MATHPAK IV Help Index

For specific information or technical support, contact Dalal Pub. Co at (408) 225-6157 from 8:00 AM to 6:00 PM PST (7 days a week). Technical support calls are free and unlimited but no collect calls will be accepted.

Below is the menu of Mathpak help.
Please click on one of the options for selection.

Commands

Calculus menu commands

The Calculus menu offers the following commands:

Chain Rule	Solves an equation using Chain Rule.
Derivative	Takes first and second deriivatives of a function.
Polynomial	Determines if given two(2) functions are intersecting each other.
Trapezoidal	Computes an area of a function using Trapezoidal 's rule of integration.
Simpson	Computes an area of a function using Simpson's rule of integration.

Matrix menu commands

The Matrix menu offers the following commands:

Crammer	Solves a system of equations using Crammer's Rule.
Gaussian	Reduces a matrix to the Row-Echolen form.
Inverse	Finds the inverse of a matrix.
Operations	Add, subtract, multiply two matrices.

Miscellaneous menu commands

The Miscellaneous menu offers the following commands:

Conversion	Converts a number from one base to another.
Quadratic	Solves a quadratic equation.
Trigonometry	Solves a trigonometry function.
Line_Equation	Finds the equation of a line given two(2) points.
Linear_Eq	Solves linear equations.
User_Defined	Solves user-defined functions.
GraphSetup	Changes default graph setup.

Chain Rule Help

Given an equation of the form:

- **F(x) = a(b X^c+ d X ^e + f) ^g**

Taking the first derivative of the equation using **Chain Rule:**

F(x) = ag(b X^c + d X ^e + f) ^(g-1) (bc X^(c-1) +de X^(e-1))

- To enter values for coefficients:
  Press TAB key repeatedly until the blinking bar (Cursor) moves
  to a desired coefficient.

- Coefficients that are left blank are considered as 0's.

- To see the graphs of the function and its 1st derivative:
  Click on the "**PLOT**" button.

First and Second Derivatives

- Given an equation of the form:

$$F(x) = \frac{ax^b + cx^d + ex^f + g}{hx^i + jx^k + lx^m + n}$$

Where **a,b,c,...n** are entered by users.
If they are treated as 0's if they are not entered.

This is a general equation that gives users flexibility in entering various forms of equations.

- For example, to enter an equation of **1/X**,
make **g = 1** and **h and i = 1**.

- The derivative of the above equation is solved by using the devision rule:

$$F(x) = \frac{f(x)}{g(x)} \quad \text{----->} \quad F'(x) = \frac{f(x)\,g'(x) - f'(x)\,g(x)}{g(x)^2}$$

Number Conversion

- **Convert a number from one base to another.**
  Following bases are supported: Base 2, Base 8, Base 10, Base 16.

- **To enter a number in a base:**
  Press the TAB key repeatedly until the blinking bar (cursor) appears on a desired base.

- **To clear all inputs:**
  Click on the "CLEAR" button.

- **To close the window:**
  Click on the "CANCEL" button.

Trigonometry Equation

- Given an equation of the form

  F(x) = a[Sine/Cos/Tan(bx^c)]

  Where **a,b,c** are entered by users.
  If they are not entered, they will be treated as 0s.

- The equation is solved for **Sine, Cosine,** and **Tan.**

- Options for plotting

  Users have options for plotting of any combination of **3 Trigonometry equations.**
  - Click on the **Check Box** button to select plotting options.
  - If the **Check Box** is checked, it means selected.

Crammer's Rule

- The matrix on the left is an unsolved system of equations.
- The matrix on the right is a solved system of equations.

- **To select a number of variables for an equation:**

  Click on a radio button that specifies a desired number of variables.

  2-Variables means solving a system of equations of the forms:

  ax1 + bx2 = c
  dx1 + ex2 = f

  The matrix representation is:
  | nnn nnn nnn|
  | nnn nnn nnn|

- **Determinants:**
  The number of determinants depends on the number of variables in the functions. Crammer's rule solves a system of equations by determinants. The determinants for the above system of 2-variable are:

  DET | a b |
  | d e |

  DETX1 | b c | DETX2 | a c |
  | e f | | d f |

  X1 = DETX1/DET X2 = DETX2/DET

  There are 3 determinants for a system of 2-variable equations.

