SCIENTIFIC CALCULATOR USER'S MANUAL	Contents Two-line Display 1 Before getting started 1 KModes 1 Input Capacity 2 Making Corrections During Input 2 Replay Function 3 Error Locator 3 KMulti-statements 3 Exponential Display Formats 4 Decimal Point and Separator Symbols 4 Initializing the Calculator 5 Basic Calculations 5 Arithmetic Calculations 5 Fraction Operations 5 Percentage Calculations 7 Degrees, Minutes, Seconds Calculations 8 FIX, SCI, RND 9 Memory Calculations 10 Answer Memory 10 Consecutive Calculations 10 Independent Memory 10 Variables 11	Scientific Function Calculations 11 Trigonometric/Inverse Trigonometric Functions 12 Hyperbolic/Inverse Hyperbolic Functions 12 Common and Natural Logarithms/Antilogarithms 13 Square Roots, Cube Roots, Roots, Squares, Cubes, Reciprocals, Factorials, Random Numbers, π, and Permutation/Combination 13 Angle Unit Conversion 14 Coordinate Conversion (Pol (x, y), Rec (r, θ)) 14 Engineering Notation Calculations 15 Statistical Calculations 15 Standard Deviation 15 Regression Calculations 18 Technical Information 22 When you have a problem 22 Error Messages 22 Order of Operations 23 Stacks 25 Input Ranges 26	The two-line display makes it possible to view both the calculation formula and its result at the same time. The upper line shows the calculation formula. The lower line shows the result. A separator symbol is displayed every three digits when the integer part of the mantissa has more than three digits. Before getting started Modes Before starting a calculation, you must first enter the correct mode as indicated in the table below. To perform this type of calculation: key operation: this mode: key operation: this mode: key operation: calculation: key operation: this mode: standard deviation calculations mem 1 COMP Standard deviation mem 2 SD Regression calculations wey are described in the sections of this manual where they are actually used to change the calculator setup. In this manual, the name of the mode you need to enter in order to perform the calculations being described is indicated in the main title of each section. Example: Statistical calculations	Note! • To return the calculation mode and setup to the initial defaults shown below, press □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	■ Replay Function • Every time you perform a calculation, the replay function stores the calculation formula and its result in replay memory. Pressing the	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. • To change the exponential display format, press the less key a number of times until you reach the exponential display format setup screen shown below. Fix Sci Norm 1 2 3 or 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. • All of the examples in this manual show calculation results using the Norm 1 format. ■ Decimal Point and Separator Symbols You can use the display setup (Disp) screen to specify the symbols you want for the decimal point and 3-digit separator. • To change the decimal point and separator symbol setting, press the est ya number of times until you reach the setup screen shown below. □ isp 1 • Display the selection screen. □ Display the selection screen.
 Press the number key (1 or 2) that corresponds to the setting you want to use. 1 (Dot): Period decimal point, comma separator 2 (Comma): Comma decimal point, period separator Initializing the Calculator Perform the following key operation when you want to initialize the calculation mode and setup, and clear replay memory and variables. Imp (II) 3 (AII) ■ Basic Calculations Use the Imp (II) 4 (AII) Imp (III) 4 (AIII) 1 (AIIII) 1 (AIIIII) 1 (AIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	• Example 1: $\frac{2}{3} + \frac{1}{5} = \frac{13}{15}$ 2	• Mixed Fraction ← Improper Fraction Conversion • Example: 1	• Example 5: To discount the sum of 168, 98, and 734 by 20% (800) 168 98 734 20 50	■ FIX, SCI, RND • To change the settings for the number of decimal places, the number of significant digits, or the exponential display format, press the key a number of times until you reach the setup screen shown below. Fix Sci Norm 1 2 3 • Press the number key (1, 2, or 3) that corresponds to the setup item you want to change. ① (Fix): Number of decimal places ② (Sci): Number of significant digits ③ (Norm): Exponential display format • Example 1: 200 ÷ 7 × 14 = 200 ÷ 7 × 14 = 400. (Specifies three decimal places.) (Internal calculation continues 200 ÷ 7 = 28.571 using 12 digits.) ■ 14	Wemory Calculations COMP Use the	• Example: 23 + 9 = 32 53 - 6 = 47 -) 45 × 2 = 90 (Total) -11 • Variables • There are nine variables (A through F, M, X and Y), which can be used to store data, constants, results, and other values. • Use the following operation to delete data assigned to a particular variable: ① □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
