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Introduction

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Internet address: **http://volftp.mondadori.com/italiani/CAZORZI/index.htm - http://einstein.freehosting.net - http://members.xoom.it/lis/index.html http://utenti.tripod.it/lis/index.html**

"einSTein" (32 bit) is a calculator with higher finance functions. It uses the Reverse Polish Notation (RPN) or accept normal expressions or functions ,as (1-x^2)*cos(x).
It has ten data storage registers, in addiction to the 8 automatic registers where most calculations take place and the 2.000 registers used for the advanced finance calculations and the other functionalities.
It has many functionalities, each with a different layout of calculator's keys:

normal functions: give you the ability to quickly and easily handle simple arithmetic operations such as adding, subtracting, multiplying and dividing, as well as more sophisticated functions such as logarithms, exponents and financial calculations with equal periodic payments (or deposit amount) and constant period. Displayes or prints the amortization schedule of a loan.
FCT: accept and calculate an arithmetic expression (Ex: 25 * 5/cos(30)). The expression can contain variables (this variables can also be an expression). You can calculate derivatives, integrals; plottern the functions and find its solutions in one given interval. If you have a sequence of points (values), you can determain the functions that better describes them. The expression remain on the display before and after its evaluation, so you can always verify and if necessary change it. The calculator hold up to ten different expressions (of functions) that you can save one by one or all together and later recall.

Calendar functions: handle almost all the operations of the normal functions (not the financial operations) as well as calculate the calendar date of a certain number of days in the future (or past), the number of days between two calendar dates and actual days.
higher financial functions: handle almost all the operations of the normal functions. Beyond that, give you the ability to calculate, quickly and easy, the compound interest rate, or the amount of loan or investment, or the amount at the end of term, with unequal periodic payments (or deposit amounts) and different periods up to a maximum of 600 cash flows.
It's possible to print, with any headline, the complete cash-flow with the interest rate.
trigonometric functions: handle almost all the operations of the normal functions. The financial functions are replaced with the trigonometric functions.
triangles solution: let you compute the area, the sites, the height and the angles of a triangle.
equations solution: let you solve equations up to 16th order.
systems: solution of system of three simultaneous linear equations.
matrices: calculation of the determinant and/or the inverse of a matrix.
vectorial and complex numbers calculator: let you simply handle arithmetic operations with vectors and complex numbers.
vectorial calculation: computing of addition, subtraction, scalar and vectorila product of three dimensional vectors..
measures converter: a window where you can convert a number between many measures.

You can navigate between all this functionality without erasing the prevoius values.
"einSTein" give you the possibility to save (with the name you choose) and resume all the values you are working with. You can always recall the data you have previously saved and so you'll recreate exactly the situation at the moment you had saved your data.

You can, while working, see the contents of the 8 working registers, the lastx register, the ten storage registers and the 5 finance registers.
You can also use a note where you can write and this can be saved as a text file.
Fast all calculator functions are accessible from the keyboard.

All the financial and mathematics functions, without the trigonometric functionality and without the measure converter are available as a stand alon program (name: aSSo!, registration fee: 30 US$ (50.000 lire, 26,00 Euro or 50 DM)).

All the einSTeins's functions, without the financial ones (but with the measure converter!), are available as a stand alone program (name: bravo!, registration fee: 22 US$ (35.000 lire, 18,00 Euro or 35 DM)).

The higher financial function is available also as a stand alone program (Name: inTer, registration fee: 15 US$ (25.000 lire ,13,00 Euro or 25 DM)).

The measure convert function is available also as a stand alone program (Name: meaSure, registration fee: 6 US$ (10.000 lire, 5,00 Euro or 10 DM)).

For who is in a hurry.

If you know the Inverse Polnische Notation (RPN), you can immediately use the calculator.If you know also the H12C of Hewlett Packard, you can also immediately use the normal financial functions without reading the instructions. For the advanced financial function (key "FIN") you can see the examples.
In the functionality expression (key 'funzioni') you have to introduce the expression exactly as yuo should write it (ex: (1+3^2)/(5-6.84^3)-14.25) and press the key "=" to get the result. If the expression contain a variable (ex: sin(1+x^2)+3*x^2/cos(x)), you have first to write the expression and second to write the value for the variable (in the examples x) on the side of its name.
To plottern the function or to calculate the derivate and the integral You can read the examples.
For every key you don't know the meaning, you can find it in the help file.

If you don't know the Inverse Polnische Notation you can immediately begin with the functionality expression (key "funzioni"). In this functionality you introduce the expression (function) exactly as you should write it(ex: (1+3^2)/(5-6.84^3)-14.25) and press the key "=" to have the result. If the expression contain a variable (ex: sin(1+x^2)+3*x^2/cos(x)), you have first to write the expression and second to write the value for the variable (in the examples x) on the side of its name.
To plottern the function or to calculate the derivate and the integral You can read the examples.
For every key you don't know the meaning, you can find it in the help file.
For the 'normal' functionality (key "normale" from the expression functionality) you can read the help file and the examples.

REVERSE POLISH NOTATION (RPN)

The technique, called Reverse Polish Notation, or RPN, requires that when you perform an operation on two numbers, you must *input the two numbers first, then specify the operator or function.*
For instance to add 5 and 3, you normally enter the numbers and operators in the following order:

YOUR INPUT	DISPLAY SHOWS
5	5
+	5
3	3
=	8

Using Reverse Polish Notation, however, you enter the operator last:

YOUR INPUT	DISPLAY SHOWS
5	5
Ent	5
3	3
+	8

The last number, 8, is now ready to start a new calculations. For instance to calculate (5+3)/2-1, use the following sequence:

YOUR INPUT	DISPLAY SHOWS
5	5
Ent	5
3	3
+	8
2	2
/	4
1	1
-	3

For one number operation such as sin, cos, etc. you need only input the number and press the desired function button.
One common difficulty is in entering a negative value. Remember, the -(minus) button is an operator, and will seem to have unexpected results when used as you would on a standard calculator (e.g., -5 to input negative 5). With RPN, you must enter the number as a positive value, then use the CaS button to make it a negative value.

During the calculations the numbers are stored in eight automatic memory registers, called X, Y, Z, T, R, S, U, V.
The memory stack, compoused of eight memories "stacked" on top of each other, allows the automatic storage of seven intermediate results. Thus your calculator simplifies even the most complicated problems.

A full understanding of the automatic memory ist not necessary to perform simple arithmetic und financial calculations, but i strongly encouraged you to optimize your use of the calculator by reading the section 'Registers'.

STANDARD FUNCTIONS

THE OPERATIONS BELOW DESCRIBED ARE THE SAME FOR ALL THE CALCULATOR'S CONFIGURATION. FOR THE OTHER CONFIGURATIONS IT WILL GIVEN AN EXPLANATION ONLY FOT THOSE KEYS THAT WILL CHANGE.

The Standard Functions is the calculator's configuration that appear initially by default.

NUMBERS

To enter a number you must press the numerical keys.

NEGATIVE VALUES

Enter the number as a positive value, then press the **CaS** button to make it a negative value.

ENTER

Pushes the displayed value onto the stack for use in a subsequent operation. Enters the displayed value into the Y-register for use in any two-value operation. (see RPN)

EXPONENTIAL NOTATION

Press the key "**SCI**". To return to the decimal notation, press the key "**NOR**" (replaced SCI).

To input a number in exponential notation, enter the base number, press esp" and input the base-10 exponent. To input a negative base value, press CaS before pressing esp. To input a negative exponent (for small values), press CaS after pressing esp but before terminating the input.

HOW TO MODIFY A NUMBER

During input you can erase the rightmost digit of the display by pressing "←".

HOW TO CLEAR A NUMBER

You can erase the displayed number (and the X-register) by pressing "**Can**"

k **DATE FORMAT**

The date format in use appears on the top left of display: "E" for the European format (dd/mm/yyyy) and "U" for the american format (mm/dd/yyyy). You can change the date formmat clicking the menu at the voice "Date format". The change has effect on the registers of the higher financial functionnality, but not on the memory registers and on the stack registers (not used in the higher financial functionality).

GRAD-RADIAN TRASFORMATION

The key "**c_gra**" turn the displayed angle into grads; the key "**c_rad**" turn the displayed angle into radians.

HOW TO STORE A NUMBER

You can store the number on the display pressing "**Mem**" followed by a number, between 0 and 9, or followed by the comma and the number between 0 and 9 for the storage registers 10 to 20. You can perform the four aritmetic operations on the register (see storage registers).

HOW TO RECALL A STORED NUMBER

You can rtecall a stored value pressing "**Rcl**" followed by a number between 0 and 9, or followed by the comma and a number between 0 and 9 for the sorage registers 10 to 20, according to the storage register where the value itself was stored.

HOW TO SEE THE STORAGE REGISTERS

You can open, pressing "**mem**" (at the right of the numeric pad) a window with the values of the ten storage registers and of the five finance registers. With the same key you can closed that window.

DECIMAL DISPLAY

The key"**dec**" followed by the number of decimal places that you will see (between 0 and 9), set the number of decimal places shown in the display. 2 is the default display.

NOTEPAD

You can open a notepad by pressing "**Note**". The notepad has a menu that permit the copy-

and past-operations, and to save (or recall) your notes. With the same key('Note') you close it.

STACK REGISTERS

You can see the eight registers used by the calculator for the Reverse Polish Notation (RPN) by pressing "**reg**".
With the same key you close the register's window. That window is very usefull for people who have'nt confidence with the Reverse Polish Notation.

AMORTIZATION

If you will see or print the amortization plan of a loan, press '**Amm**' after the introducing of all financial values.

HOW TO SAVE YOUR WORK

Pressing "**save**" you save all the registers of the main calculator (under any name), so you can later use the calculator in the same conditions as it was at the moment of storage.

HOW TO SAVE ON EXIT

If you want to save the dates on exit, click the voice "Save on exit" of the menu. In this way when you turned off the calculator all the dates are saved in the file "Einstein.mcd". The letter "S" appears on the top left of the display to indicate that the function "save on exit" ist on.

HOW TO RECALL ON STARTING

If you checked the menu-key "Recall on running" when you start again the programm, all the dates stored in the file einstein.mcd will be recalled automatically.The letter "C" appears on the top left of the display to indicate that the function "recall on start" ist on.

HOW TO RECALL YOUR WORK

Pressing "**load**" you can load all the storaged informations. The calculetor is now exactly in the same conditions it was at the moment of storage.

HOW TO CHANGE INTO THE 'EXPRESSION' MODALITY

Pressing "**FCT**" the calculator changed to the expression functionality. The key change its name in "**RPN**".

HOW TO REDUCE THE DIMENSIONS OF THE CALCULATOR

You can reduce the dimension of the calculator pressing the little key upon the display. You can still work with the keyboard. Unchecking the option box lets the calculator back to its normal size.

Left are the function keys that, in the other configurations (calendar, higher financial and trigonometric) can be different.

On the right they are also the configuration's key. Von From top: pressing "**TRI**" you toggle between the trigonometric configratione. and the standard one. No register is changed.
Pressing "**FIN**" you toggle between the higher financial configuration. and the standard one.No register is changed.
Pressing "**CAL**" you toggle between the calendar configuration and the standard one. No register is changed.
Pressing "**Eq**" you open the equations window.
Pressing "**C/V**" you open the complex numbers window.
Pressing "**MIS"** you open the window that allow you to convert the measures.

On the left side are the function's keys that, in the other configurations (calendar, trigonometric, higher finance) can be different.

In the lower row are the keys::

"**OFF**" : to close the calculator window and exit from this program.

"**LAST**": restored the previously entered value to the display. Use this to restart after an error or to reuse a value for several calculations. Wen you make a calculation that changes

the value in X-register, the number in x-register is stored in LastX-register (you can see it in the register's window).
"**Down**": roll the register stack down, moving X (the display) to V, V to U, U to S, S to R, R to T, T to Z, Z to Y and Y to X. (see RPN). You may rewiev the contents of the stack by pressing 'Down' 8 times (or simpli opening the register's window).
"**X-Y**": swap X and Y registers. Exchange the contents of the X and Y registers. Use this to store an intermediate answer in Y register, and to return it to the display (the X register) when it's needed.
"**Can**": clear the X-register (display).
"**int**": Converts a numeric expression to an integer by removing the fractional part of the expression. The original number is sored in lastx and you can recall it by pressing 'ULT'.
"**fra**": Removes the integer part of a numeric expression leaving the fractional part. The original number is sored in lastx and you can recall it by pressing 'ULT'.

'**copy**': copy a number or a date from X-register (display) to the clipboard.
'**paste**' a number or a date from the clipboard to the X-register (display). Attention: the number must not be formatted (no thousand separators, yes decimal point !)

In the row above are the keys:
"**y^x**": raises the previously entered value (Y-register) to the power specified by the number in the display (X-register).
"**e^x**": calculates natural exponential, where e is approximatly 2,71828 and x is the variable exponent.
"**/¯x**": computes the square root of the displayed number (must be positive). For higher root you must use the function y^x: for instance the cubic root of y ist y^(1/3).
"**Ln**": computes the natural logarithm of the displayed number..
"**Log**": computes the common logarithm of the displayed number..

"**%T**": computes the percentage thet the displayed number is of the number in Y-register. Example: a company has sell for 560 millions in America and for 72 millions in Europe. Compute the percentage that the European sales make on the entire sales (America + Europe):

560	
ENT	(enter the first number and separe it from second number)
72	
+	(total sales)
72	(european sales)
%T	(compute the percentage on the entire sales)

"**D%**": computes the percentage difference between the previously entered value (Y-register) and the value in the display (X-register). Example: compute percentage change between 34.500 and 38.900

34500	
ENT	(enter the first number and separe it from second number)
38900	
D%	(computes the percentage difference)

"**%**": computes X percent of the value in the Y register. Example: compute 12% of 450

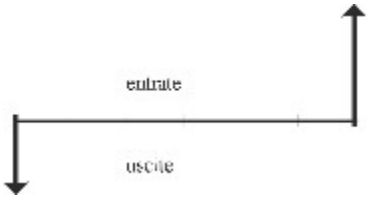
450	
ENT	(enter the first number and separe it from second number)
12	
%	(computes the percent).

"**1/x**": computes the reciprocal (inverse) of any rational displayed number.

