ativa

AT-30i

2-lines display Scientific Calculator

with advance statistical functions

Owner's Manual

Please read before using.

Safety Precautions

Be sure to read the following safety precautions before using this calculator. Keep this manual handy for later reference.

Batteries

- After removing the batteries from the calculator, put them in a safe place where there is no danger of them getting into the hands of small children and accidently swallowed.
- Keep batteries out of the reach of children. If accidentally swallowed, consult with a physician immediately.
- Never charge batteries, try to take batteries apart, or allow batteries to become shorted. Never expose batteries to direct heat or dispose of them by incineration.
- Misuse of batteries can cause them to leak acid that can cause damage to nearby items and creates the possibility of fire and personal injury.
- Always make sure that a battery's positive (+) and negative (–) sides are facing correctly when you load it into the calculator.
- Remove the batteries if you do not plan to use the calculator for a long time.
- Use only the type of batteries specified for this calculator in this manual.
- Do not mix old and new batteries. Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickle cadmium) batteries.
- Battery Contains Mercury. Do Not Put in Trash. Recycle or Manage as Hazardous Waste.

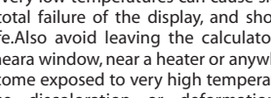
Disposing of the Calculator

- Never dispose of the calculator by burning it. Doing so can cause certain components to suddenly burst, creating the danger of fire and personal injury.
- The displays and illustrations (such as key markings) shown in this Owner's Manual are for illustrative purposes only, and may differ somewhat from the actual items they represent.
- The contents of this manual are subject to change without notice.

Handling Precautions

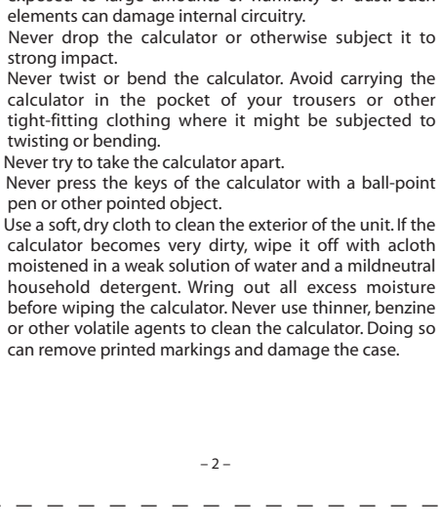
- Be sure to press the "ON/AC" key before using the calculator for the first time.
- Even if the calculator is operating normally, replace the battery at least once every three years. Dead battery can leak, causing damage to and malfunction of the calculator. Never leave the dead battery in the calculator.
- The battery that comes with this unit discharges slightly during shipment and storage. Because ofthis, it may require replacement sooner than the normal expected battery life.
- Low battery power can cause memory contents to become corrupted or lost completely. Always keep written records of all important data.
- Avoid use and storage in areas subjected to temperature extremes. Very low temperatures can cause slow display response,total failure of the display, and shortening of battery life.Also avoid leaving the calculator in direct sunlight, neara window, near a heater or anywhere else it might become exposed to very high temperatures. Heat can cause discoloration or deformation of the calculator's case, anddamage to internal circuitry.
- Avoid use and storage in areas subjected to large amounts of humidity and dust. Take care never to leave the calculator where it might besplashed by water or exposed to large amounts of humidity or dust. Such elements can damage internal circuitry.
- Never drop the calculator or otherwise subject it to strong impact.
- Never twist or bend the calculator. Avoid carrying the calculator in the pocket of your trousers or other tight-fitting clothing where it might be subjected to twisting or bending.
- Never try to take the calculator apart.
- Never press the keys of the calculator with a ball-point pen or other pointed object.
- Use a soft, dry cloth to clean the exterior of the unit. If the calculator becomes very dirty, wipe it off with acloth moistened in a weak solution of water and a mildneutral household detergent. Wring out all excess moisture before wiping the calculator. Never use thinner, benzine or other volatile agents to clean the calculator. Doing so can remove printed markings and damage the case.

Two-lines Display



You can simultaneously check the calculation formula and its answer. The first line displays the calculation formula. The second line displays the answer.

Keys Layout



Before Starting Calculations

Operation Modes

When using this calculator, it is necessary to select the proper mode to meet your requirements. This can be done by pressing **[MODE]** to scroll through sub-menus. Then select the appropriate mode by keying in the number.

Press **[MODE]** once to read the first page of the main menu.

```
COMP SD REG
  1  2  3
```

Press **[MODE]** again.

```
Deg Rad Gra
  1  2  3
```

Press **[MODE]** further.

```
Fix Sci Norm
  1  2  3
```

Press **"MODE"** once more to leave the menu.

```
_                0.
```

Calculation Modes

"COMP" mode : - general calculations, including function calculations can be executed.
"SD" mode:- standard deviation calculation can be executed. "SD" symbol appears in display.
"REG" mode:- regression calculations can be performed. "REG" symbol appears in display.

Angular Measurement Modes

"DEG" mode:- specify measurement in "degrees". **"D"** symbol appears in display window.
"RAD" mode:- specify measurement in "radians". **"R"** symbol appears in display window.
"GRA" mode:- specify measurement in "grads". **"G"** symbol appears in display window.

Display Modes

"FIX" mode:- specify number of decimal places. **"Fix"** symbol appears in display window.
"SCI" mode:- specify number of significant digits. **"Sci"** symbol appears in display window.

"NORM" mode:- cancels "Fix" and "Sci" specifications.

Note:-

- Mode indicators appear in the lower part of the display.
- The "COMP", "SD", and "REG" modes can be used in combination with the angle unit modes.
- Be sure to check the current calculation mode (COMP, SD, REG) and angle unit mode (DEG, RAD, GRA) before beginning a calculation.

Calculation Priority Sequence

Calculations are performed in the following order of precedence:-

1. Coordinate transformation: Pol(x, y),Rec(r, θ)
2. Type A functions :-
   These functions are those in which the value is entered and than the function key is pressed, such as x^2, x^{-1}, x!, °'".
3. Powers and roots, x^y, $\sqrt[x]{}$
4. Fractions, $a^b/_c$
5. Abbreviated multiplication format in front of π, memory name or variable name, such as 2π, 5A, πA, etc.
6. Type B functions :-
   These functions are those in which the function key is pressed and then the value is entered such as √, $\sqrt[3]{}$, log, ln, e^x, 10^x, sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, (–).
7. Abbreviated multiplication format in front of Type B functions, such as, 2√3, A log2, etc.
8. Permutation, combination, nPr, nCr
9. ×, ÷
10. +, –

- When functions with the same priority are used in series, execution is performed from right to left for :- $e^x\ln\sqrt{120} \rightarrow e^x\{\ln(\sqrt{120})\}$. Otherwise, execution is from left to right.
- Operations enclosed in parentheses are performed first.

Stacks

This calculator uses memory areas, called "stacks", to temporarily store values (numeric stack) and commands (command stack) according to their precedence during calculations. The numeric stack has 10 levels and the command stack has 24 levels. A stack error (stk ERROR) occurs whenever you try to perform a calculation that is so complex that the capacity of a stack is exceeded.

Error Loacator

Pressing **[◂]** or **[▸]** after an error occurs display the calculation with the cursor positioned at the location where the error occured.

