TO THE CONSUMER

FULL ONE YEAR WARRANTY

For one year from date of purchase. APF will repair defects in material or workmanship. free of charge. which appear in the operation of this electronic calculator. unless caused by damage resulting from corrosive leakage of batteries or from the unreasonable use of this product.

To obtain service under this warranty. return this calculator to your Dealer with evidence of date of purchase. or return it directly to APF Service. prepaid. with proof of purchase date.

OUT OF WARRANTY SERVICE. State the nature of your difficulty. As with any fine equipment. pack carefully and forward via insured. prepaid parcel post to:

APF SERVICE CENTER
43-17 Queens St.
Long Island City, N.Y. 11101

APF ELECTRONICS, INCORPORATED
New York, N.Y. 10022 Printed in Japan
PART NO. 0405152

APF APF APF APF

mark 51

scientific electronic calculator

operating instructions

APF ELECTRONICS INC. NEW YORK N.Y. 10022

SPECIFICATIONS AND FEATURES

- A.C. or Battery Operation
- Pocket Size, Yet Capable To Calculate Complex Scientific Problems
- Supplied With 9 Volt Battery
- Large Nine Digit, Easy To Read Fluorescent Type Display
- Algebraic Logic
- Scientific Notation—Enter Numbers Or Calculate Results From 10^{99} to 10^{-99}
- Convert Key—Changes Between Floating Point Notation And Scientific Notation.
- 5 Function, Full Accumulating Memory: M+, M−, MR, MC, X⇄M
- Transcendental Functions: Sin, Cos, Tan, Sin^{-1} Cos^{-1}, Tan^{-1}, Lnx, e^x
- Trig Functions Calculated In Radians Or Degrees
- $\sqrt{x}$ and 1/x Functions
- π Key
- Capability To Calculate $\sqrt[y]{x}$ and x^y
- Chain Calculations
- Automatic Power On Clear
- Trailing Zero Suppression
- Automatic Constant
- MOS/LSI Solid State Circuitry For Durability And Dependability
- Size: 1" x 3" x 5-½"
- Weight (With Battery): 8 ounces

INTRODUCTION

The APF Mark 51 Scientific Calculator utilizes recent developments in solid state integrated circuitry to provide a vast extension of conventional slide-rule capabilities, with far more accuracy. It is also more versatile, and it is compact enough to be pocketable. It replaces tedious and eye-straining correlation of finely inscribed slide-rule scales with a simpler touching of buttons on a keyboard. At the same time, it reduces determination of a numerical result to the reading of the result directly from a large, clear display.

To simplify operation, your calculator is programmed for "THINK AND TOUCH"—"THINK" the mathematical sequence and "TOUCH" the appropriate keys as you think.

Your calculator handles the 4 basic algebraic functions (addition, subtraction, multiplication, and division), as well as 11 scientific functions at the simple touch of keys.

It also provides a memory that eases progress through complex multiple-operation problems.

Entry numbers, or results can be displayed in either 8 digit floating decimal point format, or in scientific notation.

Although it was designed primarily for scientists and engineers, its price puts it well within the reach of students and schools and its power makes it invaluable for any commercial or industrial manager.

Please review the instructions in this booklet. Work through the examples illustrated, and within a very short time you will become proficient in using your new calculator.

SUGGESTED USES

School

Check Basic Arithmetic Away From Home
Budget • School Tuition
Slide Rule Calculations
Mathematics • Scientific Calculations

Business

Expense Report • Percentage Profit • Cost Analysis
Compound Interest • Payroll • Taxes • Invoicing
Engineering • Finance
Physics • Mathematics

Home

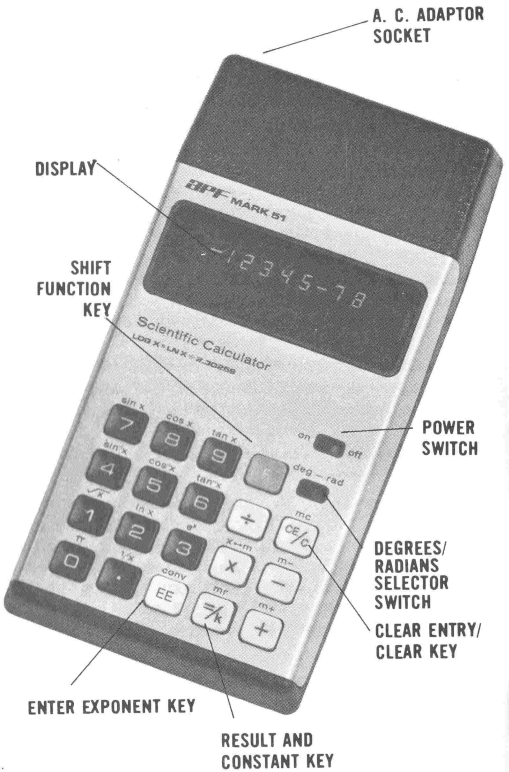
Budgets • Unit Pricing • Stock & Bond Investments
Interest Rate • Check Book Balancing
Clothing Invoices • Grocery Bills • Taxes