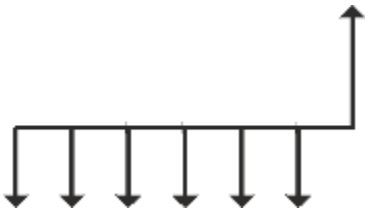
The other keys belong to the financial calculations and they are explained in the next section, the financial configuration (normal) .

Cash flows

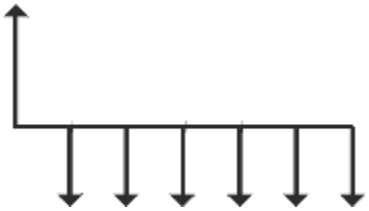
Before solving a financial problem, it's better to draw a cash flow.Hier are some examples.



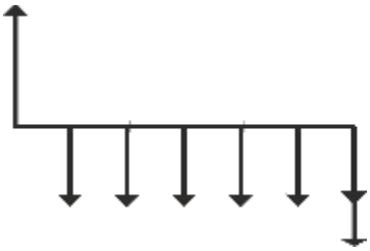
Compunded interestrate, Savings book; revaluation, etc.



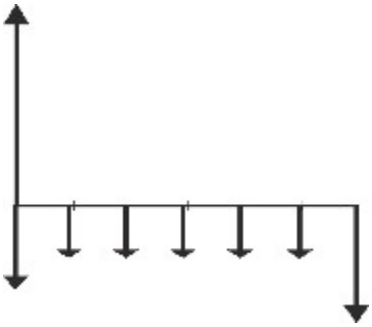
Investment fund, Pension fund, etc. (payments at the beginning of periods)



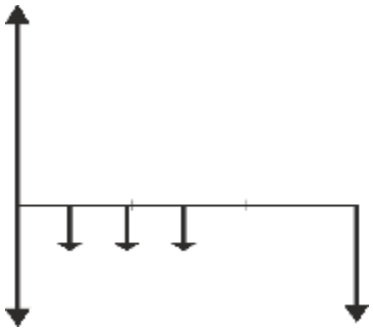
Mortages, loans (payments at the end of periods).



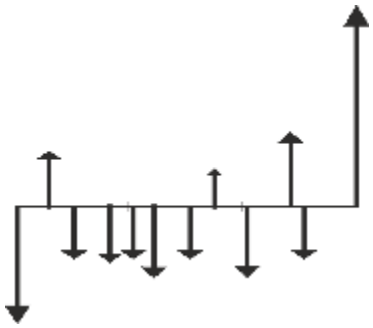
Mortages with a final payment (payments at the end of periods).



Leasing with first bigger fee and final ransom. (payments at the beginning of periods)



Leasing with advance payments and final ransom. (payments at the beginning of periods)



The cash flows are different and the periods are not the same (that's what normally happened!). In that case you must use the higher financial functionality. If you draw a graph of your cash flows, you can easier introduce your values and avoid errors.

FINANCIAL CONFIGURATION (NORMAL)

"**einSTein**" have five finance registers where the values used for financial calculations are store. These registers are indicated with the letters n, i, att, per, fut.
Compound interest calculations involve monies where interest is compounded at regular interval. A compounding period may be a day, month, year, etc. If intervals are not regular, switched to higher financial configuration.

STORAGE
To store a data to a finance register enter the number and press the proper financial key. (oder enter the number and press '**Mem**' followed by the financial key).
RECALL
To recall and display the contents of a storage register press **Rcl** followed by one of the five financial keys.
CANCEL
To clears the five financial registers you muss store a null in every one.

A cash flow diagram (a picture of money received and money paid out) enables you to describe a compound interest problem in terms that the calculator can understand. Once you. Once you draw and label your diagram, you simply key in the known data and solve for unknown value.

Once you have drawn the cash flow diagram, label your diagram with all the known data that pertains to the problem: interest rate, duration of the transaction, number of compounding periods, payment amounts, amount of the loan or investment, etc.
Remember:

the '**n**' value represent the total number of compounding or payments period.
the '**i**' value is the interest rate per period.
the '**per**' value represent the periodic payment or deposit amount. It has always the same sign.
It assumes equal periodic payments and must correspond to the same time frame as 'n' or 'i'.
the '**att**' value represent the amount of money at the start of a transaction or the discounted amount of a future cash flow.
the '**fut**' represent the future value of money or the amount you will obtain/pay at the end of the term. Or you can use 'fut' to solve for a balloon payment at the end of a transaction. It has always the opposite sign as 'att'.

There are four simple rules to remember:

1. Given three or four of the financial values (n, i, att, per or fut), you can solve for the four and/or fifth values, as long as n and/or i are known. Both n and i are involved in all financial calculations. You can enter the values in any order.
2. Use the cash flow sign convention throughout all compound interest calculation: *cash received is representing by a positive value (+); cash paid out is represented by a negative value (-). (You can use all the opposite convention also, but it's very important that you use the sign convention that you've choosed throughout all the calculation!)*
3. Whenever payments (per) are involved, it is always necessary to specify whether the payments are made at the beginning of the payment period or whether the payments are made at the end of the payments period (default), by pressing the key 'ANT' ('POS')-
4. Remember that 'n' and 'i' must correspond to the same time frame. If n is months, then i must be the monthly interest rate; if n is the number of quarterly compounding periods, i must be the quarterly interest rate (see example 2).

A few examples are in the section examples.

AMORTIZATION

If you will see or print the amortization plan of a loan, press '**Amm**' after the introducing of all financial values.

"**LEA**" switch the calculator to compute leasing calculation with advance payments. When you pressed it, it appears the ket "**c/a**". The number of advance payments is keyed in and is pressed **c/a**. You can see how it works in the section Leasing and seing the Examples of leasing's computing.
Il calcolo avviene considerando i movimenti periodici posticipati (avvengono cioè alla fine di ogni periodo).

By default all the payments are made at the end of the payments period.

ANT: press this key if the payments are made at the beginning of the payment period (The letter A appears left below the main display). Its name change in "**POS**": press this key again to indicate that all payments are made at the end of the payments period (The letter P appears left below the main display).

SIGN CONVENTION
Cash received is representing by a positive value (+); cash paid out is represented by a negative value (-). (You can also use all the opposite convention, but it's very important that you use the sign convention that you've choosed throughout all the calculation!).

The five financial keys, beseides the storage property, have also a calculating function. What happened when a financial key is pressed, dipend from the last operation: if the last operation was the enter of a number, when you press a financial key you stre this number in the financial register; otherweise when you press the financial key, you calculate that value.
So, given three or four of the financial values (n, i, att, per or fut), you can solve for the four and/or fifth values see exemple 1). N.B.: remember to erase previous financial values entering a zero in all the financial registers. You can see the value associated with the financial registers opening the register window by perssing 'reg'.

It can happen that the periodic payments are not equal and/or that the time between each periodic payment is different. In that case you must use the higher financial function that allow calculations up to 600 cash flows, jeder different from the other.

AMORTIZATION

You can generate a complete amortization schedule, one payment period at a time, by simple pressing '**Amm**'. The calculator compute the accumulated interest, principal portion of your payments, and remaining balance of your loan. You can choose to see or to print it. Naturally you must enter before the values in the financial registers: amount of loan (att), interest rate (i), payment amount (per), number of periods (n) and the future value (fut).

Leasing

Often leasing several payments are made at the begin of the lease. The cash flows hat so a first payment bigger as the others and some final ones null.
In this case, pressing "**LEA**", it's appears the new key "**c/a**". You use this key to introduce the number of advance payments. You key in the number, so it is displayed, and press c/a. In this way the number of advance payments is stored, is displayed on the c/a key and, if opened, on the memory windows.
The calculations is then similiar to the other compound calculations you saw in the financial section (see Examples of leasing calculationsg), without pressing 'LEA'. Remember thet the number of periods to introduce in n is the same as the total number of periods, the present value to introduce in att is the total leasing value and the future value to introduce in fut is the residual value at the end of the term (it cann be of course also null).

If the first payment is bigger as the others, but is not the result of advance payments (no later payment is null), the calculation is similiar to the other (standard) compound calculations (see Examples of leasing calculations) senza bisogno, without pressing 'LEA'.

Date Format

Starting the date format is european: mm/gg/aaaa. You can change it to the USA format (mm/dd/yyyy) with the menu command 'Date format'.

Once choosed, the date format remain the same auch when you turn the calculator off.
(It's always possible to use the decimal format: dd,mmyyyy).
It accepts: 02/05/1994 - 02/5/1994 - 2/05/1994 - 2/5/1994 - 2.051994.

The date format in use appears on the top left of display: "E" for the European format (dd/mm/yyyy) and "U" for the american format (mm/dd/yyyy). The change has effect on the registers of the higher financial functionnality, but not on the memory registers and on the stack registers (not used in the higher financial functionality).

HIGHER FINANCIAL FUNCTION
(Avalaible also as a stand alone program. Name: **inTer**, registration cost: 35 $)

Press "**FIN**" to enter in this functionality (and press 'FIN' again to come back).
This functionality change the three rows at the top link of calculator.
The calculator accepts up to 600 movements, anyone characterized from a value (obtained/paid amount) and a date (or number of days after the earlier movement).
The calculator acceppts either dates or number of days. You can't use for some movements the date and for the others the numbers of days!
Dates must be entered in the format you have choosed (menu): dd/mm/yyyy or yy/dd/yyyy: key in the number of the day (two digit), press ":", key in the month as two digit, press ":", key in the full year (and press 'Date/days"). The calculetor itself uses the format dd,mmyyyy: dates can so be entered also in this format (For instance the date 31/12/1996 can be entered also as 31,121996); in this case set the number with 6 decimal places (press 'dec' followed by 6). You can store tha dates into any of the ten storage registers. If you recall them, they'll be in the format you have specified with the menu's command.
Pay great **attention** to the sign of values (payment, loan or investment amount): cash received is represented by a positive value; cash paid out is represented by a negative value.
You can enter the values in any order (erst the date and later the amount, or erst the amount and later the date) and also you have'nt to respect the chronological order.
ATTENTION: the dates (or the days) are entered with the key "Date/days"; the payment, loan or investment values are entered with the key "Pay out/in". The key "ENT" preserve its normal functionality and has no effect on entering financial values into financial registers.
The interest rate, when known, is entered by pressing "i".
By default the calculator (key 'run') calculates the interest rate, except the first or the final movement are zero. In that case the calculator calculates this movement.
The examples help you to easily understand that mechanics, that can seem difficult only when you don't try to test practically it. The examples techs you auch how to recover from any mistakes.

"**Date/days**": enter the date (or the number of days) into the financial registers; the date appear now into the box in the middle under the main display. If that is the first value of a movement, the order number appears into the little box on the right, otherwise (being that the last value of the movement) the calculator is rady to accept the entries or a new movement. You have nothing to do: you must only enter the next values. At the right site of the main display appears (in italic) the number 1 if you has entered the first value (1 means that the calculator wait for one more value) or appears the number 0 if you has entered the second and last value of the movement.
"**Pay out/in**": enter the payment, loan or investment values; that value appear now into the box on the left under the main display. If that is the first value of a movement, the order number appears into the little box on the right, otherwise (being that the last value of the movement) the calculator is ready to accept the entries or a new movement. You have nothing to do: you must only enter the next values. At the right site of the main display appears (in italic) the number 1 if you has entered the first value (1 means that the calculator wait for one more value) or appears the number 0 if you has entered the second and last value of the movement.
"**:**": when you enter a date, you must separate the day from the month and the month from the year pressing this key.
"**Forward**": you can see the next movement with this key. You can also go forwards up to a movement you will change. and enter the new values.
"**Backward**": you can see the previous movement. You can also go back up to a movement you will change and enter the new values.
You can go ten movements forwards with Pag_up e ten movement back with Pag_down from keyboard. You can also see the first or the last movement pressing Home or End

from keyboard.
"**C/T**": clears all the 600 financial registers of the higher financial configuration. You must use that key before you begin a new calculation.
"**i**": You must use this key when you will enter the interest rate. (The interest rate is always yearly). You must enter the interest in % and then press i. You can see the stored interest rate pressing "Ric" + "i". The interest rate must be always yarlu; it will from calculator automatically transformed in a daily interest rate (365 days basis).
"**run**": begin the calculation. The unknown value is calculated. Only thre values can miss: the interest rate, the first value or the last value. the outcome is stored and appears into the main box. when noone of the trhee value is null, it's calculated the interest rate.
"**P**": print all the movements and, if calculated, the interest rate. When you press 'P', appears a window where you can input a print headline.

In that functionality, where you are dealing with many values, becomes expecially important the possibility to save your work. when you press "Save"it appears a window asking the name of the file to save. You must only the name ohne prefix (.95d) geben und then press "**Save**". (N.B.: if the name already exist, the old file is exchanged with the new one).
"**Load**": you can load the values you had stored with this key. Also in this case it appears a window asking the name of the file to load.

CALENDAR FUNCTIONALITY

You open this functionality pressing "**CAL**". You return back to the standard functionality pressing once more the same key.

The current date appears on calculator.

This functionality change only the two rows at the top link of calculator.
In order to use the calendar functions, dates must be entered in the format you choosed, dd/mm/yyyy or mm/dd/yyyy, in the menu. You enter the simbol / pressing the key ':'.
You can calculate the number of days between two calendar dates, or the calendar date of a certain number of days in the future (past).

"**D/days**": press this key to calculate. You must first enter the first date (or number of days); press 'ent' to enter this value; enter the second date (or number of days) and press "D/days".
":": when you enter a date, you must separate the day from the month and the month from the year pressing this key.
The examples help you to easily understand that mechanics

RECORDING

The performed operations are recorded automatically if the voice "**Tape On/Off**" of menu has been activated or has been opened the window " Tape Mode" with the key " **R** ".
They can be checked in any moment pressing the key "**R** " set on the right of the display.
The same key closes again the window.
It's possible to print, to save and to reload the performed sequence.

CALENDAR

Double clicking on the date under the display in the modality 'calendar' (or checking 'calendar' from menu in any modality) let appesr a small calendar.
Double clicking on the day on the calendar introduce the date on the display (the calculator must be in RPN mode).

