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User manual CASIO FX-570ES PLUS
User guide CASIO FX-570ES PLUS
Operating instructions CASIO FX-570ES PLUS
Instructions for use CASIO FX-570ES PLUS
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fx-570ES PLUS *fx-991ES PLUS* *User's Guide*



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scroll. first and then use Display indicators This indicator: Means this: The keypad has been shifted by pressing the key. The keypad will unshift and this indicator will disappear when you press a key. The alpha input mode has been entered by pressing the key. The alpha input mode will be exited and this indicator will disappear when you press a key. There is a value stored in independent memory. The calculator is standing by for input of a variable name to assign a value to the variable. This indicator appears after you press (STO). The calculator is standing by for input of a variable name to recall the variable's value.

This indicator appears after you press . The calculator is in the STAT Mode. The calculator is in the CMLPX Mode. The calculator is in the MATRIX Mode. The calculator is in the VECTOR Mode. The default angle unit is degrees. The default angle unit is radians. The default angle unit is grads. FIX SCI Math A fixed number of decimal places is in effect.



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A fixed number of significant digits is in effect.

Natural Display is selected as the display format. Calculation history memory data is available and can be replayed, or there is more data above/below the current screen. S A M STO RCL STAT CMPLX MAT VCT E-4 Disp The display currently shows an intermediate result of a multi-statement calculation.

Important: For some type of calculation that takes a long time to execute, the display may show only the above indicators (without any value) while it performs the calculation internally. Using Menus Some of the calculator's operations are performed using menus.

Pressing or , for example, will display a menu of applicable functions. The following are the operations you should use to navigate between menus. · You can select a menu item by pressing the number key that corresponds to the number to its left on the menu screen. · The indicator in the upper right corner of a menu means there is another menu below the current one. The indicator means another menu above.

and to switch between menus. Use . · To close a menu without selecting anything, press Specifying the Calculation Mode When you want to perform this type of operation: General calculations Complex number calculations Statistical and regression calculations Calculations involving specific number systems (binary, octal, decimal, hexadecimal) Equation solution Matrix calculations Generation of a number table based on an expression Vector calculations

Perform this key operation: (COMP) (CMPLX) (STAT) (BASE-N) (EQN) (MATRIX) (TABLE) (VECTOR) Note: The initial default calculation mode is the COMP Mode. Configuring the Calculator Setup First perform the following key operation to display the setup menu: (SETUP). Next, use and and the number keys to configure the settings you want. Underlined () settings are initial defaults. MthIO LineIO Specifies the display format. Natural Display (MthIO) causes fractions, irrational numbers, and other expressions to be displayed as they are written on paper. E-5 Linear Display (LineIO) causes fractions and other expressions to be displayed in a single line. Note: · The calculator switches to Linear Display automatically whenever you enter the STAT, BASE-N, MATRIX, or VECTOR Mode.

· In this manual, symbol next to a sample operation indicates Natural Display, while the symbol indicates Linear Display. the Deg Rad Gra Specifies degrees, radians or grads as the angle unit for value input and calculation result display. Note: In this manual, the symbol next to a sample operation indicates symbol indicates radians. degrees, while the Fix Sci Norm Specifies the number of digits for display of a calculation result. Fix: The value you specify (from 0 to 9) controls the number of decimal places for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed. $100 \div 7 = 14.286$ (Fix 3) Example: 14.29 (Fix 2) Sci: The value you specify (from 1 to 10) controls the number of significant digits for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed.

$1 \div 7 = 1.4286$ 101 (Sci 5) Example: 1.429 101 (Sci 4) Norm: Selecting one of the two available settings (Norm 1, Norm 2) determines the range in which results will be displayed in non-exponential format. Outside the specified range, results are displayed using exponential format. Norm 1: 102 |x|, |x| 1010 Norm 2: 109 |x|, |x| 1010 Example: $1 \div 200 = 5$ 103 (Norgn is omitted Permutation (nPr), combination (nCr), complex number polar coordinate symbol () Dot product (·) Multiplication, division (, ÷) Addition, subtraction (+, -) Logical AND (and) Logical OR, XOR, XNOR (or, xor, xnor) 5th 6th 7th 8th 9th 10th 11th 12th 13th Inputting with Natural Display Selecting Natural Display makes it possible to input and display fractions and , , x-1, 10 , e , , d/dx , Abs) just certain functions (log, x2, x3, x , , as they are written in your textbook.

result. form of the result will not appear in this case. The Basic Calculations Fraction Calculations Note that the input method for fractions is different, depending upon whether you are using Natural Display or Linear Display. $2+1=7$ 3 2 6 or $2 \ 2 \ 3 \ 2 \ 1 \ 1 \ 4-3 = 2 \ 2 \ 4 \ (\ 4 \ 3) 3 \ 3 \ 3 \ 1 \ 1 \ 1 \ 1 \ 2 \ 2 \ 2 \ 2 \ 7 \ 6 \ 7 \ 6 \ 1 \ 2 \ 1 \ 2$ Note: · Mixing fractions and decimal values in a calculation while Linear Display is selected will cause the result to be displayed as a decimal value. ·

Fractions in calculation results are displayed after being reduced to their lowest terms.

To switch a calculation result between improper fraction and mixed () fraction format: Perform the following key operation: To switch a calculation result between fraction and decimal format: · Press E-10 Percent Calculations Inputting a value and pressing a percent. $150 \ 20\% = 30$ (%) causes the input value to become $150 \ 20$ (%) $30 \ 75 \ 2875 \ 2625$ Calculate what percentage of 880 is 660. (75%) $660 \ 880$ Increase 2500 by 15%. (2875) $2500 \ 2500$ Discount 3500 by 25%. (2625) $3500 \ 3500$ (%) 15 (%) 25 (%) Degree, Minute, Second (Sexagesimal) Calculations Performing an addition or subtraction operation between sexagesimal values, or a multiplication or division operation between a sexagesimal value and a decimal value will cause the result to be displayed as a sexagesimal value. You also can convert between sexagesimal and decimal. The following {minutes} is the input format for a sexagesimal value: {degrees} . {seconds} Note: You must always input something for the degrees and minutes, even if they are zero. $2^{\circ}20'30'' + 39'30'' = 3^{\circ}00'00''$ $2 \ 20 \ 30 \ 0 \ 39 \ 30 \ 3^{\circ}0'0'2^{\circ}15'18.2$.

