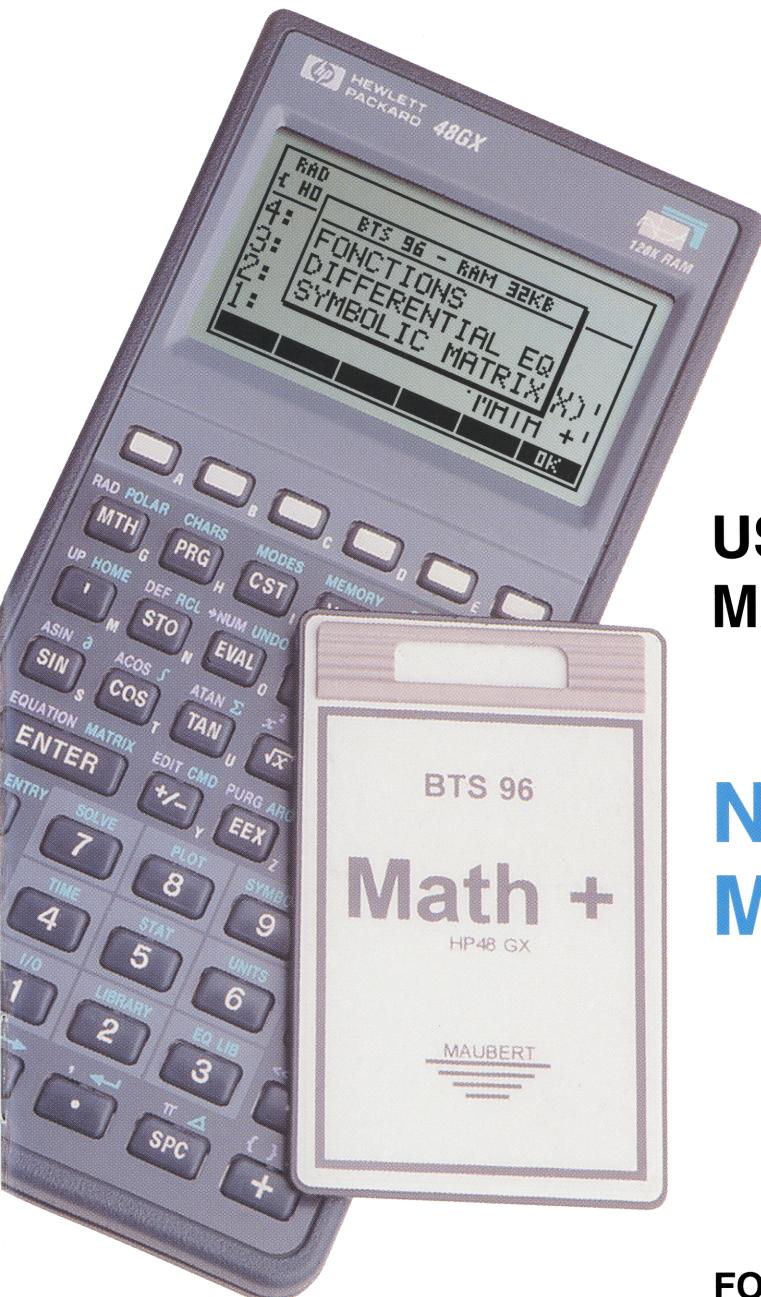


**MAUBERT**

 **HEWLETT  
PACKARD**



**RAM 48  
BTS 96**

**USER  
MANUAL**

**NEW  
MATH+**

**FOR HP 48GX**



# **MATH+**

**ver. 1.0**

**A mathematical program for HP 48GX**

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1st edition 1996**

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# 1. CONTENTS

"MATH+" is a 32KB RAM card that includes two software packages (which can be deleted). It is intended for use with your HP48GX calculator:

- Symbolic matrices  
Library 796 : Symbolic MatrixWriter BTS'96
- Function analysis - Differential equations - Statistical functions  
Library 975 : MATH + BTS'96

## 1.1. Backing up/loading the MATH + software

- **System requirements**
  - PC or MAC computer (see Transfer Kit Manual for further details).
  - Hewlett-Packard connection kit.
- **Backing up the MATH+ software on your computer.**