ALARM

Above to the display there is a small icon of an alarm clock.
When you click on it a window appears in which you can introduce up to sixty different alarms. For every alarm different formalities can be chosen: with the option 'in' I can write the times, the minutes and the lacking seconds to the sound of the alar; checking the option '**at**', I can introduce the time and in the special box the date: the alarm will play to the time and the select date. (checking the box '**recurring**' disappears the box of the date and the alarm clock it will play every day to the select time); choosing one day of the week in the left listbox the alarm clock, if I have not checked '**recurring**', will play to the time of the select day; checking '**recurring**' it will play every select day (for instance every Tuesday) to the select time; the same choosing one month in the right listbox; choosing either one day that one month, the alarm clock will play a first day of the select month (for instance the first Tuesday of next May); checking '**recurring**' it will play every select day of every select month (for instance every Tuesday of May of every year to come). The same if you choose the days name and the week (f.i.: the 1st minday)
With the key '**cancel**' you can cancel the actual alarm, with the key '**C/T**' you can cancel them all and you are and reset the alarm clock.
With the key **SAVE**' you save the setting of the actual alarm. With the key '**exit**' you close the window leaving everything as it was.
To side of the icon, when the alarm clock is in operation, it appears the current time, the lacking time to the alarm clock and the time when it will play. Clicking repeatedly on the icon of the alarm clock every time the window of the alarms appears that, if already inserted, you can close with the key ' exit', and the writings to side of the icon alternatively appear and disappear. The calculator can also be used with the working alarm clock...
THE ALARM'S DATE ARE SAVED IN THE EINSTEIN DIECTORY IN THE FILE APR98Z.DMC

TRIGONOMETRIC FUNCTION

You open this functionality pressing "**TRI**". You return back to the standard functionality pressing once more the same key.

This functionality change only the row at the top link of calculator.
By default, angles are input as decimal degrees (the whole part are degrees between 0 and 360, the fractional part is the decimal fraction of degrees).

ATTENTION: the calculator uses decimal grad, ° ' " or radians. You can transform decimal degrees in degrees (°), minutes (') and seconds (") and vice versa, or radians in decimal degree and viceversa. The formality '° ' "' (minutes and seconds) it has alone value for the angles; Keep therefore a lot of attention, above all if in the expression they are present also not trigonometric functions!
Also in the window 'Complex calculations' and 'Vectors' it is possible to use the angle in the form of degrees, minutes and seconds in the computation.

"**d/' ''**": transform an angle in decimal degrees into an angle in degrees, minutes and seconds.
"**' ''/d**": transform an angle in degrees, minutes and seconds into an angle in decimal degrees.
"**c.gra**": transform an angle in decimal degrees into an angle in radians.
"**c.rad**": transform an angle in radians in an angle in decimal degrees.

"**sen**": sinus.
"**cos**": cosinus.
"**tan**": tangent.
"**Cota**": cotangent.
"**aCot**": inverse cotangent.
"**at**": inverse tangent.
"**aSe**": inverse sinus.
"**aCo**": inverse cosinus.
"**more...**": show the keys:
"**Sec**": Secant
"**aSec**": inverse secant.
"**hSec**": hyperbolic secant.
"**haSc**": inverse hyperbolic secant.
"**Csc**": Cosecant.
"**aCsc**": inverse cosecant.
"**hCsc**": hyperbolic cosecant.
"**haCs**": inverse hyperbolic cosecant.
"**hTa**": hyperbolic tangent
"**haTa**": hyperbolic inverse tangent.
"**hSen**": hyperbolic sinus.
"**haSe**": hyperbolic inverse sinus.
"**hCt**": hyperbolic cotangent.
"**haCt**": hyperbolic inverse cotangent.
"**hCos**": hyperbolic cosinus.
"**haCo**": inverse hyperbolic cosinus.

"°": sets the calculator to use grad for the trigonometric functions. You can choose from the menu decimalgrad or grad in grad, minutes and seconds. Over the display appears " °D " or " ° ' " ". The key will change in "RAD". Pressing now this key the calculator is set to use radians.

"**RAD**": sets the calculator to use radians for trigonometric functions. Over the display appears " °R ". The key will change in "°". Pressing now this key the calculator is set to use grads.

"Δ": pressing this key, it appears the triangle's window. In this window you can calculate all the values of a triangle (Height, size, area, angles). First you must indicate the elements you know checking the wright choice. You can choose between: one side and two angles, two sides and the angle between, three sides, one side the base and the height, the base one angle and the height.
Now can you introduce the known data. Pressing 'compute' the unknown data are calculated.
You can switch between grades and radians with the key "rad" ("°"). This key doesn't affect the calculator.
Of course you can copy or paste a number. You need only to choose the number corresponding the little window you want copy from or paste to.

EQUATION WINDOW

You open this window pressing the key "**Eq**".
You can solve equations up to the 4th order. The equations are in the form:

a + bx + cx^2 + d x^3 + ex^4 = 0

where a, b, c, d and e are real numbers.

Once you have introduced the coefficients, pressing "compute" you get the solutions.
The 4 keys at the right site are for pasting the four coefficients from clipboard.
With the other keys you can copy the real or the complex portion of any solution.
You can also storage the solution (complex or real) in the four double registers A, B, C and D.
These four registers are shared with the complex numbers window.

The window stay open also if you close the calculator.

Pressing '**higher**' you open the window for polynomilas up to 16th degree (with real coefficients).
The equations are in the form:

a0 + a1x + a2x^2 +.....+ a15x^15 + a16x^16 = 0

where a*n* are real numbers.

With the key **fact** you can factorize the equation. With the first pressing you find the first factor and the coefficients of the reduced equation (white background). With any other pressing you find the remaining factors with the coefficients of the reduced equation.
Below the key '**fact**' appear a little colored window with the rest of the division. This rest is different from null when the equation is divided through a factor that is not a root of the equation selbst.
If the little box above the key 'run' is checked, the roots will be displayed with 15 decimal digits.
If you double click the box of a root, its content wil be pasted on the clipboard.

Precision: *in the box down on the left you can choose a value between 0 and 4.With the value 0 it is considered as a root of f(x) the value of x that makes |f(x)| <= 1E-13. The imag-teil of the root is put =0 if its absolute value is smaller of 1E-8.To the value 1 is associeted 1E-12; to the value 2 1E-9; to the value 3 1E-6 and to the value 4 1E-3.The calculator begin to compute the rootswith the value 0 (if you have not choose anothe one) and change it automatically if needed. The value corresponding to the solution is displayed in the little gray box .The real- and the complex -part of any root is indicated as0 if smaller as 1E-8.*

You can also see the **example**.

Systems

With einSTein you can solve a system of three linear equations.
Choose the functionality expression (key "**FCT**") and press the key "**sis**". It appears a window where you can write the coefficents of the equations of the system:

a1x+b1y+c1z=d1
a2x+b2y+c2z=d2
a3x+b3y+c3z=d3

With the key "**compute**" you find the values of x, y e z thet solve the system.
These values can be stored in the stac registers x, y and z with the key "**sto x,y,z**".
Examples

Matrices

Always in the expression's functionality (key "FCT"), pressing the key "**mat**" you open the window for matrix's calculation. You can compute the determinant and the inverse of a trhee x three matrix, calculate the product, the sum or the difference of two matrices.

DETERMINANT and INVERSE
Introduce the values (for a two x two matrix the third line and row are of the type 0,0,1) and with the key "**Determinant**" you compute the determinant, while with the key "**Invers**" the value of the initial matrix are substitute withe the value of it inverse. If you have calculated the determinant, with the key "**sto x**" you store the result in the x register.

MATRIX'S COMPUTING
The product of two matrices where the number of columns of the first is unequal to the number of rows of the second is undefined, as is the sum or difference of two matrices of unequal dimension. These illegal operations will be undetected by this program, since it assumes each matrix is a submatrix of a 3x3, all undefined elements of which are zero. Correct answer will result for legal operations, but care must be taken thet the operations are indeed legal.
For two matrices X and Y, each with dimension less than or equal to three, this program will solve for the product or sum of them, the difference between them, or the result of a scalar multiplication of either. Each matriz is stored upper left justified in a 3x3 array. All results replace the matrix on the display and are upper justified.

/ product of two matrices

x scalar product

/ scalar division

+ sum

- difference

last recall the last input

x-y

canc erase the display

Examples

COMPLEX NUMBERS WINDOW

Pressing "**C/V**" open this window.
Here you can perform complexe calculations.
The input formats are: x + yi or r/ß
Angles: you have to introduce the angles in the form of decimal degrees if the box below the angles-display is'nt checked. If this box is checked (the angles-display is now divided in three part) you can introduce the angle as degrees, minutes and seconds.

You can toggle between the two formats with the options keys on the left (also during a calculation).
The calculator has 8 stac registers that are displayed on the top of window.
It has four memory (A, B, C, and D), shared with the equations window.
The example let you see how it work.

The trigonometric keys are the same described in the trigonometric teil. The angles are in radians.

Vectorial calculations (three dimension)

From the expression functionality you can open with the key "**vet**", the window for the vector's computing. The window works as a little RPN calculator with four registers. In the white fields you can introduce the Cartesian or polar coordinate (according to the checked option) of the vector.
Angles: you have to introduce the angles in the form of decimal degrees if the box below the angles-display is'nt checked. If this box is checked (the angles-display is now divided in three part) you can introduce the angle as degrees, minutes and seconds.
You can in any moment change the coordinate from cartesian to polar and viceversa.
With the key "ENTRA" you separated the first vector from the second one. The first appear now on the first line of the stac. Once you have tipped the second vector, choose the appropriated operations and press the key:
"**/**": vectorial multiplication
"**X**" scalar multiplication.
"**+**" additio
"**-**" subtraction.
The last vector is saved and can be rcalled wuith the key "ULT". The keys "su" e "giù" move the stack values up or down..
Examples

Quaternion's computing

From the expression functionality open the window 'vector's computing' with the key 'vet'.
Then press the key '**quaternion**'.
A quaternion is a 4-tuple which can be regarded as a scalar plus a vector.
The 'quaternion's window' is a little RPN-quaternion-calculator.
It has one stac-register (black fields) and one display (white boxes).

You have to key in the first quaternion, separate it from the second pressing 'ENTER', key in the second one and pressing the desired operation-key.

"*": multiplication
"**/**" division.
"**.**" scalar multiplication
"**+**" sum
"**-**" difference.
"**inv**" Inverse
The last input for any operation is automatically saved and it can be recalled with the key '**ult**'.
With the key '**up**' and '**dwn**' you can scroll the register-stac.
Examples

MEASURES CONVERTER
(Available also as a stand alone program. Name: **meaSure**, registration fee: 6 US$)

You open this function pressing the key '"**MIS**".
You have to choose first the kind of measure (Area, lenght, etc.).
The last two categories ('Currencies' and 'Other') are modifiable from the user. To modify them you have to checkd both the box 'Change' and one of the two boxes 'Currencies' or 'Other'. It appears a window with two keys: 'Yes' and 'No'. Pressing 'No' closed the window; pressing 'Yes' open the window. Now you can change the values (and the names of the measures: the category 'Other' is empty). If you will save the new values you have to press the key 'Save'. If you introduced new entry, but you will not save it, you can use these new entry by pressing the key 'O.K.', without closing the window (or minimizing the window without closing it). Pressing the key 'Restore' you overwrite your new entry withe the original one (only in the 'Currencies' category).
After that you choose the measure you want convert. You choose it from the list that appear as you press the little arrow of the upper box.
Now you can enter the number to convert. You can get it from a register or from a memory pressing the key '**Rec**' followed by the register- memory-key. But you can also key the number in with the number-key or using the keyboard or get it from *clipboard* using the key '**paste**'.

The key '**dec**' followed by a number (0 to 9) displayed the required decimal units.

Now select the required conversion in the lower combi-box and press the key '**compute**'.
With the key '**copy**' you can calculate the conversion and, at the same moment, copy the results into the *clippboard*.

You can save the results in one or more registers or/and in one or more memories with the key '**mem**' followed by the required key.
'←' cancel the last digit.
'**chs**' change the sign.
'**clx**' cancel the number to convert.
'**x-y**' change the converting number with the converted number. the
The key '**exit**' ended the program.

KEYS	KEYBOARD	
Chs	s or S	
x_y	x	
Paste	p or i	
Copy	c	
Rcl	r	(followed by a number or x....v)
Mem	m	(followed by a number or x ....v)
Help	F1	
Clx	Canc (Del)	
exit	Esc	

EXPRESSIONS

Pressing "**FCT**" the calculator is in the functionality 'expressions'. In this functionality you can enter the expressions (or function) as you normally write them. The contents of all memory and register of the 'normal' (RPN) functionality remain unchanged, only the stac register x is used in the expression functionality.
The expression is introduced in the white display. The little, long key below the display is used to expand the display. The same key let the display to return to its normal size. The result appear in the black display.

Limits
The expressions you can untroduce can have a maximum of 64.000 digits. The maximum numbers of parenthesis is 240. The letter E (capital letter) is uded for the scientific notation (f.i.: 1E-2, or -1.5E3 or 0.25E2.4). The letter e (lower case) points out the constant 2,71828...
The same limits are valid also for every costant-box and register-box. That means that, since the expression on the display or in the box or register can recall any box or register, its lenght can be very large.
Pay particolary attention to the circular reference: f.i. A recall B that recall the register of C that recall A.
Before computing the expression the program make an orthographic control. This control is made only the firts time the expression is computed.
If the computing keep more then 5 seconds, an indicator-window appears.