Overflow and Errors

The calculator is locked up while an error message is on the display. Press [ON/AC] to clear the error, or press **[◂]** or **[▸]** to display the calculation and correct the problem.

"Ma ERROR" caused by:-

- Calculation result is outside the allowable calculation range.
- Attempt to perform a function calculation using a value that exceeds the allowable input range.
- Attempt to perform an illegal operation (division by zero, etc.).

Action

- Check your input values and make sure they are all within the allowable ranges. Pay special attention to values in any memory areas you are using.

"Stk ERROR" caused by:-

- Capacity of the numeric stack or operator stack is exceeded.

Action

- Simplify the calculation. The numeric stack has 10 levels and the operator stack has 24 levels.
- Divide your calculation into two or more separate parts.

"Syn ERROR" caused by:-

- Attempt to perform an illegal mathematical operation.

Action

- Press to display the calculation with the cursor located at the location of the error. Make necessary corrections.

Number of Input/output Digits and Calculation Digits

The memory area used for calculation input can hold 79 "steps". One function comprises one step. Each press of numeric or + , − , × and ÷ keys comprise one step. Though such operations as **[SHIFT] [x!]** (x^{-1} key) require two key operations, they actually comprise only one function, and, therefore, only one step. These steps can be confirmed using the cursor. With each press of the **[◂]** or **[▸]** key, the cursor is moved one step.

Whenever you input the 73rd step of any calculation, the cursor changes from "_" to "■" to let you know memory is running low. If you still need to input more, you should divide you calculation into two or more parts.

When numeric values or calculation commands are input, they appear on the display from the left. Calculation results, however, are displayed from the right.

The allowable input/output range (number of digits) of this unit is 10 digits for a mantissa and 2 digits for the exponent. Calculations, however, are performed internally with a range of 12 digits for a mantissa and 2 digits for an exponent.

Example: $3 \times 10^5 \div 7 =$
3**[EXP]**5[÷]7**[=]**

```
3E5÷7
   42857.14286
```

3**[EXP]**5[÷]7[−]42857**[=]**

```
3E5÷7−42857
      0.1428571
```

Corrections

To make corrections in a formula that is being input, use the **[◂]** and **[▸]** keys to move to the position of the error and press the correct keys.

Example: To change an input of 122 to 123 :-
[1] [2] [2]

```
122_             0.
```

[◂]

```
122              0.
```

[3]

```
123_             0.
```

Example: To change an input of cos60 to sin60 :-
[cos] [6] [0]

```
cos 60_          0.
```

[◂] [◂] [◂]

```
cos 60           0.
```

[sin]

```
sin 60           0.
```


Arithmetic Operations & Parenthesis Calculations

- Arithmetic operations are performed by pressing the keys in the same order as noted in the formula.
- For negative values, press [(-)] before entering the value
- For mixed basic arithmetic operations, multiplication and division are given priority over addition and subtraction
- Assuming that display mode "Norm 1" is selected.

Example	Operation	Display (Lower)
23 + 4.5 −53 =−25.5	23 [+] 4.5 [−] 53 [=]	−25.5
56×(−12)÷(−2.5)=268.8	56[×][(−)]12[÷][(−)]2.5[=]	268.8
12369×7532×74103= 6.903680613×10^{12}	12369[×] 7532 [×] 74103[=]	6.903680613^{12}
(4.5×10^{75})×(−2.3×10^{-79}) = −1.035×10^{-3}	4.5[EXP]75 [×] [(−)]2.3 [EXP] [(−)]79 [=]	−1.035^{-03}
(2+3)×10^2=500	[(] 2 [+] 3[)][×] 10[x^2] [=]	500.
(1×10^5)÷7= 14285.71429	1[EXP]5 [÷] 7 [=]	14285.71429
(1×10^5)÷7−14285= 0.7142857	1[EXP]5[÷]7 [−] 14285 [=]	0.7142857
please note that internal calculation is calculated in 12 digits for a mantissa and the result is displayed and rounded off to 10 digits.		
3 + 5 × 6 = 33	3 [+] 5 [×] 6 [=]	33.
7 × 8 − 4 × 5 = 36	7 [×] 8 [−] 4 [×] 5 [=]	36.
1 + 2 − 3 × 4 ÷ 5 + 6 = 6.6	1 [+] 2 [−] 3 [×] 4 [÷] 5 [+] 6 [=]	6.6
100 − (2+3) × 4 = 80	100 [−][(] 2 [+] 3[)] [×] 4 [=]	80.
2 + 3 × (4 + 5) = 29	2 [+] 3 [×] [(] 4 [+] 5 [=] Closed parentheses occurring immediately before operation of the [=] key may be omitted.	29.
(7 − 2) × (8 + 5) = 65	[(] 7 [−] 2 [)][(] 8 [+] 5 [=] A multiplication sign [×] occurring immediately before an open parantheses can be omitted.	65.
10 − { 2 + 7 × (3 + 6)} = −55	10 [−][(] 2 [+] 7 [(] 3 [+] 6 [=]	−55.

Percentage Calculations

Use the "COMP" mode for percentage calculations.

Example	Operation	Display (Lower)
Percentage		
26% of $15.00	15 [×]26 [SHIFT] [%]	3.9
Ratio		
75 is what % of 250?	75[÷]250 [SHIFT] [%]	30.

Specifying the Format of Calculation Results

You can change the precision of calculation results by specifying the number of decimal places or the number of significant digits. You can also shift the decimal place of a displayed value three places to the left or right for one-touch conversions of metric weights and measures.

Upon power up reset, the display format is defaulted at "Norm1". Each time when you press **"[MODE] [MODE] [MODE] [3]"** you can choose either "Norm 1" or "Norm 2" by keying in [1] or [2] respectively.
Norm 1 :- all values less than 10^{-2} or greater than 10^9 are automatically expressed as exponents.
Norm 2 :- all values less than 10^{-9} or greater than 10^9 are automatically expressed as exponents.
Note: You cannot specify the display format (Fix, Sci) while the calculator is in Base-N mode.

Specifying the Number of Decimal Places

The calculator always performs calculations using a 10-digit mantissa and 2-digit exponent, and results are stored in memory as a 12-digit mantissa and 2-digit exponent no matter how many decimal places you specify. Intermediate results and final results are then automatically rounded off to the number of decimal places you have specified.
It should be noted that displayed results are rounded to the specified number of decimal places, but stored results are normally not rounded.
To specify the number of decimal places (Fix), press **"[MODE] [MODE] [MODE] [1]"** and then a value indicating the number of decimal places (0~9).

```
Fix 0~9?
```

At this time, you should be able to see "Fix" on the display. The number of decimal places specified will remain in

effect until "Norm" (to select "Norm" press **"[MODE] [MODE] [MODE] [3]"**) is specified or significant digits are specified using **"[MODE] [MODE] [MODE] [2]"**.