Transfer the contents of the card to your computer:  
Please refer to the Connection Kit User's Guide for your calculator: Chapter 28 «*Objects-Backup*”
- **Loading the MATH+ software from your computer.**
  - Transfer the two libraries (see Connection Kit Manual)
  - Install the two libraries on the card:  
Please refer to the User's Guide for your calculator :  
Chapter 28 "Objets-Backup"

*NB : In order to use the available 32 KB on the RAM card, delete the content of the latter (after having backed up the software packages ).*

## 1.2. Getting started

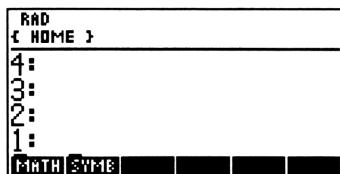
**The 32 KB RAM card with the MATH+ software operates on port 1 or 2 of your HP48 GX calculator and requires 25 KB of free memory.**

Press the following keys :

-  To access or return to the main menu of the software.
-  To go from one menu page to another.

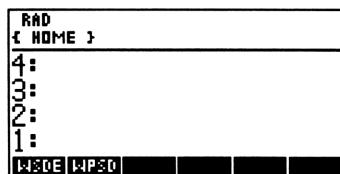
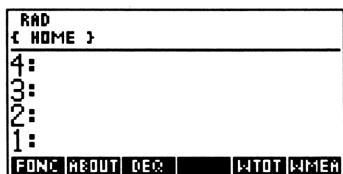
### 1.2.1. LIBRARY menu

The LIBRARY menu displays **MATH** and **SYMB**



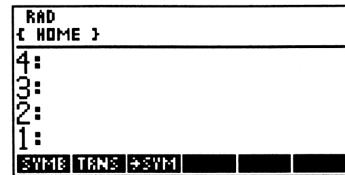
### 1.2.2. Library menus : **MATH**

- **FONC** Function analysis.
- **MEOUT** Information concerning the card.
- **DEG** Symbolic solution of second order differential equations.
- **WTOT**, **WMEM**, **WEDE**, **WPSC** Statistical functions.



### 1.2.3. Library menus : SYMB

- Supplementary functions/programs and Symbolic Matrix Editor.



## 1.3. User interface

The MATH+ software menu system is easy to use. The graphic interface used is similar to that developed for the HP48 GX: Chapter 6 «Data entry forms»

- During calculations, all the indicators flash.
- The Programs/Functions relating to SYMBOLIC MATRICES are executed from the **SYMB** library menus or by keying the name of the function on the keypad..

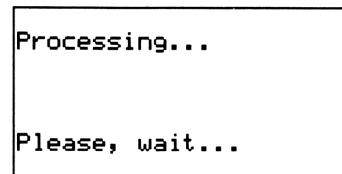
## 1.4. Changing the battery on the RAM card

Please refer to the User's Guide for your HP48 GX calculator. Chapter A-5

## 2. FUNCTION ANALYSIS.

### Note :

- When entering data, please refer to the User's Guide supplied with your calculator,  
CHAPTER 6: «Data entry forms (INFORM)».
- This program analyses continuous functions over their definition set.
- During calculations or when the program is initialised, the various indicators of the  
calculator flash simultaneously and the following screen page appears:



- Typical example :

for  $f(x)=\sin(x)$

The programme calculates :

- Function signs
- Derivative and its signs
- Table of variations
- Tangent equation
- Table of values
- Curve plot.

## 2.1. Running the program

Run the FUNCTION ANALYSIS program by pressing key **[FONC]**

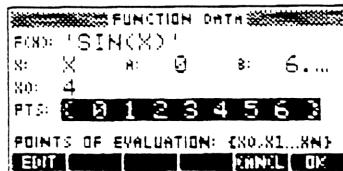
## 2.2. Entering data

- Enter the data for the function analysis (see User's Guide Chapter 6): *Unknown, Xmin, Xmax, Tangent calculation Point and Table of values.*

Definition table for fields and their content

Name of field	Description	Type (TYPES)	Required for analysis?	INFO ?
F(x)	Field for entering the function to be analysed	'Algebraic'	YES	YES
X	Name of variable/unknown	Name	YES	YES
A	Lower limit of function plot	Real number	YES	YES
B	Upper limit of function plot	Real number	YES	YES
X0	Calculation point of tangent	Real number	NO	YES
PTS	Calculation points to obtain a table of points.	{ List}	NO	YES

- Display after data entry:



- Confirm by pressing : **[ENTER]** or **[OK]**

## 2.3. Signs of function, roots, signs table

A new screen page displays the roots of the function(if there are any) and, on the second page, the signs table.

