

Calculations Using Engineering Prefixes

Calculation can be executed in NORMAL mode (excluding N-base) using the following 9 types of prefixes.

Prefix	Operation	Unit
k (kilo)	 3 0	10 ³
M (Mega)	 3 1	10 ⁶
G (Giga)	 3 2	10 ⁹
T (Tera)	 3 3	10 ¹²
m (milli)	 3 4	10 ^{−3}
μ (micro)	 3 5	10 ^{−6}
n (nano)	 3 6	10 ^{−9}
p (pico)	 3 7	10 ^{−12}
f (femto)	 3 8	10 ^{−15}

Modify Function

Decimal calculation results are internally obtained in scientific notation, with up to 14 digits in the mantissa. However, since calculation results are displayed in the form designated by the display notation and the number of decimal places indicated, the internal calculation result may differ from that shown in the display. By using the modify function (2ndF MDF), the internal value is converted to match that of the display, so that the displayed value can be used without change in subsequent operations.

- When using the WriteView editor, if the calculation result is displayed using fractions or irrational numbers, press Optn to convert it to decimal form first.
- The modify function can be used in NORMAL, STAT, MATRIX, or LIST modes.

Simulation Calculation (ALGB)

If you have to find values consecutively using the same expression, such as plotting a curve line for 2x² + 1, or finding the variable values for 2x + 2y =14, once you enter the expression, all you have to do is to specify the value for the variable in the equation.

Usable variables: A–F, M, X and Y

- Simulation calculations can only be executed in NORMAL mode.
- Calculation ending instructions other than = cannot be used.

Performing calculations

- Press MODE 0.
- Input an expression with at least one variable.
- Press MATH 1.
- The variable entry screen will appear. Enter a value, then press ENTER to confirm. The calculation result will be displayed after you have entered a value for each variable used in the equation.
 - After completing the calculation, press MATH 1 to perform calculations using the same equation.
 - Variables and numerical values stored in the memories will be displayed in the variable entry screen. If you do not want to change any values, simply press ENTER.
- Performing simulation calculation will cause values in memory to be overwritten with new values.

Solver Function

The solver function finds the value for *x* that reduces the entered expression to zero.

- This function uses Newton's method to obtain an approximation. Depending on the function (e.g. periodic) or start value, an error may occur (ERROR 02) due to there being no convergence to the solution for the equation.
- The value obtained by this function may include a margin of error. If it is larger than acceptable, recalculate the solution after changing the “Start” and *dx* values.
- Change the “Start” value (e.g. to a negative value) or *dx* value (e.g. to a smaller value) if:
 - no solution can be found (ERROR 02).
 - more than two solutions appear to be possible (e.g. a cubic equation).
 - to improve arithmetic precision.
- The calculation result is automatically stored in the X memory.
- Press ON/C to exit the solver function.

Performing solver function

- Press MODE 0.
- Input an expression with an *x* variable.
- Press MATH 2.
- Enter a “Start” value and press ENTER. The default value is “0”.
- Enter a *dx* value (minute interval).
- Press ENTER.

trans <i>matrix name</i>	Returns the matrix with the columns transposed to rows and the rows transposed to columns.
mat→list <p>MATH 7</p>	Creates lists with elements from the left column of each matrix. (matA→L1, matB→L2, matC→L3, matD→L4) <p>Mode changes from MATRIX mode to LIST mode.</p>
matA→list <p>MATH 8</p>	Creates lists with elements from each column of the matrix. (matA→L1, L2, L3, L4) <p>Mode changes from MATRIX mode to LIST mode.</p>

Notes:

- When the matrix entry screen is displayed, you cannot perform matrix calculations because the MATH menu is not available.
- If the calculation result is a matrix, it will be displayed in the matrix entry screen (note that this replaces any existing data in the buffer). To store the calculation result, first press ON/C to exit the matrix entry screen. Press MATH 4 and select a memory (matA–matD) to store the newly-created matrix in.
- When the calculation results are in matrix form, pressing neither ◀ nor ▶ will bring you back to the original expression.

LIST CALCULATIONS

You can store and calculate up to four lists up to sixteen elements each in LIST mode.

Press MODE S to enter LIST mode.

Note: You can use the MATH menu in LIST mode to edit, recall, and store lists, as well as to call list-specific functions.

