

WriteView EL-W506X MODEL EL-W516X

OPERATION MANUAL

PRINTED IN CHINA / IMPRIME EN CHINE / IMPRESSO EN CHINA T05C2/TN50G68H/TN2Z2

INTRODUCTION

Thank you for purchasing the SHARP Scientific Calculator Model EL-W506X/W516X. About the calculation examples (including some formulas and tables), refer to the calculation example sheet. Refer to the number on the right of each title in the manual for use. After reading this manual, store it in a convenient location for future reference. Notes: • Some of the models described in this manual may not be available in some countries. • This product uses a period as a decimal point.

Operational Notes

- Do not carry the calculator around in your back pocket, as it may break when you sit down. The display is made of glass and is particularly fragile.
- Keep the calculator away from extreme heat such as a car dashboard or near a heater, and avoid exposing it to excessively humid or dusty environments.
- Since this product is not waterproof, do not use it or store it where fluids, for example water, can splash onto it. Raindrops, water spray, juice, coffee, steam, perspiration, etc., will also cause malfunction.
- Clean with a soft, dry cloth. Do not use solvents or a wet cloth. Avoid using a rough cloth or anything else that may cause scratches.
- Do not drop or apply excessive force.
- Never dispose of batteries in a fire.
- Keep batteries out of the reach of children.
- For the sake of your health, try not to use this product for long periods of time. If you need to use the product for an extended period, be sure to allow your eyes, hands, arms, and body adequate rest periods (about 10-15 minutes every hour).
- If you experience any pain or fatigue while using this product, discontinue use immediately. If the discomfort continues, please consult a doctor.
- This product, including accessories, may change due to upgrading without prior notice.

NOTE • SHARP strongly recommends that separate permanent writing records be kept of all important data. Data may be lost or altered in virtually any electronic memory product under certain circumstances. Therefore, SHARP assumes no responsibility for data lost or otherwise rendered unusable whether as a result of improper use, repairs, deterioration, or other causes. • SHARP assumes no responsibility for data lost or otherwise rendered unusable whether as a result of improper use, repairs, deterioration, or other causes. • SHARP assumes no responsibility for data lost or otherwise rendered unusable whether as a result of improper use, repairs, deterioration, or other causes. • SHARP assumes no responsibility for data lost or otherwise rendered unusable whether as a result of improper use, repairs, deterioration, or other causes.

- Press the RESET switch (on the back), with the tip of a ball-point pen or similar object, only when the following cases: • When using for the first time • After replacing the battery • To clear all memory contents • When an abnormal condition occurs and all keys are inoperative
- Do not use an object with a breakable or sharp tip. Note that pressing the RESET switch erases all data stored in memory. If service should be required on this calculator, use only a SHARP service dealer, SHARP approved service facility, or SHARP repair service dealer.

The CATALOG Menu

Using the CATALOG menu, you can select functions and variables that are available for what you are doing in the currently selected mode. To display the CATALOG menu, press [CATALOG] . Press [F1] or [F2] to move the cursor ([F1] and [F2] to select. Press [F3] or [F4] to scroll up or down. Press [F5] or [F6] to jump to the first or last item. Note: You cannot bring up the CATALOG menu when entering values or items in STAT, MATRIX, LIST, or EQUATION modes, or into solver functions or simulation calculations.

Multi-Line Playback Function

This calculator is equipped with a function to recall previous equations and answers in NORMAL, or CPLX modes. A maximum of 340 characters can be stored in memory. When the memory is full, stored equations will be deleted to make room, starting with the oldest. Pressing [RECALL] will display the previous equation. Further pressing [RECALL] will display preceding equations (after returning to the previous equation, press [F1] to view equations in order). In addition, [RECALL] can be used to jump to the oldest equation, and [RECALL] to jump to the newest one. To edit an equation after recalling it, press [F4] or [F5] . The multi-line memory will be cleared by the following operations: [RECALL] (CALC mode change, RESET, N-base conversion, angular unit conversion, editor, [RECALL] or [RECALL] or [RECALL]), and memory clear [RECALL] . Equations that have one result require an additional eleven characters' worth of memory to store in order to hold the result. In addition to the amount of memory needed to store an equation, the WriteView editor will require a certain amount for the sake of display. Equations also include calculation ending instructions, such as "=".

