

**Professional calculator for
the scientist, engineer
and mathematician**



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International
Corporation**

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Instruction Manual for:

Summit S190

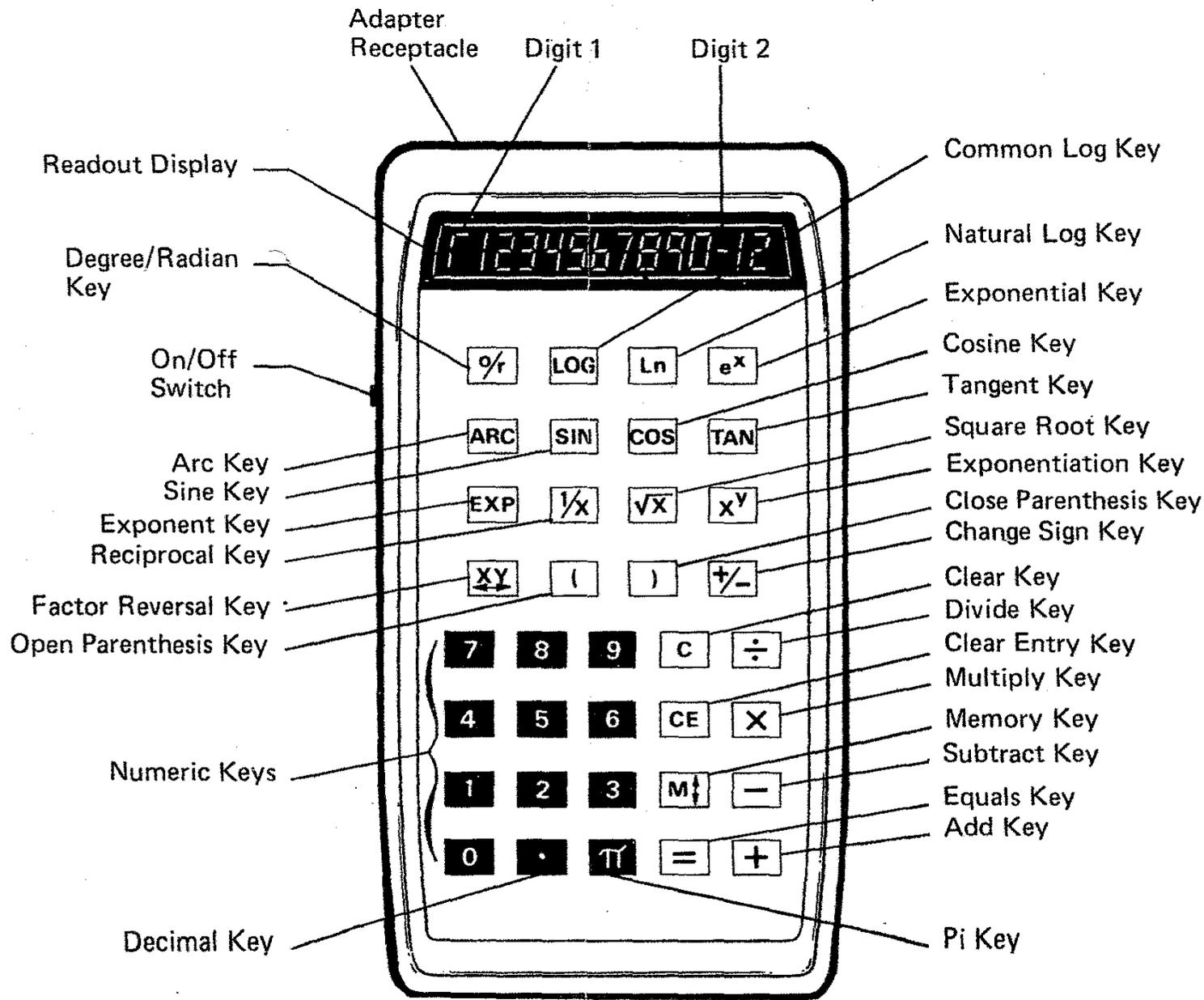


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INTRODUCTION

The SI-90 has been designed to put a fast, simple to operate and accurate scientific calculator into a functional and attractive case.

