fx-350W
fx-270W
fx-83W
fx-82W
User's Guide

CASIO®

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Safety Precautions

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

⚠ Caution

This symbol is used to indicate information that can result in personal injury or material damage if ignored.

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 small children. If accidently 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.
- Never use an old battery together with a new one.
- Never mix batteries of different types.
- Use only the type of batteries specified for this calculator in this manual.

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.

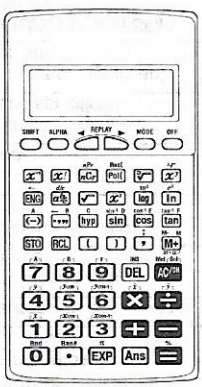
- The displays and illustrations (such as key markings) shown in this User's Guide are for illustrative purposes only, and may differ somewhat from the actual items they represent.
- The contents of this manual are subject to change without notice.
- In no event shall CASIO Computer Co., Ltd. be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of the purchase or use of these materials. Moreover, CASIO Computer Co., Ltd. shall not be liable for any claim of any kind whatsoever against the use of these materials by any other party.

Handling Precautions

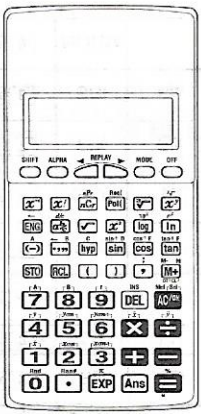
- **Be sure to press the P button on the back of the calculator (step ⑥ on page 50) before using it for the first time.**
- **Even if the calculator is operating normally, replace batteries at least once every three years for the fx-350W/fx-270W/fx-83W, or at least once every two years for the fx-82W.**
  Dead batteries can leak, causing damage to and malfunction of the calculator. Never leave dead batteries in the calculator.
- **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, near a 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, and damage 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 be splashed 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 a cloth moistened in a weak solution of water and a mild neutral 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.

Contents



fx-350W/fx-270W/fx-83W



fx-82W

■ Modes

Application	Key Operation	Mode Name	Mode Indicator
Normal calculations	MODE 1	COMP	–
Standard deviation calculations	MODE 2	SD	SD
Regression calculations	MODE 3	LR	LR
Calculations using degrees	MODE 4	DEG	D
Calculations using radians	MODE 5	RAD	R
Calculations using grads	MODE 6	GRA	G
Number of decimal place specification	MODE 7	FIX	Fix
Number of significant digit specification	MODE 8	SCI	Sci
Cancels FIX and SCI settings	MODE 9	NORM	–

Note!

- Mode indicators appear in the lower part of the display.
- The DEG, RAD, and GRA modes can be used in combination with the SD and LR modes.

- MODE 1 exits the SD and LR modes, but does not clear SCI or FIX specifications.
- MODE 9 does not exit the SD or LR mode.
- Before beginning a new calculation, be sure to check the current calculation mode (SD, LR, COMP) and angular unit setting (DEG, RAD, GRA).

■ Input Capacity

- The memory area used for calculation input can hold 127 "steps." One step is taken up each time you press a number key or an arithmetic operator key (+, −, ×, ÷). A SHIFT or ALPHA key operation does not take up a step, so inputting SHIFT √, for example, takes up only one step.
- You can input up to 127 steps for a single calculation. Whenever you input the 121st 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 your calculation into two or more parts.

■ Making Corrections in Calculations

- **Example 1**: To correct cos60 to sin60

cos 60

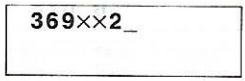
```
cos 60_
```

◀ ◀ ◀ sin

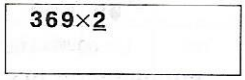
```
sin 60
```

- **Example 2**: To use the [DEL] key to correct 369 × × 2 to 369 × 2

369 [×] [×] 2

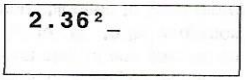


[◀] [◀] [DEL]

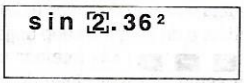


- **Example 3**: To use the Insert Mode to correct 2.36^2 to $\sin 2.36^2$

2 [•] 3 6 [x^2]



[◀] [◀] [◀] [◀] [◀]
[SHIFT] [INS] [sin]



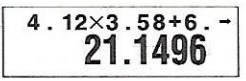
- Pressing [SHIFT] [INS] changes the cursor to "[ ]" to indicate that you are in the Insert Mode. Pressing [◀], [▶], [SHIFT] [INS], or [=] exits the Insert Mode.

■ Replay Function

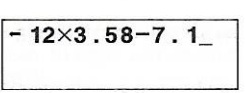
- Pressing [▶] or [◀] recalls the last calculation you performed. You can then make any changes you want in the calculation and re-execute it.

- **Example 1**: $4.12 \times 3.58 + 6.4 = 21.1496$
  $4.12 \times 3.58 - 7.1 = 7.6496$

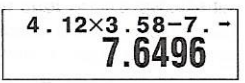
4.12 [×] 3.58 [+] 6.4 [=]



[◀] [◀] [◀] [◀] [◀] [−] 7.1



[=]



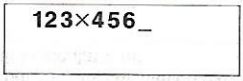
- Replay memory can hold up to 127 steps (page 9).
- Pressing [AC] and turning power off does not clear Replay memory, so you can recall the last calculation even after you press [AC] or turn the calculator off.

- **Example 2**:

123 [×] 456 [=]

[AC]

[◀]

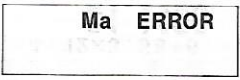


- Replay memory is cleared whenever you start a new calculation or change to another mode.