Entering and Storing Lists

Before performing list calculations, a list must be created. Follow the steps below to enter and store lists.

- Press MODE S to enter LIST mode.
- Press MATH 2 to bring up the list entry screen.
 - Any list data remaining in the buffer, along with any previously entered, loaded, or calculated list data, will be displayed.
- Define the list size (up to sixteen elements) by entering a value using the number keys and pressing ENTER.

 LIST SIZE 4	List size
 1 0	Element fields
 0	Entry field

- Enter each element in the list by entering a value in the entry field and pressing ENTER.

- Each list element can display up to eight digits (the decimal point counts as one digit). If an element exceeds eight digits in length, it will be displayed in exponent notation within the list.
- A maximum of six elements can be displayed at one time. Use ▶, ▼, ◀, and ▶ to move the cursor through the list.

- When you have entered a value for each element, press ON/C to exit the list entry screen.

- Press MATH 4 and select a memory (L1–L4) to store the newly-created list in.

Modifying a stored list

- To load a stored list into the list entry screen, press MATH 3, then select the memory (L1–L4) that holds the list you wish to modify.
 - Loading new data into the screen will automatically replace any data that may already exist there.
- Using the list entry screen, you can modify the values of elements in the list. Assign new values wherever necessary and press ENTER after each one.
 - If you wish to modify the size of a list, first press ON/C MATH 2. You can then enter new values for the list size.
- When you have finished making changes, press ON/C to exit the list entry screen.
- Press MATH 4 and select a memory (L1–L4) to store the newly-created list in.

STATISTICAL CALCULATIONS

Statistical calculations can be performed in STAT mode.

There are eight sub-modes within STAT mode. Press MODE 1, then press the number key that corresponds to your choice:

- 0 (S t a t 0 [SD]): Single-variable statistics
- 1 (S t a t 1 [LINE]): Linear regression
- 2 (S t a t 2 [QUAD]): Quadratic regression
- 3 (S t a t 3 [E _EXP]): Euler exponential regression
- 4 (S t a t 4 [LOG]): Logarithmic regression
- 5 (S t a t 5 [POWER]): Power regression
- 6 (S t a t 6 [INV]): Inverse regression
- 7 (S t a t 7 [G _EXP]): General exponential regression

Statistical Calculations and Variables

The following statistics can be obtained for each statistical calculation (refer to the table below):

Single-variable statistical calculation

Statistics of 1 and the value of the normal probability function.

Linear regression calculation

Statistics of 1 and 2. In addition, the estimate of *y* for a given *x* (estimate *y*[′]) and the estimate of *x* for a given *y*[′] (estimate *x*[′]).

Quadratic regression calculation

Statistics of 1 and 2, and coefficients *a*, *b*, *c* in the quadratic regression formula (*y* = *a* + *b**x* + *c**x*²). (For quadratic regression calculations, no correlation coefficient (*r*) can be obtained.) When there are two *x*[′] values, each value will be displayed with “1.” or “2.”, and stored separately in the X and Y memories.

Euler exponential regression, logarithmic regression, power regression, inverse regression, and general exponential regression calculations

Statistics of 1 and 2. In addition, the estimate of *y* for a given *x* and the estimate of *x* for a given *y*. (Since the calculator converts each formula into a linear regression formula before actual calculation takes place, it obtains all statistics, except coefficients *a* and *b*, from converted data rather than entered data.)

	 x	Mean of samples (<i>x</i> data)
	 sx	Sample standard deviation (<i>x</i> data)
1	 σx	Population standard deviation (<i>x</i> data)
	 n	Number of samples
	 Σx	Sum of samples (<i>x</i> data)
	 Σx²	Sum of squares of samples (<i>x</i> data)
		 y
	 sy	Sample standard deviation (<i>y</i> data)
2	 σy	Population standard deviation (<i>y</i> data)
	 Σy	Sum of samples (<i>y</i> data)
	 Σy²	Sum of squares of samples (<i>y</i> data)
	 Σxⁱy^j	Sum of products of samples (<i>x</i> , <i>y</i>)
		 r
	 a	Coefficient of regression equation
	 b	Coefficient of regression equation
	 c	Coefficient of quadratic regression equation

- Use ALPHA and RCL to perform a variable calculation in STAT mode.
- Optn does not function in STAT mode.