- **View matrices for determinants**
  Click on the **MATRIX** button.
  There are 3 matrices for a system of 2-variable equations.

  One matrix for **Determinant**
  One matrix for **Determinant of X1**
  One matrix for **Determinant of X2**

Reduce a matrix using Gausian Technique

- To select a size for a matrix:

  Click on **Number of Row** or **Number of Columns**,
  a menu of predefined sizes is displayed.
  Select a desired from the menu.
  The **Input Matrix** and **Result Matrix** will change accordingly.

- To enter data into the matrix:

  Set the **Cursor** to one of the entries in the matrix by either pressing the **TAB** key or **click** on the entry.
  If any data is entered, the **Result** matrix will be initialized to 0's.

- To view the solution:

  There are 2 ways of viewing the solution.

  - Click on the **Result** button which will display the **Final** solution on the Result matrtix.

  - Click on the **Step** button.
    This will display the process of solving the matrix by steps.
    Every click on the **Step** button will show the next step toward the solution of the matrix.

Finding the inverse of a matrix

- To select a size for the matrix

  Click on the **Down Arrow** of the "Matrix Size", then select a desired size from the menu.
  You will notice the matrices instantly change accordingly.

- To enter data into the matrix:

  Set the **Cursor** to one of the entries in the matrix by either pressing the **TAB** key or **click** on the entry.
  If any data is entered, the **Result** matrix will be initialized to 0's.

- To view the solution of the inverse

  There are 2 ways of viewing the solution.

  - Click on the **Result** button which will display the **Final** solution on the Result matrtix.

  - Click on the **Step** button.
    This will display the process of finding the inverse of the matrix by step.
    Every click on the **Step** button will show the next step toward the the solution of the matrix.

Find the equation of a line

- Finding the equation of a line using 2 points,
  point 1 (**X1,Y1)** and point2. **(X2,Y2)**

  The equation of the form: **F(x) = mX + B**
  Where **m = slope** and **B = Y-Intercept.**

- The **Slope** is computed as follows**:**

$$m = \frac{X2 - X1}{Y2 - Y1}$$

- The **Y-Intercept** is computed as follows**:**

  Y-Intercept = (-m * X1) / Y1

- The **Distance** between 2 points is computed as shown below:

$$\text{Distance} = [\,(Y2-Y1)2 + (X2-X1)2]1/2$$

Linear Equation

- Given 2 linear equations of the form:

  f(x) = mx + b and **g(x) = ay + d**

  For F(X) = G(X), and let **F(x) = y**, we have

  $$F(x) = \frac{mx + b - d}{a}$$

- Given 2 linear equations of the form above (**F(x)**),
  the program will determine conditions of the equations according to
  the initial input value.

Matrix Operations

- **Add, Subtract and Multiply 2 matrices.**

- Select matrix operation

  Click on the **Addition** or **Subtraction** or **Multiplication** radio buttton
  to select the operation.

  - **Matrix Addition and Subtraction** requires
  the matrix **A** and **B**have the same size (ie, same number of rows
  as well as number of columns).

  - **Matrix Multiplication** requires the number of columns
  of matrix A to be equal with the number of rows of matrix B.

  - Otherwise, the matrices cannot be computed with the selected operation.

- To change the **sizes** of matrix **A** or matrix **B**

  Click on the **Down arrow** next to the default size of the matrix.
  Then select a size from the menu.

Polynomial Intersection

- **Determine whether 2 polynomials are intersected at a given point.**

- Given 2 equations of the form

  F1(x) = ax^3 + bx^2 + cx + d

  F2(x) = ax^3 + bx^2 + cx + d

- Coefficients **a,b,c,d** are supposed to be enterred.
  If they are left blanks, their values are assumed to be 0's.

- **How it works**

  The initial value **X** is substituded in the equations to solve for **F(x).**
  If **F1(x) = F2(x)** then, it means these 2 functions are intersected at the given point of **X.**

Numerical Integration using Simpson's Rule

- Given an equation of the form:

$$F(x) = \frac{ax^b + cx^d + ex^f + g}{hx^i + jx^k + lx^m + n}$$

  Where **a,b,c,...n** are entered by users.
  If they are treated as 0's if they are not entered.