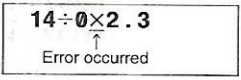
■ Error Locator

- Pressing [▶] or [◀] after an error occurs displays the calculation with the cursor positioned at the location where the error occurred.
- **Example** : When 14 ÷ 0 × 2.3 is input by mistake for 14 ÷ 10 × 2.3

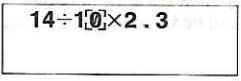
14 [÷] 0 [×] 2.3 [=]



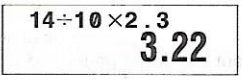
[▶] (or [◀])



[◀] [SHIFT] [INS] 1



[=]



■ Exponential Display Formats

This calculator can display up to 10 digits. Larger values are automatically displayed using exponential notation. In the case of decimal values, you can select between two formats that determine at what point exponential notation is used.

• NORM 1

With NORM 1, exponential notation is automatically used for integer values with more than 10 digits and decimal values with more than two decimal places.

• NORM 2

With NORM 2, exponential notation is automatically used for integer values with more than 10 digits and decimal values with more than nine decimal places.

To switch between NORM 1 and NORM 2

Press [MODE] [9]. There is no indication on the display of which format is currently in effect, but you can determine the setting by performing the following calculation.

1 [÷] 200 [=] 5.$^{-03}$ (NORM 1 format)

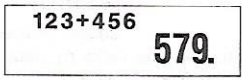
0.005 (NORM 2 format)

- All of the examples in this manual show calculation results using the NORM 1 format.

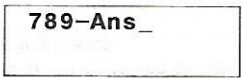
■ Answer Memory

- Whenever you press [=] after inputting values or an expression, the calculated result is automatically stored in Answer Memory. You can recall Answer Memory contents by pressing [Ans].
- **Example**: 123 + 456 = 579
  789 − 579 = 210

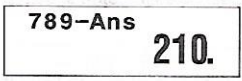
123 [+] 456 [=]



789 [−] [Ans]



[=]

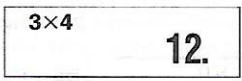


- Answer Memory can store up to 12 digits for the mantissa and two digits for the exponent.
- In addition to [=], Answer Memory contents are also replaced with a new value whenever you press [SHIFT] [%], [M+], [SHIFT] [M−] or [STO] (followed by a letter from A through F, or the letter M). Answer Memory contents are not changed if the operation performed by any of the above key operations results in an error.

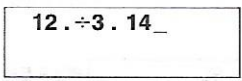
■ Consecutive Calculations

- A calculation result produced by pressing [=] can be used in the next calculation.
- **Example**: To calculate 3 × 4 and divide the result by 3.14

3 [×] 4 [=]



(Continuing) [÷] 3.14



[=]

- The result of a calculation can also be used with a subsequent Type A function (see page 45), +, −, x^y, $\sqrt[x]{}$, and °' ".

Basic Calculations

- Use the COMP mode for basic calculations.
- **Example 1:** 23+4.5−53

  23 [+] 4.5 [−] 53 [=] → −25.5

- **Example 2:** 56×(−12)÷(−2.5)

  56 [×] [(−)] 12 [÷] [(−)] 2.5 [=] → 268.8

- **Example 3:** $2\div3\times(1\times10^{20})$

  2 [÷] 3 [×] 1 [EXP] 20 [=] → 6.666666667^{19}

- **Example 4:** 7×8−4×5 =36

  7 [×] 8 [−] 4 [×] 5 [=] → 36.

- **Example 5:** $\frac{6}{4\times5} = 0.3$

  6 [÷] [(] 4 [×] 5 [)] [=] → 0.3

- **Example 6:** 2×[7+6×(5+4)] = 122

  2 [×] [(] 7 [+] 6 [×]
  [(] 5 [+] 4 [)] [)] [=] → 122.

- You can skip all [)] operations before [=].

Memory Calculations

■ Independent Memory

- Values can be input directly into memory, added to memory, or subtracted from memory. Independent memory is convenient for calculating cumulative totals.
- Independent memory uses the same memory area as variable M (See page 18).
- To clear independent memory, input [SHIFT] [Mcl] or [0] [STO] [M].

- **Example:**

  23 + 9 = 32
  53 − 6 = 47
  −) 45 × 2 = 90
  99 ÷ 3 = 33
  (Total) 22

  23 [+] 9 [STO] [M] → 32.
  53 [−] 6 [M+] → 47.
  45 [×] 2 [SHIFT] [M−] → 90.
  99 [÷] 3 [M+] → 33.
  [RCL] [M] → 22.

■ Variables

- There are seven variables (A through F, and M), which can be used to store data, constants, results, and other values.

- **Example 1:** 193.2 ÷ 23 = 8.4
  193.2 ÷ 28 = 6.9
  193.2 ÷ 42 = 4.6

193.2 STO A ÷ 23 =	8.4
RCL A ÷ 28 =	6.9
RCL A ÷ 42 =	4.6

- **Example 2:** $\frac{9 \times 6 + 3}{(7 - 2) \times 8} = 1.425$

9 × 6 + 3 STO B	57.
(7 − 2) × 8 STO C	40.
ALPHA B ÷ ALPHA C =	1.425

Fraction Calculations

- Use the COMP mode for fraction calculations.
- Values are automatically displayed in decimal format whenever the total number of digits of a fractional value (integer + numerator + denominator + separator marks) exceeds 10.

- **Example 1:** $\frac{2}{3} + \frac{4}{5} = 1\frac{7}{15}$

2 a⅞ 3 + 4 a⅞ 5 =	1⌟7⌟15.