### *Display of results*

The arrow keys and are used to go from one page to another, the key **EXIT** is used to quit these screen pages and continue the rest of the calculations

The menu bar displays the total number of pages and the current page number

- Roots of  $f(x)=\sin(x)$

Look at the sign of:  
 $\sin(x)$   
Zero:  
 $x = 1*\pi$

PAGE 1 FOR 2 ↑↓ EXIT

- Table of signs of the function  $f(x)=\sin(x)$

TABLE OF VARIATION			
x	1	3.1	3
$F'(x)$			
$F(x)$		+	-

PAGE 2 FOR 2 ↑↓ EXIT

Press **EXIT** in order to continue the rest of the calculation.

## 2.4. Signs of derivative, roots, table of variation of f(x)

Two screen pages are displayed:

- Roots of the derivative function  $f'(x)=\cos(x)$

Look at the sign of:  
 $\cos(x)$   
Zero:  
( '1/2\*pi' '3/2\*pi' )

PAGE 1 FOR 2 †.‡ EXIT

- Table of variations of function  $f(x)=\sin(x)$  and its derivative  $f'(x)=\cos(x)$

TABLE OF VARIATION

X	A	1.6	4.7	B
F'(X)	+	-	+	
F(X)	[Graph]	[Graph]	[Graph]	[Graph]

PAGE 2 FOR 2 †.‡ EXIT

Press **EXIT** in order to continue the rest of the calculation.

## 2.5. Calculating the equation of a tangent

Note :

This calculation is performed if field **X0** was defined.

- Equation of the tangent of  $f(x)$  at point  $X0=4$

Tangent Equation  $F(Xt)$   
at  $X_0$ :  
'Y=1.86-0.65\*X'

Press **ENTER** to continue the calculation.

## 2.6. Calculating the table of values

### Note :

*This calculation is performed if the PTS field has been defined.*

- This table of values appears in the matrix editor environment  
( see chapter 8 : « Applications Matrix Writer » )

1	2	3	4	5	6
1	0.00	0.00			
2	1.00	0.84			
3	2.00	0.91			
4	3.00	0.14			
5	4.00	-0.76			

1-1: 0.00

EDIT VEC +WID WID+ GO+ GO+

Press **ENTER** to continue the calculation.

## 2.7. Plotting the curve of $f(x)$

- Points A and B delimit the X bounds ( $X_{\min}$  and  $X_{\max}$ ) of the plot.



- In order to quit the graphics mode and return to the standard environment of your calculator, press the **ON** key

### Note :

*The function analysis program may leave a certain number of data items on the stack resulting from the calculation. These do not effect use of the calculator (this data has already been stored in the Maths directory-see Table on next page).*

## 2.8. Accessing the function analysis data

- Press the **VAR** key
- Press the menu key that corresponds to the *Maths* directory

Description of variables (content and type)

Name of variable	Description	Type
EQ	Equation analysed for internal use for other applications of the calculator	Algebraic
FG	Equation analysed in <b>FONC</b>	Algebraic
VARIABLE	Variable / unknown	List containing the name of the variable/unknown.
DEFA	Lower limit	Real number A<B
DEFB	Upper limit	Real number B>A
Xt	Calculation point of tangent	Real number
Pnts	List of points in table of values	List of real numbers
DATA	Table of values	Real Matrix
Yt	Equation of tangent of f(x)	Character string
Yd	Equation of derivative of f(x)	Algebraic
Zero.f	Root(s) of function	List of real numbers
Zero.d	Roots of derivative of f(x)	List of real numbers
PPAR	Graphic environment parameters	List
FLAGS	Save user's flags	List of two binary numbers

### 3. SECOND ORDER DIFFERENTIAL EQUATIONS

This program allows the symbolic solution of second order differential equations.

Note :

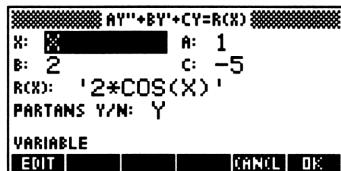
- When entering data, please refer to the User's Guide supplied with your calculator

#### 3.1. Entering data

See CHAPTER 6 : « Data entry forms» (INFORM).