Priority Levels in Calculation

This calculator performs calculations according to the following priority: ① Fractions (F1, F4), ② \angle , Engineering prefixes ③ Functions preceding by their argument (tan^{-1} , e^x , ln , etc.), ④ \times , \div , \angle (Implied multiplication of a number (2y, etc.) ⑤ Functions following by their argument (sin, cos, etc.), ⑥ Implied multiplication of a function (tan30, $\text{e}^{\text{tan}30}$, etc.) ⑦ nCr, nPr, \rightarrow (e.g. $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ AND XOR, XOROR ⑧ M_1 , M_2 , M_3 , M_4 , M_5 , M_6 , M_7 , M_8 , M_9 , M_{10} , M_{11} , M_{12} , M_{13} , M_{14} , M_{15} , M_{16} , M_{17} , M_{18} , M_{19} , M_{20} , M_{21} , M_{22} , M_{23} , M_{24} , M_{25} , M_{26} , M_{27} , M_{28} , M_{29} , M_{30} , M_{31} , M_{32} , M_{33} , M_{34} , M_{35} , M_{36} , M_{37} , M_{38} , M_{39} , M_{40} , M_{41} , M_{42} , M_{43} , M_{44} , M_{45} , M_{46} , M_{47} , M_{48} , M_{49} , M_{50} , M_{51} , M_{52} , M_{53} , M_{54} , M_{55} , M_{56} , M_{57} , M_{58} , M_{59} , M_{60} , M_{61} , M_{62} , M_{63} , M_{64} , M_{65} , M_{66} , M_{67} , M_{68} , M_{69} , M_{70} , M_{71} , M_{72} , M_{73} , M_{74} , M_{75} , M_{76} , M_{77} , M_{78} , M_{79} , M_{80} , M_{81} , M_{82} , M_{83} , M_{84} , M_{85} , M_{86} , M_{87} , M_{88} , M_{89} , M_{90} , M_{91} , M_{92} , M_{93} , M_{94} , M_{95} , M_{96} , M_{97} , M_{98} , M_{99} , M_{100} , M_{101} , M_{102} , M_{103} , M_{104} , M_{105} , M_{106} , M_{107} , M_{108} , M_{109} , M_{110} , M_{111} , M_{112} , M_{113} , M_{114} , M_{115} , M_{116} , M_{117} , M_{118} , M_{119} , M_{120} , M_{121} , M_{122} , M_{123} , M_{124} , M_{125} , M_{126} , M_{127} , M_{128} , M_{129} , M_{130} , M_{131} , M_{132} , M_{133} , M_{134} , M_{135} , M_{136} , M_{137} , M_{138} , M_{139} , M_{140} , M_{141} , M_{142} , M_{143} , M_{144} , M_{145} , M_{146} , M_{147} , M_{148} , M_{149} , M_{150} , M_{151} , M_{152} , M_{153} , M_{154} , M_{155} , M_{156} , M_{157} , M_{158} , M_{159} , M_{160} , M_{161} , M_{162} , M_{163} , M_{164} , M_{165} , M_{166} , M_{167} , M_{168} , M_{169} , M_{170} , M_{171} , M_{172} , M_{173} , M_{174} , M_{175} , M_{176} , M_{177} , M_{178} , M_{179} , M_{180} , M_{181} , M_{182} , M_{183} , M_{184} , M_{185} , M_{186} , M_{187} , M_{188} , M_{189} , M_{190} , M_{191} , M_{192} , M_{193} , M_{194} , M_{195} , M_{196} , M_{197} , M_{198} , M_{199} , M_{200} , M_{201} , M_{202} , M_{203} , M_{204} , M_{205} , M_{206} , M_{207} , M_{208} , M_{209} , M_{210} , M_{211} , M_{212} , M_{213} , M_{214} , M_{215} , M_{216} , M_{217} , M_{218} , M_{219} , M_{220} , M_{221} , M_{222} , M_{223} , M_{224} , M_{225} , M_{226} , M_{227} , M_{228} , M_{229} , M_{230} , M_{231} , M_{232} , M_{233} , M_{234} , M_{235} , M_{236} , M_{237} , M_{238} , M_{239} , M_