- **Example 2:** $3\frac{1}{4} + 1\frac{2}{3} = 4\frac{11}{12}$

3 a⅞ 1 a⅞ 4 +	
1 a⅞ 2 a⅞ 3 =	4⌟11⌟12.

- **Example 3:** $\frac{2}{4} = \frac{1}{2}$ 2 a⅞ 4 = | 1⌟2.

- **Example 4:** $\frac{1}{2} + 1.6 = 2.1$

1 a⅞ 2 + 1.6 =	2.1

- Fraction/decimal calculation results are always decimal.

- **Example 5:** $\frac{1}{2} \leftrightarrow 0.5$ (Fraction ↔Decimal)

1 $a\frac{b}{c}$ 2 =	1⌟2.
$a\frac{b}{c}$	0.5
$a\frac{b}{c}$	1⌟2.

- **Example 6:** $1\frac{2}{3} \leftrightarrow \frac{5}{3}$

1 $a\frac{b}{c}$ 2 $a\frac{b}{c}$ 3 =	1⌟2⌟3.
SHIFT d/c	5⌟3.
SHIFT d/c	1⌟2⌟3.

Percentage Calculations

- Use the COMP mode for percentage calculations.
- **Example 1:** To calculate 12% of 1500

1500 × 12 SHIFT %	180.

- **Example 2:** To calculate what percentage of 880 is 660

660 ÷ 880 SHIFT %	75.

- **Example 3:** To add 15% onto 2500

2500 × 15 SHIFT % +	2875.

- **Example 4:** To discount 3500 by 25%

3500 × 25 SHIFT % −	2625.

- **Example 5:** If 300 grams are added to a test sample originally weighing 500 grams, what is the percentage increase in weight?

$$\frac{300 + 500}{500} \times 100 = 160\ (\%)$$

300 + 500 SHIFT %	160.

- **Example 6:** If temperature changes from 40°C to 46°C, what percentage did it rise?

$$\frac{46 - 40}{40} \times 100 = 15\ (\%)$$

46 − 40 SHIFT %	15.

Scientific Function Calculations

- Use the COMP mode for scientific function calculations.
- Some calculations may take a long time to complete.
- Wait for the result before starting the next calculation.
- $\pi = 3.1415926536$

■ Trigonometric/Inverse Trigonometric Functions

- **Example 1:** $\sin 63°52'41'' = 0.897859012$

  [MODE] [4] →"D"

  [sin] 63 [°'"] 52 [°'"] 41 [°'"] [=] → 0.897859012

- **Example 2:** $\cos\left(\frac{\pi}{3}\text{ rad}\right) = 0.5$

  [MODE] [5] →"R"

  [cos] [(] [SHIFT] [π] [÷] 3 [)] [=] → 0.5

- **Example 3:** $\tan(-35\text{grad}) = -0.612800788$

  [MODE] [6] →"G"

  [tan] [(−)] 35 [=] → −0.612800788

- **Example 4:** $\sin^{-1}0.5 = 30°$ (x when $\sin x = 0.5$)

  [MODE] [4] →"D"

  [SHIFT] [sin] 0.5 [=] → 30.

- **Example 5:** $\cos^{-1}\frac{\sqrt{2}}{2} = 0.785398163\text{rad} = \frac{\pi}{4}\text{ rad}$

  [MODE] [5] →"R"

  [SHIFT] [cos] [(] [√] 2 [÷] 2 [)] [=] → 0.785398163

  [Ans] [÷] [SHIFT] [π] [=] → 0.25

- **Example 6:** $\tan^{-1}0.741 = 36.53844577°$

  [MODE] [4] →"D"

  [SHIFT] [tan] 0.741 [=] → 36.53844577

■ Hyperbolic/Inverse Hyperbolic Functions

- **Example 1:** $\sinh 3.6$

  [hyp] [sin] 3.6 [=] → 18.28545536

- **Example 2:** $\sinh^{-1} 30$

  [hyp] [SHIFT] [sin] 30 [=] → 4.094622224

■ Common and Natural Logarithms/ Antilogarithms

- **Example 1:** log 1.23

  [log] 1.23 [=] → 0.089905111

- **Example 2:** ln 90 ($=\log_e 90$)

  [ln] 90 [=] → 4.49980967

- **Example 3:** $\dfrac{\log 64}{\log 4}$

  [log] 64 [÷] [log] 4 [=] → 3.

- **Example 4:** e^{10} [SHIFT] [e^x] 10 [=] → 22026.46579

- **Example 5:** $10^{0.4}+5\,e^{-3}$

  [SHIFT] [10^x] 0.4 [+]

  5 [×] [SHIFT] [e^x] [(−)] 3 [=] → 2.760821773

- **Example 6:** 2^3 2 [x^y] 3 [=] → 8.

- **Example 7:** 2^{-3} 2 [x^y] [(−)] 3 [=] → 0.125

■ Square Roots, Cube Roots, Squares, Reciprocals, Factorials and Random Numbers

- **Example 1:** $\sqrt{2}+\sqrt{3}\times\sqrt{5}$

  [√] 2 [+] [√] 3 [×] [√] 5 [=] → 5.287196909

- **Example 2:** $\sqrt[3]{5}+\sqrt[3]{-27}$

  [$\sqrt[3]{}$] 5 [+] [$\sqrt[3]{}$] [(−)] 27 [=] → −1.290024053

- **Example 3:** $123+30^2$

  123 [+] 30 [x^2] [=] → 1023.

- **Example 4:** $\dfrac{1}{\frac{1}{3}-\frac{1}{4}}$

  [(] 3 [x^{-1}] [−] 4 [x^{-1}] [)] [x^{-1}] [=] → 12.