The calculator is capable of performing calculations of all types. The four basic arithmetic functions, ten transcendental functions, two convenience functions, and chain calculations, using any combination of the others, are all computed with speed and accuracy. All entries are limited to the range of numbers whose absolute value is no more than $9.999999999 \times 10^{99}$ and no less than 1×10^{-99} . Results outside this range of numbers are considered overflow (underflow) and are explained in the Calculation Instructions, page 10. Zero, though outside this range, is acceptable as both an entry and a result.

The case is well suited for both hand-held and desk-top use. The readout size, readout location, keyboard arrangement, overall case size and colors were all carefully chosen to arrive at the attractive and functional design used.

To get the full use of your Scientific Calculator, please read this manual carefully for instruction on care, operation, and full potential usage.

In the event that it should fail to operate properly, take the following steps:

Plug in the AC Adapter/Charger as explained in Battery/AC Operation, page 3. Allow battery pack to charge or operate directly from the AC Adapter/Charger. A dead or weak battery is the most common cause of malfunctions.

Check your procedures with the operating section of this manual.

Should you still have difficulty, read the warranty section for factory repair. We'll be glad to make it work for you.

By treating the SI-90 Scientific Calculator with the respect due any fine instrument, you can expect years of accurate, dependable service and you will find it useful as a constant companion.

FEATURES

1. The components used in SI-90 have been especially designed to give unsurpassed reliability.
2. The SI-90 will perform the following calculations:
 - Four basic arithmetic functions;
 $+$, $-$, \times , \div
 - Ten transcendental functions;
 \sin , \cos , \tan , \sin^{-1} , \cos^{-1} , \tan^{-1} , \log , \ln , e^x , X^Y
 - Two convenience functions;
 $1/x$, \sqrt{x}
 - Chain calculations using any or all of the possible functions.
3. Algebraic logic, two parentheses levels, and a factor reversal key simplify problem entry.
4. Direct π entry.
5. Degree or radian selection for calculation of transcendental functions.
6. The display contains a ten digit mantissa (with sign) and two digit exponent (with sign).
7. All entries and results are accurate to ten significant digits.
8. Numbers over ten digits long are entered using scientific notation.
9. Results over ten digits long are displayed in scientific notation.
10. The SI-90 will operate from the permanent battery pack or from an AC adapter/charger (supplied with calculator). Operation for both is explained on page 3.

11. To save power the display will blank out during all calculations, or if no keys are depressed after approximately 30 seconds.
12. There are special indications for display blanking, negative numbers, negative exponents, errors, and the radian mode of calculations. (See Display Indications, page 5.)

BATTERY/AC OPERATION

Battery Operation

The SI-90 is equipped with a rechargeable battery pack which will supply about four hours of operation time when fully charged. To operate, simply push the Power Switch (left side of case) to the ON position, and follow the Calculation Instructions, page 10. When the batteries are too low to provide reliable calculations, the display will totally blank out. The display also blanks temporarily during calculations to save power, but will return immediately upon completion of the calculation.

To recharge the batteries, first plug the AC Adapter/Charger into an electrical outlet. Then with the Power Switch in the OFF position, plug the Adapter/Charger into the receptacle in the top of the calculator (see Foldout, inside front cover.) The Power Switch may then be pushed to ON, if desired. The batteries will charge irrespective of the Power Switch position (ON or OFF). A completely dead battery requires 14 hours for a full charge. There is no danger of an overcharge, however, so over night charging is permissible. Also, there is no need to wait until the battery pack is dead, you can recharge it whenever you have a chance.

You may replace a faulty battery pack, after the warranty period, instead of sending the unit into a service center. Extra battery packs are available and can be purchased from Summit International. Each battery pack comes with easy to follow installation instructions.