$255 \ 2^{\circ}15'18''$ Convert $2^{\circ}15'18''$ to its decimal equivalent. $2 \ 15 \ 18$ (Converts sexagesimal to decimal.) (Converts decimal to sexagesimal.) Multi-Statements You can use the colon character (:) to connect two or more expressions and . execute them in sequence from left to right when you press $3+3:3 \ 3 \ 3 \ 3$ (:) $3 \ 3 \ 6 \ 9$ Using Engineering Notation A simple key operation transforms a displayed value to engineering notation. Transform the value 1234 to engineering notation, shifting the decimal point to the right. $1234 \ 1234 \ 1.234 \times 10^3 \ 1234 \times 100$ E-11 Transform the value 123 to engineering notation, shifting the decimal point to the left. $123 \ 123$ () 0.123×10^3 () 0.

000123×10^6 Calculation History In the COMP, CMPLX, or BASE-N Mode, the calculator remembers up to approximately 200 bytes of data for the newest calculation. You can scroll and . through calculation history contents using $1+1=2 \ 2+2=4 \ 3+3=6 \ 1 \ 1 \ 2 \ 2 \ 3 \ 3$ (Scrolls back.) (Scrolls back again.) $2 \ 4 \ 6 \ 4 \ 2$ Note: Calculation history data is all cleared whenever you press , when you change to a different calculation mode, when you change the display format, or whenever you perform any reset operation.



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Replay While a calculation result is on the display, you can press the expression you used for the previous calculation. $4 \times 3 + 2.5 = 14.5$ $4 \times 3 - 7.1 = 4.9$ 4 (Continuing) 3 or to edit 2.5 7.1 14.5 4.9 Note: If you want to edit a calculation when the indicator is on the right side of a calculation result display (see "Reading the Display"), press and to scroll the calculation. and then use Answer Memory (Ans) The last calculation result obtained is stored in Ans (answer) memory. Ans memory contents are updated whenever a new calculation result is displayed. To divide the result of 3 4 by 30 3 (Continuing) 4 30 123 + 456 = 579 789 579 = 210 (Continuing) 123 456 789 E-12 Variables (A, B, C, D, E, F, X, Y) Your calculator has eight preset variables named A, B, C, D, E, F, X, and Y. You can assign values to variables and also use the variables in calculations. To assign the result of 3 + 5 to variable A 3 5 To multiply the contents of variable A by 10 (Continuing) To recall the contents of variable A To clear the contents of variable A (STO) (A) 8 80 (A) 10 (A) (A) (Continuing) 0 (STO) 8 0 Independent Memory (M) You can add calculation results to or subtract results from independent memory.

The "M" appears on the display when there is any value other than zero stored in independent memory. To clear the contents of M To add the result of 10 5 to M 0 (Continuing) (STO) 10 5 (M) 0 50 15 35 To subtract the result of 10 + 5 from M (Continuing) To recall the contents of M 10 5 (M) (M) (Continuing)

Note: Variable M is used for independent memory. Clearing the Contents of All Memories Ans memory, independent memory, and variable contents are retained even , change the calculation mode, or turn off the calculator. if you press Perform the following procedure when you want to clear the contents of all memories. (CLR) (Memory) (Yes) Function Calculations For actual operations using each function, see the "Examples" section following the list below. : is displayed as 3.141592654, but internal calculations. internal calculations. sin, cos, tan, sin-1, cos-1, tan-1 : Trigonometric functions. Specify the angle unit before performing calculations.

See 1. sinh, cosh, tanh, sinh-1, cosh-1, tanh-1 : Hyperbolic functions. Input a . The angle unit function from the menu that appears when you press setting does not affect calculations. See 2 .

= 3.14159265358980 is used for e : e is displayed as 2.718281828, but e = 2.71828182845904 is used for E-13 °, r, g : These functions specify the angle unit. ° specifies degrees, r radians, and g grads.

Input a function from the menu that appears when you perform the following key operation: (DRG) . See 3. , : Exponential functions. Note that the input method is different depending upon whether you are using Natural Display or Linear Display. See 4. log : Logarithmic function. Use the key to input logab as log (a, b). Base key also 10 is the default setting if you do not input anything for a. The can be used for input, but only while Natural Display is selected. In this case, you must input a value for the base.

See 5. ln : Natural logarithm to base e. See 6. x2, x3, x , , , x-1 : Powers, power roots, and reciprocals. Note , , and are different depending upon that the input methods for x , whether you are using Natural Display or Linear Display. See 7. x3, x , x-1. If you input 2 Note: The following functions cannot be input in consecutive sequence: x2, , for example, the final will be ignored. To 2 , press the key, and then press . input 22 , input 2 : Function for performing numerical integration using the Gauss-Kronrod method.

Natural Display input syntax is b f(x), while Linear Display input a syntax is (f(x), a, b, tol). tol specifies tolerance, which becomes 1 105 when nothing is input for tol. Also see "Integration and Differential Calculation Precautions" and "Tips for Successful Integration Calculations" for more information. See 8. : Function for approximation of the derivative based on the central difference method.

Natural Display input syntax is Linear Display input syntax is d , while dx (f(x)) x=a d (f(x), a, tol). tol specifies tolerance, dx which becomes 1 1010 when nothing is input for tol. Also see "Integration 9. b and Differential Calculation Precautions" for more information. See : Function that, for a specified range of f(x), determines sum = f(a) + f(a+1) + f(a+2) + .

..+ f(b). Natural Display input syntax is x=a b (f(x)) (f(x)) , x=a while Linear Display input syntax is (f(x), a, b). a and b are integers that 10 10 can be specified within the range of 1 10 a b 1 10 . See 10. Note: The following cannot be used in f(x), a, or b: Pol, Rec, , d/dx, . Pol, Rec : Pol converts rectangular coordinates to polar coordinates, while Rec converts polar coordinates to rectangular coordinates. See 11 . Pol(x, y) = (r,) Rec(r,) = (x, y) Specify the angle unit before performing calculations.

The calculation result for r and and for x and y are each assigned respectively to variables X and Y. Calculation result is displayed in the range of -180° 180°. Rectangular Coordinates (Rec) Polar Coordinates (Pol) E-14 x ! : Factorial function. See 12 . Abs : Absolute value function. Note that the input method is different depending upon whether you are using Natural Display or Linear Display. See 13 . Ran# : Generates a 3-digit pseudo random number that is less than 1. The result is displayed as a fraction when Natural Display is selected. See 14 .