Example :  $1*Y''+2*Y'-5*Y=2*\cos(X)$

- Screen page after data entry :



Confirm by pressing : **ENTER** or **OK**

Summary table of data needed to solve a differential equation.

Name of field :	Description :	Type :	INFO
X	Name of variable/unknown.	Name	YES
A	Real Coefficient	Real number	YES
B	Real Coefficient	Real number	YES
C	Real Coefficient	Real number	YES
R(x)	Represents data entry fields of function to be analysed	'Algebraic'	YES
PARTANS Y/N	Allows calculation of intermediate steps Yes: Y No: N	Name	YES

(\*) : Selecting N (No), takes you directly to the solution placed on the stack

### 3.2. Characteristic equations/roots - general solution

- 1st page of menu: Characteristic equation/roots - General Solution

```
Characteristic eqn.:
x^2+2*x-5=0
x1=-1+√6   x2=-1-√6
Yh =
A*EXP(-(1+√6)*X)+B
*B*EXP(-(1-√6)*X)

PAGE | 1 | FOR | 3 | ↑↓←→ | EXIT
```

- 2nd page of menu :

```
Choosing Yp:
K*SIN(X)+L*COS(X)

PAGE | 2 | FOR | 3 | ↑↓←→ | EXIT
```

- 3rd page of menu :

```
Yp =
1/10*SIN(X)-3/10*C
OS(X)
Y = Yp + Yh

PAGE | 3 | FOR | 3 | ↑↓←→ | EXIT
```

Press **EXIT** in order to continue the rest of the calculation.

### 3.3. Symbolic result

- Return to standard display:

The symbolic expression is at level 1 of the stack.

```
1 HOME
1: 'A*EXP(-(1+√6)*X)+B
    *EXP(-(1-√6)*X)+(1/
    10*SIN(X)-3/10*COS(
    X))'
FONC ABOUT DEG | | |
```

## 4. STATISTICAL FUNCTIONS

The functions WTOT,WMEAN, WSDEV, WPSDEV perform calculations taking into account the two columns in the matrix **XHT**. They take the content of the statistical variable as their argument ( 2-dimensional matrix [X Populations] ).

- **WTOT** : Calculate the sum of two products ( function :  $\Sigma X \times Y$  ).
- **WMEAN** : Calculate the mean
- **WSDE** : Calculate the standard deviation for a sample.
- **WPSD** : Calculate the standard deviation for a population.

### Example :

Enter the statistical matrix and save it in the variable : **XHT**  
( See chapter 21 of User's Guide ).

```
[[ 1 2 ]  
[ 2 4 ]  
[ 3 5 ]  
[ 2 5 ]]
```

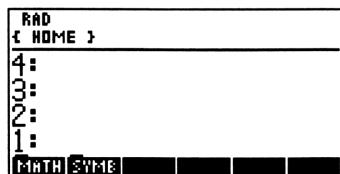
### Press the function key :

- **WTOT** puts on stack at level 1 : 35
- **WMEAN** puts on stack at level 1 : 2,1875
- **WSDE** puts on stack at level 1 : 0,655108133568
- **WPSD** puts on stack at level 1 : 0,634305722818

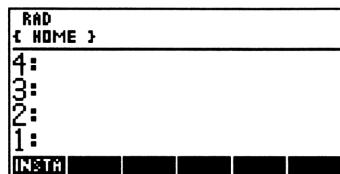
## 5. SYMBOLIC MATRIX EDITOR

### 5.1. Installing the Symbolic Matrix Editor

- Go to the library menu : **SYME**



- Press **INSTA**



The Symbolic Matrix Editor Library is now installed.

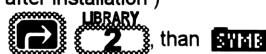
*NB : This installation operation must be performed each time the library is deleted  
and requires 15Kb of the calculators memory.*

### 5.2. Accessing the Symbolic Matrix Editor

**MATH**

- Access the Symbolic Matrix Editor menu ( after installation )

Press the following keys :



## 5.3. Using the Symbolic Matrix Editor

### 5.3.1. How to key in a new symbolic matrix;

Press the following keys :



### 5.3.2. Operation of the Symbolic Matrix Editor



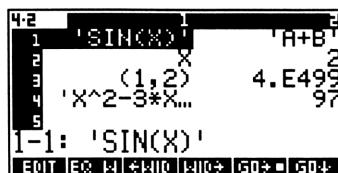
The Symbolic Matrix Editor works in a similar way to the original editor of your calculator ( see Chapter 8 ) but with the additional facility to switch to the Equation Editor in order to enter algebraic objects by pressing **EQ W** key as well as several functions for manipulating columns and rows.