[ON/AC] [MODE]

```
COMP SD REG
  1  2  3
```

[MODE]

```
Deg Rad Gra
  1  2  3
```

[MODE]

```
Fix Sci Norm
  1  2  3
```

[1]

```
Fix 0~9?
```

[4] (to specify 4 decimal places)

```
_              0.0000
```

Reset to "Norm"
[ON/AC] [MODE]

```
COMP SD REG
  1  2  3
```

[MODE]

```
Deg Rad Gra
  1  2  3
```

[MODE]

```
Fix Sci Norm
  1  2  3
```

[3]

```
Norm 1~2?
```

[1]

Example	Operation	Display (Lower)
100÷6 = 16.66666666	100 [÷] 6 [=]	16.66666667
specify 4 decimal places	[MODE][MODE][MODE][1][4]	16.6667
cancel specification	[MODE][MODE][MODE] [3] [1]	16.66666667
200÷7×14 = 400	200[÷]7 [×] 14[=]	400.
rounded to 3 decimal places	[MODE][MODE][MODE][1][3]	400.000
	200 [÷] 7[=] The intermediate result is automatically rounded to the specified three decimal places.	28.571

Example	Operation	Display (Lower)
The stored 10-digit result (28.571421857) is used when you continue the calculation by simply pressing [×] or any other arithmetic function key.	[×]	Ans × (upper display)
	14 [=] (The final result is automatically rounded to the specified three decimal places.)	400.000
Cancel specification by specifying "Norm" again.	[MODE][MODE][MODE][3][1]	400.

Rounding the Intermediate Result

As the number of decimal places is specified, the intermediate result will be automatically rounded to the specified decimal places. However, the stored intermediate result is not rounded. In order to match the displayed value and the stored value, **[SHIFT] [Rnd]** can be input.

You can compare the final result obtained in the previous example with the final result of the following example.

Example	Operation	Display (Lower)
200÷7×14 = 400	200[÷]7 [×] 14[=]	400.
rounded to 3 decimal places	[MODE][MODE][MODE][1][3]	400.000
	200[÷]7 [=] The intermediate result is automatically rounded to the specified three decimal places.	28.571
round the stored intermediate result to the specified three decimal places	[SHIFT] [Rnd]	28.571
	[×]	Ans × (upper display)
	14 [=]	399.994
Cancel specification by specifying "Norm" again.	[MODE][MODE][MODE][3][1]	399.994

Specifying the Number of Significant Digits

This specification is used to automatically round intermediate results and final results to the number of digits you have specified.

As with the number of decimal places, displayed results are rounded to the specified number of digits, but stored results are normally not rounded.

To specify the number of significant digits (Sci.), select **[SCI]** in the sub-menu "FIX/SCI/NORM" and then you are asked to enter a value indicating the number of significant digits (0~9) as below.

```
Sci 0~9?
```

Note : "0" indicating 10 significant digits.
Meanwhile, the "Sci" indicator will appear on the display.

Example	Operation	Display (Lower)
100÷6 = 16.66666666	100[÷]6 [=]	16.66666667
specify 5 significant digits	[Mode][Mode][Mode][2][5]	1.6667^{01}
Cancel specification by specifying "Norm" again.	[Mode][Mode][Mode][3][1]	16.66666667

Shifting the Decimal Place

You can use the key **[ENG]** to shift the decimal point of the displayed value three places to the left or right. Each 3-place shift to the left is the same as dividing the value by 1000, and each shift to the right is the same as multiplying by 1000. This means that this function is useful when converting metric weights and measures to other metric units.

Example	Operation	Display (Lower)
123m×456 = 56088m	123[×]456 [=]	56088.
= 56.088km	[ENG]	56.088^{03}
78g×0.96 = 74.88g	78[×]0.96 [=]	74.88
= 0.07488kg	[SHIFT] [ENG]	0.07488^{03}

Memory

This calculator contains 9 standard memories. There are two basic types of memories, i.e., "variable" memories, which are accessed by using the **[STO]** and **[RCL]** keys in combination with the alphabets A, B, C, D, E, F, M, X and Y. The "independent" memory, which is accessed by using the **[M+]** , **[Shift] [M−]** and **[RCL]** and **[M]** keys. The independent memory uses the same memory area as variable M.
Contents of both the variable and independent memories are protected even when the power is turned OFF.

Variable memories

Up to 9 values can be retained in memory at the same time, and can be recalled when desired.

Example: Input 123 into memory "A" :-
[ON/AC] 123

```
123_             0.
```

[STO] [A]

```
A=             123.
```

[ON/AC]

```
_                0.
```

[RCL] [A]

```
A=             123.
```

When formulas are input, the result of the formula's calculation is retained in memory.

Example: Input the result of 123×456 into memory "B" :-
[ON/AC] 123 [×] 456

```
123X456_         0.
```

[STO] [B]

```
B=           56088.
```

[ON/AC]

```
_                0.
```

[RCL] [B]

```
B=           56088.
```


If a variable expression is entered, the expression is first calculated according to the values stored in the variable memory specified for the result.
Example: Input the results of A×B into memory "C" :-
[ON/AC] [ALPHA] [A] [×] [ALPHA] [B]

```
AXB_             0.
```

[STO] [C]

```
C=          6898824.
```

[ON/AC]

```
_                0.
```

[RCL] [C]

```
C=          6898824.
```

Deleting memories

To delete all contents of variable memories, press **[Shift]** followed by **[Mcl] [=]**.

Independent Memory

Addition and subtraction (to and from sum) results can be stored directly in memory. Results can also be totalized in memory, making it easy to calculate sums. The icon **"M"** will be lighted as long as M is not empty.
Example: Input 123 to independent memory.
[ON/AC] [1] [2] [3]

```
123_             0.
```

[M+]

```
123            123.
```

Recall memory data
[ON/AC]

```
_                0.
```

[RCL] [M]

```
M=             123.
```

Add 25, subtract 12
25 [M+] 12 [SHIFT] [M−]

```
12              12.
```

Recall memory data
[ON/AC]

```
_                0.
```

[RCL] [M]

```
M=             136.
```


To clear memory contents, press **[0] [STO] [M]**.

Addition/subtraction to or from sum in memory cannot be carried out with **[M+]**, **[SHIFT] [M−]** keys in **"SD" mode** and **"REG"** mode.

Difference between [STO][M] and [M+], [SHIFT][M−] :-

Both **[STO] [M]** and **[M+]**, **[SHIFT] [M−]** can be used to input results into memory, however when the **[STO] [M]** operation is used, previous memory contents are cleared. When either **[M+]** or **[SHIFT] [M−]** is used, value is added or subtracted to or from present sum in memory.

Example: Input 456 into memory "M" using **[STO] [M]** procedure. Memory already contains value of 123.
[ON/AC] [1] [2] [3] [STO] [M]

```
M=
  M            123.
```

[ON/AC] [4] [5] [6] [STO] [M]

```
M=
  M            456.
```

[ON/AC]

```
_
  M              0.
```

[RCL] [M]

```
M=
  M            456.
```

Example: Input 456 into memory "M" using M+. Memory already contains value of 123.
[ON/AC] [1] [2] [3] [STO] [M]

```
M=
  M            123.
```

[ON/AC] [4] [5] [6] [M+]

```
456
  M            456.
```

[ON/AC]

```
_
  M              0.
```

[RCL] [M]

```
M=
  M            579.
```


Special Functions

Answer Function

This unit has an answer function that stores the result of the most recent calculation. Once a numeric value or numeric expression is entered and **[=]** is pressed, the result is stored by this function.

To recall the stored value, press the **[Ans] [=]** key. When **[Ans]** is pressed, "Ans" will appear on the display, and the value can be used in subsequent calculations.