RanInt# : For input of the function of the form RanInt#(a, b), which generates a random integer within the range of a to b. See 15 . nPr, nCr : Permutation (nPr) and combination (nCr) functions. See 16 . Rnd : The argument of this function is made a decimal value and then rounded in accordance with the current number of display digits setting (Norm, Fix, or Sci).

With Norm 1 or Norm 2, the argument is rounded off to 10 digits. With Fix and Sci, the argument is rounded off to the specified digit. When Fix 3 is the display digits setting, for example, the result of $10 \div 3$ is displayed as 3.333, while the calculator maintains a value of 3.33333333333333 (15 digits) internally for calculation.

@@@See 17 . @@@@When specifying tol, use value that is 1 1014 or greater. @@@@Precautions for Differential Calculation Only · If convergence to a solution cannot be found when tol input is omitted, the tol value will be adjusted automatically to determine the solution. · Non-consecutive points, abrupt fluctuation, extremely large or small points, inflection points, and the inclusion of points that cannot be differentiated, or a differential point or differential calculation result that approaches zero can cause poor precision or error. E-15 Tips for Successful Integration Calculations When a periodic function or integration interval results in positive and negative f(x) function values Perform separate integrations for each cycle, or for the positive part and the negative part, and then combine the results.



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$\int a \cdot b \cdot f(x) dx = a \cdot \int b \cdot f(x) dx + (c \cdot \int f(x) dx)$ S Positive S Negative Positive Part Negative Part (S Positive) (S Negative) When integration values fluctuate widely due to minute shifts in the integration interval Divide the integration interval into multiple parts (in a way that breaks areas of wide fluctuation into small parts), perform integration on each part, and then combine the results. $\int f(x) \cdot b \cdot a \cdot x^1 \cdot x^2 \cdot f(x) dx = b \cdot a \cdot \int f(x) dx + x^1 \cdot \int f(x) dx + \dots$

$\int 0 \cdot a \cdot x^1 \cdot x^2 \cdot x^3 \cdot x^4 \cdot b \cdot f(x) dx$ Examples $1 \sin 30^\circ = 0.5 \sin -10.5 = 30^\circ 2 \sinh 1 = 1.175201194 \cosh 1 = 0.3 / 2$ radians = 90° , 50 grads = 45° () 2 50 4 To calculate e^5 (SETUP) (DRG) (DRG) (r) (g) 30 (sin-1) 0.5 (sinh) 1 (cosh-1) 1 0.5 30 1.175201194 0 90 45 2 to three significant digits (Sci 3) () 5 () 5 2 2 1000 2 () 16 2 16 (Sci) 2.97 \times 10² 2.97 \times 10² 3 4 4 4.

$50 \times 100 5 \log 101000 = \log 1000 = 3 \log 216 = 4 6$ To calculate $\ln 90$ (= loge 90) to three significant digits (Sci 3) (SETUP) 7 1.2 (Sci) 1.2 1 5 5 1 ((90 10 2) 5) 32 3 2 (x3) 32 103 = 1200 (1+1)2+2 = 16 (52)3 = 15625 5 32 = 2 1200 16 15625 2 2 E-16 To calculate ' $\times 3$ (= $3'$ = 4.242640687..

(.) to three decimal 2 2 places (Fix 3) (SETUP) (Fix) 2 3 3' 2 2 8 $\ln(x) e 3 4.243 4.243 = 1$ (X) 1 1 (X) (,) (e) (e) (,) 1 1 9 To obtain the derivative at point $x = 1/2$ for the function $y = \sin(x)$ (((,) 5) ()) () 2 (X) 2 (X) 0 0 10 $x = 1$ (x + 1) = 20 (()) (X) 1 1 (X) 1 (,) 5 5 (,) 1 20 20 11 To convert rectangular coordinates (' , ') to polar coordinates 22 (Pol) (Pol) 2 2 (,) (,) 2 2 $r=2, =45 r = 2 = 45$ To convert polar coordinates (' , 45°) to rectangular coordinates 2 (Rec) 12 (5 + 3) ! @@@@Note that SOLVE can be used in the COMP Mode () only. @@@@An expression like $X^2 + 2X - 2$ is treated as $X^2 + 2X - 2 = 0$.

@@@@@x Solution Screen Contents Solutions are always displayed in decimal format. Equation (The equation you input.) Math Variable solved for Solution (Left Side) (Right Side) result "(Left Side) (Right Side) result" shows the result when the right side of the equation is subtracted from the left side, after assigning the obtained value to the variable being solved for. The closer this result is to zero, the higher the accuracy of the solution. Continue Screen SOLVE performs convergence a preset number of times. If it cannot find a solution, it displays a confirmation screen that shows "Continue: [=]", asking if you want to continue. Press to continue or to cancel the SOLVE operation. To solve $y = x^2 + x + 1$ for x when $y = 3, 7$, and 13 (Y) (X) (X) (=) 1 (SOLVE) E-21 3 Input an initial value for X (Here, input 1): 1 7 13 Statistical Calculations (STAT) To start a statistical calculation, perform the key operation (STAT) to enter the STAT Mode and then use the screen that appears to select the type of calculation you want to perform. To select this type of statistical calculation: (Regression formula shown in parentheses) Press this key: Single-variable (X) Paired-variable (X, Y), linear regression ($y = A + Bx$) Paired-variable (X, Y), quadratic regression ($y = A + Bx + Cx^2$) Paired-variable (X, Y), logarithmic regression ($y = A + B \ln x$) Paired-variable (X, Y), exponential regression ($y = Ae^{Bx}$) Paired-variable (X, Y), ab exponential regression ($y = ABx$) Paired-variable (X, Y), power regression ($y = Ax^B$) B (1-VAR) (A+BX) (+CX2) (ln X) (e^X) (A^B^X) (A^X^B) (1/X) Paired-variable (X, Y), inverse regression ($y = A + B/x$) Pressing any of the above keys (to) displays the Stat Editor. Note: When you want to change the calculation type after entering the STAT Mode, perform the key operation (STAT) (Type) to display the calculation type selection screen.