  This is a general equation that gives users flexibility in entering various forms of equations.

- For example, to enter an equation of **1/X**,
  make **g = 1** and **h and i = 1**.

- **Simpson's Algorithm** approminating the graph of **F(x).**

  Integration of **F(x)** from **a to b**:

$$\frac{b-a}{3n}\left[f(X0) + 4f(X1) + 2f(X2) + 4f(X3] + ...+2f(Xn-2) + 4f(Xn1) + f(Xn)\right.$$

- Variable descriptions

  n **:** Number of partitions between the limit **a** and **b.**
  Xi : X value on the partition.
  F(xi) : Y value at Xi.
  m : can be 1,2, or 4. The coefficient of the **Simpson's algorithm** as
  : shown above.
  Solution: is the final result of the **Simpson's algorithm.**

- To view a value at a partition
  Click on the **Down arrow** of **Xi** and select a desired parition.
  The value for selected partition is displayed as **F(xi) or mF(xi).**

Numerical Integration using Trapezoidal Rule

- Given an equation of the form:

$$F(x) = \frac{ax^b + cx^d + ex^f + g}{hx^i + jx^k + lx^m + n}$$

  Where **a,b,c,...n** are entered by users.
  If they are treated as 0's if they are not entered.

  This is a general equation that gives users flexibility in entering various forms of equations.

- For example, to enter an equation of **1/X**,
  make **g = 1** and **h and i = 1**.

- **Trapezoidal algorithm** approminating the graph of **F(x).**

  Integration of **F(x)** from **a to b**:

$$\frac{b-a}{2n}\left[f(X0) + 2f(X1) + 2f(X2) + \ldots + 2f(Xn-1) + f(Xn) \right]$$

- Variable descriptions

  n **:** Number of partitions between the limit **a** and **b.**
  Xi : X value on the partition.
  F(xi) : Y value at Xi.
  m : can be 1 or 2, The coefficient of the **Trapezoidal algorithm** as
  : shown above.
  Solution: is the final result of the **Trapezoidal algorithm.**

- **Error Estimate for the Trapezoidal rule**

  The **Maximum** error using the **Trapezoidal rule** is **NOT** greater than

  M(b-a}^3/12n^2

  Where **M** is a positive real number such that **F"(x) < M** for all x in [a..b].
  Note: **F"** is second derivative of F(x).

- To view a value at a partition
  Click on the **Down arrow** of **Xi** and select a desired parition.
  The value for selected partition is displayed as **F(xi) or mF(xi).**

User-Defined Function

- Given an equation of the form:

$$F(x) = \frac{ax^b + cx^d + ex^f + g}{hx^i + jx^k + lx^m + n}$$

Where **a,b,c,...n** are entered by users.
If they are treated as 0's if they are not entered.

This is a general equation that gives users flexibility in entering various forms of equations.

- For example, to enter an equation of **1/X**,
make **g = 1** and **h and i = 1**.

Graph Setup - default settings

- **Scale Value for Zoom in** and **Zoom out:**

  Zoom in means making each unit in the function equal to **x** number of units on the **display device**.
  If the **Scale** value is 5, then each function unit is equivalent to 5 units on the display.

  Zoom out is opposit of the **Zoom out.**
  If the **Scale** value is 5, then each unit on the **display** is equivalent to 5 units in the function.

- **Scale Value for Draw Grid**

  The scale value of grid is based on the **Scale Value for Zooming**.
  The **Grid Scale** = the **Grid Scale Value** times **Zooming Scale Value.**

  If the **Scale** value for grid is 5 and the **Scale Value for zomming in** is 10, the grid will be drawn for every 50 units on the display.

Quadratic Equation

- Given an equation of the form

  ax^2 + bx + c = 0

  Where **a,b,c** are entered by users
  If **a or b or c** is not entered, then it will be treated as 0.

- The equation is sovled by using

  -

- If (**b^2 - 4ac)** is less than 0, the **X solutions** will be imaginary because the square root of a nagative number is undefined.

- Otherwise, the equation has 2 solutions (**X1, X2).**