- **Example 5:** 8! 8 [$x!$] [=] → 40320.

- **Example 6:** To generate a random number between 0.000 and 0.999

  [SHIFT] [Ran#] [=] → 0.664

  Example (results differ each time)

FIX, SCI, RND

- **Example 1:** 200÷7×14=400

	200 ÷ 7 × 14 =	400.
(Specifies three decimal places.)	MODE 7 3	400.000 Fix
(Calculation continues using 10 display digits)	200 ÷ 7 =	28.571 Fix
	× 14 =	400.000 Fix

Performing the same calculation using the specified number of decimal places

	200 ÷ 7 =	28.571 Fix
(Internal rounding)	SHIFT Rnd	28.571 Fix
	× 14 =	399.994 Fix

- Press MODE 9 to clear FIX specification.

- **Example 2:** 1÷ 3, displaying result with two significant digits (SCI 2)

	MODE 8 2 1 ÷ 3 =	3.3^{-01} Sci

- Press MODE 9 to clear SCI specification.

ENG Calculations

- **Example 1:** To convert 56,088 meters to kilometers

	56088 = ENG	56.088^{03}

- **Example 2:** To convert 0.08125 grams to milligrams

	0.08125 = ENG	81.25^{-03}

Coordinate Conversion (Pol(x, y), Rec (r, θ))

- Calculation results are automatically assigned to variables E and F.
- **Example 1:** To convert polar coordinates (r=2, θ=60°) to rectangular coordinates (x, y) (DEG mode)

x	SHIFT Rec(2 , 60) =	1. D
y	RCL F	1.732050808 D

RCL E, RCL F swaps displayed value with value in memory.

- **Example 2:** To convert rectangular coordinates $(1, \sqrt{3})$ to polar coordinates (r, θ) (RAD mode)

r Pol(1 , √ 3) = → 2.

θ RCL F → 1.047197551

RCL E, RCL F swaps displayed value with value in memory.

Permutation

- **Example:** To determine how many different 4-digit values can be produced using the numbers 1 through 7
  - Numbers cannot be duplicated within the same 4-digit value (1234 is allowed, but 1123 is not).

7 SHIFT nPr 4 = → 840.

Combination

- **Example:** To determine how many different 4-member groups can be organized in a group of 10 individuals

10 nCr 4 = → 210.

Statistical Calculations

Standard Deviation (SD Mode)

- Press MODE 2 to enter the SD Mode for statistical calculations using standard deviation.
- Data input always starts with SHIFT Scl = to clear statistical memory.
- Input data is used to calculate values for n, Σx, and Σx^2, which you can recall using the key operations noted nearby.

ALPHA 1	Σx^2
ALPHA 2	Σx
ALPHA 3	n

- **Example:** To calculate σ_{n-1}, σ_n, $\bar{x}$, n, Σx, and Σx^2 for the following data : 55, 54, 51, 55, 53, 53, 54, 52

Enter SD Mode MODE 2

SHIFT Scl = (Memory Clear)

55 DT

54 DT 51 DT

55 DT 53 DT DT

54 DT 52 DT → 52. (SD)

(Sample Standard Deviation σ_{n-1}) SHIFT xσn-1 = → 1.407885953

(Population Standard Deviation σ_n) SHIFT xσn = → 1.316956719

(Arithmetic Mean $\bar{x}$) SHIFT x̄ = → 53.375

(Number of Data n)	ALPHA 3 =	8.
(Sum of Values Σx)	ALPHA 2 =	427.
(Sum of Squares of Values Σx^2)	ALPHA 1 =	22805.

Data Input Precautions

- DT DT inputs the same data twice.
- You can also input multiple entries of the same data using SHIFT ;. To input the data 110 ten times, for example, press 110 SHIFT ; 10 DT.
- The above results can be obtained in any order, and not necessarily that shown above.
- To delete data you have just input, press SHIFT CL.

Making Corrections During Data Input

- **Example 1:** To change data you have just input

Correct	Actual	Correction
51 DT	50 DT	SHIFT CL 51 DT
130 SHIFT ; 31 DT	120 SHIFT ;	AC 130 SHIFT ; 31 DT
130 SHIFT ; 31 DT	120 SHIFT ; 31	AC 130 SHIFT ; 31 DT

- **Example 2:** To change data you previously input

Correct	Actual	Correction
51 DT	49 DT	49 SHIFT CL 51 DT
130 SHIFT ; 31 DT	120 SHIFT ; 30 DT	120 SHIFT ; 30 SHIFT CL 130 SHIFT ; 31 DT

■ Regression Calculations (LR Mode)

- Press MODE 3 to enter the LR Mode for regression calculations.
- Data input always starts with SHIFT Scl = to clear statistical memory.

- Input data is used to calculate values for n, Σx, Σx^2, Σy, Σy^2, and Σxy, which you can recall using the key operations noted nearby.

ALPHA 1	Σx^2
ALPHA 2	Σx
ALPHA 3	n
ALPHA 4	Σy^2
ALPHA 5	Σy
ALPHA 6	Σxy

• Linear Regression

The regression formula for linear regression is: $y = A + Bx$.

• Example: Atmospheric Pressure vs. Temperature

Temperature	Atmospheric Pressure
10°C	1003 hPa
15°C	1005 hPa
20°C	1010 hPa
25°C	1011 hPa
30°C	1014 hPa

Perform linear regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate atmospheric pressure at 18°C and temperature at 1000 hPa. Finally, calculate the critical coefficient (r^2) and covariance $\left(\frac{\Sigma xy - n \cdot \bar{x} \cdot \bar{y}}{n-1}\right)$.