{240} , M_{241} , M_{242} , M_{243} , M_{244} , M_{245} , M_{246} , M_{247} , M_{248} , M_{249} , M_{250} , M_{251} , M_{252} , M_{253} , M_{254} , M_{255} , M_{256} , M_{257} , M_{258} , M_{259} , M_{260} , M_{261} , M_{262} , M_{263} , M_{264} , M_{265} , M_{266} , M_{267} , M_{268} , M_{269} , M_{270} , M_{271} , M_{272} , M_{273} , M_{274} , M_{275} , M_{276} , M_{277} , M_{278} , M_{279} , M_{280} , M_{281} , M_{282} , M_{283} , M_{284} , M_{285} , M_{286} , M_{287} , M_{288} , M_{289} , M_{290} , M_{291} , M_{292} , M_{293} , M_{294} , M_{295} , M_{296} , M_{297} , M_{298} , M_{299} , M_{300} , M_{301} , M_{302} , M_{303} , M_{304} , M_{305} , M_{306} , M_{307} , M_{308} , M_{309} , M_{310} , M_{311} , M_{312} , M_{313} , M_{314} , M_{315} , M_{316} , M_{317} , M_{318} , M_{319} , M_{320} , M_{321} , M_{322} , M_{323} , M_{324} , M_{325} , M_{326} , M_{327} , M_{328} , M_{329} , M_{330} , M_{331} , M_{332} , M_{333} , M_{334} , M_{335} , M_{336} , M_{337} , M_{338} , M_{339} , M_{340} , M_{341} , M_{342} , M_{343} , M_{344} , M_{345} , M_{346} , M_{347} , M_{348} , M_{349} , M_{350} , M_{351} , M_{352} , M_{353} , M_{354} , M_{355} , M_{356} , M_{357} , M_{358} , M_{359} , M_{360} , M_{361} , M_{362} , M_{363} , M_{364} , M_{365} , M_{366} , M_{367} , M_{368} , M_{369} , M_{370} , M_{371} , M_{372} , M_{373} , M_{374} , M_{375} , M_{376} , M_{377} , M_{378} , M_{379} , M_{380} , M_{381} , M_{382} , M_{383} , M_{384} , M_{385} , M_{386} , M_{387} , M_{388} , M_{389} , M_{390} , M_{391} , M_{392} , M_{393} , M_{394} , M_{395} , M_{396} , M_{397} , M_{398} , M_{399} , M_{400} , M_{401} , M_{402} , M_{403} , M_{404} , M_{405} , M_{406} , M_{407} , M_{408} , M_{409} , M_{410} , M_{411} , M_{412} , M_{413} , M_{414} , M_{415} , M_{416} , M_{417} , M_{418} , M_{419} , M_{420} , M_{421} , M_{422} , M_{423} , M_{424} , M_{425} , M_{426} , M_{427} , M_{428} , M_{429} , M_{430} , M_{431} , M_{432} , M_{433} , M_{434} , M_{435} , M_{436} , M_{437} , M_{438} , M_{439} , M_{440} , M_{441} , M_{442} , M_{443} , M_{444} , M_{445} , M_{446} , M_{447} , M_{448} , M_{449} , M_{450} , M_{451} , M_{452} , M_{453} , M_{454} , M_{455} , M_{456} , M_{457} , M_{458} , M_{459} , M_{460} , M_{461} , M_{462} , M_{463} , M_{464} , M_{465} , M_{466} , M_{467} , M_{468} , M_{469} , M_{470} , M_{471} , M_{472} , M_{473} , M_{474} , M_{475} , M_{476} , M_{477} , M_{478} , M_{479} , M_{480} , M_{481} , M_{482} , M_{483} , M_{484} , M_{485} , M_{486} , M_{487} , M_{488} , M_{489} , M_{490} , M_{491} , M_{492} , M_{493} , M_{494} , M_{495} , M_{496} , M_{497} , M_{498} , M_{499} , M_{500} , M_{501} , M_{502} , M_{503} , M_{504} , M_{505} , M_{506} , M_{507} , M_{508} , M_{509} , M_{510} , M_{511} , M_{512} , M_{513} , M_{514} , M_{515} , M_{516} , M_{517} , M_{518} , M_{519} , M_{520} , M_{521} , M_{522} , M_{523} , M_{524} , M_{525} , M_{526} , M_{527} , M_{528} , M_{529} , M_{530} , M_{531} , M_{532} , M_{533} , M_{534} , M_{535} , M_{536} , M_{537} , M_{538} , M_{539} , M_{540} , M_{541} , M_{542} , M_{543} , M_{544} , M_{545} , M_{546} , M_{547} , M_{548} , M_{549} , M_{550} , M_{551} , M_{552} , M_{553} , M_{554} , M_{555} , M_{556} , M_{557} , M_{558} , M_{559} , M_{560} , M_{561} , M_{562} , M_{563} , M_{564} , M_{565} , M_{566} , M_{567} , M_{568} , M_{569} , M_{570} , M_{571} , M_{572} , M_{573} , M_{574} , M_{575} , M_{576} , M_{577} , M_{578} , M_{579} , M_{580} , M_{581} , M_{582} , M_{583} , M_{584} , M_{585} , M_{586} , M_{587} , M_{588} , M_{589} , M_{590} , M_{591} , M_{592} , M_{593} , M_{594} , M_{595} , M_{596} , M_{597} , M_{598} , M_{599} , M_{600} , M_{601} , M_{602} , M_{603} , M_{604} , M_{605} , M_{606} , M_{607} , M_{608} , M_{609} , M_{610} , M_{611} , M_{612} , M_{613} , M_{614} , M_{615} , M_{616} , M_{617} , M_{618} , M_{619} , M_{620} , M_{621} , M_{622} , M_{623} , M_{624} , M_{625} , M_{626} , M_{627} , M_{628} , M_{629} , M_{630} , M_{631} , M_{632} , M_{633} , M_{634} , M_{635} , M_{636} , M_{637} , M_{638} , M_{639} , M_{640} , M_{641} , M_{642} , M_{643} , M_{644} , M_{645} , M_{646} , M_{647} , M_{648} , M_{649} , M_{650} , M_{651} , M_{652} , M_{653} , M_{654} , M_{655} , M_{656} , M_{657} , M_{658} , M_{659} , M_{660} , M_{661} , M_{662} , M_{663} , M_{664} , M_{665} , M_{666} , M_{667} , M_{668} , M_{669} , M_{670} , M_{671} , M_{672} , M_{673} , M_{674} , M_{675} , M_{676} , M_{677} , M_{678} , M_{679} , M_{680} , M_{681} , M_{682} , M_{683} , M_{684} , M_{685} , M_{686} , M_{687} , M_{688} , M_{689} , M_{690} , M_{691} , M_{692} , M_{693} , M_{694} , M_{695} , M_{696} , M_{697} , M_{698} , M_{699} , M_{700} , M_{701} , M_{702} , M_{703} , M_{704} , M_{705} , M_{706} , M_{707} , M_{708} , M_{709} , M_{710} , M_{711} , M_{712} , M_{713} , M_{714} , M_{715} , M_{716} , M_{717} , M_{718} , M_{719} , M_{720} , M_{721} , M_{722} , M_{723} , M_{724} , M_{725} , M_{726} , M_{727} , M_{728} , M_{729} , M_{730} , M_{731} , M_{732} , M_{733} , M_{734} , M_{735} , M_{736} , M_{737} , M_{738} , M_{739} , M_{740} , M_{741} , M_{742} , M_{743} , M_{744} , M_{745} , M_{746} , M_{747} , M_{748} , M_{749} , M_{750} , M_{751} , M_{752} , M_{753} , M_{754} , M_{755} , M_{756} , M_{757} , M_{758} , M_{759} , M_{760} , M_{761} , M_{762} , M_{763} , M_{764} , M_{765} , M_{766} , M_{767} , M_{768} , M_{769} , M_{770} , M_{771} , M_{772} , M_{773} , M_{774} , M_{775} , M_{776} , M_{777} , M_{778} , M_{779} , M_{780} , M_{781} , M_{782} , M_{783} , M_{784} , M_{785} , M_{786} , M_{787} , M_{788} , M_{789} , M_{790} , M_{791} , M_{792} , M_{793} , M_{794} , M_{795} , M_{796} , M_{797} , M_{798} , M_{799} , M_{800} , M_{801}