Example: 123+456 = 579
789−579 = 210

[ON/AC][1][2][3][+][4][5][6][=]

```
123+456
                 579.
```

[7][8][9][−][Ans]

```
789−Ans_         579.
```

[=]

```
789−Ans          210.
```

Numeric values with 12 digits for a mantissa and 2 digits for an exponent can be stored in the **"Ans"** memory. The **"Ans"** memory is not erased even if the power of the unit is turned OFF. Each time [=] , [Shift] [%] , [M+] , [Shift] [M−] , and [STO] ∞ (∞ = A ~ F, M, X, Y) is pressed, the value in the Ans memory is replaced with the new value produced by the calculation execution. When execution of a calculation results in an error, however, the **"Ans"** memory retains its current value.
Note:- Contents of **"Ans"** memory are not altered when RCL ∞ (∞ = A~F, M, X, Y) is used to recall contents of variable memory. Also, contents of **"Ans"** memory are not altered when variables are input when the variable input prompt is displayed.

Omitting the multiplication sign (×)

When inputting a formula as it is written, from left to right, it is possible to omit the multiplication sign (×) in the following cases :-

- Before the following functions :-
  sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, log, ln, 10^x, e^x, √, $\sqrt[3]{}$, Pol(x,y), Rec(r, θ)
  example: 2sin30, 10log1.2, 2√3, 2Pol(5, 12), etc.
- Before fixed numbers, variales and memories :-
  example: 2π, 2AB, 3Ans, etc.
- Before parentheses :-
  example: 3(5+6), (A+1)(B−1), etc.

Continuous Calculation Function

Even if calculations are concluded with the **[=]** key, the result obtained can be used for further calculations. In this case, calculations are performed with 10 digits for the mantissa which is displayed.

Example: To calculate ÷3.14 continuing after 3×4=12
[ON/AC] [3] [×] [4] [=]

```
3x4
                12.
```

(continuing) **[÷] [3] [•] [1] [4]**

```
Ans÷3.14_
                12.
```

[=]

```
Ans÷3.14
   3.821656051
```

Example: To calculate 1÷3×3 =
[AC] [1] [÷] [3] [×] [3] [=]

```
1÷3x3
                 1.
```

[1] [÷] [3] [=]

```
1÷3
   0.333333333
```

(continuing) **[×] [3] [=]**

```
Ansx3
                 1.
```


This function can be used with Type A functions (x^2, x^{-1}, x!), +, −, x^y, $\sqrt[x]{}$ and °' ".

Example: To calculate 78÷6=13
[ON/AC] [7] [8] [÷] [6] [=]

```
78÷6
                13.
```

(continuing) **[x^2]**

```
Ans²_
                13.
```

[=]

```
Ans²
               169.
```

Replay Function

This function stores formulas that have been executed. After execution is complete, pressing either the **[◂]** or **[▸]** key will display the formula executed.
Pressing **[▸]** will display the formula from the beginning, with the cursor located under the first character.
Pressing **[◂]** will display the formula from the end, with the cursor located at the space following the last character. After this, using the **[▸]** and **[◂]** to move the cursor, the formula can be checked and numeric values or commands can be changed for subsequent execution.

Example:
[ON/AC] [1] [2] [3] [×] [4] [5] [6] [=]

```
123x456
               56088.
```

[▸]

```
123x456
               56088.
```

[=]

```
123x456
               56088.
```

[◂]

```
123x456_
               56088.
```

Example:
4.12×3.58+6.4 = 21.1496
4.12×3.58−7.1 = 7.6496
[ON/AC] [4] [•] [1] [2] [×] [3] [•] [5] [8] [+] [6] [•] [4] [=]

```
4.12x3.58+6.
      21.1496
```

[◀]

```
←12x3.58+6.4
      21.1496
```

[◀] [◀] [◀] [◀]

```
4.12x3.58+6.
      21.1496
```

[−] [7] [•] [1]

```
←12x3.58−7.1
      21.1496
```

[=]

```
4.12x3.58−7.
       7.6496
```

The replay function is not cleared even when **[ON/AC]** is pressed or when power is turned OFF, so contents can be recalled even after **[ON/AC]** is pressed.

Replay function is cleared when mode or operation is switched.

Error Position Display Function

When an **ERROR** message appears during operation execution, the error can be cleared by pressing the **[ON/AC]** key, and the values or formula can be re-entered from the beginning. However, by pressing the **[◀]** or **[▶]** key, the ERROR message is cancelled and the cursor moves to the point where the error was generated.

Example: 14÷0×2.3 is input by mistake
[ON/AC] [1] [4] [÷] [0] [×] [2] [.] [3] [=]

```
Ma ERROR
```

[◀] (or **[▶]**)

```
14÷0x2.3
       0.
```

Correct the input by pressing
[◀] [SHIFT] [INS] [1]

```
14÷10x2.3
       0.
```

[=]

```
14÷10x2.3
      3.22
```


Scientific Function

Trigonometric functions and inverse trigonometric functions

- Be sure to set the unit of angular measurement before performing trigonometric function and inverse trigonometric function calculations.
- The unit of angular measurement (degrees, radians, grads) is selected in sub-menu.
- Once a unit of angular measurement is set, it remains in effect until a new unit is set. Settings are not cleared when power is switched OFF.

Example	Operation	Display (Lower)
sin 63°52'41" = 0.897859012	[MODE][MODE][1]("DEG" selected) [sin] 63 [° ' "] 52 [° ' "] 41 [° ' "][=]	0.897859012
cos (π/3 rad) = 0.5	[MODE][MODE][2]("RAD" selected) [cos](() [SHIFT][π][÷]3 []) [=]	0.5
tan (−35 grad) = −0.612800788	[MODE][MODE][3] ("GRA" selected) [tan] [(−)] 35 [=]	−0.612800788
2sin45°×cos65° = 0.597672477	[MODE][MODE][1]("DEG") 2[sin] 45 [cos] 65 [=]	0.597672477
$\sin^{-1}$ 0.5 = 30	[SHIFT][$\sin^{-1}$] 0.5 [=]	30.
$\cos^{-1}$ (√2/2) = 0.785398163 rad = π/4 rad	[MODE][MODE][2]("RAD") [SHIFT][$\cos^{-1}$][(][√]2 [÷]2 [)][=] [÷][SHIFT][π][=]	0.785398163 0.25
$\tan^{-1}$ 0.741 = 36.53844577° = 36°32' 18.4"	[MODE][MODE][1]("DEG") [SHIFT][$\tan^{-1}$]0.741[=] [SHIFT] [←°' "]	36.53844576 36°32°18.4°
If the total number of digits for degrees/minutes/seconds exceed 11 digits, the higher order values are given display priority, and any lower-order values are not displayed. However, the entire value is stored within the unit as a decimal value.		
2.5×($\sin^{-1}$0.8−$\cos^{-1}$0.9) = 68°13'13.53"	2.5[×] [(] [SHIFT] [$\sin^{-1}$]0.8 [−] [SHIFT] [$\cos^{-1}$] 0.9 [)] [=] [SHIFT] [←°' "]	68°13°13.53°

Example	Operation	Display (Lower)
Using any four numbers from 1 to 7, how many four digit even numbers can be formed if none of the four digits consist of the same number? (3/7 of the total number of permutations will be even.) 7P4×3÷7 = 360	7[SHIFT][nPr]4[×]3[÷] 7[=]	360.
If any four items are removed from a total of 10 items, how many different combinations of four items are possible? 10C4 = 210	10[nCr]4[=]	210.
If 5 class officers are being selected for a class of 15 boys and 10 girls, how many combinations are possible? At least one girl must be included in each group. 25C5−15C5 = 50127	25[nCr]5[−]15[nCr]5[=]	50127.