Inputting Data Use the Stat Editor to input data. Perform the following key operation to display the Stat Editor: (STAT) (Data). The Stat Editor provides 80 rows for data input when there is an X column only, 40 rows when there are X and FREQ columns or X and Y columns, or 26 rows when there are X, Y, and FREQ columns. E-22 Note: Use the FREQ (frequency) column to input the quantity (frequency) of identical data items. Display of the FREQ column can be turned on (displayed) or off (not displayed) using the Stat Format setting on the setup menu. 1 To select linear regression and input the following data: (170, 66), (173, 68), (179, 75) STAT (STAT) (A+BX) STAT 170 173 179 STAT 66 68 75 Important: · All data currently input in the Stat Editor is deleted whenever you exit the STAT Mode, switch between the single-variable and a pairedvariable statistical calculation type, or change the Stat Format setting on the setup menu. · The following operations are not supported by the Stat Editor: , (M), (STO). Pol, Rec, and multi-statements also cannot be input with the Stat Editor. To change the data in a cell: In the Stat Editor, move the cursor to the cell that contains the data you want to change, input the new data, and then press . To delete a line: In the Stat Editor, move the cursor to the line that you want to delete and then press .

To insert a line: In the Stat Editor, move the cursor to the location where you want to insert the line and then perform the following key operation: (STAT) (Edit) (Ins). To delete all Stat Editor contents: In the Stat Editor, perform the following key operation: (STAT) (Edit) (Del-A). Obtaining Statistical Values from Input Data To obtain statistical values, press while in the Stat Editor and then recall the statistical variable (x_n, x_2 , etc.) you want. Supported statistical variables and the keys you should press to recall them are shown below.

For single-variable statistical calculations, the variables marked with an asterisk (*) are available. x_2^* , x^* , y_2 , y , xy , x_3 , x_2y , x_4 (STAT) (Sum) to Number of Items: n^* , Mean: \bar{x} , \bar{y} , Population Standard Deviation: s_n^* , s_n , Sample Standard Deviation: s_{n1}^* , s_{n1} (STAT) (Var) to Regression Coefficients: A, B, Correlation Coefficient: r, Estimated Values: , (STAT) (Reg) to Regression Coefficients for Quadratic Regression: A, B, C, Estimated Values: 1, 2, (STAT) (Reg) to Sum: E-23 · See the table at the beginning of this section of the manual for the regression formulas. , 1, 2 and are not variables. They are commands of the type that take an argument immediately before them. See "Calculating Estimated Values" for more information.

Minimum Value: $\min X^*$, $\min Y$, Maximum Value: $\max X^*$, $\max Y$ (STAT) (MinMax) to Note: While single-variable statistical calculation is selected, you can input the functions and commands for performing normal distribution calculation from the menu that appears when you perform the following key operation: (STAT) (Distr).



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@@@Specify Fix 3 (three decimal places) for results. @@@Specify Fix 3 for the result. @@@@@To enter the BASE-N Mode, switch to the binary mode, and calculate $112 + 12$ (BASE-N) (BIN) 111 Continuing from above, switch to the hexadecimal mode and calculate $1F16 + 116$ (HEX) 1 (F) 1 Continuing from above, switch to the octal mode and calculate $78 + 18$ (OCT) 71 Note: · Use the following keys to input the letters A through F for hexadecimal values: (A), (B), (C), (D), (E), (F). · In the BASE-N Mode, input of fractional (decimal) values and exponents is not supported. If a calculation result has a fractional part, it is cut off. · The input and output ranges is 16 bits for binary values, and 32 bits for other types of values. The following shows details about input and output ranges. Base-n Mode Binary Octal Decimal Input/Output Ranges Positive: 0000000000000000 Negative: 1000000000000000 Positive: 0000000000 Negative: 2000000000 2147483648 x x 0111111111111111 1111111111111111 x x 1777777777 3777777777 x 2147483647 E-26 Hexadecimal Positive: 00000000 Negative: 80000000 x x 7FFFFFFF FFFFFFFF Specifying the Number Mode of a Particular Input Value You can input a special command immediately following a value to specify the number mode of that value. The special commands are: d (decimal), h (hexadecimal), b (binary), and o (octal).

To calculate $1010 + 1016 + 102 + 108$ and display the result as a decimal value (DEC) (BASE) (d) 10 (BASE) (h) 10 (BASE) (b) 10 36 (BASE) (o) 10 Converting a Calculation Result to another Type of Value You can use any one of the following key operations to convert the currently displayed calculation result to another type of value: (DEC) (decimal), (HEX) (hexadecimal), (BIN) (binary), (OCT)(octal). To calculate $1510 3710$ in the decimal mode, and then convert the result to hexadecimal, binary, and octal (DEC) 15 37 555 (HEX) 0000022B (BIN) 000001000101011 (OCT) 0000001053 Logical and Negation Operations Your calculator provides you with logical operators (and, or, xor, xnor) and functions (Not, Neg) for logical and negation operations on binary values. Use the menu that appears when you press (BASE) to input these logical operators and functions. All of the following examples are performed in the binary mode ((BIN)). To determine the logical AND of 10102 and 11002 (10102 and 11002) 000000000001000 1010 (BASE) (and) 1100 To determine the logical OR of 10112 and 110102 (10112 or 110102) 1011 (BASE) (or) 11010 000000000011011 To determine the logical XOR of 10102 and 11002 (10102 xor 11002) 000000000000110 1010 (BASE) (xor) 1100 To determine the logical XNOR of 11112 and 1012 (11112 xnor 1012) 111111111110101 1111 (BASE) (xnor) 101 E-27 To determine the bitwise complement of 10102 (Not(10102)) (BASE) (Not) 1010 111111111110101 To negate (take the two's complement) of 1011012 (Neg(1011012)) (BASE) (Neg) 101101 111111111010011 Note: In the case of a negative binary, octal or hexadecimal value, the calculator converts the value to binary, takes the two's complement, and then converts back to the original number base. For decimal (base-10) values, the calculator merely adds a minus sign. Equation Calculations (EQN) You can use the following procedure in the EQN Mode to solve simultaneous linear equations with two or three unknowns, quadratic equations, and cubic equations. 1. Press (EQN) to enter the EQN Mode. 2.