CALCULATIONS USING ENGINEERING PRECISION

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

Prefix	Operation	Unit
X (Hecto)	$\text{MATH} \rightarrow \text{[H]} \rightarrow \text{[=]}$	10^2
M (Mega)	$\text{MATH} \rightarrow \text{[M]} \rightarrow \text{[=]}$	10^6
G (Giga)	$\text{MATH} \rightarrow \text{[G]} \rightarrow \text{[=]}$	10^9
T (Tera)	$\text{MATH} \rightarrow \text{[T]} \rightarrow \text{[=]}$	10^{12}
Y (Yotta)	$\text{MATH} \rightarrow \text{[Y]} \rightarrow \text{[=]}$	10^{24}
μ (micro)	$\text{MATH} \rightarrow \text{[μ]} \rightarrow \text{[=]}$	10^{-6}
m (milli)	$\text{MATH} \rightarrow \text{[m]} \rightarrow \text{[=]}$	10^{-3}
n (nano)	$\text{MATH} \rightarrow \text{[n]} \rightarrow \text{[=]}$	10^{-9}
p (pico)	$\text{MATH} \rightarrow \text{[p]} \rightarrow \text{[=]}$	10^{-12}
f (femto)	$\text{MATH} \rightarrow \text{[f]} \rightarrow \text{[=]}$	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 ([MOD] [SET] []), 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 Write/View mode, if the calculation result is displayed using fractions or rational numbers, press [MOD] [] to convert it to decimal form first.
- The modify function can be used in NORMAL, STAT, MATRIX, or LIST modes.

SIMULATION CALCULATION (ALGB)

You have to find values consecutively using the same expression, such as plotting a graph line for $2x^2 + 1$, 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.

- Use 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 [ON/OFF] [] .
- Input an expression with at least one variable.
- Press [MOD] [] .
- The variable entry screen will appear. Enter a value, then press [MOD] [] 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 [MOD] [] 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 [MOD] [] .
- 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.

- The 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 ΔX values.
 - Change the "Start" value (e.g. to a negative value) or ΔX value (e.g. to a smaller value).
 - no calculation 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 [MOD] [] to exit the solver function.

PERFORMING SOLVER FUNCTION

- Press [ON/OFF] [] .
- Input an equation with an X variable.
- Press [MOD] [] .
- Enter a "Start" value and press [MOD] [] . The default value is "0".
- Enter a ΔX value (minute interval).
- Press [MOD] [] .

TRANS MATRIX NAME

Returns the matrix with the columns transposed to rows and the rows transposed to columns.

mat-list [MOD] []	Create lists with elements from the list of column matrix. (matA=1, matB=2, matC=4, matD=5) Move changes from MATRIX mode to LIST mode.
matA-list [MOD] []	Create lists with elements from each list of the matrix. (matA=1, L1, L3, L4) Move changes from MATRIX mode to LIST mode.

- 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 [MOD] [] to exit the matrix entry screen. Press [MOD] [] and select a memory (matA-matD) to store the newly-created matrix.
 - When the calculation results are a matrix form, pressing [] (nor []) will bring you back to the original expression.

LIST CALCULATIONS

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

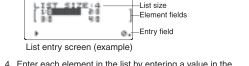
Press [MODE] [] to enter LIST mode.

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] [] to enter LIST mode.
 - Press [MOD] [] to bring up the list entry screen.
 - Press [MOD] [] to remove the list from the buffer, along with any previously entered, loaded, or calculated list data, will be displayed.

3. Define the list size (up to sixteen elements) by entering a value using the number keys and pressing [MOD] [] .



List entry screen (example)

4. Enter each element in the list by entering a value in the entry field and pressing [MOD] [] .
- Each 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 [] (left), [] (right), and [] (down) to move the cursor to the list.

5. When you have entered a value for each element, press [MOD] [] to exit the list entry screen.

6. Press [MOD] [] 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 [MOD] [] , 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 [MOD] [] after each one.
 - If you wish to modify the size of a list, first press [MOD] [] , then select the memory (L1-L4) that holds the list. Then you can enter new values for the list size.
- When you have finished making changes, press [MOD] [] to exit the list entry screen.
- Press [MOD] [] 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 the STAT mode. Press [MODE] [] , then press the number key that corresponds to your choice:

- 1 [] (STAT 1 [1-1]): Single-variable statistics
- 2 [] (STAT 1 [1-2]): Linear regression
- 3 [] (STAT 2 [0-0]): Quadratic regression
- 4 [] (STAT 3 [E-EXP]): Euler exponential regression
- 5 [] (STAT 4 [L-LOG]): Logarithmic regression
- 6 [] (STAT 5 [P-POWER]): Power regression
- 7 [] (STAT 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 \hat{y}) and the estimate of x for a given y (estimate \hat{x})

Quadratic regression calculation

Statistics of 1 and 2, and coefficients a , b , c in the quadratic regression formula $y = ax^2 + bx + c$ (For quadratic regression calculation, 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, I obtain all statistics, except coefficients a and b, from converted data rather than entered data.)