Below are the keys with all the usable functions.
To introduce your expression you can use the keys or you can tipped them from keyboard (in this case pay attention to the operands: the have to be written exactly as they appear on the keys, with exception for trigonometric operands that can be written wuith all lower-case letter (but you have to write hsin or h sen for sinh, hasin for asinh, and so on).
The variables x,y,z,t,r,s,u,v,w,A,B,C,D,F,G,H can be used as elements of the expression. The values of these variables is to be entered in the appropriate boxes. (The small key "**b**" left of the key ' registri' magnifies the box of the memories within which the mouse_pointer is found, with the same key the box returns to its normal dimensions; the key "**r**" has the same function for the memories of the constants.). With the key "**registri**" you change the name of the variables w to H into x to v (registers values). With the same key that now is changed in "**costanti**" you return back to the previous names. This change have no effect for the expression (if the expression contain a x, the value used for it is the value in the first case also if the variable name is w), but has a meaning for the two keys "rcl" and "sto" as described below.
The operators (numbers) can be wrote also in the form 1.5E-2, that means .015, or can be racalled from memories or stac registers (see below).
After the expression has been entered, you may just press the "=" (or the enter) key and the result appear in the black result display.
You can introduce up to 11 different expression, everyone with 8 variables (the variables may also been expression without variables). To introduce more expressions, after the first press one of the key with the little arrow (not the ones on the display!). The index change and you can introduce a new expression.
The two arrow on the display serve to read the expression when it is longer as the display itself.
Below the order's number of the expression ther are 8 function's keys that are not usable, exept "**pi**" in the expression, bat recall special functionalities. They are:

rad: change from grad to radians. Its name change to "°" and now serve to change from radians to grad;

pi:insert in the expression the costant pi (3,14...) (you can also write direct pi from keyboard) The calculator recognised also the constant e that can bo written from

keyboard.
int: open a window for the computing of integral. You can choose between trhe different approximations: the Gaussian quadrature, the only that allow to compute an integral from a finit value to an infinite one), the Simpson method and the numeric method. The result appear in the result display of calculator.
Gaussian: introduce the values for a and b (INF for infinite) and pressed "**compute**"
Simpson: introduce the values for a and b (both finit). Below you can introduce a number that influence the precision. Smaller the number, greater the precision, but greater also the computing time. The suggested number is normally sufficient.
Numeric: teil the inteval and added the computed for each teil. Introduce the values for a and b (both finit). Below you can introduce a number that influence the precision. Smaller the number, greater the precision, but greater also the computing time. The suggested number is normally sufficient.
N.B.: the values for a e b can be introduce also as expressions (for i.: sen(2*pi/4)).
It is also indicated if the angles are in grad or radians.
der: allows to compute the derivate of the current expression trated as a function of x (or w). You must first tippen the value of x at wich the function derivative is to computed and then press "der". In the windows that appears you must press the key "**compute**". The value of the derivate appears on the resultat display of the calculator.You can increase the precision by entering a smaller value in the derivate window.
gra: open a window with trhee possibility:
1. k**Graph**: first enter the expression in the display as a function of x (or w). Then click "gra" and enter the x- and y- limits and press the key "**show**". The green points are calculated, the red ones not. Its possible to improve the precision checking the boxes near the voice'more precision (the first box to the right increases the precision of 10 times, the second of 25 times, all together of 50 times)',also if the drawing's time will greater.
Checking '**overlap**' you can plotter a second function over the first one.
The drawing process can be interrupted with the key "**break**".
The graph can be printed marking the box to the right (**print**) and pressing the key '**show**'. Marking also the second box, you can print graphs of more functions above the same grate. To do it:
mark the two print's boxes. Press the key '**show**'. Change in the calculator the function (or the constants of the preceding function). Mark the box '**Overlap**' and to press '**show**'. Repeat the last two passages for how many times you desire and then to press the key '**S**', to the right of the two boxws 'print'.

2. Solution of f(x)=0 in a given interval: enter the expression in the display as a function of x (or w). Then press "gra" and enter the x-limits. Enter null for the y-limits and press "**show**". The solution, if it exist, will display in the little x-window on the calculator. With the key "**next**" the calculator try to find another solution in the same interval.
3. Approximate a series of values with a function:To find a function (linear, logarithmic or exponential), that better describes a series of values, you first press "gra", then the key "**?f(x)**". Enter the values, x and y, pressing the arrow after any entry. Press once more the arrow after the last entry and then the key "**show**". It appears the graph of the desired function (the red points are the given values) and the box 'prec." will show a numer: is this number near to one, then the approximation is good. With "**next**" you can compute the other three functions with their approximations-grad. The possible functions are: y=a+bx, y=a*e^(bx), y=a+b*Ln(x) e y=a*x^b.
The computed functions is displayed on the calculator.
For printing, see above.

Below are the keys: "**RPN**", "**save**" e "**load**".

The key "**RPN**" restore the normal (RPN) functionality.
Pressing "**save**" you can save one or more functions. In the saving window you choose firt a name for the function. Enter below left the order's number of the function you will save; if you enter in the second box the same number, only the function you have indicated is saved. If you will save more than one function, enter the number of the fisrt function left and the number of the last function right. The program append automatically, between two parenthesis, the number of saved functions to the name of the file.
Pressing "**load**" you can load a saved function or group of functions. Enter the filename and pressed load. if you enter an order number in the box below, the function(s) will be loaded beginning from that order number.
N.B.: when the menu's voice "save on exit" is checked (only registered programs) the functions are saved and recalled automatically when you close and load the program.

Over the number's keys there are the four keys "**Ric**", "**Mem**", "**Rcl**" and "**Sto**":

Ric: followed by a number between 0 and 9 recall the value from the memory marked by the number and insert it in the display.
Followed by x, y, z, t, r, s, u or v recall the value from the indicated register and insert it in the corresponding box.
Mem: followed by a number between 0 and 9 stored the result in the indicated memory.
Followed by x, y, z, t, r, s, u or v store the result in the indicated stack register.
Followed by w, A,B,C,D,F,G or H insert the result in the indicated box.
Rcl: Followed by a number between 0 and 9 insert in the display the value stored in the indicated memory in the form of "RCLn".
Followed by x, y, z, t, r, s, u or v insert the value of the indicated stack register in the indicated box.
Followed by w, A, B, C, D, F, G or H insert in the expression the term "RCLn" where n recall the value stored in the corresponding box-memory.
Sto: followed by x, y, z, t, r, s, u or v store the value in the indicated box in the corresponding stack register.
Followed by w, A, B, C, D, F, G or H stored the value in the box into the indicated box-memory.
The keys "**Canc**" and "**C/T**" cancel respectively the displayed expression or all the eleven expressions.
"**dec**" (followed by a number between 0 and 9) set the number of decimal digits that are displayed in the result fenster.

Common errors: inserting the expression you must pay attention to the right syntaxNo problems if you use the calculator's keys; if you use the keyboard you must pay attention: write the operators normally as they appear on the keys;here some examples:
z + x ^ (t - 1) + 4 * x or z+x^(t-1)+4 are correct, z + x ^ (t - 1) + 4x or z+x(t-1)+4*x or Z+x^(t+1)*4*x are not correct.
Pay attention at the grad format (grad or radians). That not only to compute an expression, but also for graphs, integrals and derivatives.
The **examples** with a little practice let you appreciate the simplicity and power of thid kind of computing.

PROGRAMMING

It's to write up to 1200 lines of program in a simple and clear manner.
To write or to run a program, first is necessary to go i the **RPN** functionality. The key "**R**" (to the right under the display), him opens the window ' TAPE' (where all the pressed keys are annotated). From this window, pressing the key "**PROG"**, bring you to the programming functionality.

A program is written simply pressing the keys of the calculator as if you were doing the calculation.
To begin to write a program, or to continue a program, is necessary to press the yellow key "**Write**"(disappears 'Write' and appears 'End') .
To this point press on the calculator the needed sequence of keys (for instance to write a program that calculate the sum between the memory 1 and the memory 2, press in sequence: RCL 1 RCL 2 +). When you have finished to write the program, press the button (grey) "**END**" and then the yellow key "**End**" (this last closes the program; now you can use the calculator without modifying the program).
The key '**Correct**' lets appear a small window where you can choose if to cancel, to change or to insert a program's line. All you need is to insert the number of the line to change, to press the key O.K. and, if you have selected 'change' or to 'insert', to press the desired keys.
The rose key "**Cancel**" serves for canceling the last written line.
To run the program press the yellow key "**Run**".
It's possible to insert logical commands as **if stacx <=**..., etc. or the repetitive function **For x = 0 to....**
In these cases the program uses some memories; precisely:
The function **IF stacx> <=...** may use the memory 18.
The function **For x = 0 to...**may use the memory 17.
The functions **Go To**... **Go Sub** (max 100 Go Sub) may use the memory 19.
Each of these functions lets appear a window in which to insert the reference. If you don't insert a number or if you insert a letter the function seeks the appropriate reference in the corresponding memory.
When the program meets a logical function (IF...) it performs the next line if the logical function is satisfied, otherwise it jumps it.
The key "**x()**" recalls the momentary value x of the function For x and she can also be used for addressing a memory indirectly; the number n between the two parentheses (1, 2,..., n) points out the corresponding function For x in the case more For x are nested, if not it is equal to 1; for instance you will write:
... for x=0 to m..... x(1)..... next..... for x=0 to n..... x(1)... next...;
or:
... for x=0 to m... for x=0 to n..... x(1).... x(2)..... next... x(1)... next..., where x(1) reported the value of the first For x and x(2) reported the value of the second For x.
x(n) has to appear between the For x which is reported and the corresponding Next.
The following little programs write the number 1 to 20 in the corresponfing memory.

For x=0 to 9
For x=0 to 9
1
1
ENTER
x(2)
+
mem
,
x(2)

NEXT
x(1)
ENTER
1
+
mem
x(1)
NEXT
END
You can see them if you open the memory window:

The key "**Step"** serves for performing the program step to step. She can be inserted in the program or used later.
With the key "**Cancel**" (on the top) the program is canceled from memory.
With the key "**Correct**" you can cancel more lines, replace a line or insert more lines of program; in this last case the writing ' correct' is changed in '**Halt**' and, to conclude the insertion, is necessary to press such key.
After having canceled or inserted lines, the program rearranges the references of the commands Go To and Go Sub, requiring you of to choose the wanted formality.
The small key to the left of the key 'End' activates the function "Tape". Pressing it, appears a **T**. This **T** means that all the operations of the program are recorded; to see them, once finished the program, return to the 'Tape' function pressing the key "**PROG**". With the 'Tape' function inserted, the program turns more slowly. For this reason such function is normally disconnected (Eliminating the sound the program also turns more quickly.).
A program can be saved or loaded. The keys are obviously "**Save**" and "**Load**".
Before loading a program remember to cancel the one eventually already present.
Loaded a program, remember to press the yellow **End** key: in this way you can introduce, if necessary, the constants in the memories.
The program can be printed (on a printer) with the key "**Print**" on the top of the window.
In the einSTein's installation-program there are three programs. (They are of well scarce utility, but they can serve to understand the logic of a program).
The program " Date.prg " calculates the number of days between two dates stored respectively in the memories 1 and 2, ordering them in such manner that the result is always positive. It uses the function **IF**.
The program " Plotter.prg " calculates the results for n values of x of the function E^x(sin(2+x))+aSi(cos(x/2))+c*x-d where c=0.35 and d=4
It is necessary to insert the constants in the respective memories: 035 in memory 2, 4 in memory 3 and n, for instance 10, in memory 7. The results, calculated for x=0,1,2... up to n, are shown with 9 decimal figures, at the end of the program, in the window " Notes ", from where it's possible to print them. This program uses the functions **For x=0 to n** and **Print** (on the bottom of the window)**.** This last visualizes the results on the window " Notes ".
The program example.prg finds the value of x (< 10) that it annuls (with an approximation between +0.1 and - 0.1) the above function (in an interval where she is always negative up to the point of annulment). It necessary to insert the constants 0.35 in memory 2, 4 in memory 3 and the approximation 0.1 in memory 8. The program is of any utility, but it uses all the logical functions.
The function **For x=0 To..** is used for increasing the value of x until the value of the expression is bigger as - 0.1. The two functions **IF stacx...** check if the value of the expression is between -0.1 and +0.1; if this is the case, the program finishes and shows the result.
Otherwise it restarts with a smaller increase of x.
In the case doesn't succeed in finding a solution, the program ends showing the number 999.

PHOTO

With the calculator in the functionality 'expression', if you double click on the black deisplay (result-display), you'll see a photo. This photo is saved in one of the directorys foto1, foto2 or foto3 of the application with the name: einsfot1.bmp or einsfot1.jpg. If you will, you can change it with another in the same format (Windows. bmp or jpg), with the same or proportional measure and saved in one of the three directorys (foto1, foto2 and foto3), with the same name (einsfot1).
Clicking on the photo you return in the expression functionality.
If available any number of photos are shown. With the scroll bar you can see the next photo. With a click sideways the last photo is shown, with a double ckick the first. The names of the photos must be: einsfot1, einsfot2, einsfot3, ... (in each directory you have to begin with einsfot1).
Links you can choose the directory to see. With the key upon the scroll bar you can toggle between automatic and manual.

REGISTERS

With the key "reg" You can open (and close) a window that show (in action) the 4 stack registers (X, Y, Z and T) and the LastX (LastX) register. To see the others you must click the key on the register windows.
During the calculation, in fact, the calculator uses the stack registers in this way:

V stores the intermediate results
U stores the intermediate results
S stores the intermediate results
R stores the intermediate results
T stores the intermediate results
Z stores the intermediate results
Y the number in this register it's used with that one in the X-register for calculation
X stores the number that appear into the main display

When you key a number into the calculator, its contents are written into the displayed X-register. In order to key in another number, you must indicate the calculator that you have completed keying in the first number and that any new digits you key in are part of a new number.
You use the 'ENT' key to separate the first number from the second.
When you press the 'ENT' key, the number in the displayed X-register is copied into Y, Y into Z, Z into T, T into R, R into S, S into U, U into V.
Immediatly after pressing 'ENT', the X-register is prepared for a new number, and that new number writes over the number in X. Now the calculator is ready to perform an arithmetic operation with the two numbers in the stacks. Every arithmetic operation involving two numbers is done with the contents of the X- and Y-registers.

The 'Can' key replaces any number in the display (X-register) with zero. If a new number is keyed in, it writes over the zero in X.

The 'x-y' and 'Down' keys allow you to rewiew the stack contents or to shift data within the stack for computation at any time.
The 'x-y' key excange the contents of the X- and Y- registers, without affecting the Z- and T-registers.
Each time you press the 'Down' key, the stack contents shift downward one register. The last number you have keyed in (X-register) will be rotated around to the V-register.

Let us see now how the registers worken with a simple operation: 5+2 (in these examples only the first four registers are shown).

T	0	0	0	0
Z	0	0	0	0
Y	0	5	5	0
X	5	5	2	3
keys	*5*	*ENT*	*2*	-

Let us see now a multiple-value calculations: $\frac{(3 \times 4) + (5 \times 6)}{7 \times 2}$

T	0	0	0	0	0	0	0	0	0	0	0
Z	0	0	0	0	0	12	12	0	0	0	0

Y	0	3	3	0	12	5	5	12	0	42	0
X	3	3	4	12	5	5	6	30	42	7	6
keys	*3*	*Enter*	*4*	*x*	*5*	*Enter*	*6*	*x*	*/*	*7*	*/*

You can see how the intermediate results are not only displayed, but also stored so that they are ready at the right momentand at the right place.