- 1 st page of menu:

**EQ W**: Used to enter an algebraic expression in the equation editor environment.



Example of data entry :



- 2 nd page menu :  
**ROW+**, **ROW+** used to perform rotation on rows.

**COL+**, **COL+** used to perform rotation on columns.

0-0	1	2
1		
2		
3		
4		
5		
1-1:		
<b>+ROW</b>	<b>ROW+</b>	<b>ROW+</b>
<b>+COL</b>	<b>COL+</b>	<b>COL+</b>

- 3 rd page of menu :  
**...↓**, duplicates current row.

**...↓**, duplicates all rows from the cursor position.

**...+**, duplicates the column in which the cursor is located.

**...↗**, duplicates all columns from the cursor position.

0-0	1	2	3
1			
2			
3			
4			
5			
1-1:			
<b>+STK</b>	<b>↑STK</b>	<b>...+</b>	<b>...+</b>
<b>...+</b>	<b>...+</b>	<b>...↗</b>	<b>...↗</b>

## 5.4. Manipulating Symbolic Matrices

### Note :

See Chapter 4 of the User's Guide for your calculator for information concerning indicators.

#### 5.4.1. **.ADDCO** ADDCON Adding constant matrix.

**Definition :** Adds a constant to all the elements of a symbolic matrix.

**Indicators :** None.

**Example :**

**Arguments :**

2 : { { 1 2 3 } { 'X' 'X+1' 'X-3' } }

1 : 'X+1'

**Key in :** ADDCON 

1 : { { '1+(X+1)' '2+(X+1)' '3+(X+1)' } }

{ 'X+(X+1)' 'X+1+(X+1)' 'X-3+(X+1)' }

#### 5.4.2. **.ADDM** ADDM Sum of two matrices

**Definition :** Finds the sum of two symbolic matrices

**Indicators :** -3 (numerical results).

**Example :**

**Arguments :**

2 : { { 1 2 3 } { 'X' 'X+1' 'X-3' } }

1 : { { -1 2 -3 } { '-X-1' 'X+1' '3-X' } }

**Key in :** ADDM 

1 : { { 0 4 0 } { '-X-1' 'X+1' '3-X' } }

<b>5.4.3.</b>	<b>[CMPL</b>	<b>CMPL</b>	Complement of a matrix.
	<b><u>Definition :</u></b>	Returns the complement of a square matrix , on the basis of the element given at level 1.	
	<b><u>Indicators :</u></b>	None.	
	<b><u>Example :</u></b>		
	<b>Arguments :</b>		
2:	{ { 1 0 0 } { '-X' '1-X' '2-X' } { -1 0 -4 } }		
1:	{ 1 1 }		
<b>Key in :</b>	<b>CMPL</b>	<b>ENTER</b>	
1:	{ { '1-X' '2-X' } { 0 -4 } }		

**5.4.4. .CONST CONSTMAT.** Creating a constant matrix

**Definition :** Used to create a constant matrix of the dimension specified at level 1.

**Indicators :** None.

**Example :**

**Arguments :**

2 : 'X-1'

1 : { 2 3 } { m n }

m : number of columns  
n : number of copies per row

**Key in :** CONSTMAT   
1 : {{'X-1' 'X-1' 'X-1'}} {{'X-1' 'X-1' 'X-1'}} { }

**5.4.5. DELCOL DELCOL Delete column**

**Definition :** Deletes the column specified by the cell cursor position.

**Indicators :** None.

**Example :**

**Arguments :**

2 : {{ 1 0 0 } { '-X' '1-X' '2-X' } { -1 0 -4 }}

1 : 1

**Key in :** DELCOL **ENTER**

1 : {{ 0 0 } { '1-X' '2-X' } { 0 -4 }}

#### 5.4.6. .**DELROW** DELROW Delete row

**Definition :** Deletes the row specified by the cell cursor position

**Indicators:** None.

**Example :**

**Arguments :**

2 : { { 1 0 0 } { '-X' '1-X' '2-X' } { -1 0 -4 } }

1 : 1

**Key in :** DELROW

**ENTER**

1 : { { '-X' '1-X' '2-X' } { 1 0 -4 } }

#### 5.4.7. .**DETERM** DETERM Calculate determinant.

**Definition :** Calculate the determinant of a square matrix.

**Indicators :** -3 (numerical results).

**Example :**

**Arguments :**

1 : { { 'X' 4 -1 '(X-2)/Y' } { 0 1 '-X' '2\*Y' } { 'Y/X' '1/X' -3 'X-Y' } }

**Key in :** DETERM

**ENTER**

1 : '-2-1/X^2-8/X^3-2/X^2+X^2+4\*X^2-X^3+12\*X^Y  
-2\*X^2+X-Y'