■ Trigonometric/Inverse Trigonometric Functions • To change the default angle unit (degrees, radians, grads), press the lew key a number of times until you reach the angle unit setup screen shown below. Deg Rad Gra 1 2 3 • Press the number key (1, 2, or 3) that corresponds to the angle unit you want to use. (90° = $\frac{\pi}{2}$ radians = 100 grads) • Example 1: $\sin 63^{\circ}52'41'' = 0.897859012$ • Example 2: $\cos \left(\frac{\pi}{3} \text{ rad}\right) = 0.5$ • Example 2: $\cos \left(\frac{\pi}{3} \text{ rad}\right) = 0.5$ • Example 3: $\cos^{-1} \frac{\sqrt{2}}{2} = 0.25\pi \text{ (rad)} \left(=\frac{\pi}{4} \text{ (rad)}\right)$ • Example 4: $\tan^{-1} 0.741 = 36.53844577^{\circ}$ • Example 4: $\tan^{-1} 0.741 = 36.53844577^{\circ}$ • Example 5: $\sin 63^{\circ} 1.53846577^{\circ}$ • Example 6: $\sin 63^{\circ} 1.53846577^{\circ}$ • Example 7: $\sin 63^{\circ} 1.53846577^{\circ}$ • Example 8: $\sin 63^{\circ} 1.538846577^{\circ}$ • Example 9: $\sin 63^{\circ} 1.538846577^{\circ}$ • Example 1: $\sin 63^{\circ} 1.538866536$ • Example 2: $\sin 63^{\circ} 1.538866536$ • Example 3: $\cos 63^{\circ} 1.5388665$	■ Common and Natural Logarithms/ Antilogarithms • Example 1: $\log 1.23 = 0.089905111$ • Example 2: $\ln 90 (= \log_e 90) = 4.49980967$ $\ln 90 = 1$ • Example 3: $e^{10} = 22026.46579$ • Example 4: $10^{1.5} = 31.6227766$ • Example 5: $2^4 = 16$ ■ Square Roots, Cube Roots, Roots, Squares, Cubes, Reciprocals, Factorials, Random Numbers, π , and Permutation/Combination • Example 1: $\sqrt{2} + \sqrt{3} \times \sqrt{5} = 5.287196909$ • Example 2: $\sqrt[3]{5} + \sqrt[3]{-27} = -1.290024053$ • Example 3: $\sqrt[7]{123} (= 123^{\frac{1}{7}}) = 1.988647795$ • Example 4: $123 + 30^2 = 1023$ • Example 5: $12^3 = 1728$ • Example 6: $\frac{1}{3} - \frac{1}{4}$ • Example 7: $8! = 40320$ • Example 8: To generate a random number between 0.000 and 0.999 • Table 1.23 = 1.24 • Example 8: To generate a random number between 0.000 and 0.999	 Example 9: 3π = 9.424777961 Example 10: 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). (840) Temple 11: To determine how many different 4-member groups can be organized in a group of 10 individuals (210) 10	 Example 2: To convert rectangular coordinates (1, √3) to polar coordinates (r,θ) (Rad)	To recall this type of value: $\Sigma \chi^2$ $\Sigma \chi$ $\pi \eta \text{sum} \text{sum} 2$ $\pi \eta \text{sum} \text{sum} 2$ $\pi \eta \text{sum} \text{sum} 2$ $\pi \chi G \eta \text{sum} \text{sum} 2$ $\chi G \eta \text{sum} 3$ $\chi G \eta \text{sum} 2$ $\chi G \eta \text{sum} 2$ $\chi G \eta \text{sum} 2$ $\chi G \eta \text{sum} 3$ $\chi G \eta \text{sum} 2$ $\chi G \eta \text{sum} 3$ $\chi G \eta 3$ $\chi G \eta$	 You can then edit the displayed data, if you want. Input the new value and then press the key to replace the old value with the new one. This also means that if you want to perform some other operation (calculation, recall of statistical calculation results, etc.), you should always press the key first to exit data display. Pressing the key first to exit data display. Pressing the key instead of after changing a value on the display registers the value you input as a new data item, and leaves the old value as it is. You can delete a data value displayed using and by pressing cultiple be shifted up. Data values following it to be shifted up. Data values you register are normally stored in calculator memory. The message "Data Full" appears and you will not be able to input any more data if there is no memory left for data storage. If this happens, press the key to display the screen shown below. Edit OFF ESC	Regression Calculations Use the well key to enter the REG Mode when you want to perform statistical calculations using regression. REG