On the menu that appears, select an equation type. To select this calculation type: Simultaneous linear equations with two unknowns Simultaneous linear equations with three unknowns Quadratic equation Cubic equation Press this key: (anX + bnY = cn) (anX + bnY + cnZ = dn) (aX² + bX + c = 0) (aX³ + bX² + cX + d = 0) 3. Use the Coefficient Editor that appears to input coefficient values. in step 2, and then input · To solve $2x^2 + x - 3 = 0$, for example, press 1 the following for the coefficients (a = 2, b = 1, c = 3): 2 3 · To change a coefficient value you already have input, move the cursor to the appropriate cell, input the new value, and then press .

will clear all of the coefficients to zero. · Pressing Important: The following operations are not supported by the Coefficient Editor: (M), (STO). Pol, Rec, and multi-statements also cannot be input with the Coefficient Editor. 4. After all the values are the way you want, press .

will display another · This will display a solution. Each press of solution. Pressing while the final solution is displayed will return to the Coefficient Editor. and keys. · You can scroll between the solutions using the · To return to the Coefficient Editor while any solution is displayed, press . Note: · Even if Natural

Display is selected, the solutions of simultaneous linear equations are not displayed using any form that includes . · Values cannot be converted to engineering notation on the solution screen. Changing the Current Equation Type Setting Press (EQN) and then select an equation type from the menu that appears. Changing the equation type causes the values of all Coefficient Editor coefficients to change to zero. E-28 EQN Mode Calculation Examples $x + 2y = 3$, $2x + 3y = 4$ (EQN) (anX + bnY = cn) 1 2 2 3 Math 3 4 (X=) 1 (Y=) 2 x y + z = 2, x + y z = 0, x + y + z = 4 (EQN) (anX + bnY + cnZ = dn) 1 1 1 2 1 1 0 1 1 1 4 Math (X=) 1 (Y=) 2 (Z=) 3 $x^2 + x + 3 = 0$ 4 (EQN) (aX² + bX + c = 0) 1 1 3 4 2 1' + 2 2i 2 1' (X2=) 2 2i (X1=) x² 2'x + 2 = 0 2 (EQN) 1 (aX² + bX + c = 0) 2 2 2 (X=) ' 2 x³ 2x² x + 2 = 0 (EQN) 1 (aX³ + bX² + cX + d = 0) 2 1 2 (X1=) 1 (X2=) 2 (X3=) 1 Matrix Calculations (MATRIX) Use the MATRIX Mode to perform calculations involving matrices of up to 3 rows by 3 columns.

To perform a matrix calculation, you first assign data to special matrix variables (MatA, MatB, MatC), and then use the variables in the calculation as shown in the example below. 2 1 21 1 To assign 1 1 to MatA and 1 2 to MatB, and then perform the following calculations: $2 1 \times 11 21 + 2 1$ (MatA+MatB) 1 2 11 2 1 (MatA×MatB), 1 2 E-29 1. Press (MATRIX) to enter the MATRIX Mode. (MatA) (2 2). 2. Press · This will display the Matrix Editor for input of the elements of the 2 2 matrix you specified for MatA. MAT "A" stands for "MatA". 3. Input the elements of MatA: 2 1 1 1. (MATRIX) (Data) 4.

Perform the following key operation: (MatB) (2 2). · This will display the Matrix Editor for input of the elements of the 2 2 matrix you specified for MatB. 1 1 2 . 5. Input the elements of MatB: 2 to advance to the calculation screen, and perform the first 6.

Press calculation (MatA MatB): (MATRIX) (MatA) (MATRIX) (MatB) . · This will display the MatAns screen with the calculation results.



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MAT MAT "Ans" stands for "MatAns". Note: "MatAns" stands for "Matrix Answer Memory". See "Matrix Answer Memory" for more information.

7. Perform the next calculation (MatA+MatB): (MatA) (MATRIX) (MatB) . MAT MAT (MATRIX) Matrix Answer Memory Whenever the result of a calculation executed in the MATRIX Mode is a matrix, the MatAns screen will appear with the result. The result also will be assigned to a variable named "MatAns". The MatAns variable can be used in calculations as described below. · To insert the MatAns variable into a calculation, perform the following key operation: (MATRIX) (MatAns). · Pressing any one of the following keys while the MatAns screen is displayed will switch automatically to the calculation screen: , , , , , (x3). The calculation screen will show the MatAns variable followed by the operator or function for the key you pressed. Assigning and Editing Matrix Variable Data Important: The following operations are not supported by the Matrix Editor: , (M), (STO). Pol, Rec, and multi-statements also cannot be input with the Matrix Editor.

To assign new data to a matrix variable: 1. Press (MATRIX) (Dim), and then, on the menu that appears, select the matrix variable to which you want to assign data. 2. On the next menu that appears, select dimension (m n). E-30 3. Use the Matrix Editor that appears to input the elements of the matrix. 1 0 1 to MatC 2 To assign 0 1 1 1 0 (MATRIX) (Dim) (MatC) (2 3) 1 0 1 1 To edit the elements of a matrix variable: (MATRIX) (Data), and then, on the menu that appears, 1.

Press select the matrix variable you want to edit. 2. Use the Matrix Editor that appears to edit the elements of the matrix. · Move the cursor to the cell that contains the element you want to change, input the new value, and then press . To copy matrix variable (or MatAns) contents: 1. Use the Matrix Editor to display the matrix you want to copy. · If you want to copy MatA, for example, perform the following key operation: (MATRIX) (Data) (MatA). · If you want to copy MatAns contents, perform the following to display the MatAns screen: (MATRIX) (MatAns) . (STO), and then perform one of the following key operations 2. Press to specify the copy destination: (MatA), (MatB), or (MatC). · This will display the Matrix Editor with the contents of the copy destination. Matrix Calculation Examples The following examples use MatA = and MatC = 1 0 1 from 0 1 1 2 1 2 1 and MatB = from 1 1 1 2 1, 2 . You can input a matrix variable into a key operation by pressing following number keys: (MATRIX) and then pressing one of the (MatA), (MatB), (MatC). 3 3 × MatA (Matrix scalar multiplication). 3 MatA 4 Obtain the determinant of MatA (det(MatA)). (MATRIX) (det) MatA 1 5 Obtain the transposition of MatC (Trn(MatC)). (MATRIX) (Trn) MatC 6 Obtain the inverse matrix of MatA (MatA⁻¹). Note: You cannot use for this input. Use the MatA key to input " 1 ". E-31 7 Obtain the absolute value of each element of MatB (Abs(MatB)). (Abs) MatB 8 Determine the square and cube of MatA (MatA², MatA³). Note: You cannot use for this input. Use to specify squaring, and (x3) to specify cubing.