Other Functions (√ , x², x⁻¹, x!, ³√, Ran#)

Example	Operation	Display (Lower)
√2+√5 = 3.65028154	[√]2[+][√]5[=]	3.65028154
$2^2+3^2+4^2+5^2$ = 54	2[x^2][+]3[x^2][+]4[x^2] [+]5[x^2][=]	54.
$(-3)^2$ = 9	[(][(−)]3[)][x^2][=]	9.
1/(1/3−1/4) = 12	[(]3[x^{-1}][−]4[x^{-1}][)][x^{-1}][=]	12.
8! = 40320	8[SHIFT][x!][=]	40320.
$\sqrt[3]{(36\times42\times49)}$ = 42	[$\sqrt[3]{}$][(]36[×]42[×]49[)][=]	42.
Random number generation (number is in the range of 0.000 to 0.999)	[SHIFT][Ran#][=]	0.792 (random)

Example	Operation	Display (Lower)
√(1−$\sin^2$40) = 0.766044443	[MODE][MODE][1]("DEG" selected) [√][(]1[−][([)][sin]40[)][x^2][)][=] [SHIFT][$\cos^{-1}$][Ans][=]	0.766044443 40.
1/2!+1/4!+1/6!+1/8! = 0.543080357	2[SHIFT][x!][x^{-1}][+] 4[SHIFT][x!][x^{-1}][+] 6[SHIFT][x!][x^{-1}][+] 8[SHIFT][x!][x^{-1}][=]	0.543080357

Fractions

Fractions are input and displayed in the order of integer, numerator and denominator. Values are automatically displayed in decimal format whenever the total number of digits of a fractional value (interger + numerator + denominator + separator marks) exceeds 10.

Example	Operation	Display (Lower)
$^2/_5+3^1/_4 = 3^{13}/_{20}$	2[$a^b/_c$]5[+]3[$a^b/_c$]1 [$a^b/_c$]4[=] [$a^b/_c$](conversion to decimal) Fractions can be converted to decimals, and then converted back to fractions.	3⌟13⌟20. 3.65
$3^{456}/_{78} = 8^{11}/_{13}$	3[$a^b/_c$]456[$a^b/_c$]78[=] [SHIFT][$d/_c$]	8⌟11⌟13. 115⌟13.
$^1/_{2578}+{}^1/_{4572}$ = 0.00060662	1[$a^b/_c$]2578[+]1[$a^b/_c$] 4572[=] When the total number of characters, including integer, numerator, denominator and delimiter mark exceeds 10, the input fraction is automatically displayed in decimal format.	6.066202547^{-04}
$^1/_2\times0.5 = 0.25$	1[$a^b/_c$]2[×].5[=]	0.25
$^1/_3\times(-{}^4/_5)-{}^5/_6 = -1^1/_{10}$	1[$a^b/_c$]3[×][(−)]4[$a^b/_c$]5 [−]5[$a^b/_c$]6[=]	−1⌟1⌟10.
$^1/_2\times{}^1/_3+{}^1/_4\times{}^1/_5 = {}^{13}/_{60}$	1[$a^b/_c$]2[×]1[$a^b/_c$]3[+] 1[$a^b/_c$]4[×]1[$a^b/_c$]5[=]	13⌟60.
$(^1/_2)/3 = {}^1/_6$	[(]1[$a^b/_c$]2[)][$a^b/_c$]3[=]	1⌟6.
$^1/(^1/_3+{}^1/_4) = 1^5/_7$	1[$a^b/_c$][(]1[$a^b/_c$]3[+] 1[$a^b/_c$]4[)][=]	1⌟5⌟7.

Example 5 30 **[DT]** 50 **[DT]** 120 **[SHIFT] [;]** 31 **[DT]**
To delete 120 **[SHIFT] [;]** 31 **[DT]**, press **[SHIFT] [CL]**.
Example 6 50 **[DT]** 120 **[SHIFT] [;]** 31 **[DT]** 40 **[DT]** 30 **[DT]**
To delete 120 **[SHIFT] [;]** 31 **[DT]**, press 120 **[SHIFT] [;]** 31 **[SHIFT] [CL]**.
Example 7 [√] 10 **[DT]** [√] 20 **[DT]** [√] 30 **[DT]**
To delete [√] 20 **[DT]**, press [√] 20 **[=] [Ans] [SHIFT] [CL]**.
Example 8 [√] 10 **[DT]** [√] 20 **[DT]** [√] 30 **[DT]**
To delete [√] 20 **[DT]**, press [√] 20 **[SHIFT] [;] [(−)]** 1 **[DT]**.

Performing calculations

The following procedures are used to perform the various standard deviation calculations.

Key operation	Result
[SHIFT][xσn]	Population standard deviation, $x\sigma_n$
[SHIFT][xσn−1]	Sample standard deviation, $x\sigma_{n-1}$
[SHIFT][$\bar{x}$]	Mean, $\bar{x}$
[RCL][A]	Sum of square of data, $\sum x^2$
[RCL][B]	Sum of data, $\sum x$
[RCL][C]	Number of data, n

Standard deviation and mean calculations are performed as shown below:
Population standard deviation $\sigma_n = \sqrt{(\sum(x_i-\bar{x})^2/n)}$
where i = 1 to n
Sample standard deviation $\sigma_{n-1} = \sqrt{(\sum(x_i-\bar{x})^2/(n-1))}$
where i = 1 to n
Mean $\bar{x} = (\sum x)/n$

Example	Operation	Display
Data 55, 54, 51, 55, 53, 53, 54, 52	[MODE][2] (SD Mode) [SHIFT][Scl][=] (Memory cleared) 55[DT]54[DT]51[DT] 55[DT]53[DT][DT]54[DT] 52[DT]	0. 0. 52.
What is deviation of the unbiased variance, and the mean of the above data?	[RCL][C](Number of data) [RCL][B](Sumof data) [RCL][A](Sum of square of data) [SHIFT][$\bar{x}$][=](Mean) [SHIFT][xσn][=](Population SD) [SHIFT][xσn−1][=](Sample SD) [SHIFT][xσn−1] [x^2][=](Sample variance)	8. 427. 22805. 53.375 1.316956719 1.407885953 1.982142857

Regression Calculation

In the REG mode, calculations including linear regression, logarithmic regression, exponential regression, power regression, inverse regression and quadratic regression can be performed.

Press **[MODE] [3]** to enter the **"REG"** mode:

```
COMP SD REG
 1    2   3
```

and then select one of the following regression types:-

```
Lin Log Exp →
 1   2   3
```

Lin: linear regression
Log: logarithmic regression
Exp: exponential regression

press **[▶]** for the other three regression types:-

```
→Pwr Inv Quad
  1   2   3
```

Pwr: power regression
Inv: inverse regression
Quad: quadratic regression

Linear regression

Linear regression calculations are carried out using the following formula:
y = A + Bx.