To recall this type of value: $\Sigma \chi^2$ $\Sigma \chi$ $\Sigma \chi^2$	• Example: Atmospheric Pressure vs. Temperature Temperature Atmospheric 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 coefficient of determination (r²) and sample covariance	• Logarithmic, Exponential, Power, and Inverse Regression • Use the same key operations as linear regression to recall results for these types of regression. • The following shows the regression formulas for each type of regression. Logarithmic Regression y = A + B · ln x Exponential Regression y = A · e ^{B·x} (ln y = ln A + Bx) Power Regression y = A · x ^B (ln y = ln A + Bln x) Inverse Regression y = A · x ^B (ln y = ln A + Bln x) Inverse Regression y = A · B · 1/x • Quadratic Regression • The regression formula for quadratic regression is: y = A + Bx + Cx ² . • Example: Xi	Data Input Precautions • ② ③ ③ ① ① Inputs the same data twice. • You can also input multiple entries of the same data using ② To input the data "20 and 30" five times, for example, press 20 ③ 30 ③ 5 ⑤ ①. • The above results can be obtained in any order, and not necessarily that shown above. • Precautions when editing data input for standard deviation also apply for regression calculations. Technical Information ■ When you have a problem If calculation results are not what you expect or if an error occurs, perform the following steps. 1. Press ③ ② ② (Mode) ⑤ 10 initialize all modes and settings. 2. Check the formula you are working with to confirm it is correct. 3. Enter the correct mode and try performing the calculation again. If the above steps do not correct the problem, press the ③ key. The calculator performs a self-check operation and deletes all data stored in memory if any abnormality is detected. Make sure you always keep written copies of all important data. ■ Error Messages The calculator is locked up while an error message is on the display. Press ⑥ 10 clear the error, or press ⑥ 10 for ⑥ 10 to display the calculation and correct the problem. See "Error Locator" for details. Math ERROR • Causes • Calculation result is outside the allowable calculation range. • An attempt to perform a function calculation using a value that exceeds the allowable input range. • An attempt to perform an illogical 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. Stack ERROR Cause The 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. Syntax ERROR Cause An attempt to perform an illegal mathematical operation. Action Press or to display the calculation with the cursor located at the location of the error and make required corrections. Arg ERROR Cause Improper use of an argument Action Press or to display the location of the cause of the error and make required corrections. Order of Operations Calculations are performed in the following order of precedence. Coordinate transformation: Pol (x, y), Rec (r, θ) Type A functions: With these functions, the value is entered and then the function key is pressed. x², x², x⁻, x¹, x!, ∞¹ " x², x̂₁, x̂₂, y² Angle unit conversions (DRG▶) 	 ③ Powers and roots: ^(x²), ³√ ④ a²/c ⑤ Abbreviated multiplication format in front of π, e (natural logarithm base), memory name, or variable name: 2π, 3e, 5A, πA, etc. ⑥ Type B functionss. With these functions, the function key is pressed and then the value is entered. √ , ³√ , log, ln, e², 10², 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√3, Alog2, etc. ⑧ Permutation and combination: nPr, nCr ⑨ x, ÷ ⑩ +, - • Operations of the same precedence are performed from right to left. e²ln √ 120 → e²{ln(√120)} • Other operations are performed from left to right. • Operations enclosed in parentheses are performed first. • When a calculation contains an argument that is a negative number, the negative number must be enclosed within parentheses. The negative sign (-) is treated as a Type B function, so particular care is required when the calculation includes a high-priority Type A function, or power or root operations. Example: (-2)⁴ = 16 −2⁴ = −16 	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 (Stack ERROR) occurs whenever you try to perform a calculation that is so complex that the capacity of a stack is exceeded. • Example: 2 × ((3 + 4 × (5 + 4) ÷ 3) ÷ 5) + 8 = 1
Input Ranges Internal digits: 12 Accuracy*: As a rule, accuracy is ± 1 at the 10th digit. Functions	Functions	67-CS183-17A				