You can change the number stored in the stack with two keys:

X-Y exchange the contents of the X and Y registers.
Down rolls the register stack down, moving X (the display) to V, V to U, U to S, S to R, R to T, T to Z, Z to Y and Y to X (the display). You may review the contents of the stack by pressing 'Down' 8 times (or by pressing 'reg').

The one-number operations such as 1/x, square root, logarithm, natural exponent, etc. use only the number in the X register (the displayed number). The other stack registers dont change: change nur the X register. The earlier value in the X register is in the UltX (LastX) register stored and you can recall it by pressing "LAST". In the higher financial function es ist used normally only the X register (save you press "ENT" or you perform a mathematic operatin). In the calendar functionality you use normally only the Y- and X regisrter.

The two-number operations such as adding, dividing, multiplying, etc., use the X- and Y register. Every time you perform a two-number operation, the results is displayed and stored in the X register, the earlier value un the X register is stored in the UltX (LastX) register (You can always recall it by pressing 'LAST') and the stack roll down: Z move to Y, T move to Z, R, move to T, S move to R, U move to S, V move to U and V remain.

This mechanism required that when you perform an operation on two numbers, you must input the two numbers first, separating the first them by pressing 'ENT', then specify the operator or function.
All that seem difficult. Initially you should try simple operations looking at the opened registers fenster.

Order of execution: you could work a problem by beginning at the left side of the equation and simply working through it in left-to-right order. All problems cannot be solved using left-to-right order, however, and the best order for solving any problem is to begin with the innermost parentheses and work outward just as you would on paper.

You can also learn very much with the examples.

NOTEPAD

You can open a notepad pressing "**note**". With the same key you'll close it.

You can save your writing with the menu command (in the notepad window) 'salva', bat not pressing the calculatore key 'save'.

STORAGE REGISTERS

"einSTein" hat ten storage registers, numbered 0...9, in addition to the automatic memory registers where most calculations take place. These storage registers allow you to store and retrieve data or results.
To store data to a register, use the 'Mem' funcion (left side) and assign a unique address from 0-9.
To retrieve data from a register, use the 'Rcl' function, again supplying the assigned address: the register value is diplayed and stored in the X register, X move to Y, Y to Z, Z to T, T to R, R to S, S to U, U to V. You don't need to press 'ENT', but you can immediatly perform an operation oder enter a new number.
You can see the values stored in the storage registers pressing 'mem ' (on the right side). With the same key you can close the memory window.

Arithmetic operations in the storage registers.
Press 'Mem' followed by +, or -, or /, or *, to add, subtract, divide or multiply the displayed number to the numbers currently stored in a given data register and replace the previous contents of the register with the new resul. For instance if the number 4 is in the register 3 and 5 is actually displayed, pressing the keys 'Mem' '+' '3', the number in the register 3 chang itself in 9 (=5 + 4).

ERRORS

Normally "einSTein" if an error happened, as a division for zero, display an error message. To clear it press 'can'.

An unexpected error switch the program off.

KEYBOARD

ALL FUNCTIIONALITYS

KEYBOARD(English)	(Deutsch)	KEY (English)	(Deutsch)
Numbers		Numbers	
.	,		
4 math. operators		4 math operators	
m		Mem	
r		Rcl	
Del (Canc)		Can	
s		CaS	
INVIO, ENTER		ENT	
BACKSPACE		←	
Alt+t		TRI	
Alt+f		FIN	
Alt+c		CAL	
Alt+i		MIS	
Alt+d		dec	
Alt+m		mem	
Alt+r		reg	
Alt+o		note	
l		LAST	
w		Down	
x		x-y	
Alt+y		y?x	
Alt+e		e^x	
Alt+x		/¯x	
Alt+n		Ln	
Alt+g		Log	
Alt+/		1/x	
F1		Help	
F2		Save	
F3		Load	
F4		Copy	
F5		Paste	
Esc		OFF	
%		%	
n		n	
i		i	
a		act	akt
p		per	
f		fut	
Alt+l		LEA	
c		c/a	
A o P		ANT o POS	
T		%T	
Alt+a		Amm	

CALENDAR FUNCTIONALITY

d		D/days	D/tages

HIGHER FINANCIAL FUNCTIONALITY

d		Date/days	Datum/Tages
p	e	Pay out/in	Ein/Auszahl
Alt+w	Alt+w	Forward	Forwärts
Alt+b	Alt+k	Backward	Rückwärts
i		i	
Pg-Dn		not existing	go ten places back
Pg_Up		not existing	go ten places ahead
Home	not existing	go to first	
End	not existing	go to last	
Alt+u		run	
Alt+p	Alt+d	P (or D or S = print)	

TRIGONOMETRIC FUNCTIONALITY

e	sine
c	cosine
t	tangent
S	arc-sine
C	arc-cosine
a	arc tangent
°	° or RAD (degrees/radians)
Alt+\	∆

KEYS

Amm	Alt+a
ANT	A or P
act	a
c/a	c
CAL	Alt+c
CaS	s
Can	Del
C/V	
copy	F4
DEC	Alt+d
Down	w
ENT	ENTER
Esp	
Eq	
FIN	Alt+f
fra	
Fut	f
i	i
incolla	F5
int	
LEA	Alt+l
Load	F3
Log	Alt+g
LN	Alt+n
MIS	Alt+i
Mem	m
mem	Alt+m
n	n
NOR	
note	Alt+o
OFF	Esc
per	p
POS	P or A
Rcl	r
reg	Alt+r
Save	F2
SCI	
TRI	Alt+t
LAST	l
%T	T
D%	D
%	%
1/x	Alt+/
y^x	Alt+y
e^x	Alt+e
/¯x	Alt+x
x-y	x
←	←

HIGHER FINANCIAL FUNCTIONALITY

Backward	Alt+b (Deutsch = Alt+k)

C/T		
Date/days	d	
Forward	Alt+w	
i	i	
P	Alt+p	(Deutsch = Alt+d)
Pay out/in	p	(Deutsch = e)
run	Alt+u	
:	:	

CALENDAR FUNCTIONALITY

D/days	d
:	:

TRIGONOMETRIC FUNCTIONALITY

aCo	C
aSe	S
at	a
cos	c
rad	°
sen	e
tan	t
°	°
Δ	Alt+\

EXAMPLES

You should open, pressing 'reg' (right down) the registers window, so you can see how the X, Y, Z and T registers work during a calculation (In these examples the other four registers are not used).

Arithmetic simple calculations

Example 1: 13:2

YOU INPUT	DISPLAY SHOWS
13	13
ENT	13,00
2	2
/	6,50

Multiple-value calculations

Example 2: 68.530 - 10.000 - 15.700 -10.540 + 1.150.000

YOU INPUT	DISPLAY SHOWS
68530	68.530
ENT	68.530,00
10000	10.000
-	58.530,00
15700	15.700
-	42.830,00
10540	10.540
-	32.290,00
1150000	1.150.000
+	1.182.290,00

Example 3: (b * (b-1)^(1/n) - (1+b)^(-n))/((0.25+b^(-1/n))*(log(b) +b^2)) ove b= 1,35 e n =3

YOU INPUT	DISPLAY SHOWS	
1,35	*1,35*	
Mem 0	*1,35*	*I stored it while I'll use it later*
ENT	*1,35*	
Rcl 0	*1,35*	
1	*1,*	
-	*0,35*	
3	*3,*	
1/x	*0,33*	
y^x	*0,70*	
x	*0,95*	
1	*1,*	
Rcl 0	*1,35*	
+	*-0.35*	
3 CaS	*-3,00*	
y^x	*0,08*	
-	*0,87*	
0,25	*0,25*	
Rcl 0	*1,35*	
3	*3,*	

1/x	*0,33*
CaS	*-0,33*
y^x	*0,90*
+	*1,15*
Rcl 0	*1,35*
Log	*0,13*
Rcl 0	*1,35*
2	*2,*
y^x	1,82
+	1,95
*	2,26
/	0,39

That's the result.

Financial calculations

Example 1: *What annual interest rate must be obtained to accumulate Lt. 10 millions in 6 years on an investment of 5 millions lire, with quarterly compounding?*

The interst rate ist annual, but quarterly coumponded. The period must be a quarters. For n you must use the value 24 (=6 x 4).

YOU INPUT	DISPLAY SHOWS	
6	*6,*	
ENT	*6,00*	
4	*4,*	
x	*24,00*	*number of periods*
n	*24,00*	*you store the number of periods*
5000000	*5.000.000,*	
CaS	*-5.000.000,00*	*pay out = negativ*
att	*-5.000.000,00*	*you store the start capital*
10000000	*10.000.000,*	*desired end capital (pay in = positiv)*
fut	*10.000.000,00*	*you store the desired end capital*
i	*2,93*	*% quarterly interest rate (calculated)*
4	*4,*	*number of periods in one year*
x	*11,72*	*% annual interest rate*

N.B.: The five financial keys, beseides the storage property, have also the calculating function. What happened when a financial key is pressed, dipend from the last operation: if the last operation was the enter of a number, when you press a financial key you stre this number in the financial register; otherweise when you press the financial key, you calculate that value.

The calculation of n and i is approximated. This approximation dipend on the number of decimal places shown in the main display. To get an higher precision, you must set the number of decimal places higher (max 9) by pressing 'dec' followed by the desired number. In this example, being two the number of decimal places (default), the first 6 decimal digits are axact, while the 7th is rounded.

Example 2: *now let's learn something about interest rates. In the first example the interest rate was quarterly compuonded. How can you calculate the correspondent annual compounded interest rate? And the montly or dayly compunded interest rate?*

In the first example the interest rate was 11,72 %, quarterly compounded. To calculate the annual compounded interest rate you'll input:

YOU INPUT	DISPLAY SHOWS	
2,93	*2,93*	*quarterly compounded (=11,72 : 4)*
i	*2,93*	
4	*4,*	
n	*4,00*	*quarters in one year*
100	*100,*	
CaS	*-100,00*	
att	*-100,00*	*I store 100 in "att"*
0	*0,*	
per	*0,00*	*I clear the value in "per"*
fut	*112,25*	
Rcl	*112,25*	

att	*-100,00*	
+	*12,25*	*That's the desired interest rate, annual compounded.*

In fact, You has calculated the future value of 100 in four quarters at the quarterly compounding rate of 2,93.,This future value is 112,25.
The percent difference in one year (four quarters) is 12,25 (=112,25 -100). That's also the annual compounded interest rate, since the basis is 100.

To calculated the interest rate, monthly compounded, you must only put in 'n' the number of months in one year (12) and calculate the interest rate. The values for 'att' (100) and 'fut' are already stored.

YOU INPUT	DISPLAY SHOWS	
12	*12,*	
Mem	*12,*	
n	*12,00*	*number of periods*
i	*0,97*	*monthly interest rate*
12	*12,*	
x	*11,61*	*Annual interest rate, monthly compunded*

The same for the dayly compounde rate:

YOU INPUT	DISPLAY SHOWS	
365	*365,*	
n	*365,00*	
i	*0,03*	*dayly interest rate*
365	*365,*	
x	*11,56*	*Annual interest rate, dayly compounded*

INTEREST RATES: *the following formula change a dayly copmpounded interest rate in a simple dayly interest rate und viceversa:*

$$\text{Simple interest} = 100 \times \ln\left(1 + \frac{\text{Compounded interest}}{100}\right)$$

$$\text{Compounded interest} = 100 \times \left(e^{\frac{\text{Simple interest}}{100}} - 1\right)$$

Example a:calculate the simple interest corrsiponding to a compound interest of 7,79%

YOU INPUT	DISPLAY SHOWS	
7,79	*7,79*	
ENT	*7,79*	
100	*100,*	
/	*0,08*	
1	*1,*	
+	*1,08*	
Ln	*0,08*	
100	*100,*	
x	*7,50*	*simple interest*

Example b: calculate the compound interest corresponding to a simple interest of 6,00%

YOU INPUT	DISPLAY SHOWS
6	*6,*
ENT	*6,00*

100	*100,*	
/	*0,06*	
e^x	*1,06*	
1	*1,*	
-	*0,06*	
100	*100,*	
x	*6,18*	*compound interest*

Example 3: ***suddendly foresight, you will make sometheng for your pension.As you think you will need in 20 years at least 200 millions, and you have now inherit 10 millions, you decide to put them in your banh account, where you 'll put monthly a part of your montly income. As yoy obtained 6,25 % after-tax interest compounded annualy, how much would you pay in, to reach the goal?***

You must first calculate the rate compounde monthly:

YOU INPUT	DISPLAY SHOWS	
12	*12,*	*month*
n	*12,00*	
100	*100*	*beginning capital*
CaS	*-100,00*	
att	*-100,00*	
0	*0,*	
per	*0,00*	*clearing 'per'*
106,25	*106,25*	
fut	*106,25*	*final value*
i	*0,51*	*rate compounde monthly*

now you can begin your calculation. You don't need to tip the interest rate, since it is already stored.

YOU INPUT	DISPLAY SHOWS	
12	*12,*	
ENT	*12,00*	
20	*20,*	
x	*240,00*	*number of periods (month)*
n	*240,00*	*is stored in 'n'*
10000000	*10.000.000,*	
CaS	*-10.000.000,00*	
att	*-10.000.000,00*	*the beginning capital is stored*
200000000	*200.000.000,*	
fut	*200.000.000,00*	*the end capital is stored*
per	*-356.793,80*	*periodic pay in.*

Example 4: ***n not integer:*** *you will calculate how much 100 lire grown in 9 month at the rate of 12,50% , annual compound. As 9 month are the 75% of one year, you can tipe for 'n' the value 0,75.*

YOU INPUT	DISPLAY SHOWS
0,75	*0,75*
n	*0,75*
12,5	*12,5*
i	*12,50*
100	*100,*
CaS	*-100,00*
att	*-100,00*

0	*0,*	
per	*0,00*	
fut	*109,24*	

Putting n as fractional means that the first period is smaller als the others.. Next example explain it better. Suppose you have get a loan of 5 millions for 48 month: the interest run from 12 July 1998, while the payment of 150.000 lire beginn ende July with montly periodicity. Let's calculate the applied interest.