T	Mean of samples (x data)
\bar{x}	Sample standard deviation (x data)
σx	Population standard deviation (x data)
n	Number of samples
Σx	Sum of samples (x data)
Σx^2	Sum of squares of samples (x data)
T	Mean of samples (y data)
\bar{y}	Sample standard deviation (y data)
σy	Population standard deviation (y data)
Σy	Sum of samples (y data)
Σy^2	Sum of squares of samples (y data)
Σxy	Sum of products of samples (x, y)
r	Correlation coefficient
a	Coefficient of regression equation
b	Coefficient of regression equation
c	Coefficient of quadratic regression equation

- Use [MOD] [] and [MOD] [] to perform a variable calculation in STAT mode.
- [MOD] [] does not function in STAT mode.

DATA ENTRY AND CORRECTION

Before entering new data, clear the memory contents ([2ND] []).

DATA ENTRY

Single-variable data

Data [] frequency [DATA] [] (To enter multiples of the same data.)

Two-variable data

Data [] data [] y [DATA] [] frequency [DATA] [] (To enter multiples of the same data.)

Data [] data [] frequency [DATA] [] (To enter multiples of the same data.)

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.

USING LISTS IN CALCULATIONS

Lists stored in memories (L1-L4) can be used in arithmetic calculations and calculations that use \hat{x} , \hat{y} , and \hat{z} . You can also use the following list-specific functions that are available in the MATH menu.

sortA list name	Sorts list in ascending order.
sortD list name	Sorts list in descending order.
dim list name, size	Returns the list size with size changed as specified.
L1 (value), size	Enters the specified value for all items.
normal list name	Sequentially calculates each item in the list.
d1, list list name	Returns a new list using the difference between adjacent items in the list.
aug list name, list name	Returns a list appending the specified lists.
min list name	Returns the minimum value in the list.
max list name, size	Returns the maximum value in the list.
mean list name	Returns the mean value of items in the list.
med list name	Returns the median value of items in the list.
sum list name	Returns the sum of items in the list.
prod list name	Returns the multiplication of items in the list.
stdv list name	Returns the standard deviation of the list.
var list name	Returns the variance of the list.
o, prod list name, list name	Returns the outer product of 2 lists (vectors).
L1 list name, list name	Returns the inner product of 2 lists (vectors).
list name	Returns the absolute value of the list (vector).
list name, size	Creates matrix with list column data from each list (L1-matA, L2-matB, L3-matC, L4-matD) Move changes from LIST mode to MATRIX mode.
list name, matA	Creates a matrix with column data from each list (L1, L2, L3, L4-matA) Move changes from LIST mode to MATRIX mode.

Notes:

- When the list entry screen is displayed, you cannot perform list calculations because the MATH menu is not available.
- If the calculation result is a list, it will be displayed in the list entry screen (note that this replaces any existing data in the buffer). To store the calculation result, first press [MOD] [] to exit the list entry screen. Press [MOD] [] and select a memory (L1-L4) to store the newly-created list in.
- When the calculation results are a list form, pressing [] (nor []) will bring you back to the original expression.

EQUATION SOLVERS

The results obtained by these functions may include a margin of error.

SIMULTANEOUS LINEAR EQUATIONS

Simultaneous linear equations with two unknowns (2-VLE) or with three unknowns (3-VLE) may be solved using the following functions.

- 2-VLE: [MODE] []
 - $a_1x + b_1y = c_1$ $a_2x + b_2y = c_2$ $[D] = \begin{bmatrix} a_1 & b_1 \\ a_2 & b_2 \end{bmatrix}$
- 3-VLE: [MODE] []
 - $a_1x + b_1y + c_1z = d_1$ $a_2x + b_2y + c_2z = d_2$ $a_3x + b_3y + c_3z = d_3$ $[D] = \begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}$

- If the determinant $D = 0$, an error occurs.
- If the absolute value of an intermediate result or calculation result is 1×10^{10} or more, an error occurs.