CAUTION: Even momentary reversal of the battery terminal hookup may cause serious damage to the calculator. Read ALL instructions and cautions BEFORE attempting to replace battery pack.

To order, write to: Summit International Corporation
P.O. Box 15736
Salt Lake City, Utah 84115

Ask for Battery Pack Assembly, 03-01361-001 and enclose a check or money order for \$8.95.

AC Operation

The SI-90 can be operated from an AC Source with the AC Adapter/Charger. Since there is no danger of an overcharge, you can use this type of operation as much as you like. This will also keep the battery pack charged and ready for use.

To operate from the AC Source, plug in the Adapter/Charger into an electrical outlet. Then with the Power Switch in the OFF position, plug the Adapter/Charger into the receptacle in the top of the calculator (See Foldout). Push the Power Switch to ON and follow the Calculation Instructions, page 10.

Exponentiation Key Causes execution of any prior command and is stored as a exponentiation command.

Common Log Key Causes immediate execution of the common log function of the display, and displays the result.

Natural Log Key Causes immediate execution of the natural log function of the display and displays the result.

Natural Anti-Log Key Causes immediate execution of the e^x function of the display and displays the result.

Square Root Key Causes immediate execution of the square root function of the display and displays the result.

Reciprocal Key Causes immediate execution of the reciprocal function of the display and displays the result.

Sine Key Causes immediate execution of the sine function of the display and displays the result.

Cosine Key Causes immediate execution of the cosine function of the display and displays the result.

Tangent Key Causes immediate execution of the tangent function of the display and displays the result.

Equal Key Causes execution of any prior function and the display of the final problem result.

Memory Key Normally, when depressed causes recall and display of the data stored in the memory register. (Also see Memory, page 19.)

ARC Key When depressed prior to the sin, cos, or tan key, conditions calculator to perform the \sin^{-1} , \cos^{-1} , or \tan^{-1} functions.

Open Parenthesis Key Causes storage of any intermediate result and prior function. Conditions the calculator to execute a sub-problem within a parentheses pair. Trying to open more than two parentheses levels causes display of the error indication.

Close Parentheses Key Causes execution of a prior function and display of the result of the sub-problem within a parentheses pair. Causes recall of the intermediate result and prior function stored at the time \square was depressed.

Clear Key Clears all of the calculator registers, except the memory register. (See Memory, page 19.)

Clear Entry Key Clears the display register only and permits a new number entry to begin.

Degree/Radian Key Allows selection of either degree or radian calculations for the trigonometric functions. Each depression of the key changes the calculation mode.

Factor Reversal
Key

Exchanges the contents of the X and Y registers (see Calculation Instructions, page 10). Each depression of the key exchanges the contents of the two registers.

CALCULATION INSTRUCTIONS

The SI-90 will swiftly and accurately solve calculations of all types, from simple addition to complex multi-step calculations. However, just as in computers even the simplest of problems must be entered correctly to obtain accurate results. (Garbage-In-Garbage-Out Theory.)

The entry sequence for the SI-90 is quite simple and uses algebraic logic. Many calculations are accomplished using just two registers, the X register (or display) and the Y register. However, a memory, scientific notation, the ability to reverse the X and Y registers, and two parenthesis levels are available for use and thereby expand the range of calculations possible with the SI-90.

The first step is to turn the calculator on, the display will read 0. and all registers will be blank. Numbers are entered by depressing the respective numeric keys in the order you would read them (left to right).

Enter	Display
$\boxed{1} \boxed{2} \boxed{3}$	123.

The decimal is entered as if it were a digit in the number.

$\boxed{\cdot} \boxed{4} \boxed{5} \boxed{6}$	123.456
---	---------

Negative numbers are entered by depressing $\boxed{+/-}$ before, after, or during the number entry.

$\boxed{+/-} \boxed{7} \boxed{8}$	-123.45678
-----------------------------------	------------

Each depression of $\boxed{+/-}$ during the entry will change the sign. The entry is terminated by depressing a function key or beginning an exponent entry (Scientific Notation).