YOU INPUT	DISPLAY SHOWS	
CAL	*I switch to calendar functionality*	
12:07:1998	*12/07/1998*	
ENT	*12/07/1998*	
31:07:1998	*31/07/1998*	
D/days	*19*	*number of days*
30	*30,*	
/	*0,63*	*fractional of n!*
CAL	*0,63*	*I come back to normal functionality*
48	*48,*	*number of periods*
+	*48,63*	*number of periods (fractional)*
n	*48,63*	
5000000	*5.000.000,*	
att	*5.000.000,00*	
150000	*150.000,*	
CaS	*-150.000,00*	
per	*-150.000,00*	
0	*0,*	
fut	*0,00*	
i	*1,55*	
12	*12*	
x	*18,64*	*interest rate annual compounded*

N.B.: the not-integer period must be smaller als the other ones. The fractional part of n is calculated by dividing the days of the first period durch die days of normap periods (30 for monthly periods).

Calculating n, a fractional result has an other meaning. Let's suppose you take a loan of Lit. 40.000.000 and that you can pay back Lit. 650.000 every month., % is the interest per annum, how many payments should you do?
First you must the annual compound rate in a monthly compound rate.

YOU INPUT	DISPLAY SHOWS	
12	*12,*	
n	*12,00*	
100	*100,*	
Cas	*-100,00*	
att	*-100,00*	
0	*0,*	
per	*0,00*	
118,5	*118,5*	
fut	*118,50*	
i	*1,42*	*monthly compound rate*

Now you can calculate n:

YOU INPUT	DISPLAY SHOWS
40000000	*40.000.000,*
att	*40.000.000,00*

680000	*680.000,*
CaS	*-680.000,00*
per	*-680.000,00*
0	*0,*
fut	*0,00*
n	*128,67*

The periodical period means that the 128th payment is greater or that you should pay a smaller 129the payment.

Yoy can examin the two assumptions:

YOU INPUT	DISPLAY SHOWS
128	*128,*
n	*128,00*
fut	*-450.287,58 balloon payment*
Rcl	*-450.286,47*
per	*-680.000,00*
+	*-1.130.287,47 last rate to pay (128th)*

or

YOU INPUT	DISPLAY SHOWS	
129	*129,*	
n	*129,00*	
fut	*223.298,86*	
Ric	*223.298,86*	
per	*-680.000,00*	
+	*-456.701,14*	*last rate to pay (129th)*

EXAMPLES OF LEASING COMPUTING

They are basic two form of leasing: the first has regular payments, exept the first (it.: maxicanone) that is bigger as the others. In this case, the nominal value of leasing is reduced by the first payment (maxicanone) and the calculations is similiar to the normal compound interest calculations (Example 1). The second form has advance payments, so that same of the final payments are null. In this case it's not possible to use the normal way of computing, bat you must use the function 'LEA' (see Example 2 and 3).

MAXICANONE

Example 1: ***A 22 millions worth photocopy machine is leased at these condition: a first payment of 10% of the purchase price, duration 48 months, residual value 5% of the purchase price. If the montly payment amount is Lit.350.000, what is the interest rate? and if the nominal yearly interest rate is 18%, what is the montly payment amount?***

YOU INPUT	DISPLAY SHOWS	
22000	*000 22.000.000,*	
Mem 0	*22.000.000,00*	
10 %	*2.200.000,00*	
-	*19.800.000,00*	
att	*19.800.000,00*	*leasing's value - first payment*
Rcl 0	*22.000.000,00*	
5 %	*1.100.000,00*	*residual value*
Cas	*-1.100.000,00*	
fut	*-1.100.000,00*	
535000	*535.000,*	*periodical payment*
Cas	*-535.000,00*	
per	*-535.000,00*	
48	*48,*	
n	*48,00*	
i	*1,26*	*monthly compounded interest rate*
12	*12,*	
x	*15,08*	*nominal yearly interest rate*

Now the second part

YOU INPUT	DISPLAY SHOWS	
18	*8,*	
ENT	*18,00*	
12	*12,*	
/	*1,50*	*interest rate compounded monthly*
i	*1,50*	
per	*565.812,49*	*montly payment amount*
LEA	*565.812,49*	*back to standard functionality*

Advance payment

Example 2: ***a machine 5 millions werth is leased for 36 months, at 145.000.lire monthly, with these conditions: 2 advance payments and a residual value of Lit. 1,5 millions. What is the interest rate?***

YOU INPUT	DISPLAY SHOWS	
LEA	appears the key 'c/a'	
2 c/a	2,00	advance payments (*c/a change to 2)*

5000000		5.000.000,	
att		5.000.000,00	leasing's value
36		36,	
n		36,00	number of periods
145000		145.000	
Cas		-145.000,00	monthly payment
per		-145.000,00	
1500000		1.500.000,	
Cas		-1.500.000,00	
fut		-1.500.000,00	residual value
i		1,51	interest rate compounded monthly
12	x	18,10	yearly nominal interest rate

Example 3: ***A 22 millions worth photocopy machine is leased at these condition:4 advance payments, duration 48 months, residual value 30% of the purchase price. If the nominal yearly interest rate is 15%, what is the montly payment amount?***

YOU INPUT		DISPLAY SHOWS	
LEA			appears the key c/a
22000000		22.000.000,	
att		22.000.000,00	
ENT		22.000.000,00	
30	%	6.600.000,00	
CaS		-6.600.000,00	
fut		-6.600.000,00	residual value
48		48,	
n		48,00	
15		15,	
ENT		15,00	
12	/	1,25	interest rate compounded monthly
i		1,25	
4	c/a	4,00	number of advance payments (c/a change to 4)
per		-487.293,83	monathly payment
LEA		-487.293,83	back to standard functionality

You can compute the other quantity (n,att e fut) pressing the respective keys.

Higher financial examples

Example 1: ***you have made these operations in the Investment Fund A: you have pay in, as first mouvment, Lit. 2.400.000 on 12/02/1994, and after Lit. 200.000 on 01/03/1994, 05/04/1994, 03/05/1994, 05/06/1994, 01/09/1994,06/10/1994, 02/11/1994, 10/12/1994,15/01/1995,01/02/1995,25/02/1995, 04/04/1995,15/05/1995. On 31/12/1996 you have accumulate Lit. 6.995.350. In this period of time the quotation of Fund A raised at a rate of 12,00 % per year. What annual interest rate have you obtained? And how much would you have accumulated when the interest rate would be like the increase of the Fund A quotation (or, in other words, by a linear growth of the Fund quotations)? And, in this case, how much would you have payed in to obtain the same result: Lit. 6.995.350?***

ATTENTION: The calculator acceppts either dates or number of days, but you can't use for some movements the date and for the others the numbers of days!
Dates must be entered in the format you've choosed in menu: dd/mm/yyyy or mm/dd/yyyy: key in the number of the day (two digit), press ":", key in the month as two digit, press ":", key in the full year (and press 'Date/days"). The calculetor itself uses the format dd,mmyyyy: dates can so be entered also in this format (For instance the date 31/12/1996 can be entered also as 31,121996); in this case set the number with 6 decimal places (press 'dec' followed by 6). You can store tha dates into any of the ten storage registers. If you recall them, they'll be in the format dd,mmyyyy.
Pay great **attention** to the sign of values (payment, loan or investment amount): cash received is represented by a positive value; cash paid out is represented by a negative value.

Let us introduce the values. We enter in the higher financial function pressing "FIN". Remember that pay in is negative, pay out positive.

YOU INPUT		*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*		
2400000	*CaS*	*-2.400.000,00*			
Pay out/in			*-2.400.000,00*	*1*	
12:02:1994		*12/02/1994*	*-2.400.000,00*	*1*	
Date/days			*-2.400.000,00*	*12/02/1994*	*1*

So you have introduce the first movement You have surely perceived the small italic number oben at the right side of main display: when you pressed "Pay out/in" it's appeared the number 1 to indicate that one value was still missing. When you pressed "Date/days" it became 0 to indicate that bothe values were introduced.
The third number below indicate the ordinal number of movement. Actually it's 1, while you have introduced the first movement. Es became 2 with the next movement, and so on.
Now let's introduce the others movements. Pay attention to these two numbers just now examined and observe also that has no importance the order in which you entered the values of one movement, the payment first or the date first.

YOU INPUT		*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*		
200000	*CaS*	*-200.000,00*	*2.400.000,00*	*12/02/1994*	*1*
Pay out/in			*-200.000,00*	*2*	
01:03:1994		*01/03/1994*	*-200.000,00*	*2*	
Date/days			*-200.000,00*	*01/03/1994*	*2*
05:04:1994		*05/04/1994*	*-200.000,00*	*01/03/1994*	*2*
Date/days			*05/04/1994*	*3*	

200000 CaS -200.000,00 05/04/1994 3
Pay out/in -200.000,00 05/04/1994 3
03:05:1994 03/05/1994 -200.000,00 05/04/1994
3
Date/days 03/05/1994 4
200000 CaS -200.000,00 03/05/1994 4
Pay out/in -200.000,00 03/05/1994 4
05:06:1994 05/06/1994 -200.000,00 03/05/1994
4
Date/days 05/06/1994 5
200000 CaS -200.000,00 05/05/1994 5
Pay out/in -200.000,00 05/06/1994 5
01:09:1994 01/09/1994 -200.000.,00 05/06/1994
5
Date/days 01/09/1994 6
200000 CaS -200.000,00 01/09/1994 6
Pay out/in -200.000,00 01/09/1994 6
06:10:1994 06/10/1994 -200.000,00 01/09/1994
6
Date/days 06/10/1994 7
200000 CaS -200.000,00 06/10/1994 7
Pay out/in -200.000.,00 06/10/1994 7
02:11:1994 02/11/1994 -200.000,00 06/10/1994
7
Date/days 02/11/1994 8
200000 CaS -200.000,00 02/11/1994 8
Pay out/in -200.000,00 02/11/1994 8
10:12:1994 10/12/1994 -200.000,00 02/11/1994
8
Date/days 10/12/1994 9
200000 CaS -200.000,00 10/12/1994 9
Pay out/in -200.000,00 10/12/1994 9
15:01:1995 15/01/1995 -200.000,00 10/12/1994
9
Date/days 15/01/1995 10
200000 CaS -200.000,00 15/01/1995 10
Pay out/in -200.000,00 15/01/1995 10
1:02:1995 01/02/1995 -200.000,00 15/01/1995
10
Date/days 01/02/1995 11
200000 CaS -200.000,00 01/02/1994 11
Pay out/in -200.000,00 01/02/1995 11
25:02:1995 25/02/1995 -200.000,00 01/02/1995
11
Date/days 25/02/1995 12
200000 CaS -200.000,00 25/02/1995 12
Pay out/in -200.000,00 25/02/1995 12
04:04:1995 04/04/1995 -200.000,00 25/02/1995
12
Date/days 04/04/1995 13
200000 CaS -200.000,00 04/04/1995 13
Pay out/in -200.000,00 04/04/1995 13
15:05:1995 15/05/1995 -200.000,00 04/04/1995
13
Date/days 15/05/1995 14

200000 CaS -200.000,00 15/05/1995 14
Pay out/in -200.000,00 15/05/1995 14

You must now introduce the capital at 31/12/1996. The way is the same, but the sign is now positive.

31:12:1996 31/12/1996 -200.000,00 15/05/1995 14
Date/days 31/12/1996 15
6995350 6.995.350, 31/12/1996 15
Pay out/in 6.995.350 31/12/1996 15

Now that you have introduced all the values, it's time to save your work. Press:

Save and the Save Window appears.

Choose a directory (a dopple click with mouse on its name and the directory will open) Tipped in the file box the name you want to save your work with (for instance "Proof"), and press "SAVE" ("CANCEL" closes the window without saving).

let's now explore other keys.

For instance you realize thet on 05/06/1994 you don't have pay in Lit. 200.000 , but Lit 600.000, while on 10/12/1994 you don't have pay in anything and on 15/12/1994 you have made a pay out of Lit. 500.000. So you must change three movements. To do that, you will use the keys "Forward" and "Backward" and also the keys Pg-Dn, Pg_Up, Home and End (Fine) from keyboard.
To show the 5th movement (05/06/1996) you can do so:

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*	
end (keyboard)	*6.995.350,00*	*6.995.350*	*31/12/1996 15*
Pg-Dn (keyboard)	*-200.000,00*	*-200.000,00*	*05/06/1994 5*

To change the pay in, introduce simply the new value:

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*	
600000	*600.000,,*	*-200.000,00*	*05/06/1994 5*
CaS	*-600.000,00*	*-200.000,00*	*05/06/1994 5*
Pay out/in		*-600.000,00*	*05/06/1994 5*

The change is made. If you introduce now a new value, you would change also the date of the 5th movement (with the key 'Date/days') or , once more the pay in (with the key 'Pay out/in'). This second value would complete the 5th movement, so a new entry would change the 6th movement. To see that the change really happened, you can press 'Forward' and then 'Backward'.
Let's change now the 9th movement (you are now seeing the 5th movement!).

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*	
Forward		*-200.000,00*	*01/09/1994 6*
Forward		*-200.000,00*	*06/10/1994 7*
Forward		*-200.000,00*	*02/11/1994 8*
Forward		*-200.000,00*	*10/12/1994 9*

That's the 9th movement. You must change both the date and the pay in. You can begin

changing the date first or the pay in. For example you can do so:

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*		
15:12:1994	*15/12/1994*		*-200.000,00*	*10/12/1994*
9				
Date/days		*-200.000,00*	*15/12/1994*	*9*
500000	*500.000,*	*-200.000,00*	*15/12/1994*	*9*
Pay out/in		*500.000,00*	*15/12/1994*	*9*

Also this change is made. The sign was positiv while it was a pay out.
You can now save your work (recommanded) once more.
So press "Salva", choose the earlier directory, click twice on "proof.95d" and your work is saved with the same name.
ATTENTION: except the first and the last movement, all the others must be different from null! If you have forget a middle movement, you can introduce it at the end (the cronological order is not important) changing the last movement. You must then introduce after it the last movement (The last movement mus always stay at end).