Enter LR Mode MODE 3

SHIFT Scl = (Memory Clear)

10 , 1003 DT

15 , 1005 DT

20 , 1010 DT

25 , 1011 DT

30 , 1014 DT → 30. LR

(Fixed Term A) SHIFT A = → 997.4

(Regression Coefficient B) SHIFT B = → 0.56

(Correlation Coefficient r) SHIFT r = → 0.982607368

(Atmospheric Pressure at 18°C) 18 SHIFT $\hat{y}$ = → 1007.48

(Temperature at 1000 hPa) 1000 SHIFT $\hat{x}$ = → 4.642857143

(Critical Coefficient) SHIFT r x^2 = → 0.965517241

(Covariance) (ALPHA 6 =

ALPHA 3 × SHIFT $\bar{x}$ ×

SHIFT $\bar{y}$) ÷

(ALPHA 3 = 1) = → 35.

• Logarithmic Regression

The regression formula for logarithmic regression is:
$y = A + B\ln x$.
Input data using the following key sequence.
[ln] <x-data> [,] <y-data> [DT]

• Example:

x_i	y_i
29	1.6
50	23.5
74	38.0
103	46.4
118	48.9

Perform logarithmic regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate $\hat{y}$ (estimated value of y) for $x_i = 80$ and $\hat{x}$ (estimated value of x) for $y_i = 73$.

Enter LR Mode [MODE] [3]
[SHIFT] [Scl] [=]

[ln] 29 [,] 1.6 [DT]
[ln] 50 [,] 23.5 [DT]
[ln] 74 [,] 38.0 [DT]
[ln] 103 [,] 46.4 [DT]
[ln] 118 [,] 48.9 [DT] → 4.770684624 LR

(Fixed Term A) [SHIFT] [A] [=] → −111.1283976
(Coefficient B) [SHIFT] [B] [=] → 34.02014749
(Correlation Coefficient r) [SHIFT] [r] [=] → 0.994013946

($\hat{y}$ when $x_i = 80$) [ln] 80 [SHIFT] [$\hat{y}$] [=] → 37.94879482

($\hat{x}$ when $y_i = 73$)
73 [SHIFT] [$\hat{x}$] [=] [SHIFT] [e^x] [Ans] [=] → 224.1541314

• Exponential Regression

The regression formula for exponential regression is:
$y = A \cdot e^{B \cdot x}$ ($\ln y = \ln A + Bx$).
Input data using the following key sequence.
<x-data> [,] [ln] <y-data> [DT]

• Example:

x_i	y_i
6.9	21.4
12.9	15.7
19.8	12.1
26.7	8.5
35.1	5.2

Perform exponential regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate $\hat{y}$ (estimated value of y) for $x_i = 16$ and $\hat{x}$ (estimated value of x) for $y_i = 20$.

Enter LR Mode [MODE] [3]
[SHIFT] [Scl] [=]

6.9 [,] [ln] 21.4 [DT]
12.9 [,] [ln] 15.7 [DT]
19.8 [,] [ln] 12.1 [DT]
26.7 [,] [ln] 8.5 [DT]
35.1 [,] [ln] 5.2 [DT] → 35.1 LR

(Fixed Term A) SHIFT e^x SHIFT A = → 30.49758742

(Coefficient B) SHIFT B = → −0.049203708

(Correlation Coefficient r) SHIFT r = → −0.997247351

($\hat{y}$ when $x_i = 16$)

16 SHIFT $\hat{y}$ = SHIFT e^x Ans = → 13.87915739

($\hat{x}$ when $y_i = 20$) ln 20 SHIFT $\hat{x}$ = → 8.574868046

• Power Regression

The regression formula for power regression is: $y = A \cdot x^B$ ($\ln y = \ln A + B \ln x$).

Input data using the following key sequence.

ln <x-data> , ln <y-data> DT

Example:

x_i	y_i
28	2410
30	3033
33	3895
35	4491
38	5717

Perform power regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate $\hat{y}$ (estimated value of y) for $x_i = 40$ and $\hat{x}$ (estimated value of x) for $y_i = 1000$.

Enter LR Mode MODE 3

SHIFT Scl =

ln 28 , ln 2410 DT

ln 30 , ln 3033 DT

ln 33 , ln 3895 DT

ln 35 , ln 4491 DT

ln 38 , ln 5717 DT → 3.63758616 LR

(Fixed Term A) SHIFT e^x SHIFT A = → 0.238801082

(Coefficient B) SHIFT B = → 2.771866148

(Correlation Coefficient r) SHIFT r = → 0.998906256

($\hat{y}$ when $x_i = 40$)

ln 40 SHIFT $\hat{y}$ = SHIFT e^x Ans = → 6587.674743

($\hat{x}$ when $y_i = 1000$)

ln 1000 SHIFT $\hat{x}$ = SHIFT e^x Ans = → 20.26225659

Data Input Precautions

- DT DT inputs the same data twice.
- You can also input multiple entries of the same data using SHIFT ; . To input the data "20 and 30" five times, for example, press 20 , 30 SHIFT ; 5 DT.
- The above results can be obtained in any order, and not necessarily that shown above.
- To delete data you have just input, press SHIFT CL.