Data Entry and Correction

Before entering new data, clear the memory contents (2ndF CA).

Data entry

Single-variable data

Data DATA

Data ↵ *frequency* DATA (To enter multiples of the same data)

Two-variable data

Data ↵ *data* Y DATA

Data ↵ *data* ↵ *frequency* DATA (To enter multiples of the same data *x* and *y*)

Note: Up to 100 data items can be entered. With the single-variable data, a data item without frequency assignment is counted as one data item, while an item assigned with frequency is stored as a set of two data items. With the two-variable data, a set of data items without frequency assignment is counted as two data items, while a set of items assigned with frequency is stored as a set of three data items.

Data correction

Correction before pressing DATA immediately after a data entry:

Delete incorrect data with ON/C, then enter the correct data.

Correction after pressing DATA:

Use ▶ and ▼ to display the previously entered data set.

Press ▼ to display the data set in ascending (oldest first) order. To reverse the display order to descending (latest first), press the ▶ key. Press 2ndF ▲ or 2ndF ▼ to jump the cursor to the beginning or end of the data set.

Each data set is displayed with “X.”, “Y.”, or “F.”.

 DATA SET 4	Data set number
 F	Frequency
 7 5 + 5	
 ▶	
 DATA SET 4	Data set number
 x	Data <i>x</i>
 y	Data <i>y</i>
 2 1 + 4 9 + 5	Frequency
 ▶	

Display and move the cursor to the data item to be modified by using ▶ and ▼, enter the correct value, then press DATA or ENTER.

- To delete a data set, display and move the cursor to an item of the data set to delete by using ▶ and ▼, then press 2ndF CD. The data set will be deleted.
- To add a new data set, press ON/C to exit the display of previously entered data and input the values, then press DATA.

Statistical Calculation Formulas

Type	Regression formula
Linear	<i>y</i> = <i>a</i> + <i>b</i> <i>x</i>
Quadratic	<i>y</i> = <i>a</i> + <i>b</i> <i>x</i> + <i>c</i> <i>x</i> ²
Euler exponential	<i>y</i> = <i>a</i> · <i>e</i> ^{<i>b</i><i>x</i>}
Logarithmic	<i>y</i> = <i>a</i> + <i>b</i> · ln <i>x</i>
Power	<i>y</i> = <i>a</i> · <i>x</i> ^{<i>b</i>}
Inverse	<i>y</i> = <i>a</i> + <i>b</i> 1⁠/⁠<i>x</i>
General exponential	<i>y</i> = <i>a</i> · <i>b</i> ^{<i>x</i>}

An error will occur when:

- The absolute value of the intermediate result or calculation result is equal to or greater than 1 × 10¹⁰⁰.
- The denominator is zero.
- An attempt is made to take the square root of a negative number.
- No solution exists in the quadratic regression calculation.

Normal Probability Calculations

In STAT mode, the three probability density functions can be accessed under the MATH menu, with a random number used as a normal distribution variable.

Notes:

- P(t), Q(t), and R(t) will always take positive values, even when t < 0, because these functions follow the same principle used when solving for an area.
- Values for P(t), Q(t), and R(t) are given to six decimal places.
- The standardization conversion formula is as follows:

t = 1⁠/⁠σ²

DRILL MODE

Math Drill: MODE 2 0

Math operation questions with positive integers and 0 are displayed randomly. It is possible to select the number of questions and operator type.

Multiplication Table (X Table): MODE 2 1

Questions from each row of the multiplication table (1 to 12) are displayed serially or randomly.

To exit DRILL mode, press MODE and select another mode.

Using Math Drill and X Table

- Press MODE 2 0 for Math Drill or MODE 2 1 for X Table.
- Math Drill:** Use ▶ and ▼ to select the number of questions (25, 50, or 100).
 - X Table:** Use ▶ and ▼ to select a row in the multiplication table (1 to 12).
- Math Drill:** Use ◀ and ▶ to select the operator type for questions (+, −, ×, ÷, or +−×÷).
 - X Table:** Use ▶ and ▶ to select the order type (“Serial” or “Random”).
- Press ENTER to start.

When using Math Drill or X Table (random order only), questions are randomly selected and will not repeat except by chance.

- Enter your answer. If you make a mistake