$\boxed{+/-} \boxed{9} \boxed{0}$	123.4567890
-----------------------------------	-------------

If the entry is to be in Scientific Notation, after entering the entire mantissa, including the sign, depress **[EXP]** to begin the exponent entry.

[EXP] 123.4567890 00

Then depress the desired numeric keys.

[8] [0] 123.4567890 80

A negative exponent is entered just like a negative number. Depress **[+/-]** anytime after depressing **[EXP]** and before depressing a function key.

[+/-] 123.4567890 -80

Each depression of **[+/-]** will change the sign of the exponent. The exponent value is changed by depressing new numeric keys. The two digits most recently entered are retained as the exponent value

[7] 123.4567890 -07

[+/-] 6 123.4567890 76

The entry is terminated by the depression of any function key. Terminating the entry causes the number to be displayed in proper scientific notation.

[=] (i.e.) 1.23456789 78

Entries acceptable by the SI-90 are limited to those numbers whose absolute value is between $9.999999999 \times 10^{99}$ and 1×10^{-99} . Zero (0) though outside this range, is also acceptable as an entry. Entry of any unacceptable number will cause display of the Error Indication (Display Indications, page 5).

[.] [1] [EXP] [9] [9] [+/-] [=] [] 0.

Turn the calculator OFF.

Turning the calculator off while its not in use, will often allow you an entire day of operation using just the batteries.

Calculation results which fall outside the range of acceptable entries will also trigger the Error Indication. Those results above the acceptable range are considered Overflow, those below are Underflow. The Error Indication is displayed along with the incomplete calculation result. The result is completed by adding a one (1) to the front of the displayed exponent. (i.e. $\int 1.23 -25$ is read as 1.23×10^{-125})

There is a third condition that will cause display of the Error Indication. Entries for certain functions are mathematically limited to a range which is less than the entry range of the calculator. Trying to perform a function with an entry outside its range causes display of the Error Indication ($\int 0.$) The following is a list of functions and their limits:

Function	Unacceptable Range
Division	By 0
Reciprocal	Of 0
Square Root	Of a negative number
Ln X	when $x \leq 0$
Log X	when $x \leq 0$
e^x	when $x \geq 100\text{Ln}10$
Tan θ	when $ \theta = n (\pi/2 \text{ RAD})$ or $ \theta = n (90^\circ)$
$\sin^{-1} x$	when $ x > 1$
$\cos^{-1} x$	when $ x > 1$
X^Y	when $y > \frac{100\text{Ln}10}{\text{Ln } x}$ or $x \leq 0$

In each case the indication must be cleared before any further entries or calculations are possible. Clearing is accomplished by depressing **C**, this clears all of the calculator registers except the Memory (see Memory, page 19).

Should an error be made during an entry, the entry can be cleared and corrected. Just depress **CE** and then re-enter the correct entry. This Clear Entry key affects only the display (X register) and does not change the data in the Y register.

Of the sixteen basic functions possible with the SI-90, eleven (\sqrt{x} , $1/x$, log, ln, e^x , sin, cos, tan, \sin^{-1} , \cos^{-1} , and \tan^{-1}) use only the number in the display at the time the function key (keys) is depressed. Execution is immediate and the result is displayed without affecting the other registers at all. Beginning a new entry clears the display. Push the Power Switch to ON and do the following examples.

EXAMPLES:

	Enter	Display
Squareroot		
$\sqrt{25}$	2 5	25.
	\sqrt{x}	5.
Reciprocal		
$1/25$	2 5	25.
	$1/x$	0.04
Common Logarithm		
$\log 72$	7 2	72.
	LOG	1.857332496

Natural Logarithm

$\ln 10$	1 0	10.
	Ln	2.302585093

Exponential (Natural Antilog)

$e^x 32$	3 2	32.
	e^x	7.896296017 13

Sine

NOTE: All angle entries must be in decimal degrees.