#### 5.4.8. .**DIMS** DIMS Matrix dimensions

**Definition :** Returns the dimensions of a matrix and checks its conformity.

**Indicators :** None.

**Example :**

**Arguments :**

1 : { { 'X' 4 -1 } { 0 1 '-X' } { -3 'X-Y' 2 } } { m n }

m:number of columns

n:number of copies per row

**Key in :** DIMS

**ENTER**

1 : { 3 3 }

**Associated commands:** SQUARE?

#### 5.4.9. .EQUAL EQUAL? Matrices of the same size ?

Definition : Checks whether two matrices have the same dimension; returns a 1 or 0.

Example :

Arguments :

2 : {{ 'X-3' 'X' }{ 2 6 }}

1 : {{ 'X' 'X+1' }{ 3 4 }}

Key in : EQUAL?

**ENTER**

4 : {{ 'X-3' 'X' }{ 2 6 }}

3 : {{ 'X' 'X+1' }{ 3 4 }}

2 : { 2 2 } { m n }

m : number of columns.

n : number of copies per row.

1 : 1

#### 5.4.10. .FACTO FACTOR Matrix x real number.

Definition : Multiplies each element of the matrix at level 2 of the stack by the real number at level 1.

Indicators : -3 (numerical results).

Example :

Arguments :

1 : {{ 2 'X' 4 }{ -1 0 'X/2' }{ 0 3 'X+1' }}

Key in : 2 FACTOR

**ENTER**

1 : {{ 4 'X^2' 8 }{ -2 0 'X/2^2' }{ 0 6 '(X+1)^2' }}

#### 5.4.11. .IDNT IDNT Generate identity matrix

Definition : Generates nth-order identity matrix.  
(n: real number placed at level 1 of the stack)

Indicators : None.

Example :

Arguments :

1 : 3

Key in : IDNT

**ENTER**

1 : {{ 1 0 0 }{ 0 1 0 }{ 0 0 1 }}

**5.4.12. .MGET MGET** Extract an element

**Definition :** Extracts an element of the symbolic matrix.

**Indicators :** None.

**Example :**

**Arguments :**

4 : { { 'X' 'Y' } { 'Z' 'W' } }

3 : 1 m : row number.

2 : 2 n : column number

**Key in :** MGET



1 : 'Y'

**5.4.13. .MPUT MPUT** Replace in matrix

**Definition :** Replaces the value contained in the position specified at level 1 by the value placed at level 2.

**Indicators :** None.

**Example :**

**Arguments :**

4 : { { 'X' 'Y' } { 'Z' 'W' } }

3 : 1 m: row number.

2 : 2 n: column number

1 : 'A'

**Key in :** MPUT



1 : { { 'X' 'A' } { 'Z' 'W' } }

**5.4.14. .MSYM MSYM?** Check matrix

**Definition :** Checks that the content of the matrix only contains: real numbers, algebraics, character string, complex numbers, units, names and whether the dimension of the matrix is valid.

**Indicators :** None.

**5.4.15. .MULT MULT** Multiply Matrices

Definition : Multiplies two matrices

Indicators : -3 (Numerical results).

Example :

Arguments :

2 : {{ 1 2 } { 'X' 'X-1' }}

1 : {{ '-X' -1 }}

Key in : MULT



1 : {{ '-X-2' } { 'X\*-X-(-1+X)' }}

**5.4.16. .SQR? SQUARE?** Square matrices?

Definition : Tests whether the matrix is square, returns the matrix at level 3 of the stack, returns the size of the matrix at level 2 and returns at 0/1 flag at level 1.

Indicators : None.

**5.4.17. .SUBM SUBM** Difference between matrices.

Definition : Returns to a matrix at level 1, the difference between two matrices of the same size.

Indicators : None.