Making Corrrections During Data Input

- **Example 1:** To change data you have just input

Correct	Actual	Correction
20 [,] 20 [DT]	20 [,] 30 [DT]	[SHIFT] [CL] 20 [,] 20 [DT]
20 [,] 30 [SHIFT] [;] 5 [DT]	20 [,] 40 [SHIFT] [;] 5	[AC] 20 [,] 30 [SHIFT] [;] 5 [DT]

- **Example 2:** To change data you previously input

Correct	Actual	Correction
20 [,] 20 [DT]	30 [,] 30 [DT]	30 [,] 30 [SHIFT] [CL] 20 [,] 20 [DT]
20 [,] 30 [SHIFT] [;] 5 [DT]	20 [,] 30 [SHIFT] [;] 6 [DT]	20 [,] 30 [SHIFT] [;] 6 [SHIFT] [CL] 20 [,] 30 [SHIFT] [;] 5 [DT]

Technical Information

■ Keys and Their Functions

• General

Power on; All clear ..... [AC/ON]
Power off ..... [OFF]
Number/decimal point input ..... [0] ~ [9], [•]
Arithmetic calculations ..... [+], [−], [×], [÷], [=]
Negative ..... [(−)]

• Memory

Memory in ..... [STO] [M]
Memory plus ..... [M+]
Memory minus ..... [SHIFT] [M−]
Memory recall ..... [RCL] [M]
All memory clear ..... [SHIFT] [Mcl]
Specify variable ..... [ALPHA] + [A] ~ [F], [M]

• Special

Select mode ..... [MODE]
Shifts key functions ..... [SHIFT]
Alpha shift ..... [ALPHA]
Cursor, Replay ..... [◀], [▶]
Exponent ..... [EXP]

π (3.1415926536) ..... SHIFT π
Answer memory ..... Ans
Delete ..... DEL
Insert mode ..... SHIFT INS
Parentheses ..... (,)
Sexagesimal ..... °'"
Decimal ↔ sexagesimal ..... SHIFT °'"
Internal rounding ..... SHIFT Rnd

• Scientific Functions

Trigonometric ..... sin, cos, tan
Inverse trigonometric ..... SHIFT sin⁻¹, SHIFT cos⁻¹
SHIFT tan⁻¹
Hyperbolic ..... hyp sin, hyp cos
hyp tan
Inverse hyperbolic ..... hyp SHIFT sin⁻¹
hyp SHIFT cos⁻¹
hyp SHIFT tan⁻¹
Natural logarithm ..... ln
Natural antilogarithm ..... SHIFT e^x
Common logarithm ..... log
Common antilogarithm ..... SHIFT 10^x
Square ..... x^2
Square root ..... $\sqrt{\ }$
Cube root ..... $\sqrt[3]{\ }$
Engineering ..... ENG, SHIFT ENG

Factorial ..... $x!$
Fraction ..... $a\frac{b}{c}$, SHIFT d/c
Percent ..... SHIFT %
Polar-to-rectangular ..... SHIFT Rec(
Rectangular-to-polar ..... Pol(
Power ..... x^y
Root ..... SHIFT $\sqrt[x]{\ }$
Random number ..... SHIFT Ran#
Reciprocal ..... x^{-1}
Permutation ..... SHIFT nPr
Combination ..... nCr

• Statistics (SD/LR Mode)

Statistical register clear ..... SHIFT Scl
Data input ..... DT
Data delete ..... SHIFT CL
Comma ..... ,
Semicolon ..... SHIFT ;
Arithmetic mean ..... SHIFT $\bar{x}$, SHIFT $\bar{y}$
Population standard deviation ..... SHIFT $x\sigma_n$, SHIFT $y\sigma_n$
Sample standard deviation ..... SHIFT $x\sigma_{n-1}$, SHIFT $y\sigma_{n-1}$
Number of data ..... ALPHA 3 (n)
Sum of squares of values ..... ALPHA 1 (Σx^2),
ALPHA 4 (Σy^2)
Sum of values ..... ALPHA 2 (Σx),
ALPHA 5 (Σy)

Sum of x and y values ..... [ALPHA] [6] (Σxy)
Fixed term ..... [SHIFT] [A]
Regression coefficient ..... [SHIFT] [B]
Correlation coefficient ..... [SHIFT] [r]
Estimated value of x ..... [SHIFT] [$\hat{x}$]
Estimated value of y ..... [SHIFT] [$\hat{y}$]

■ When you have a problem.....

If calculation results are not what you expect or if an error occurs, perform the following steps.

1. [MODE] [1] (COMP mode)
2. [MODE] [4] (DEG mode)
3. [MODE] [9] (NORM mode)
4. Check the formula you are working with to confirm it is correct.
5. Enter the correct modes to perform the calculation and try again.

If the above steps do not correct your problem, press the P button (see page 49 or 50) on the back of the calculator to reset it.

Important!

- Pressing the P button deletes all data stored in calculator memory. Make sure you always keep written copies of all important data.

■ Overflow and Error Check

The following conditions cause an error message to appear and lock up the calculator.

- An Ma ERROR occurs when a result (either intermediate or final) of a value in memory exceeds $\pm 9.999999999 \times 10^{99}$.
- An Ma ERROR occurs when an attempt is made to perform a function calculation using a value that exceeds the applicable input range (page 51).
- An Ma ERROR occurs when an illogical operation is attempted during statistical calculations (such as an attempt to calculate $\bar{x}$ and $x\sigma_n$ when $n = 0$).
- A Stk ERROR occurs when the capacity of the numeric stack or operator stack is exceeded (page 46). This error is caused, for example, by pressing [(] 23 times and then performing the following calculation: 2 [+] 3 [×] 4.
- A Syn ERROR occurs when an attempt is made to perform an illegal mathematical operation. (such as 5 [×] [×] 3 [=]).

The calculator is locked up while an error message is on the display. Press [AC] to clear the error, or press [◄] or [►] to display the calculation and correct the problem. See "Error Locator" on page 12 for details.