$\sin 5^\circ 45'$ (5.75°)	5 . 7 5	5.75
	SIN	0.100188061

Cosine

$\cos 7^\circ 45'$ (7.75°)	7 . 7 5	7.75
	COS	0.990865897

Tangent

$\tan 120^\circ 30'$ (120.5°)	1 2 0 . 5	120.5
	TAN	-1.69766312

Arc Sine

NOTE: All angle results are in decimal degrees.

$\sin^{-1} .7071$. 7 0 7 1	0.7071
	ARC SIN	44.9994505

Enters number into display.

$\boxed{-}$ 75.

Enters display into Y register and stores a subtract command.

$\boxed{6}$ 6.

Enters number into display.

$\boxed{)}$ 69.

Completes calculations within this parentheses pair (second), returns the contents of the Y register and the function at the time this parentheses pair was opened. (10.÷)

Contents of the Y register may be checked by depressing

$\boxed{X \leftrightarrow Y}$
 $\boxed{X \leftrightarrow Y}$ 10.

This stores the contents of the display (69.) into the Y register, and displays the old contents of the Y register (10.). Depressing the Reversal Key a second time returns the 69. to the X register and the 10. to the Y register.

$\boxed{X \leftrightarrow Y}$ 69.

$\boxed{)}$ 1.449275362 -01

Completes calculations within the first parenthesis pair, returns the contents of the Y register and the function stored at the time this parentheses pair was opened. (31.70790533,x)

$\boxed{=}$ 4.595348598

This completes the multiply command previously entered and displays the result. A new calculation may begin at this point by entering a new number. Or the calculation can continue by depressing a new function key.

$\boxed{\text{LOG}}$ 6.623184622 -01.

Executes log function of display and displays the result.

$\boxed{1/X}$ 1.509847689

Executes reciprocal function of display and displays the result. Turn the calculator OFF.

This example could go on until every function on the keyboard was used several times. Hopefully, this has been enough to show you how to enter a problem. Written Algebraically the equation you have completed is:

$$\log \left[\frac{1}{(\sqrt{175.24} + 19 - \sin 32^\circ) \times \left(\frac{10}{75-6}\right)} \right]$$

Often times trigonometric functions are calculated using Radians instead of Degrees. If you desire this mode of calculation, simply depress $\boxed{\text{O/r}}$. A special indication (Display Indications, page 5) will appear, and remain until you again Press $\boxed{\text{O/r}}$. As long as this indication is in the display all angle entries must be in Radians and all angle results will be in Radians.

MEMORY

The memory used in the SI-90 is controlled by a single key, **M**. Contents of the memory are recalled when **M** is depressed at anytime, except right after the **=**. Depression of **M** immediately following **=** enters the display into the memory, replacing the previous contents. The memory is not affected by either **C** or **CE**. To clear the memory use the key sequence **0** **=** **M** or turn the calculator OFF then ON.

Enter	Display
2 =	2.
M Enters Memory	2.
C	0.
M Recalls Memory	2.
+ 7 5 =	77.
M Enters New Memory	77.
C	0.
M Recalls Memory	77.

PRACTICAL EXAMPLES

The following examples are shown with one way to solve them. This is not necessarily the only key sequence that will arrive at the correct answer. As you come to understand the entry procedure better, you may see different ways to solve these equations.

If \$10.00 is deposited at 6% interest compounded annually, what is the total amount at the end of 12 years?

$$\text{Value} = (1 + \text{Rate})^{\text{No. of years}} \times \text{Principle}$$

Enter	Display	Remarks
1 . 0 6	1.06	1 + Rate
XY	1.06	
1 2	12.	No. of years
X	2.01219646	
1 0	10.	Principle
=	20.1219646	

After 12 years you would have \$20.12.

If a company had a gross sales of \$102 million in 1968 and sales increased to \$185 million in 1973 (5 years later), what is the growth rate compounded annually? Use the formula:

$$\% \text{ Rate} = \left[\left(\frac{\text{Final Sales}}{\text{Initial Sales}} \right)^{1/\text{years}} - 1 \right] \times 100$$

$$\% \text{ Rate} = \left[\left(\frac{\$185 \text{ Million}}{\$102 \text{ Million}} \right)^{1/5} - 1 \right] \times 100$$

Enter	Display	Remarks
1 8 5 EXP 6	185.06	Final Sales
÷	185000000.	