Now, please, close the calculator pressing "OFF" and then start once more the program. As the calculator appears, press "Load". Choose the directory where you saved your work and click on the file "Proof" e then press "LOAD" (or double click on "Proof".). When the file is loaded, the calculator appears exactly as it was by saving..
In that case, you shoul see on the lower display the values 500.000,00, 15/12/1994 e 9.
Let's now finally compute the interest rate of the investment. To do it:

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*		
run	*16,38*	*500.000,00*	*15/12/1994*	*9*

That ist the desired interest rate! (All data are saved in the two files provided with the program 'prov_eu.95d' in european date format and 'prov_us.95d' in usa date format).

As you see it, you remember that you had forget a pay in of Lit. 400.000 lire that you did on 10/12/1994. Not to be afraid. You'll introduce it at once.

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*		
End(Fine)	*6.995.350,00*		*6.995.350*	*31/12/1996*
15				
Mem 0	*6.995.350*	*6.995.350*	*31/12/1996*	*15*
400000 CaS	*-400.000,00*		*6.995.350,00*	*31/12/1996*
15				
Pay out/in		*-400.000,00*	*31/12/1996*	*15*
10:12:1994	*10/12/1994*		*-400.000,00*	*31/12/1996*
15				
Date/days		*-400.000,00*	*10/12/1994*	*15*
Rcl 0	*6.995.350*	*-400.000,00*	*10/12/1994*	*15*
Pay out/in		*6.995.350,00*		*16*
31:12:1996	*31/12/1996*		*6.995.350,00*	
16				
Date/days		*6.995.350*	*31/12/1996*	*16*

Practically you have changed the last movement with the missing one, then you have introduced the last movement once more. In fact this movement must the last sein. you

have also seen how you can use the storage registers.
Now can you compute the new interest rate:

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*
run	*13.05*	*6.995.350,00 31/12/1996 16*

That is the annual desired interest rate, dayly compounded !!!
N.B.: The interest rate is automatically stored. To see that press "Can", clearing so the display, then press'Rcl' followed by "i". The interest rate is displayed. if both the first and last movement are not null, pressing 'run' you compute the interest rate.

Before going on, you can save that result on memory 0. To do it:

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*
Mem 0	*13,05*	*6.995.350,00 31/12/1996 16*

Switch the printer on. Let's print all. Press 'P'. Introduce the print header "Proof". Press 'OK'. The printed copy should be as follow:

Proof

Nr.	DATE	PAYMENT	
1	12/02/1994	-2.400.000	pay-out
2	01/03/1994	-200.000	pay-out
3	05/04/1994	-200.000	pay-out
4	03/05/1994	-200.000	pay-out
5	05/06/1994	-600.000	pay-out
6	01/09/1994	-200.000	pay-out
7	06/10/1994	-200.000	pay-out
8	02/11/1994	-200.000	pay-out
9	15/12/1994	500.000	pay-in
10	15/01/1995	-200.000	pay-out
11	01/02/1995	-200.000	pay-out
12	25/02/1995	-200.000	pay-out
13	04/04/1995	-200.000	pay-out
14	15/05/1995	-200.000	pay-out
15	10/12/1994	-400.000	pay-out
16	31/12/1996	6.995.350	pay-in

Interest: 13.04 %

Now let's see the final amount if the annual interest rate is 12,00%.

YOU INPUT	*MAIN DISPLAY SHOW (OBEN)*	*DISPLAY SHOW BELOW*		
12	*12*	*6.995.350,00 31/12/1996 16*		
i	*12,00*	*6.995.350,00 31/12/1996 16*		*annual rate.*
End	*6.995.350,00*		*6.995.350,00*	*31/12/1996*
16				

You pressed 'End', also if the last movement was already displayed, why a new entry would

be the 17th.
Now you must clkear the final capital. Only so, being the beginning capital and the interest rate different from null, the calculator computes the final capital.

YOU INPUT	MAIN DISPLAY SHOW (OBEN)	DISPLAY SHOW BELOW			
0	0	6.995.350,00	31/12/1996	16	
Pay out/in		0,00	31/12/1996	16	
run	6.828.709,42		6.828.709,42		31/12/1996
16					

That is the final capital you would get at the rate of 12,00% per annum.
Let's now see how much would you pay in initially to accumulate Lit. 6.995.350 at the rate of 12 % per annum.

YOU INPUT	MAIN DISPLAY SHOW (OBEN)	DISPLAY SHOW BELOW			
End	6.828.088,51		6.828.088,51		31/12/1996
16					
6995350	6.995.350,	6.828.088,51	31/12/1996	16	
Pay out/in		6.995.350,00	31/12/1996	16	final capital
Home	-2.400.000,00	-2.400.000,00	12/02/1994	1	
0	0,	-2.400.000,00	12/02/1994	1	
Pay out/in		0,00	12/02/1994	1	you clear the initial pay in
run	-2.520.168,36	-2.520.168,36	12/02/1994	1	

That is the initially pay in to obtain the same final amount (6.995.350) at the rate of 12%.

Example 2 : *you need 5 millions lire! A "friend" lend you the sum at these conditions: you must pay in 500.000 lire after 45 days; 500.000 lire after 45 days more; 9 payments of 500.000 lire every 30 days after the second payment. You have to pay back so Lit. 5.500.000 lire in 360 days. What is the interest rate applied?*

Being the paymento of Lit. 500.000 recurring, you can use the memory 1 so you have not to introduce many times the same value.

YOU INPUT	MAIN DISPLAY SHOW (OBEN)	DISPLAY SHOW BELOW				
C/T				to clear all		
5000000	5.000.000,			loan (= sign +)		
Pay out/in		5.000.000,00		1		
0	0	5.000.000,00		1		
Date/days		5.000.000,00	0,00	1		
500000	500.000,	5.000.000,00	0,00	1		
CaS	-500.000,00		5.000.000,00			0,00
1	(sign -)					
Mem 1	-500.000,00		5.000.000,00			0,00
1						
Pay out/in		-500.000,00		2		
45	45	-500.000,00		2		
Date/days		-500.000,00	45	2	days	
Rcl 1	-500.000,00		-500.000,00		45	2
Pay out/in		-500,000,00		3		
45	45	-500.000,00		3		
Date/days		-500.000,00	45	3		
Rcl 1	-500.000,00		-500.000,00		45	3
Pay out/in		-500.000,00		4		

30	*30*	*-500.000,00*		*4*	
Date/days		*-500.000,00*	*30*	*4*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*4*
Pay out/in		*-500.000,00*		*5*	
30	*30*	*-500.000,00*		*5*	
Date/days		*-500.000,00*	*30*	*5*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*5*
Pay out/in		*-500.000,00*		*6*	
30	*30*	*-500.000,00*		*6*	
Date/days		*-500.000,00*	*30*	*6*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*6*
Pay out/in		*-500.000,00*		*7*	
30	*30*	*-500.000,00*		*7*	
Date/days		*-500.000,00*	*30*	*7*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*7*
Pay out/in		*-500.000,00*		*8*	
30	*30,*	*-500.000,00*		*8*	
Date/days		*-500.000,00*	*30*	*8*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*8*
Pay out/in		*-500.000,00*		*9*	
30	*30*	*-500.000,00*		*9*	
Date/days		*-500.000,00*	*30*	*9*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*9*
Pay out/in		*-500.000,00*		*10*	
30	*30*	*-500.000,00*		*10*	
Date/days		*-500.000,00*	*30*	*10*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*10*
Pay out/in		*-500.000,00*		*11*	
30	*30*	*-500.000,00*		*11*	
Date/days		*-500.000,00*	*30*	*11*	
Rcl 1	*-500.000,00*		*-500.000,00*	*30*	*11*
Pay out/in		*-500.000,00*		*12*	
30	*30*	*-500.000,00*	*30*	*12*	
Date/days		*-500.000,00*	*30*	*12*	
run	*18,35 ,*	*-500.000,00*	*30*	*12*	

He applied the annual interest rate of 18,35 %, dayly compounde.

Examples of calendar computing

You enter in the calendar functionality pressing "CAL".

Example 1*: determine the date 289 days before the 7/7/96*

YOU INPUT	*MAIN DISPLAY*
Can	*0,00*
CAL	*0,00*
07:07:1996	*07/07/1996*
ENT	*07/07/1996*
289 CaS	*-289*
D/days	*22/09/1995 Fri*

Lun(edì) = Monday *Ven(erdì) = Friday*
Mar(tedì)= Tuesday *Sab(ato) = Saturday*
Mer(coledì)= Wednesday *Dom(enica) = Sunday*
Gio(vedì) = Thursday

Example 2: *determine the numbers of day between 01/01/1997 and 31/12/2000?*

YOU INPUT	*MAIN DISPLAY*
01:01:1997	*01/01/1997*
ENT	*01/01/1997*
31:12:2000	*31/12/2000*
D/days	*1.460 days*

The first entered date (or days) is in the Y register, so you can still use it simply recalling it and entering a new value (date or days). The second one is actually in the UltX (LastX) register and you can recall it pressing "LAST".
So, if you will compute the date after 3.000 days on 01/01/1997, you have to recall the date in the Y register, pressing:

YOU INPUT	*MAIN DISPLAY*
x-y	*1,011997 date format in memory*
3000	*3000*
D/days	*20/03/2005 date.*

N.B.: Now in the UltX (LastX) register is the value 3.000 and not the previous date. If you would use that date, you had to stre it in a storage register..

EXAMPLE OF EQUATION SOLUTION

0 = 25.4 + 32.25x^2 - 12x^3

Iintroduce the values 25.4 for a, 0 for b,32.25 f or c and 12 for d (b and e are null or empty).
Pressing "compute" you get the roots:

x1=0,12 + 0,84i
x2=0,12 - 0,84i
x3 = -2,93

Pressing "mem" sitely of x2, followed by A, I storage the value 0,12 -0,84i in A.

I can recall this complex numbers in the "complex number window".

Pressing r (sitely of x2) I copy 0,12 into the clipboard.
pressing 1 I copy -0,84 into the clipboard.

POLYNOMIANS OF HIGHER ORDER

Pressing '**superiore**' you open the window to solve polynomians up to 16th degree.
Example 1: find the root of the preceding polynomian:
0 = 25,4 + 32,25x^2 - 12x^3

Introduce the values:
25.4 a0
32.25 a2
-12 a3

Press '**run**'
The roots are displayed.

Example 2: find the root of:
x^5-x^4-101x^3+101x^2+100x-100=0

Introduce the coefficients:

-100 a0
100 a1
101 a2
-101 a3
-1 a4
1 a5

The roots are: -10, 10, -1, 1, 1

With the key **fact** *you can factorize the equation:*
Clicking one time you get:
(x-1)(x^4-101x^2+100)
clicking once more:
(x-1)(x-1)(x^3+x^2-100x-100)
and clicking another time:
(x-1)(x-1)(x+1)(x^2-100)

Example 3: reduce the equation 2x^16+5x^15-12x^14-29x^13+25x^12+48x^11-39x^10-29x^9+65x^8+51x^7-55x^6-90x^5+23x^4+52x^3-11x^2-8x+2 to a tenth grad equation through its roots.

Clicking six times **fact** *you get:*

(x-0.45)(x-0.28)(x-0.62)(x+0.50)(x-1)(x+1)(2x^10+6.69x^9-4.15x^8-27.28x^7-9.8x^6+14.19x^5-7.39x^4-8.87x^3+29.42x^2+72.12x+51.44)

Examples: solution of systems

Examples: find the solution of this system:

x + y + z = 1
2x + 3y - z = -2
3x + y + 2z = 3

*Pressing "**FCT**" open the expressions's functionality, then pressing "**sis**" open the window for the system's solution.*
*Introduce the values in the wright order: 1, 1, 1, 1, 2, 3, 1, -2, 3, 1, 2, 3. and then press the key "**compute**". The solution is: x= -0,33, y=-1,33, z=2,67.*

Two equations's systems: *introduce zero as value of z in the first two equations and zero as values of x and y and 1 as value for z in the third equation. For instance to find the solution of this system:*

x + y = 1
2x + 3y = -2

*you have to introduce the values : 1, 1, 0, 2, 1, 3, 0, -2, 0, 0, 1, 0 and then to press "**compute**". The solution are: x=5 e y=-4.*

Examples of matrices computing

Examples 1: *find the determinat and the inverse of the matrix:*

23 15 17
8 11 -6
4 15 12

*Open the matrix window with the key "**mat**" (from the expression functionality) and insert the values: 23, 15, 17, 8, 11, -6, 4, 15, 12. Pressing "**Determinant**" appear the result: 4598. If you now press the key "**Invers**" appear the inverse-matrix.*

Matrix with two rows and two columns: introduce *0, 0, 1 in the third column. For instance the determinant of the matrix*

23 15
8 11

is: 133. To compute it, you introduce the values 23, 15, 0, 8, 11, 0, 0, 0, 1.

Examples 2: Find (A+B)*C where:

A = 5 2 3 B = -3 5 1 C = 9 4
7 4 7 -6 2 -4 1 4
2 5

and then multiply the resulting matrix for 10 (scalar multiplication).
Key in the first matrix:
5 2 3
7 4 7
0 0 0
ENTER

Key in the second matrix:
-3 5 1
-6 2 -4
0 0 0

Find the sum:
+

Key in the third matrix:
9 4 0
1 4 0
2 5 0

Find the product:
/\

The result is a second order matrix:
33 56
21 43

To multiply the result for 10, first cancel the display:
canc

then introduce the value:

10

and press the key:

x

The result is:
330 560
210 430

EXAMPLE OF COMPLEX CALCULATION

Let us do this calculation:

{[(25/30 + 45/0) x 30/15]/28/-75 -15/86]}^0,5

The format is already prepared.

I introduce the first number:

25	it appears in the 0 register
tab	
30	it appears in the 0 register
ENTRA	the number appears also in the 1 register

The number in the first inputbox is highlighted. I can so write the new one.

45	it appears in the 0 register
tab	
0	it appears in the 0 register
+	addition

The 0 register display the results of addition. The register 1 display the value that were in register 2 (and so on).
I can now input the third number.:

30	it appears in the 0 register
tab	
15	it appears in the 0 register
x	multiplication

I key in the fourth number:

28	it appears in the 0 register
tab	
-75	it appears in the 0 register
/	division

I key in the fifth number:

15	it appears in the 0 register
tab	
86	it appears in the 0 register
-	subtraction
/¯x	square root

The result is displayed:
7,63/52,17

N.B.: When I introduce a number, it will automatically converted and displayed also in the other format.