**5.4.18. .SYMB SYMBMAT→** Break down matrix.

Definition : Returns the elements of a matrix to the stack at level 2, as well as the dimensions at level 1.

Indicators : None.

**5.4.19.** .**TRNSP** TRNSP Transpose matrix.

**Definition :** Calculates the transpose of the matrix.

**Indicators :** None.

**5.4.20.** .**SYMBMAT** →SYMBMAT Create matrix

**Definition :** Orders the creation of a symbolic matrix of n-elements on the stack and, at level 1, a list containing the number of rows and columns.

**Indicators :** None.

## **6. WARRANTY AND SERVICE.**

### **6.1. Technical support**

If you have any queries regarding the operation of your application card, please contact your usual HEWLETT-PACKARD Calculator Technical Support directly.

### **6.2. 6-month warranty**

The 32Kb RAM-card and the "Math+" software are guaranteed against any fault in materials or defect of fabrication for SIX (6) months from the date of purchase. This warranty does not cover the power supply of the RAM-card. During the warranty period, Maubert Electronic undertakes to repair or replace any defective components.

This warranty covers parts and labour, but is void in the event of use other than in accordance with the specifications stated in the User's Guide or modification or work carried out by any third party.

### **6.3. Repair**

Please return to:

MAUBERT ELECTRONIC  
49, Bd. St Germain  
75005 PARIS  
FRANCE  
Tel: (33) 1 43-29-40-04 - Fax: (33) 1 46-34-78-85

Cost of repairs

Cards no longer covered by the warranty will be replaced against payment of a fixed charge (including parts and labour). VAT is payable on this fixed charge in FRANCE and similar taxes are payable in other countries.

### Despatch instructions :

It is vital to enclose the following when returning any item:

- A description of the fault, your address and telephone number.
- The invoice for the purchase of your HP 48GX calculator ( card under warranty)
- Send the card postage paid in protective packaging in order to prevent any damage in transit (such damage is not covered by the warranty). It is advisable to insure the package.
- **Under warranty:** You must pay shipping charges and any customs fees. Items are returned postage paid.
- **Out of warranty:** You must pay all shipping costs and the custom fees (in both directions).

### **6.4.    Reload the program**

Please return to:

MAUBERT ELECTRONIC  
49, Bd. St Germain  
75005 PARIS  
FRANCE  
Tel: (33) 1 43.29.40.04 - Fax: (33) 1 46.34.78.85

### Despatch instructions

If you have to send your card so that the program can be reloaded:

- Send the card postage paid in order to prevent any damage in transit (such damage is not covered by the warranty) Use the envelope enclosed.
- **Under warranty:** You must pay shipping charges and any customs fees. Items are returned postage paid.
- **Out of warranty:** Please contact Maubert Electronic.

## **6.5. Environment**

To ensure reliable operation keep your MAUBERT ELECTRONIC 32 Kb RAM-card away from humidity and make sure that the following temperature ranges are not exceeded;

- Operating temperature: 0° to 45°C.
- Storage temperature: -20°C to 60°C.
- Humidity during operation and storage: 90%. relative humidity max. at 40° C max.

## 7. ACCESSORIES FOR HP48 GX

### 7.1. APPLICATION CARDS

#### MATHEMATICS

<b>MATH 1</b>	<b>BB Marketing</b>	<b>College/school</b>	
Algebra, 2D curves, Series, Complex numbers, Linear equations, Equations... etc.			
<b>MATH 2</b>	<b>BB Marketing</b>	<b>School &amp; HE</b>	
Linear algebra, Symbolic matrices, Equation system, Transforms ... etc.			
<b>MATH 2 PROF.EXT.</b>	<b>BB Marketing</b>	<b>School &amp; HE</b>	
MATH 2 Prof.Ext. with programming utilities			
<b>MATH PRO</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
Algebra, trigonometry, topography, triangular solutions ... etc.			
<b>GEOMETRY/SURV.</b>	<b>BB Marketing</b>	<b>School &amp; HE</b>	
Analytical geometry, topography, triangular solutions and Surveying with field measurements.			
<b>STATISTICS</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
PC conversions, distribution laws, hypothesis testing, curve plotting ... etc.			