■ Error Messages

Ma ERROR

- **Cause**
  - 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 illogical operation during statistical calculations.
- **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

- **Cause**
  - Capacity of the numeric stack or operator stack is exceeded.
- **Action**
  - Simplify the calculation. The numeric stack has nine levels and the operator stack has 24 levels.
  - Divide your calculation into two or more separate parts.

Syn ERROR

- **Cause**
  - Attempt to perform an illegal mathematical operation.
- **Action**
  - Press ◀ or ▶ to display the calculation with the cursor located at the location of the error. Make necessary corrections.

■ Order of Operations

Calculations are performed in the following order of precedence.

① Coordinate transformation: Pol (x, y), Rec (r, θ)

② Type A functions:
With these functions, the value is entered and then the function key is pressed.
x^2, x^{-1}, $x!$, $\circ\,'\,''$

③ Powers and roots: x^y, $\sqrt[x]{\ }$

④ $a^b/_c$

⑤ Abbreviated multiplication format in front of π, memory name, or variable name: 2π, 5A, πA etc.

⑥ Type B functions:
With these functions, the function key is pressed and then the value is entered.
$\sqrt{\ }$, $\sqrt[3]{\ }$, 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: $2\sqrt{3}$, Alog2 etc.

⑧ Permutation and combination: nPr, nCr

⑨ ×, ÷

⑩ +, −

* Operations of the same precedence are performed from right to left. $e^x\ln\sqrt{\ }120 \rightarrow e^x\{\ln(\sqrt{\ }120)\}$
Other operations are performed 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 nine 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.

Example:

$2 \times ((3 + 4 \times (5 + 4) \div 3) \div 5) + 8 =$

① ② ③ ④ ⑤

[1] [2] [3] [4] [5] [6] [7]

Numeric Stack

①	2
②	3
③	4
④	5
⑤	4
⋮	

Command Stack

[1]	×
[2]	(
[3]	(
[4]	+
[5]	×
[6]	(
[7]	+
⋮	

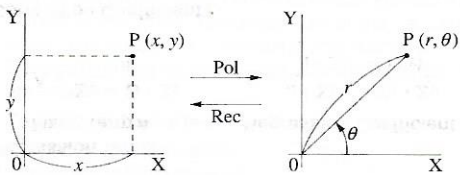
- Calculations are performed in sequence according to the order of operations described on page 45. Commands and values are deleted from the stack as the calculation is performed.

■ Formulas, Ranges, and Conventions

The following are the formulas, ranges, and conventions that are applied to various calculations that can be performed using this calculator.

Coordinate Transformation

- With polar coordinates, θ can be calculated within a range of $-180° < \theta \leq 180°$. The calculation range is the same for radians and grads.



Permutation

- Input range: $n \geq r \geq 0$ (n, r : integers)
- Formula: ${}_nP_r = \dfrac{n!}{(n-r)!}$

Combination

- Input range: $n \geq r \geq 0$ (n, r : integers)
- Formula: ${}_nC_r = \dfrac{n!}{r!(n-r)!}$

Population Standard Deviation

$$\sigma_n = \sqrt{\frac{\sum_{i=1}^{n}(xi-\bar{x})^2}{n}} = \sqrt{\frac{\Sigma x^2-(\Sigma x)^2/n}{n}}$$

Sample Standard Deviation

$$\sigma_{n-1} = \sqrt{\frac{\sum_{i=1}^{n}(xi-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2-(\Sigma x)^2/n}{n-1}}$$

Arithmetic Mean

$$\bar{x} = \frac{\sum_{i=1}^{n} xi}{n} = \frac{\Sigma x}{n}$$

Regression Terms

Fixed Term A

$$A = \frac{\Sigma y - B \cdot \Sigma x}{n}$$

Regression Coefficient B

$$B = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{n \cdot \Sigma x^2 - (\Sigma x)^2}$$

Correlation Coefficient *r*

$$r = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{\{n \cdot \Sigma x^2 - (\Sigma x)^2\}\{n \cdot \Sigma y^2 - (\Sigma y)^2\}}}$$

Estimated Value of *y*

$$\hat{y} = A + Bx$$

Estimated Value of *x*

$$\hat{x} = \frac{y - A}{B}$$

■ Power Supply

The type of batteries you should use depends on the model number of your calculator.

The fx-350W/fx-270W/fx-83W is powered by two G13 type (LR44) button type batteries, and the fx-82W is powered by two AA-size batteries.

• Replacing Batteries

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

• To replace batteries

<fx-350W/fx-270W/fx-83W>

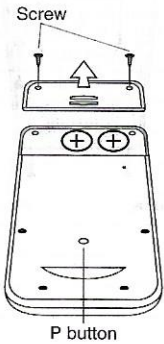
① Press [OFF] to turn power off.

② Remove the two screws that hold the battery cover in place and then remove the battery cover.

③ Remove the old batteries.

④ Wipe off the sides of two new batteries with a dry, soft cloth. Load them into the unit with their positive ⊕ side facing up (so you can see them).

⑤ Replace the battery cover and secure it in place with the two screws.



⑥ Use a thin, pointed object to press the P button. Be sure not to skip this step.

⑦ Press [ON] to turn power on.

<fx-82W>

① Press [OFF] to turn power off.

② Remove the six screws that hold the back cover in place and then remove the back cover.

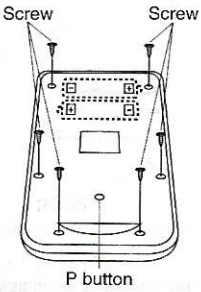
③ Remove the old batteries.

④ Load two new batteries into the unit so their positive ⊕ and negative ⊖ sides are facing correctly.