102. 06 Initial Sales
 1.81372549
 5. No. of years
 0.2
 1.1264562
 1.
 0.1264562
 100.
 12.64562

The annual growth rate is 12.6% (Approx).

If your income in 1966 was \$6,240 and in 1973 (7 years later) it had increased to \$10,150, what was your annual growth rate? Was it above or below the average inflationary rate of 5.5%?

$$\% \text{ Rate} = \left[\left(\frac{\text{Current Annual Income}}{\text{Initial Annual Income}} \right)^{1/\text{Year}} - 1 \right] \times 100$$

$$\% \text{ Rate} = \left[\left(\frac{10,150}{6,240} \right)^{1/7} - 1 \right] \times 100$$

Enter	Display	Remarks
<input type="text" value("(""=""/>	0.	Opens first parentheses pair
<input type="text" value("(""=""/>	0.	Opens second parentheses pair

<input type="text" value="1"/> <input type="text" value="0"/> <input type="text" value="1"/> <input type="text" value="5"/> <input type="text" value="0"/>	10150.	Current Annual Income
<input type="text" value="÷"/>	10150.	
<input type="text" value="6"/> <input type="text" value="2"/> <input type="text" value="4"/> <input type="text" value="0"/>	6240.	Initial Income
<input type="text" value=")"/>	1.626602564	Completes calculations inside of second parentheses pair
<input type="text" value="XY"/>	1.626602654	
<input type="text" value="7"/>	7.	No. of years
<input type="text" value="1/X"/>	1.428571428 -01	
<input type="text" value="-"/>	1.07197106	
<input type="text" value="1"/>	1.	
<input type="text" value=")"/>	0.07197106	Completes calculations inside of first parentheses pair
<input type="text" value="X"/>	0.07197106	
<input type="text" value="1"/> <input type="text" value="0"/> <input type="text" value="0"/>	100.	
<input type="text" value="="/>	7.197106	Annual Growth Rate (%)
<input type="text" value="-"/>	7.197106	

5 . 5

5.5

Average Inflation Rate

=

1.697106

Percentage Points above average inflation rate (negative number indicates your income is below average inflation rate).

XY

2.295332588

2

2.

)

5.26855167

Completes calculations inside of second parentheses pair

=

5.26855167

(

0.

Opens second parentheses pair

3 - 1

3.1

+

3.1

. 9

0.9

÷

4.

π

3.141592654

XY

1.273239544

2

2.

)

1.62113893

Completes calculations inside second parentheses pair

)

3.64741274

Completes calculations inside first parentheses pair

√X

1.90982008

Solve the following in Radians:

$$\left(\sin \frac{1}{\sqrt{\left(\frac{7.0 + 0.211}{\pi}\right)^2 - \left(\frac{3.1 + .9}{\pi}\right)^2}} \right)^3$$

Enter	Display	Remarks
(0.	Opens first parentheses pair
(0.	Opens second parentheses pair
7	7.	
+	7.	
. 2 1 1	0.211	
÷	7.211	
π	3.141592654	

$1/X$	5.0236095328 -01
o/r	\ 5.0236095328 -01 Selects radian mode for further calculations
SIN	\ 0.500009314
XY	\ 0.500009314
3	\ 3.
$=$	\ 0.125006985

Solve the following in degrees:

$$\left(\sin \frac{1}{\sqrt{\left(\frac{5+2}{900}\right) - \left(\frac{9-3}{900}\right)}} \right)^3$$

Enter	Display	Remarks
o/r	0. .	Return calculations to degree mode
5	5.	
$+$	5.	
2	2.	
\div	7.	
9 0 0	900.	
$-$	7.77777777 -03	