MatA MatA (x3) Creating a Number Table from a Function (TABLE) TABLE generates a number table for x and f(x) using an input f(x) function. Perform the following steps to generate a number table. 1. Press (TABLE) to enter the TABLE Mode. 2. Input a function in the format f(x), using the X variable. (X) when generating a number · Be sure to input the X variable (table. Any variable other than X is handled as a constant. · The following cannot be used in the function: Pol, Rec, , d/dx, . 3.

In response to the prompts that appear, input the values you want to use, pressing after each one. For this prompt: Input this: Start? End? Input the lower limit of X (Default = 1). Input the upper limit of X (Default = 5). Note: Make sure that the End value is always greater than the Start value. Input the increment step (Default = 1).

Note: The Step specifies by how much the Start value should be sequentially incremented as the number table is generated. If you specify Start = 1 and Step = 1, X sequentially will be assigned the values 1, 2, 3, 4, and so on to generate the number table until the End value is reached. Step? · Inputting the Step value and pressing generates and displays the number table in accordance with the parameters you specified. while the number table screen is displayed will return to · Pressing the function input screen in step 2. 1 To generate a number table for the function f(x) = x² + for the 2 range 1 x 1, incremented in steps of 0. 5 Math (TABLE) E-32 Math (X) 1 2 Math 1 1 0.5 Note: · You can use the number table screen for viewing values only. Table contents cannot be edited. · The number table generation operation causes the contents of variable X to be changed. Important: The function you input for number table generation is deleted whenever you display the setup menu in the TABLE Mode and switch between Natural Display and Linear Display. Vector Calculations (VECTOR) Use the VECTOR Mode to perform 2-dimensional and 3-dimensional vector calculations. To perform a vector calculation, you first assign data to special vector variables (VctA, VctB, VctC), and then use the variables in the calculation as shown in the example below. 1 To assign (1, 2) to VctA and (3, 4) to VctB, and then perform the following calculation: (1, 2) + (3, 4) (VECTOR) to enter the VECTOR Mode. 1. Press 2.

Press (VctA) (2). · This will display the Vector Editor for input of the 2-dimensional vector for VctA. VCT "A" stands for "VctA". 3. Input the elements of VctA: 1 2 . 4. Perform the following key operation: (VECTOR) (Data) (VctB) (2). · This will display the Vector Editor for input of the 2-dimensional vector for VctB. 4 . 5.

Input the elements of VctB: 3 to advance to the calculation screen, and perform the calculation 6. Press (VctA + VctB): (VECTOR) (VctA) (VECTOR) (VctB) . · This will display the VctAns screen with the calculation results. VCT VCT "Ans" stands for "VctAns". Note: "VctAns" stands for "Vector Answer Memory". See "Vector Answer Memory" for more information. E-33 Vector Answer Memory Whenever the result of a calculation executed in the VECTOR Mode is a vector, the VctAns screen will appear with the result. The result also will be assigned to a variable named "VctAns". The VctAns variable can be used in calculations as described below. · To insert the VctAns variable into a calculation, perform the following key operation: (VECTOR) (VctAns). · Pressing any one of the following keys while the VctAns screen is displayed will switch automatically to the calculation screen: , , , .



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The calculation screen will show the VctAns variable followed by the operator for the key you pressed. Assigning and Editing Vector Variable Data
Important: The following operations are not supported by the Vector Editor: \cdot , (M), (STO). Pol, Rec, and multi-statements also cannot be input with the Vector Editor. To assign new data to a vector variable: (VECTOR) (Dim), and then, on the menu that appears, 1. Press select the vector variable to which you want to assign data. 2. On the next menu that appears, select dimension (m). 3. Use the Vector Editor that appears to input the elements of the vector.

2 To assign (2, 1, 2) to VctC (VECTOR) (Dim) 2 (VctC) (3) 1 2 To edit the elements of a vector variable: (VECTOR) (Data), and then, on the menu that appears, 1. Press select the vector variable you want to edit. 2. Use the Vector Editor that appears to edit the elements of the vector. · Move the cursor to the cell that contains the element you want to change, input the new value, and then press . To copy vector variable (or VctAns) contents: 1. Use the Vector Editor to display the vector you want to copy. · If you want to copy VctA, for example, perform the following key operation: (VECTOR) (Data) (VctA). · If you want to copy VctAns contents, perform the following to display the VctAns screen: (VECTOR) (VctAns) . (STO), and then perform one of the following key operations 2.

Press to specify the copy destination: (VctA), (VctB), or (VctC). · This will display the Vector Editor with the contents of the copy destination. Vector Calculation Examples The following examples use VctA = (1, 2) and VctB = (3, 4) from 1, and VctC = (2, 1, 2) from 2. You can input a vector variable into a key operation by pressing (VECTOR) and then pressing one of the following number keys: (VctA), (VctB), (VctC). E-34 $3 \times \text{VctA}$ (Vector scalar multiplication), $3 \times \text{VctA} \cdot \text{VctB}$ (Calculation example using VctAns) $3 \text{ VctA} \cdot \text{VctB}$ 4 $\text{VctA} \cdot \text{VctB}$ (Vector dot product) $\text{VctA} \cdot \text{VctB}$ (VECTOR) (Dot)VctB 5 $\text{VctA} \times \text{VctB}$ (Vector cross product) $\text{VctA} \times \text{VctB}$ 6 Obtain the absolute values of VctC.

(Abs)VctC 7 Determine the angle formed by VctA and VctB to three decimal places (Fix 3). $(\text{A} \cdot \text{B}) / (|\text{A}| \cdot |\text{B}|)$, which becomes \cos^{-1} (cos = AB AB (SETUP) (Fix) VctA (VECTOR) (Dot)VctB VCT FIX (Abs)VctA VctB (Abs) VCT FIX (cosI) Scientific Constants Your calculator comes with 40 built-in scientific constants that can be used in any mode besides BASE-N. Each scientific constant is displayed as a unique symbol (such as π), which can be used inside of calculations. To input a scientific constant into a calculation, press (CONST) and then input the two-digit number that corresponds to the constant you want. E-35 To input the scientific constant C0 (speed of light in a vacuum), and display its value (CONST) (C0) To calculate $C0 = 1 \cdot 1 \cdot 0$ (CONST) (CONST) ((0) 0) The following shows the two-digit numbers for each of the scientific constants.