SOLVING SIMULTANEOUS LINEAR EQUATIONS

- Press [MODE] [] to enter the equation screen.
- Enter the value for each coefficient (c, etc.).
 - Coefficients can be entered using ordinary arithmetic operations.
 - To clear the entered coefficient, press [ON/OFF] [] .
 - Press [] or [] to move the cursor up or down through the coefficients. Press [2ND] [] or [2ND] [] to jump to the first or last coefficient.
- When all coefficients have been entered, press [MOD] [] to solve the equation.
 - While the solution is displayed, press [MOD] [] or [MOD] [] to return to the coefficient entry display. To clear all the coefficients, press [2ND] [] .

DATA CORRECTION

Correction before pressing [MOD] [] immediately after a data entry: Delete incorrect data with [MOD] [] , then enter the correct data.

Correction after pressing [MOD] [] :

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 [2ND] [] or [2ND] [] to jump to the cursor to the beginning or end of the data set. Each data set is displayed with "X", "Y", or "F".



Display and move the cursor to the data item to be modified by using [] and [] , enter the correct value, then press [DATA] [] .

- To delete a data set, display and move the cursor to an item of the data set to delete by using [] and [] , then press [2ND] [] . The data set will be deleted.
- To add a new data set, press [MOD] [] to exit the display of previously entered data and input the values, then press [DATA] [] .

STATISTICAL CALCULATION FORMULAS

Type	Regression formula
Linear	$y = a + bx$
Quadratic	$y = a + bx + cx^2$
Euler exponential	$y = a \cdot e^{bx}$
Logarithmic	$y = a + b \cdot \ln x$
Power	$y = a \cdot x^b$
Inverse	$y = a + \frac{b}{x}$
General exponential	$y = a \cdot b^x$

- General error will occur when:
- The absolute value of the intermediate result or calculation result is equal to or greater than 1×10^{10} .
 - 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 normal distribution variable.

- P(0, Q), and R(Q) will always take positive values, even when $1 < 0$, because these functions follow the same principle used when solving for P(X, Y).
- Values for P(0, Q), and R(Q) are given to six decimal places.
- The standardization conversion formula is as follows:
$$z = \frac{x - \bar{x}}{\frac{\sigma}{\sqrt{n}}}$$

DRILL MODE

Math Drill: [MODE] [] []

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] [] []

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

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

USING MATH DRILL AND X TABLE

- Press [MODE] [] or [MODE] [] 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 ($+$, $-$, \times , \div , or []).
- X Table: Use [] and [] to select the order type ("Serial" or "Random").
- Press [MOD] [] to start.
- When using Math Drill or X Table (random order only), questions are randomly selected and will not repeat except by chance.

QUADRATIC AND CUBIC EQUATIONS

Quadratic ($ax^2 + bx + c = 0$) or cubic ($ax^3 + bx^2 + cx + d = 0$) equations may be solved using the following functions.

- Quadratic equation solver: [MODE] [] []
- Cubic equation solver: [MODE] [] []

-solving quadratic and cubic equations

- Press [MODE] [] or [MODE] [] .
- Coefficient input: These coefficients can be entered in the same manner as those for simultaneous linear equations.

ERRORS AND CALCULATION RANGES

An error will occur if an operation exceeds the calculation ranges, or if a mathematically illegal operation is attempted. When an error occurs, the display shows the error code and automatically moves the cursor back to the place in the equation where the error occurred. Edit the equation or press [ON/OFF] [] or [2ND] [] to clear the equation.

ERROR CODES AND ERROR TYPES

- ERROR 01: Syntax error
- An attempt was made to perform an invalid operation.
 - Ex. $2 \div (-) 8 \div (-)$
- ERROR 02: Calculation error
- The absolute value of an intermediate or final calculation result equals or exceeds 10^{10} .
 - An attempt was made to divide by zero (or an intermediate calculation resulted in zero).
 - The calculation ranges were exceeded while performing calculations.
- ERROR 03: Nesting error
- The available number of buffers was exceeded. There are 10 buffers for numeric values and 64 buffers for calculation instructions).
 - 5 buffers in CPLX mode, and 1 buffer for matrix/list data.
- ERROR 04: Data over error
- Data items exceeded 100 in STAT mode.
- ERROR 07: Definition error
- Matrix/List definition error or the attempted entering of an invalid value.
- ERROR 08: DIM unmatched error
- Matrix/List dimensions inconsistent while calculating.
- ERROR 09: Invalid DIM error
- Size of matrix/invalid exceeds calculation range.
- ERROR 10: Undefined error
- Undefined matrix/List used in calculation.