Data input
Press **[MODE] [3] [1]** to specify linear regression under the **"REG"** mode.
Press **[Shift] [Scl] [=]** to clear the statistical memories.
Input data in the following format: <x data> [,] <y data> [DT]
- When multiples of the same data are input, two different entry methods are possible:

Example 1 Data: 10/20, 20/30, 20/30, 40/50
Key operation: 10 [,] 20 [DT]
20 [,] 30 [DT] [DT]
40 [,] 50 [DT]
The previously entered data is entered again each time the **[DT]** key is pressed (in this case 20/30 is re-entered).

Example	Operation	Display
Temperature and length of a steel bar	[MODE][3][1] ("REG" then select linear regression)	0.
Temp / Length	[SHIFT][Scl][=] (Memory cleared)	0.
10°C 1003mm	10[,]1003[DT]	10.
15°C 1005mm	15[,]1005[DT]	15.
20°C 1010mm	20[,]1010[DT]	20.
25°C 1011mm	25[,]1011[DT]	25.
30°C 1014mm	30[,]1014[DT]	30.
Using this table, the regression formula and correlation coefficient can be obtained. Based on the coefficient formula, the length of the steel bar at 18°C and the temperature at 1000mm can be estimated. Furthermore the critical coefficient (r^2) and covariance can also be calculated.	[SHIFT][A][=](Constant term A) [SHIFT][B][=] (Regression coefficient B) [SHIFT][r][=] (Correlation coefficient r) 18[SHIFT][$\hat{y}$](Length at 18°C) 1000[SHIFT][$\hat{x}$](Temp at 1000mm) [SHIFT][r][x^2][=] (Critical coefficient) [(][(][RCL][F][)][−][RCL][C][)][×] [SHIFT][$\bar{x}$][×][SHIFT][$\bar{y}$][)][÷] [(][(][RCL][C][−]1[)][)][=](Covariance)	997.4 0.56 0.982607368 1007.48 4.642857143 0.965517241 35.

Logarithmic regression

Logarithmic regression calculations are carried out using the following formula:
$y = A + B\cdot\ln x$

Data input
Press **[MODE] [3] [2]** to specify logarithmic regression under **"REG"** mode.
Press **[SHIFT] [Scl] [=]** to clear the statistical memories.
Input data in the following format: <x data>, <y data> [DT]
- To make multiple entries of the same data, follow procedures described for linear regression.

Deleting input data
To delete input data, follow the procedures described for linear regression.

Deleting input data
To delete input data, follow the procedures described for linear regression

Performing calculations
If $1/x$ is stored instead of x itself, the inverse regression formula $y = A + (B/x)$ becomes the linear regression formula $y = a + bx$. Therefore, the formulas for constant term A, regression coefficient B and correlation coefficient r are identical the power and linear regression.
A number of inverse regression calculation results differ from those produced by linear regression. Note the following:

Linear regression	Inverse regression
$\sum x$	$\sum(1/x)$
$\sum x^2$	$\sum(1/x)^2$
$\sum xy$	$\sum(y/x)$

Example		Operation	Display
xi	yi	[MODE][3][▶][2]	0.
2	2	("REG" then select Inv regression)	
3	3	[SHIFT][Scl][=] (Memory cleared)	0.
4	4	2[,]2[DT]	2.
5	5	3[,]3[DT]	3.
6	6	4[,]4[DT]	4.
Through inverse regression of the above data, the regression formula and correlation coefficient are obtained. Furthermore, the regression formula is used to obtain the respective estimated values of y and x, when xi = 10 and yi = 9.		5[,]5[DT] 6[,]6[DT] [SHIFT][A][=](Constant term A) [SHIFT][B][=] (Regression coefficient B) [SHIFT][r][=] (Correlation coefficient r) 10[SHIFT][$\hat{y}$](y when xi=10) 9[SHIFT][$\hat{x}$](x when yi=9)	5. 6. 7.272727272 −11.28526646 −0.950169098 6.144200627 −6.533575316

Deleting input data
To delete input data, follow the procedures described for linear regression

Performing calculations
The following procedures are used to perform the various linear regression calculations.
The regression formula is y = A + Bx + Cx^2 where A, B, C are regression coefficients.
$C = [(n\sum x^2-(\sum x)^2)(n\sum x^2y-\sum x^2\sum y)-(n\sum x^3-\sum x^2\sum x)(n\sum xy-\sum x\sum y)] \div [(n\sum x^2-(\sum x)^2)(n\sum x^4-(\sum x^2)^2)-(n\sum x^3-\sum x^2\sum x)^2]$
$B = [n\sum xy-\sum x\sum y-C(n\sum x^3-\sum x^2\sum x)] \div (n\sum x^2-(\sum x)^2)$
$A = (\sum y-B\sum x-C\sum x^2)/n$

To read the value of $\sum x^3$, $\sum x^4$ or $\sum x^2y$, you can recall memory [RCL] M, Y and X respectively.

Example		Operation	Display
xi	yi	[MODE][3][▶][3]	
29	1.6	("REG" then select Quad regression)	
50	23.5	[SHIFT][Scl][=]	0.
74	38	29[,]1.6[DT]	29.
103	46.4	50[,]23.5[DT]	50.
118	48	74[,]38[DT]	74.
Through power regression of the above data, the regression formula and correlation coefficient are obtained. Furthermore, the regression formula is used to obtain the respective estimated values of y and x, when xi = 16 and yi = 20.		103[,]46.4[DT] 118[,]48[DT] [SHIFT][A][=](Constant term A) [SHIFT][B][=] (Regression coefficient B) [SHIFT][C][=] (Regression coefficient C) 16[SHIFT][$\hat{y}$](y when xi=16) 20[SHIFT][$\hat{x}_1$](x1 when yi=20) [SHIFT][$\hat{x}_2$](x2 when yi=20)	103. 118. −35.59856935 1.495939414 −6.716296671^{-03} −13.38291067 47.14556728 175.5872105

Performing Hyperbolic and Inverse Hyperbolic Functions

Example	Operation	Display (Lower)
sinh3.6= 18.28545536	[hyp][sin] 3.6 [=]	18.28545536
cosh1.23 = 1.856761057	[hyp][cos] 1.23 [=]	1.856761057
tanh2.5= 0.986614298	[hyp][tan] 2.5 [=]	0.986614298
cosh1.5−sinh1.5 = 0.22313016	[hyp][cos] 1.5 [−][hyp] [sin] 1.5 [=]	0.22313016
sinh^{-1} 30 = 4.094622224	[hyp][SHIFT][$\sin^{-1}$] 30 [=]	4.094622224
cosh^{-1} (20/15) = 0.795365461	[hyp][SHIFT][$\cos^{-1}$][(] 20 [÷] 15 [)][=]	0.795365461
x = (tanh^{-1} 0.88) / 4 = 0.343941914	[hyp][SHIFT][$\tan^{-1}$]0.88 [÷]4[=]	0.343941914
sinh^{-1} 2×cosh^{-1}1.5 = 1.389388923	[hyp][SHIFT][$\sin^{-1}$]2[×] [hyp][SHIFT][$\cos^{-1}$]1.5[=]	1.389388923
sinh^{-1} (2/3)+tanh^{-1}(4/5) = 1.723757406	[hyp][SHIFT][$\sin^{-1}$][(]2[÷] 3[)][+][hyp][SHIFT][$\tan^{-1}$] [(]4[÷]5[)][=]	1.723757406