01: (mp) proton mass 03: (me) electron mass 05: (a0) Bohr radius 07: (N) nuclear magneton 09: (h) Planck constant, rationalized 11: (re) classical electron radius 13: (p) proton gyromagnetic ratio 15: (cn) neutron Compton wavelength 17: (u) atomic mass constant 19: (e) electron magnetic moment 21: (mu) muon magnetic moment 23: (e) elementary charge 25: (k) Boltzmann constant 27: (R) molar gas constant 29: (C1) first radiation constant 31: (sigma) Stefan-Boltzmann constant 02: (mn) neutron mass 04: (m) muon mass 06: (h) Planck constant 08: (B) Bohr magneton 10: (alpha) fine-structure constant 12: (c) Compton wavelength 14: (cp) proton Compton wavelength 16: (R) Rydberg constant 18: (p) proton magnetic moment 20: (n) neutron magnetic moment 22: (F) Faraday constant 24: (NA) Avogadro constant 26: (Vm) molar volume of ideal gas 28: (C0) speed of light in vacuum 30: (C2) second radiation constant 32: (0) electric constant E-36 33: (0) magnetic constant 35: (g) standard acceleration of gravity 34: (0) magnetic flux quantum 36: (G0) conductance quantum 37: (Z0) characteristic impedance of 38: (t) Celsius temperature vacuum 39: (G) Newtonian constant of gravitation 40: (atm) standard atmosphere The values are based on CODATA recommended values (March 2007). Metric Conversion The calculator's built-in metric conversion commands make it simple to convert values from one unit to another. You can use the metric conversion commands in any calculation mode except for BASE-N and TABLE. To input a metric conversion command into a calculation, press (CONV) and then input the two-digit number that corresponds to the command you want. To convert 5 cm into inches 5 (CONV) (cm in) To convert 100 g into ounces 100 (CONV) (g oz) To convert 31°C into Fahrenheit 31 (CONV) (°C °F) The following shows the two-digit numbers for each of the metric conversion commands. 01: in 05: yd cm m m 02: cm 06: m 10: m 14: 18: km 22: g in yd n mile pc oz 03: ft m km m2 m/s 04: m 08: km 12: m2 16: 20: m/s 24: kg ft mile acre gal (UK) km/h lb 07: mile 11: acre 19: km/h 23: lb kg 09: n mile 13: gal (US) 17: pc 21: oz km g gal (US) 15: gal (UK) E-37 25: atm 29: hp 37: °F Pa kW J °C 26: Pa 30: kW 34: J 38: °C atm hp kgf · m °F 27: mmHg 31: kgf/cm2 35: lbf/in2 39: J cal Pa kPa 28: Pa 36: kPa 40: cal mmHg kgf/cm2 lbf/in2 J Pa 32: Pa 33: kgf · m Conversion formula data is based on the "NIST Special Publication 811 (1995)".

Note: The J cal command performs conversion for values at a temperature of 15°C. Calculation Ranges, Number of Digits, and Precision The calculation range, number of digits used for internal calculation, and calculation precision depend on the type of calculation you are performing. Calculation Range and Precision Calculation Range Number of Digits for Internal Calculation Precision 1 1099 to 9.999999999 1099 or 0 15 digits In general, 1 at the 10th digit for a single calculation.

Precision for exponential display is 1 at the least significant digit. Errors are cumulative in the case of consecutive calculations. Function Calculation Input Ranges and Precision Functions DEG sinx RAD GRA DEG cosx RAD GRA DEG tanx sin1x cos1x tan x sinhx coshx sinh1x 1 Input Range 0 0 0 0 0 0 x x x x x x 9 1 9 1 109 1010 109 1010 90. /2. 100. 157079632.7 157079632.7 Same as sinx, except when x = (2n1) Same as sinx, except when x = (2n1) Same as sinx, except when x = (2n1) 1 9.999999999 230.2585092 1099 RAD GRA 0 0 0 0 1 0 x x x cosh1x tanhx x 4. 999999999 1099 x 4.999999999 1099 x 9.999999999 1099 E-38 tanh1x logx/lnx 10x ex x' x2 x 1 3 x x! nPr nCr Pol(x, y) Rec(r,) x 9.999999999 101 x 999999999 1099 x 99.99999999 9.999999999 1099 x 230.2585092 0 x 1 10100 x 1 1050 x 1 10100 ; x 0 x 1 10100 0 x 69 (x is an integer) 0 n 1 1010, 0 r n (n, r are integers) 0 0 1 0 1 {n!/(nr)!} 1 10100 n 1 1010, 0 r n (n, r are integers) n!/r! 1 10100 or 1 n!/(nr)! 1 10100 x, y 9.



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999999999 1099 x2 + y2 9.

999999999 1099 0 r 9.999999999 : Same as $\sin x$ 1099 ° " a , b , c 1 10100 0 b , c The display seconds value is subject to an error of 1 at the second decimal place. x 1 10100 Decimal Sexagesimal Conversions 0°0 0 x 99999999°59 59 x y x y x 0: 1 10100 ylogx 100 x = 0: y 0 m x 0: y = n, 2n+1 (m, n are integers) However: 1 10100 ylog x 100 y 0: x 0, 1 10100 1/x logy 100 y = 0: x 0 y 0: x = 2n+1, 2n+1 (m 0; m, n are integers) m However: 1 10100 1/x log y 100 Total of integer, numerator, and denominator must be 10 digits or less (including division marks). a b/c RanInt#(a, b) a b; a , b 1 1010; b a 1 1010 · Precision is basically the same as that described under "Calculation Range and Precision", above. x y, · xy, ' 3 , x!, nPr, nCr type functions require consecutive internal calculation, which can cause accumulation of errors that occur with each calculation. · Error is cumulative and tends to be large in the vicinity of a function's singular point and inflection point. E-39 Errors The calculator will display an error message whenever an error occurs for any reason during a calculation.