Alert Messages

Cannot delete

- The selected item cannot be deleted by pressing [BS] [] or [2ND] [] in the Write/View editor.

Ex. [2ND] [] [] [] [] [] []

In this example, delete the exponent before attempting to delete the parentheses.

- The function or operation stored in definable memory (D1 to D4) cannot be called.
- Ex. An attempt was made to recall a statistical variable from within NORMAL mode.

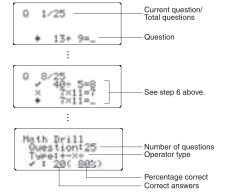
- Expressions stored in formula memories (F1 to F4) cannot be called.

Buffer full

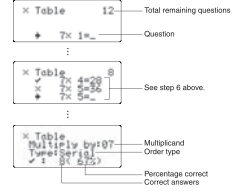
- The equation (including any calculation ending instructions) exceeds its maximum input buffer (150 characters in the Write/View editor or 161 characters in the Line editor). An equation may not exceed its maximum input buffer.

- Enter answer. If you make a mistake, press [ON/OFF] [] or [BS] [] to clear any answer stored, and enter your answer again.
- Press [MOD] [] .
- If the answer is correct, "✓" appears and the next question is displayed.
- If the answer is wrong, "✗" appears and the same question is displayed. This will be counted as an incorrect answer.
- If you press [MOD] [] without entering an answer, the correct answer is displayed and then the next question is displayed. This will be counted as an incorrect answer.
- Continue answering the series of questions by entering the answer and pressing [MOD] [] .
- After you finish, press [MOD] [] and the number and percentage of correct answers are displayed.
- Press [MOD] [] to return to the initial screen for your current drill.

MATH DRILL SAMPLE



X TABLE SAMPLE



RANGES OF MATH DRILL QUESTIONS

- Range of questions for each operator type is as follows.
- Addition operator: "0" to "0" to "20" to "20"
 - Subtraction operator: "0" to "0" to "20" to "20", answers are positive integers and 0.
 - Multiplication operator: "1" to "0" to "0" to "1" to "12" to "12"
 - Division operator: "1" to "10" to "144" to "144", answers are positive integers from 1 to 112 and 0, dividends of up to 144, and divisors of up to 12.
 - Mixed operators: Questions within all the above ranges are displayed.

COMPLEX NUMBER CALCULATIONS

To carry out addition, subtraction, multiplication, and division using complex numbers, press [MODE] [] to select CPLX mode. Results of complex number calculations are expressed using two systems.

- [MOD] [] : Rectangular coordinate system (The [] symbol appears.)
- [MOD] [] : Polar coordinate system (The [] symbol appears.)

Complex Number Entry

- Rectangular coordinates
 - x-coordinate [] y-coordinate []
 - or x-coordinate [] y-coordinate []
- Polar coordinates
 - r : absolute value
 - θ : argument
- On selecting another mode, the imaginary part of any complex number stored in the independent memory (M) and the last answer memory (ANS) will be cleared.

CALCULATION RANGES

- Within the ranges specified, this calculator is accurate to ± 1 of the 10th digit of the mantissa. However, a calculation error increases in continuous calculations due to accumulation of calculation errors. (This is the same for y^x , \sqrt{x} , n^{th} root, in Matrix/List calculations, etc., where continuous calculations are performed internally.) Additionally, a calculation error will accumulate and become larger in the vicinity of inflection points and singular points of functions.
- Calculation ranges
 - $\pm 10^{10}$ to $\pm 9.99999999 \times 10^{10}$ and 0.
 - If the absolute value of an equation or a final or intermediate result of a calculation is less than 10^{-10} , the value is considered to be 0 in calculations and in the display.

Display of results using $\sqrt{\quad}$

Calculation results may be displayed using $\sqrt{\quad}$ when all of the following conditions are met:

- When intermediate and final calculation results are displayed in the following form:
$$\frac{a \pm b \sqrt{c}}{d \pm e \sqrt{f}}$$
- When each coefficient falls into the following ranges:
 $1 \leq a < 100$; $-1 < b < 1,000$; $0 \leq c < 100$;
 $1 \leq d < 1,000$; $1 \leq e <$