Logarithmic and Exponential Functions

Example	Operation	Display (Lower)
log1.23 = 8.9905111×10^{-2}	[log] 1.23 [=]	0.089905111
ln90 = 4.49980967	[ln] 90 [=]	4.49980967
log456÷ln456 = 0.434294481	[log]456÷[ln]456 [=]	0.434294481
$10^{1.23}$ = 16.98243652	[SHIFT][10^x] 1.23 [=]	16.98243652
$e^{4.5}$ = 90.0171313	[SHIFT][e^x]4.5[=]	90.0171313
$10^4\cdot e^{-4}+1.2\cdot10^{2.3}$ = 422.5878667	[SHIFT][10^x]4[×][SHIFT][e^x] [(−)]4[+]1.2[×][SHIFT][10^x] 2.3[=]	422.5878667
$(-3)^4$ = 81	[(][(−)] 3 [)] [x^y] 4 [=]	81.
-3^4 = −81	[(−)] 3 [x^y] 4 [=]	−81.
$5.6^{2.3}$ = 52.58143837	5.6 [x^y] 2.3 [=]	52.58143837
$^7\sqrt{123}$ = 1.988647795	7 [SHIFT][$\sqrt[x]{}$] 123 [=]	1.988647795
$(78-23)^{-12}$ = 1.305111829×10^{-21}	[(]78[−]23[)][x^y][(−)]12[=]	1.305111829^{-21}
2+3×$\sqrt[3]{64}$−4 = 10	2[+]3[×]3[SHIFT][$\sqrt[x]{}$]64 [−]4[=]	10.
2×3.4$^{(5+6.7)}$ = 3306232	2[×]3.4[x^y][(]5[+]6.7[)][=]	3306232.001

Degree, Radian, Gradient Interconversion

Degree, radian and gradient can be converted to each other with the use of **[SHIFT][DRG>]**. Once **[SHIFT] [DRG>]** have been keyed in, the **"DRG"** selection menu will be shown as follows.

```
D  R  G
1  2  3
```

Example	Operation	Display
Define degree first	[MODE][MODE][1]("DEG" selected)	
Change 20 radian to degree	20[SHIFT][DRG>][2][=]	20^r 1145.91559
To perform the following calculation :- 10 radians+25.5 gradients The answer is expressed in degree.	10[SHIFT][DRG>][2] [+]25.5[SHIFT][DRG>][3] [=]	10^r+25.5^g 595.9077951

Degrees, Minutes, Seconds Calculations

You can perform sexagesimal calculations using degrees (hours), minutes and seconds. And convert between sexagesimal and decimal values.

Example	Operation	Display
To express 2.258 degrees in deg/min/sec.	2.258[° ' "][=]	2°15°28.8
To perform the calculation: 12°34'56"×3.45	12[° ' "]34[° ' "]56[° ' "][×] 3.45[=]	43°24°31.2

Example 2 Data: 10/20, 20/30, 20/30, 20/30, 20/30, 20/30, 40/50
Key operation: 10 [,] 20 [DT]
20 [,] 30 [SHIFT] [;] 5 [DT]
40 [,] 50 [DT]
By pressing **[SHIFT]** and then entering a semicolon followed by a value that represents the number of times the data is repeated (5, in this case) and the **[DT]** key, the multiple data entries (for 20/30, in this case) are made automatically.

Deleting input data

There are various ways to delete value data, depending on how and where it was entered.

Example 1 10 [,] 40 [DT]
20 [,] 20 [DT]
30 [,] 30 [DT]
40 [,] 50
To delete 40 [,] 50, press **[ON/AC]**

Example 2 10 [,] 40 [DT]
20 [,] 20 [DT]
30 [,] 30 [DT]
40 [,] 50
To delete 40 [,] 50 [DT], press **[SHIFT][CL]**

Example 3
To delete 20 [,] 20 [DT], press **20 [,] 20 [SHIFT][CL]**

Example 4 [√] 10 [,] 40 [DT]
[√] 40 [,] 50 [DT]
To delete[√]10[,]40[DT],
press **[√]10[=][Ans][,]40[SHIFT][CL]**

Performing calculations
If we assume that ln$y = y$ and lnA = a', the exponential regression formula $y = A\cdot e^{B\cdot x}$ (ln y = ln A $+Bx$) becomes the linear regression formula y =a' + bx if we store ln(y) instead of y itself. Therefore, the formulas for constant term A, regression coefficient B and correlation coefficient r are identical for exponential and linear regression.

A number of exponential regression calculation results differ from those produced by linear regression. Note the following:

Linear regression	Exponential regression
$\sum y$	$\sum \ln y$
$\sum y^2$	$\sum(\ln y)^2$
$\sum xy$	$\sum x\cdot\ln y$

Example		Operation	Display
xi	yi	[MODE][3][3]	0.
6.9	21.4	("REG" then select Exp regression)	
12.9	15.7	[SHIFT][Scl][=] (Memory cleared)	0.
19.8	12.1	6.9[,]21.4[DT]	6.9
26.7	8.5	12.9[,]15.7[DT]	12.9
35.1	5.2	19.8[,]12.1[DT]	19.8
Through exponential regression of the above data, the regression formula and correlation coefficient are obtained. Furthermore, the regression formula is used to obtain the respective estimated values of y and x, when xi = 16 and yi = 20.		26.7[,]8.5[DT] 35.1[,]5.2[DT] [SHIFT][A][=](Constant term A) [SHIFT][B][=] (Regression coefficient B) [SHIFT][r][=] (Correlation coefficient r) 16[SHIFT][$\hat{y}$](y when xi=16) 20[SHIFT][$\hat{x}$](x when yi=20)	26.7 35.1 30.49758742 −0.049203708 −0.997247351 13.87915739 8.574868045

Power regression

Power regression calculations are carried out using the following formula:
$y = A\cdot x^B$ (ln$y$ = lnA + Bln$x$)

Data input
Press **[MODE] [3] [▶] [1]** to specify "power regression".
Press **[SHIFT] [Scl] [=]** to clear the statistical memories.
Input data in the following format: <x data>,<y data> [DT]
- To make multiple entries of the same data, follow procedures described for linear regression.

Deleting input data
To delete input data, follow the procedures described for linear regression

Replacing the Battery

Dim figures on the display of the calculator indicate that battery power is low. Continued use of the calculator when the battery is low can result in improper operation. Replace the battery as soon as possible when display figures become dim.

To replace the battery:-
- Remove the screws that hold the back cover in place and then remove the back cover,
- Remove the old battery,
- Wipe off the side of the new battery with a dry, soft cloth. Load it into the unit with the positive(+) side facing up.
- Replace the battery cover and secure it in place with the screws.
- Press **[ON/AC]** to turn power on.

Auto Power Off

Calculator power automatically turns off if you do not perform any operation for about six minutes. When this happens, press **[ON/AC]** to turn power back on.

Specifications

Power supply: AG13 x 2 batteries
Operating temperature: 0° ~ 40°C (32°F ~ 104°F)

Coordinate Transformation

- This scientific calculator lets you convert between rectangular coordinates and polar coordinates, i.e., P(x, y) ↔ P(r, θ)
- Calculation results are stored in variable memory E and variable memory F. Contents of variable memory E are displayed initially. To display contents of memory F, press **[RCL] [F]**.
- With polar coordinates, θ can be calculated within a range of −180°< θ≤180°.
(Calculated range is the same with radians or grads.)