⑤ Replace the back cover and secure it in place with the six screws.

⑥ Use a thin, pointed object to press the P button. Be sure not to skip this step.

⑦ Press [ON] 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] to turn power back on.

■ Input Ranges

Internal digits: 12
Accuracy: As a rule, accuracy is ±1 at the 10th digit.

Functions	Input Range	
		However, for tan x:
$\sin x$	(DEG) $\lvert x\rvert<9\times10^{9}$	$\lvert x\rvert\neq 90(2n+1)$:DEG
$\cos x$	(RAD) $\lvert x\rvert<5\times10^{7}\pi$ rad	$\lvert x\rvert\neq \pi/2\cdot(2n+1)$:RAD
$\tan x$	(GRA) $\lvert x\rvert<1\times10^{10}$ grad	$\lvert x\rvert\neq 100(2n+1)$:GRA
$\sin^{-1}x$ $\cos^{-1}x$	$\lvert x\rvert\leq 1$	
$\tan^{-1}x$	$\lvert x\rvert< 1\times10^{100}$	
$\sinh x$ $\cosh x$	$\lvert x\rvert\leq 230.2585092$	For sinh and tanh, errors are cumulative and accuracy is affected at a certain point when x=0.
$\tanh x$	$\lvert x\rvert< 1\times10^{100}$	
$\sinh^{-1}x$	$\lvert x\rvert< 5\times10^{99}$	
$\cosh^{-1}x$	$1\leq x< 5\times10^{99}$	
$\tanh^{-1}x$	$\lvert x\rvert< 1$	
$\log x/\ln x$	$1\times10^{-99}\leq x< 1\times10^{100}$	
10^{x}	$-1\times10^{100}< x< 100$	
e^{x}	$-1\times10^{100}< x\leq 230.2585092$	
$\sqrt{x}$	$0\leq x< 1\times10^{100}$	
x^{2}	$\lvert x\rvert< 1\times10^{50}$	
$1/x$	$\lvert x\rvert< 1\times10^{100}$; $x\neq 0$	

Functions	Input Range
$\sqrt[3]{x}$	$\|x\| < 1\times10^{100}$
$x!$	$0 \le x \le 69$ (x is an integer)
$n\mathrm{P}r$/$n\mathrm{C}r$	Result$<1\times10^{100}$ (n and r are integers) $0 \le r \le n$ $n<1\times10^{10}$
Pol(x, y)	$\sqrt{x^2+y^2}<1\times10^{100}$
Rec(r, θ)	$0 \le r < 1\times10^{100}$ However, for $\tan\theta$: (DEG) $\|\theta\|<9\times10^{9}$ $\|\theta\| \neq 90(2n+1)$:DEG (RAD) $\|\theta\|<5\times10^{7}\pi$ rad $\|\theta\| \neq \pi/2\cdot(2n+1)$:RAD (GRA) $\|\theta\|<1\times10^{10}$ grad $\|\theta\| \neq 100(2n+1)$:GRA
°' "	$\|a\|, b, c < 1\times10^{100}$ $0 \le b, c$
$\overleftarrow{\text{°' "}}$	$\|x\| < 2.777777777\times10^{96}$ Decimal ↔ Sexagesimal Conversions $\|x\| \le 2777777.777$
x^y	$x>0$: $-1\times10^{100}<y\log x<100$ $x=0$: $y>0$ $x<0$: $y=n$, $\frac{1}{2n+1}$ (n is an integer) However: $-1\times10^{100} < y\log\|x\|<100$

Functions	Input Range
$\sqrt[x]{y}$	$y>0$: $x \neq 0$ $-1\times10^{100}<1/x\log y<100$ $y=0$: $x>0$ $y<0$: $x=2n+1, \frac{1}{n}$ ($n \neq 0$; n is an integer) However: $-1\times10^{100} < 1/x\log\|y\|<100$
$a^b/_c$	Total of integer, numerator, and denominator must be 10 digits or less (including division marks).
SD (LR)	$\|x\| < 1\times10^{50}$ $\|y\| < 1\times10^{50}$ $\|n\| < 1\times10^{100}$ $x\sigma_n$, $y\sigma_n$, $\bar{x}$, $\bar{y}$ A, B, r : $n \neq 0$ $x\sigma_{n-1}$, $y\sigma_{n-1}$: $n \neq 0, 1$

* Erros are cumulative with such internal continuous calculations as x^y, $\sqrt[x]{\ }$, $x!$, and $\sqrt[3]{x}$, so accuracy may be adversely affected.

Specifications

Power Supply:

fx-350W/fx-270W/fx-83W:
Two G13 Type button batteries (LR44)

fx-82W: Two AA-size batteries (R6P (SUM-3))

Battery Life:

fx-350W/fx-270W/fx-83W:
Approximately 1,700 hours continuous display of flashing cursor.
Approximately 3 years when left with power turned off

fx-82W: Approximately 17,000 hours continuous display of flashing cursor.
Approximately 2 years when left with power turned off

Dimensions:

fx-350W/fx-270W/fx-83W:
10(H)×76(W)×150(D) mm
$3/8$″(H)×3″(W)×$5\,7/8$″(D)

fx-82W: 19(H)×76(W)×164(D) mm
$3/4$″(H)×3″(W)×$6\,7/16$″(D)

Weight:

fx-350W/fx-270W/fx-83W:
93g (3.3oz) including batteries

fx-82W: 133.5g (4.7oz) including batteries

Power Consumption: 0.0014W

Operating Temperature: 0°C ~ 40°C (32°F ~ 104°F)

MEMO