There are two ways to exit an error message display: Pressing or to display the location of the error, or pressing to clear the message and calculation. Displaying the Location of an Error While an error message is displayed, press or to return to the calculation screen. The cursor will be positioned at the location where the error occurred, ready for input.

Make the necessary corrections to the calculation and execute it again. When you input $14 \div 0.2 =$ by mistake instead of $14 \div 10.2 =$ Math (or) 1 Clearing the Error Message While an error message is displayed, press to return to the calculation screen. Note that this also clears the calculation that contained the error. Error Messages Math ERROR Cause: · The intermediate or final result of the calculation you are performing exceeds the allowable calculation range. · Your input exceeds the allowable input range (particularly when using functions). · The calculation you are performing contains an illegal mathematical operation (such as division by zero). Action: · Check the input values, reduce the number of digits, and try again. · When using independent memory or a variable as the argument of a function, make sure that the memory or variable value is within the allowable range for the function. Stack ERROR Cause: · The calculation you are performing has caused the capacity of the numeric stack or the command stack to be exceeded. · The calculation you are performing has caused the capacity of the matrix or vector stack to be exceeded.

Action: · Simplify the calculation expression so it does not exceed the capacity of the stack. · Try splitting the calculation into two or more parts. Syntax ERROR Cause: There is a problem with the format of the calculation you are performing. E-40 Action: Make necessary corrections. Argument ERROR Cause: There is a problem with the argument of the calculation you are performing.

Action: Make necessary corrections. Dimension ERROR (MATRIX and VECTOR Modes only) Cause: · The matrix or vector you are trying to use in a calculation was input without specifying its dimension. · You are trying to perform a calculation with matrices or vectors whose dimensions do not allow that type of calculation. Action: · Specify the dimension of the matrix or vector and then perform the calculation again. · Check the dimensions specified for the matrices or vectors to see if they are compatible with the calculation.

Variable ERROR (SOLVE feature only) Cause: · You did not specify a solution variable, and there is no X variable in the equation you input. · The solution variable that you specified is not included in the equation you input. Action: · The equation you input must include an X variable when you do not specify the solution variable. @@@@Action: · Check for errors in the equation that you input. @@@@Action: Narrow the table calculation range by changing the Start, End, and Step values, and try again. Time Out Error Cause: The current differential or integration calculation ends without the ending condition being fulfilled. Action: Try increasing the tol value. Note that this also decreases solution precision. Before Assuming Malfunction of the Calculator..

· Perform the following steps whenever an error occurs during a calculation or when calculation results are not what you expected. If one step does not correct the problem, move on to the next step. Note that you should make separate copies of important data before performing these steps. 1. @@2. @@key. This will 3. @@@@4. Initialize all modes and settings by performing the following operation: (CLR) (Setup) (Yes).

Replacing the Battery A low battery is indicated by a dim display, even if contrast is adjusted, or by failure of figures to appear on the display immediately after you turn on the calculator. If this happens, replace the battery with a new one. Important: Removing the battery will cause all of the calculator's memory contents to be deleted. 1. Press (OFF) to turn off the calculator.

· To ensure that you do not accidentally turn on power while replacing the battery, slide the hard case onto the front of the calculator (fx-991ES PLUS). 2. Remove the cover as shown in the illustration and replace the battery, taking care that its plus (+) and minus (-) ends are facing correctly. Screw Screw Screw fx-570ES PLUS fx-991ES PLUS 3. Replace the cover.

4. Initialize the calculator: · Do not skip the above step! (CLR) (All) (Yes) Specifications Power Requirements: fx-570ES PLUS: AAA-size battery R03 (UM-4) 1 fx-991ES PLUS: Built-in solar cell; button battery LR44 (GPA76) 1 Approximate Battery Life: fx-570ES PLUS: 17,000 hours (continuous display of flashing cursor) fx-991ES PLUS: 3 years (based on one hour of operation per day) Power Consumption: 0.0002 W (fx-570ES PLUS) Operating Temperature: 0°C to 40°C (32°F to 104°F) Dimensions: fx-570ES PLUS: 13.8 (H) 80 (W) 162 (D) mm 1/2 (H) 31/8 (W) 63/8 (D) fx-991ES PLUS: 11.1 (H) 80 (W) 162 (D) mm 3/8 (H) 31/8 (W) 63/8 (D) E-42 Approximate Weight: fx-570ES PLUS: 100 g (3.5 oz) including the battery fx-991ES PLUS: 95 g (3.4 oz) including the battery Frequently Asked Questions How can I perform input and display results the same way I did on a model that does not have Natural Textbook Display? (SETUP) (LineIO). See Perform the following key operation: "Configuring the Calculator Setup" on page E-5 for more information. How can I change a fraction format result to decimal format? How can I change a fraction format result produced by a division operation to decimal format? See "Toggling Calculation Results" on page E-9 for the procedure.



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What is the difference between Ans memory, independent memory, and variable memory? Each of these types of memory acts like "containers" for temporary storage of a single value.

Ans Memory: Stores the result of the last calculation performed. Use this memory to carry the result of one calculation on to the next. Independent Memory: Use this memory to totalize the results of multiple calculations. Variables: This memory is helpful when you need to use the same value multiple times in one or more calculations. What is the key operation to take me from the STAT Mode or TABLE Mode to a mode where I can perform arithmetic calculations? (COMP). Press How can I return the calculator to its initial default settings? (CLR) (Setup) (Yes) Perform the following operation: When I execute a function calculation, why do I get a calculation result that is completely different from older CASIO calculator models? With a Natural Textbook Display model, the argument of a function that uses parentheses must be followed by a closing parenthesis. Failing to press after the argument to close the parentheses may cause unwanted values or expressions to be included as part of the argument. Example: $(\sin 30) + 15$ Older (S-VPAM) Model: Natural Textbook Display Model: Failure to press 30 30 30 15 15 15 15.5 15.5 here as shown below will result in calculation of $\sin 45$.

0.7071067812 E-43 Manufacturer: CASIO COMPUTER CO., LTD. 6-2, Hon-machi 1-chome Shibuya-ku, Tokyo 151-8543, Japan Responsible within the European Union: CASIO EUROPE GmbH Bornbarch 10 22848 Norderstedt, Germany This mark applies in EU countries only. CASIO COMPUTER CO., LTD. 6-2, Hon-machi 1-chome Shibuya-ku, Tokyo 151-8543, Japan SA0802-A .



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