Example	Operation	Display (Lower)
x=14 and y=20.7, what are r and θ°?	[MODE][MODE][1]("DEG" selected) [Pol(][14 [,]20.7[)][=] [RCL][F] [SHIFT][←°' "]	24.98979792(r) 55.92839019(θ) 55°55°42.2(θ)
x=7.5 and y=−10, what are r and θ rad?	[MODE][MODE][2]("RAD" selected) [Pol(]7.5[,][(−)]10[)][=] [RCL][F]	12.5(r) −0.927295218(θ)
r=25 and θ= 56°, what are x and y?	[MODE][MODE][1]("DEG" selected) [SHIFT][Rec(]25 [,]56[)][=] [RCL][F]	13.97982259(x) 20.72593931(y)
r=4.5 and =2π/3 rad, what are x and y?	[MODE][MODE][2]("RAD" selected) [SHIFT][Rec(]4.5[,][(]2[÷] 3[×][SHIFT][π][)][)][=] [RCL][F]	−2.25(x) 3.897114317(y)

Permutation and Combination

Total number of permutations nPr = n!/(n−r)!
Total number of combinations nCr = n!/(r!(n−r)!)

Example	Operation	Display (Lower)
Taking any four out of ten items and arranging them in a row, how many different arrangements are possible? 10P4 = 5040	10[SHIFT][nPr]4[=]	5040.

Statistical Calculations

This unit can be used to make statistical calculations including standard deviation in the **"SD"** mode, and regression calculation in the **"REG"** mode.

Standard Deviation

In the **"SD"** mode, calculations including 2 types of standard deviation formulas, mean, number of data, sum of data, and sum of square can be performed.

Data input
1. Press **[MODE] [2]** to specify **SD** mode.
2. Press **[SHIFT] [Scl] [=]** to clear the statistical memories.
3. Input data, pressing **[DT]** key (= **[M+]**) each time a new piece of data is entered.

Example Data: 10, 20, 30
Key operation: 10 **[DT]** 20 **[DT]** 30 **[DT]**
- When multiples of the same data are input, two different entry methods are possible.
Example 1 Data: 10, 20, 20, 30
Key operation: 10 **[DT]** 20 **[DT]** **[DT]** 30 **[DT]**
The previously entered data is entered again each time the DT is pressed without entering data (in this case 20 is re-entered).
Example 2 Data: 10, 20, 20, 20, 20, 20, 20, 30
Key operation: 10 **[DT]** 20 **[SHIFT] [;]** 6 **[DT]** 30 **[DT]**

By pressing **[SHIFT]** and then entering a semicolon followed by value that represents the number of items the data is repeated (6, in this case) and the **[DT]** key, the multiple data entries (for 20, in this case) are made automatically.

Deleting input data

There are various ways to delete value data, depending on how and where it was entered.

Example 1 40 **[DT]** 20 **[DT]** 30 **[DT]** 50 **[DT]**
To delete 50, press **[SHIFT] [CL]**.
Example 2 40 **[DT]** 20 **[DT]** 30 **[DT]** 50 **[DT]**
To delete 20, press 20 **[SHIFT] [CL]**.
Example 3 30 **[DT]** 50 **[DT]** 120 **[SHIFT] [;]**
To delete 120 **[SHIFT] [;]** , press **[ON/AC]**.
Example 4 30 **[DT]** 50 **[DT]** 120 **[SHIFT] [;]** 31
To delete 120 **[SHIFT] [;]** 31, press **[AC]**.

Key Operations to recall regression calculation results

Key operation	Result
[SHIFT][A][=]	Constant term of regression A
[SHIFT][B][=]	Regression coefficient B
[SHIFT][C][=]	Regression coefficient C
[SHIFT][r][=]	Correlation coefficient r
[SHIFT][$\bar{x}$][=]	Estimated value of x
[SHIFT][$\hat{y}$][=]	Estimated value of y
[SHIFT][yσn]	Population standard deviation, $y\sigma_n$
[SHIFT][yσn−1]	Sample standard deviation, $y\sigma_{n-1}$
[SHIFT][$\bar{y}$]	Mean, $\bar{y}$
[SHIFT][xσn]	Population standard deviation, $x\sigma_n$
[SHIFT][xσn−1]	Sample standard deviation, $x\sigma_{n-1}$
[SHIFT][$\bar{x}$]	Mean, $\bar{x}$
[RCL][A]	Sum of square of data, $\sum x^2$
[RCL][B]	Sum of data, $\sum x$
[RCL][C]	Number of data, n
[RCL][D]	Sum of square of data, $\sum y^2$
[RCL][E]	Sum of data, $\sum y$
[RCL][F]	Sum of data, $\sum xy$

Performing calculations

The following procedures are used to perform the various linear regression calculations.

The regression formula is y = A + Bx. The constant term of regression A, regression coefficient B, correlation r, estimated value of x, and estimated value of y are calculated as shown below:

$A = (\sum y-\sum x)/n$
$B = (n\sum xy-\sum x\sum y) / (n\sum x^2-(\sum x)^2)$
$r = (n\sum xy-\sum x\sum y) / \sqrt{((n\sum x^2-(\sum x)^2)(n\sum y^2-(\sum y)^2))}$
$y = A + Bx$
$x = (y-A) / B$

Performing calculations
If we assume that ln$y = y$, lnA =a' and ln $x = x$, the power regression formula $y = A\cdot x^B$ (ln$y$ = lnA + Bln$x$) becomes the linear regression formula $y = a' + bx$ if we store ln(x) and ln(y) instead of x and y themselves. Therefore, the formulas for constant term A, regression coefficient B and correlation coefficient r are identical the power and linear regression.
A number of power regression calculation results differ from those produced by linear regression. Note the following:

Linear regression	Power regression
$\sum x$	$\sum \ln x$
$\sum x^2$	$\sum(\ln x)^2$
$\sum y$	$\sum \ln y$
$\sum y^2$	$\sum(\ln y)^2$
$\sum xy$	$\sum \ln x\cdot\ln y$

Example		Operation	Display
xi	yi	[MODE][3][▶][1]	0.
28	2410	("REG" then select Pwr regression)	
30	3033	[SHIFT][Scl][=] (Memory cleared)	0.
33	3895	28[,]2410[DT]	28.
35	4491	30[,]3033[DT]	30.
38	5717	33[,]3895[DT]	33.
Through power regression of the above data, the regression formula and correlation coefficient are obtained. Furthermore, the regression formula is used to obtain the respective estimated values of y and x, when xi = 40 and yi = 1000.		35[,]4491[DT] 38[,]5717[DT] [SHIFT][A][=](Constant term A) [SHIFT][B][=] (Regression coefficient B) [SHIFT][r][=] (Correlation coefficient r) 40[SHIFT][$\hat{y}$](y when xi=40) 1000[SHIFT][$\hat{x}$](x when yi=1000)	35. 4491 0.238801069 2.771866156 0.998906255 6587.674587 20.26225681

Inverse regression

Power regression calculations are carried out using the following formula:
$y = A + (B/x)$

Data input
Press **[MODE] [3] [▶] [2]** to specify "inverse regression".
Press **[SHIFT] [Scl] [=]** to clear the statistical memories.
Input data in the following format: <x data>,<y data> [DT]
- To make multiple entries of the same data, follow procedures described for linear regression.