as much page real-estate this way.

$\text{VectorError}(x,y) := \left[2 \cdot x \;\; 3 \cdot x^2 \;\; 6 \cdot x^2 \cdot y\right]$

$a := 1$

$b := 2$

$\text{VectorError}(a,b) = (2 \;\; 3 \;\; 12)$

$\text{VectorError}(a,b)_0 = 2$

$\text{VectorError}(a,b)_1 =$

$\text{VectorError}(a,b)_2 =$

$\text{VectorError}(a,b)_{0,0} = 2$

$\text{VectorError}(a,b)_{0,1} = 3$

$\text{VectorError}(a,b)_{0,2} = 12$

notes: If we are not going to be itterating over the vector, it is ok to not transpose the row vector as long as you know what is going on. However, if you do not transpose it, MathCAD may not behave as you think it will. The data is still in the vector, but is stored in the first row, meaning that the first index must be "0" followed by a comma, and then the index of the cell that you are wanting to access.

MathCAD Quirk Alert (heads up for 625 people):

If you are wanting to iteratively declare a vector of functions, say the polynomials from x^0 to x^3, one would *think* that it can simply be done like:

$i := 0 .. 3 \qquad (i : 0 ; 3)$

$f(x)_i := x^i$

However, this generates an error. To get around this error you can either explicitly declare the function such as this:

$f(x) := \left[1 \;\; x \;\; x^2 \;\; x^3\right]$

Or....

Or... you could declare a function using the programming tools provided within MathCAD:

$$f(x) := \left| \begin{array}{l} \text{for } i \in 0..3 \\ \quad a_i \leftarrow x^i \\ f \leftarrow a \end{array} \right.$$

notes: In most programming languages, once the function is done processing, you pass out data from the function. This is exactly what happens on the last line of this code, the function "f" is assigned the value of the temporary variable "a" which has been generated by the loop

$$f(x) \rightarrow \begin{bmatrix} 1 \\ x \\ x^2 \\ x^3 \end{bmatrix}$$

(f(x) CTRL+. x ^ 3) this is symbolic evaluation (CTRL+.) which allows you to see the form of the function without actually evaluating it for a certain "x"

Tips and Tricks:

Keyboard Short-Cuts: MathCAD has many keyboard shortcuts. Most of these short-cuts are listed if you place the mouse over the control panel and leave it there. For instance, open up the "Graph" control panel, and then place the mouse over the upper left icon representing the x-y plots. You will see a pop-up message which says that you need to press "SHIFT+2" to create a x-y graph. Through this method, you can teach yourself many shortcuts.

In addition, by using the keyboard, you can navigate the menu items just like any other Windows software. For instance, if you wanted do a subscript in a text box, you could do the following key sequence:

(ALT+o t <TAB> <TAB> <TAB> <TAB> <TAB> b <ENTER>)

The "ALT+o" opens the format window, the "t" selects the text option in the format window (notice that the "t" in the word text is underlined denoting it as the hot key). The "<TAB>"s select the correct field that opens up in the text format window, and the "b" selects the "subscript" option (again notice that the "b" is underlined denoting that it is the hot key)

Greek Letters: If you want to type a greek character, but do not want to change the font to symbol and then back to the original font, just type a letter, and then hit CTRL+g

α : **(a CTRL+g)**
β : **(b CTRL+g)**
γ : **(g CTRL+g)**
etc...

Plots: **(@)**

Derivative: **(SHIFT+/)**

Integral: **(SHIFT+/)**