$($	0.	Opens first parentheses pair
9	9.	
$-$	9.	
3	3.	
\div	6.	
9 0 0	900.	
$)$	6.66666666 -03	Completes calculations inside the first parentheses pair
$=$	1.11111111 -03	
\sqrt{x}	3.33333333 -02	
$1/X$	30.	
SIN	0.499999999	
XY	0.499999999	
3	3.	
$=$	0.124999999	

Solving Hyperbolic Functions

$$\text{Sinh } x = \frac{e^x - e^{-x}}{2}$$

$$\text{Cosh } x = \frac{e^x + e^{-x}}{2}$$

$$\text{Tanh } x = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

Assume $x = 0.3$

Enter

Display

\boxed{C} .0

$\boxed{-} \boxed{3} \boxed{=} \boxed{M\uparrow}$ 0.3

\boxed{C}

Sinh (0.3) $\boxed{M\uparrow} \boxed{e^x} \boxed{-} \boxed{M\uparrow} \boxed{+/-} \boxed{e^x} \boxed{\div} \boxed{2} \boxed{=} \quad 0.304520293$

\boxed{C}

Cosh (0.3) $\boxed{M\uparrow} \boxed{e^x} \boxed{+} \boxed{M\uparrow} \boxed{+/-} \boxed{e^x} \boxed{\div} \boxed{2} \boxed{=} \quad 1.045339514$

\boxed{C}

Tanh (0.3) $\boxed{M\uparrow} \boxed{e^x} \boxed{-} \boxed{M\uparrow} \boxed{+/-} \boxed{e^x} \boxed{\div}$

$\boxed{(} \boxed{M\uparrow} \boxed{e^x} \boxed{+} \boxed{M\uparrow} \boxed{+/-} \boxed{e^x} \boxed{)} \boxed{=} \quad 0.291312612$

Inverse Hyperbolic Sine

$$\text{Sinh}^{-1} x = \text{Ln} (x + \sqrt{x^2 + 1})$$

Assume $x = 2$

\boxed{C} 0.

$\boxed{2} \boxed{=} \boxed{M\uparrow}$ 2.

\boxed{C} 0.

$\boxed{M\uparrow} \boxed{+} \boxed{(} \boxed{M\uparrow} \boxed{x^y} \boxed{2} \boxed{+} \boxed{1}$

$\boxed{)} \boxed{\sqrt{x}} \boxed{=} \boxed{\text{Ln}}$ 1.443535475

CONSUMER WARRANTY

Summit International Corporation has taken utmost care to provide you with a high quality calculator. Your calculator has been tested to meet a rigid set of standards. It is warranted for One Year from date of purchase against defects in materials or workmanship as follows.

If your calculator proves defective in workmanship and/or materials, return it to:

Summit Service Center
170 West 2950 South
Salt Lake City, Utah 84115

In order to receive warranty service, please send your calculator postage paid and Insured and enclose a check or money order for \$3.00 to cover the handling charge, return postage and Insurance.

Your calculator will be repaired or replaced, whichever is necessary in the judgment of Summit International Corporation. You must identify the problem you are having with your unit. This warranty will be voided if the calculator has been subject to misuse or abuse, improper voltage, or has been tampered with or repaired by any unauthorized personnel or agency. The warranty does not cover replacement of expendable accessories.

This warranty is valid only for the original owner, and the warranty registration card must be completed and mailed to Summit International Corporation within ten (10) days from date of purchase.

The above warranty is in lieu of all other warranties, expressed, implied or statutory, including but not limited to any implied warranty of merchantability or fitness for a particular purpose and or any other warranty obligation on the part of seller.

AVAILABLE ACCESSORIES

Charger/Adapter	\$5.95
Carrying Pouch	\$2.00
Instruction Manual	\$1.00
Battery Pack Assembly, 03-01361-001	\$8.95

Send order with check or money order to:

SUMMIT INTERNATIONAL CORPORATION
P.O. Box 15736
Salt Lake City, Utah 84115

Note: All prices are subject to change without notice.