#### PHYSICS

<b>ELECTRICITY</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
Network analysis - digital signals - amplifiers - motors - electromagnetic fields etc.			
<b>EE PRO</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
1000 equations and reference tables - FOURIER transforms ...etc.			
<b>ELECTRONIC</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
MOS NOT gate - junctions - transistor - analyses - integrated circuits ... etc.			
<b>SPICE 48</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
Electronic circuit simulator with analysis and graphical symbols			
<b>MECHANICAL ENGINEERING</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
Beam calculations - fluid mechanics - heat flow - mechanics ... etc.			
<b>STRENGTH OF MATERIALS</b>	<b>TDS</b>	<b>School &amp; HE</b>	
Beam analysis/solid lattice structure/concrete pillars - steel columns and beams...etc.			
<b>PHYSICS</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
Angular motion - vibration - force - power - work - mechanical engineering - optics... etc.			
<b>TOPOGRAPHY</b>	<b>TDS</b>	<b>Professional</b>	
Sealed package - connectable package ...etc.			

## CHEMISTRY

<b>CHEMISTRY</b>	<b>SPARCOM</b>	<b>School &amp; HE</b>	
Periodic table of elements - acids/alkalis - binding energy... etc.			

## FINANCE

<b>FINANCE</b>	<b>BB Marketing</b>		
Constant flow - cashflow - bonds - loans - multiple regression analysis ... etc.			
<b>FINANCE</b>	<b>TDS</b>		
Interest - calculation of margin/percentage - self financing ... etc.			

## PERSONAL ORGANISER

<b>PIM</b>	<b>SPARCOM</b>		
Personal organiser card - telephone directory ... etc.			

## NAVIGATION

<b>NAVIGARE</b>	<b>BB Marketing</b>		
Navigation Pac. Can be connected to GPS ...etc.			
<b>FLIGHT NAV.SYSTEM</b>	<b>BB Marketing</b>		
Air Navigation - can be connected to GPS ...etc.			
<b>CELESTIAL</b>	<b>SPARCOM</b>		
Celestial navigation			

## 7.2. RAM MEMORY CARDS FOR HP48GX

<b>128 Kb</b>	<b>HEWLETT PACKARD</b>	<b>1 year warranty</b>
<b>256 Kb ( 2x128Kb)</b>	<b>T.D.S</b>	<b>15 month warranty</b>
<b>512 Kb ( 4x128Kb )</b>	<b>T.D.S</b>	<b>15 month warranty</b>
<b>1 Mb ( 9x128Kb )</b>	<b>HEWLETT PACKARD</b>	<b>1 year warranty</b>

## 7.3. OTHER ACCESSORIES

<b>3.5" DISKETTE DRIVE</b>	<b>SPARCOM</b>	<b>1 year warranty</b>
Serial/parallel converter for printer.	GreenWich	<b>1 year warranty</b>
<b>Keypad overlay HP 82220 A</b>	<b>HEWLETT PACKARD</b>	
<b>Infra-red printer HP 82240 B</b>	<b>HEWLETT PACKARD</b>	<b>1 year warranty</b>

Other available accessories:

Programming manuals, slip covers, program diskettes, etc.

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# MATH +

HP48 GX

*For High School - College and University*  
**BTS - 96**

**32Kb RAM Card + Mathematical Applications for students.**

Easy to use. Menudriven programs with argument control and on line help.

Special for HEWLETT-PACKARD's calculator HP48GX

TABLE OF VARIATIONS			
X	A	1.5	B
F'(X)	-		+
F(X)	--	--	--
PAGE	2	A	
		2	↑, ↓ EXIT

## FONCTIONS

*Kind of functions*

*Differentiation*

*Zeros of functions*

*Sign of functions*

*Variation of function  
(increase and decrease)*

*Tangent line*

*Table of values*

*Curves*

## DIFFERENTIAL EQUATIONS OF 2<sup>nd</sup> DEGREE

*Symbolic Solution With Partial Answers*

AY''+BY'+CY=R(X)	
X:	1
B:	2
R(X):	'2*COS(X)'
PARTANS Y/M:	Y
VARIABLE	
EDIT	CANCEL OK

4:3	J	Z	H
1	'A+B'	'Y-C'	4.56
2	'(J-...)	'Y-C'	0
3	'(A+..)	12	'A+B'
4-1:	'(A+B)*C'		
EDIT EQ W FWD WIDG GO> GO<			

## SYMBOLIC MATRIX WRITER

*Calculation on  
Symbolic matrices - Symbolic determinant  
Symbolic inversion - Symbolic manipulation*