Examples of vectorial computing (three dimensions vectors)

Examples: compute ((A + B) /\ C - D) x F where:
A = 1x - 0,5y
B = -0,8x + 1,2 y - 3,5z
C= 2,79 /229.40° /41,25°
D = 1,82 /306,16° /62,17°
F = 3,41 /41,99° /52,03°

Control that the cartesian coordinates are checked and beginn with the addition. Insert the first vector:

1,00	-0,50	0	press "ENTRA" and insert the second vector
-0,80	1,20	-3,5	press "+". The result is displayed. Check now the polar coordinates (the other vectors are in polar form) and decimal degree and insert the third vector:
2,79	229,4	41,25	press "/\" (vectorial or cross product). Insert the fourth vector:
1,82	306,16	62,17	and press "-". Insert the fifth vector:
3,41	41,99	52,03	and press "x" (scalar or dot product). The result is:

-2.46

Examples of quaternions computing.

Example 1: find q1*q2 + q3 where:
q1 = [s,v1] = 2,5, 3i+1,7j-4,8k q2 = -7,8, -8,2i+4,5j+7k q3 = 4,4, 5,8i-7,6j+2,3k

Key in the first quaternion:
2,5 3 1,7 -4,8

Key in the second quaternion:
-7,8 -8,2 4,5 7
ENER

Multiply:
*
The intermediate result is:
31,05 -77.40i-20.37j+27.50k

Key in the third quaternion:
4,4 5,8 -7,6 2,3

Sum it:
+

The result is:
35.45 -71.60i+27.97j+28.80k

Example 2: multiply the preceeding quaternion (the result of example 1) respectively for 10 (scalar) and for the quaternion 10, 10i-5j+20k.

*Since I need twice the same quaternion, copy it in the second stac-register pressing '*ENTER*'.*
*Cancel the display pressing '*canc*'.*
Key in:
10
Multiply:
'.'
The first result is:
354.50 (scalar).

Now prepare the data for the second multiplication:
dwn
x-y
ENTER

*Cancel the display pressing '*canc*' and key in:*
10 10 5 20

Multiply:
'.'
The result is:
94.65 (scalar).

Examples of expressions, integrals, derivatives and graphs computing.

For lazy man: the expression and the functions used in these examples are saved in the file test(5).flm. You can load and utilize them without write them. To move from one to another expression use the arrows.

Expressions
Esempio 1: compute the value of the expression (1+3^2)^.5-(5/(1+2arcsen(.5))) where the grads are in radians!

First press the key "**rad**". The key-name change in "°" and the grads are in radians.
Now introduce the expression with the calculator's keys, or from keyboard, or paste it with the key ctrl+v (ctrl+c to copy). The display show::
(1+3^2)^.5-(5/(1+2*aSe.5)) Note: 2arcsen become 2*aSe. The operator * is necessary, The parenthesis here not.
Press "**=**" (or enter) and the result appears in the black box below the display:
0.72
(With grad express in decimal grad, the result is: 3.08)
The same expression can be wrote so:
/¯(1+3^2)/-(5/(1+2*ase.5)) The result is the same.
0.72

You can write the expression also using the constants. Say, f.i., Poniamo ad esempio A=(1+3^2)^.5 and B=1+2*arcsin(.5). The expression become:
A-5/B
while in the A box you must write the value of square of ten, or the expression (1+3^2)^.5; and in the B box the expression 1+2*ase.5
Press now "=" (or enter) and you have the result.

Example 2: compute the expression (example 3 of mathematic simple calculations): (b * (b-1)^(1/n) - (1+b)^(-n))/((0.25+b^(-1/n))*(log(b) +b^2)) ove b= 1.35 e A =3
You can copy this expression (ctrl+c) and paste it in the display (ctrl+v) or write it. The display shows:

(B * (B-1)^(1/A) - (1+B)^(-A))/((0.25+B^(-1/A))*(log(B) +B^2))

Introduce now the values for A and B.In the A-box write 3 and in the B-box 1.35.
Press "**=**" (or enter). The result is:

0.39

<u>Functions</u>
Example 3: compute the function 1/(x Ln x)^3) for x=2. First write or paste the function. The display show:
1/(x*Lnx)^3) oppure 1/(w*Lnw)^3)
In the w box write: 2
Press "**=**" and the result is displayed:
1.50
Compute now the integral in the interval: e ... e^2.
The function is already displayed. Press "**int**" opening the integral window. Insert the interval, above (box 'a') e, below (box b) e^2. Press "**compute**" and the integral is

computed using the Gaussian method. Its value is:
0.37
and is displayed on the calculator.
We want to try now the Simpson and the Numeric methods. First press "int", insert the interval and checked Simpson. Leave the value in the precision box and press "**compute**".
After a few second the result appears:
0.38
Press now "int", introduce the interval's values and cheked the third possibility (numeric), don't change the precision box and press "**compute**". The result is:
0.38
The exact result is: 3/8=0,3750
If the compute keep too much time, with "**annulla**" you can stop it.
To compute the derivate of this function in the point x=e, you have to introduce the value of (e) x in the x-box and to press the "**der**"-key. In the derivate-window you can introduce a value for the computing precision. With this value equal to 0.001 pressing "**compute**" the result is:
-4.00

Graphs
Example 4
Draw the graph of the function sen(x)*Ln(x^2)+4/cos(x)-pi where pi is 3,14... .
On the display the function is:
Senx*Ln(x^2)+4/Cosx-pi
Press "**rad**" (angles in radians!).
Now press "**gra**".
As interval try x(min)=0, x(max)=10, y(min)=-50 and y(max)=50
Press "**show**" and the functions is plotted.
You can see that in the interval 5< x <8 perhaps the function passes through zero. That is a good occasion to try to find the values of x that annul the function in this interval.
Introduce zero for y(min) and y(max), 5 for x(min) and 8 for x(max). Press now "**show**": a number change in the y(min)-box. After few seconds it stopped. That is the first point:
5,53072403
This value is saved in the x-box of calculator.
Pressing "**next**" the calculator try to find a second value. Attention: if founded, this second value erase the first in the x-box. Press the key and the second value appears:
5,9890228793

Introducing y(min)=-1 and y(max)=10 and pressing premendo "show" you see that the function passes through zero in this two points.
If the computing time is too much you can stop the calculator pressing "**break**".
Checking the box "magg. precisione", you increase the precision of the plotting (increasing also the computing time!).
The key "**?f(x)**" is explained below.

Description of a number of points through a function (key ?f(x).
Example 5:
A firm hasd this sales progress: first month 15 pieces, second month 37 pieces, third month 52 pieces, fourth month 60 pieces, funfth month 83 pieces and sixth month 92 pieces. If the trend remain unchenged, how many pieces should be selled the twelfth month? And when the 150 pieces per month will be reached?
Open the graphs-window pressing "**gra**".
Press "**?f(x)**" and introduce the values: months as x-values and pieces as y-values. As you have introduced the first month and number of pieces, press the up-arrow and introduce the next ones, and so on. When you have introduced the last couple of values, press once more the up-arrow (the counter in this example show 7) and press "**show**": the function

that better describes the introduced values is plotted and displayed on the calculator. The red points are the values you have introduced.
When you have introduced the wright values, you can now see the graph of a line. The precision index is very good (0.9830): that means that the function is correct. Sie is 3,4 + 15,1714 * x and is displayed on the calculator.
To find the pieces that are probably selled in the twelfth month closed the graph-windows pressing "**exit**" and write 12 in the x-(w-)box. Then press "=" or enter. The result is: 185,46 pieces. To find you reache the 150 pieces pro month, you have two possibility: to try with different values of x oder to find the value of x that annul the function 3.4 + 15.1714*x - 150. Try the second way. Insert in the display (at the end) -150, press "**gra**", insert x(min)=0, x(max)=12, y(min)= - 150 and y(max)=100 and press "". The graph show that the function is null when x is labout 9,6. That means that 150 pieces are reached after about 6 months and 18 days (30*60/100). You can find the exact value inserting x(min)=0, x(max)=12, y(min)=y(max)=0 and pressing "**show**". The result is 9,6629 (30 months and 20 days).

Example 6:
During a test man measure the speed of an object in different moments. The value are: t1= 5 sec, v1=140 m/s, t2=6 sec, v2=149 m/sec, t3=7 sec, v3=159 m/sec, t4=9 sec, v4=175 m/sec. What is the initial speed and what is the speed after 20 seconds?
Open the graphs window, press "?f(x) and introduce the values (x=t and y=v). Rmember the up-arrow. Am ende the counter show 5.
Press "show" and see the function. The precision index is good (0,9988), but the result is not to accept: the functio is exponential and we know that the speed-time function is linear. Try also the next function pressing the key "**next**".Now the function is the wright one. The precision-index is very good (0,9977).
Close now the graphs window and write 0 as value for x (x-box). Pressing "=" or enter you find the value 96,54, the initial speed (at time null). Inserting 20 in the x-box and pressing "=" you find 271,97, the speed after 20 seconds.

Examples 7:
In an expansion test man measure this values for volume (v) and pression (p): v1=10, p1=210, v2=30, p2=40, v3=50, p3=12, v4=70, p4=9, v5=90, p5=9,8. Compute the politropic costant that describes the process. Many expansion process are described with a function like p=av^(-b); so you have to find the value of b.
Open the graph window, press "?f(x)", introduce the values, v as x e p as y, and press "show".
The constant you looked for is: -1,5152... .
The precision.index is very good: 0,9632.

Example 8: The file Test3.flm contains an example of long expression.
When you load it, the expression has the following dimension:
On the display a lenght of 12.647 digits with one racall of box D, two recalls of box g, one recall of F-register and two recall of C-register.
Box d has a lenght of 3.304 digits.
Box G has a lenght of 6.630 digits.
F-register has a lenght of 3.314 digits.
C-register has a lenght of 10.105 digits.
The resolution time (Pentium 60 e 16 M of Ram) is about 18 minutes.

GAMMA function

einSTein has no key to compute the Gamma function, but, in the functions functionality it recognized the operator "gamma" (or "Gamma" or "GAMMA") and compute it.
As a second choice you can compute the gamma function also using the integrals window.
The Gamma(y) function in fact is the integral from null to infinite of the function: x^(y-1) * e^(-x) dx.
To compute its value, you can use the 'integral' function.
You will choose the numeric method with a precision value of 0,005 and an interval from niull to 10*y. (With the Gaussian quadratur the approximation is too large).
With the described choices the first 5 ddecimals digits are correct. With a precision factor of 0.01 the first trhee decimal digits are correct.

Example 1: Compute the Gamma function for y = 3,5.
Tipp:
gamma3.5
and press "="
The result appears:
3,32

Using the integrals window:
From the functionality 'expressions'' (key 'FCT' from the normal functionality) load the Gamma function, provided with the file named 'gamma.flm', tippe 3,5 in the A-box (y-box) and open the integral window with the key "**int**".
As interval write 0 in the 'a'-box and 10*A in the 'b' - box.
Check the numeric method.
Write 0,005 in the precision-box.
Press 'compute'. The result is:
3,32 .

Example 2: Compute the Gamma function for y=8.
Tipp:
gamma 8
and press "="
The result appears:
5.040,00

Using the integrals window:
Load the Gamma function, write 8 in the A-box (y-box), open with "int" the integral window, write 0 in the 'a'-box, 10*A in the 'b'-box, check the 'numeric' method, change the precision to 0,005 and press 'compute'. The result is:
5.040,00

FACTORIAL

einSTein has no key to compute factorial.
In the 'functions' functionality aber einSTein recognized the operator '!'

You can also compute a factorial, also of a non-integer argument, when you think that x! = Gamma(x+1).
In the previous chapter you have seen how to compute the gamma function; now two examples how to compute the factorial.

Example 1: compute the factorial of 6.
Key in:
6!
and press "="
The result appear: 720

Or, if you prefer, load the Gamma function and compute it for y= 7 (see previous chapter):
6! = Gamma(7) = 720

Example 2: compute the factorial of 4,25.
Key in:
4.25!
and press "="
The result appears: 35.21

Or you can use the integrals window:
4,25! = Gamma(5,25) = 35.21

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To register, you just need to send me 35 US$ (60.000 lire or 60 DM) by credit card, mail, checks or postal money order.

N.B.: Send ALWAYS the full name and the 'supply number' that you find in the Registration Window to:

email: **eschmit@tin.it - eschmit@bigfoot.com**

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Internet address: **http://volftp.mondadori.com/italiani/CAZORZI/index.htm - http://einstein.freehosting.net - http://members.xoom.it/lis/index.html http://utenti.tripod.it/lis/index.html**

Mail, Check or postal money order
Send me 35 US$ (60.000 lire or 60 DM) by mail, checks or postal money order., along with the following registration form:

First Name
Second name
Age
Company/Profession
Address
e-mail
Supply number (you can find it in the registration window, that appear when you press the key 'REGISTRATION')

Send this to:

Lis Ca' Zorzi
v.le J. F. Kennedy 14
I - 05010 Porano (TR)
Italy

REGISTRATION CODE

After your registration I will send you the registration number that you have to put in the box of the registration window (the one that open when you choose 'Registration' from menu.

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email: **eschmit@tin.it - eschmit@bigfoot.com**
Internet address: **http://volftp.mondadori.com/italiani/CAZORZI/index.htm - http://einstein.freehosting.net - http://members.xoom.it/lis/index.html http://utenti.tripod.it/lis/index.html**

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The full name on registration window is: _____ _____

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I HAVE READ AND ACCEPT THE EVALUATION AGREEMENT!

Signature: _____

UNINSTALL

Preferibly use the Windows98/95 function to delete the programs.

Otherwise:

Delete the einSTein's directory with all its files.
Windows directory

Delete the files:

ahi.wav	
ap98z.dmc	initialization file
einst_en.hlp	Help (english)
einstein.hlp	Help (Italian)
einstein.mcd	(if present)*
einstein.fml	(if present)*
einstein.fm1	(if present)*
numero.wav	
tasto.wav	
yes.wav	System directory of Windows

Delete the file (if you don't need it for other applications):

vb40032.dll	Visual Basic's librery
comdlg32.ocx	librery

* einstein.mcd and einstein.fml are create only from registered programms when the command 'Save on exit' is on.

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