CONVENIENT, RAPID, ACCURATE. YOU'LL FIND MANY USES FOR YOUR ELECTRONIC CALCULATOR.

PORTABLE BATTERY OR A.C. OPERATION

- Your Portable Electronic Calculator is supplied with a 9 volt carbon zinc battery.
- When the battery is almost discharged a low battery warning signal will appear on the left side of the display [L]. To prevent improper calculations the battery must be replaced as soon as possible.
- To replace battery, slide the battery cover off the battery compartment, and CAREFULLY remove the battery. The battery cover is located on the underside of the calculator. Hold the battery in one hand and GENTLY unsnap the battery connector. Snap a new battery into the connector, replace in the battery compartment and slide the cover back in place.
- Note: To prevent damage to your calculator, remove a bad battery. Do not store your calculator for extended periods of time with a battery in the battery compartment.
- Under normal operating conditions a new 9 volt carbon zinc battery will provide about 6 to 10 hours of calculating time. A new 9 volt alkaline battery will provide about 20 hours of calculating time.
- To conserve battery life turn the calculator off when not in use.
- For A.C. operation, it will be necessary to use the optional model 710 or 751S A.C. adaptor, designed specifically for this calculator. Turn the power switch off, connect the adaptor to any convenient source of 110-120 volts A.C., and push the jack into the socket at the top side of the case. When the jack is inserted, the battery is automatically disconnected.

  NOTE: Use of any A.C. adaptor other than the type specifically designed for this calculator, may cause damage to the electronic circuits within the unit. See your Dealer for purchase of the proper A.C. adaptor.



I KEYS AND SWITCHES

POWER SWITCH—Turns the calculator "ON" or "OFF" Slide power switch to the left to turn on calculator. In the "ON" position, a red dot will be visible.

DEGREE/RADIAN—Calculate trigonometric or inverse trigonometric functions in degrees or radians.

In order to give your portable calculator maximum capability in a minimum size, 17 keys incorporate a SHIFT FUNCTION SYSTEM similar to a typewriter. THE CALCULATOR RESPONDS TO THE FUNCTION IMPRINTED ON THE KEYS IN THE UNSHIFTED MODE, AND THE FUNCTIONS ABOVE THE KEYS IN THE SHIFTED MODE.

NOTE: In all examples and explanations in this book [ ] shall represent the unshifted function and ■ the shifted function.

[F] - This is the calculator's SHIFT FUNCTION KEY. Touching the [F] key enables the dual function keys to respond to the shifted mode. The unshifted mode may be reestablished by touching any key, including the [F] key.

NOTE: Use of any shifted function must be preceded by touching the [F] key.

UNSHIFTED FUNCTIONS

NUMERIC KEYS—Standard 1 to 9 keyboard is provided as well as [0] and decimal point [.].

[CE/C] CLEAR ENTRY/CLEAR KEY—This key will clear the display of the last entry or result on the first push and on the second push will clear the calculator of all previous calculations. NOTE: FOR MEMORY CLEAR see page 8.

[+] [−] [×] [÷] OPERATE KEYS—These keys will perform any previous operation as well as instruct the calculator as to the next operation to be performed.

[=/K] RESULT KEY—At the conclusion of calculation, touching this key will immediately place the answer on the display. Also, this key operates the AUTOMATIC CONSTANT (K). (See pages 13 and 14).

[EE] Key—Sets the 2 right most digits to zero and prepares the calculator to accept the number in scientific notation.

SIGN CHANGE – To change the sign of the displayed number (+ to − or − to +) simply touch [−] [=/K] [=/K], then continue your calculation.

SHIFTED FUNCTIONS

NOTE: These Functions Must Be Preceded By Depressing the [F] Key

MEMORY OPERATIONS

MC or [F] [CE/C] MEMORY CLEAR—Clears the memory of all previous entries.

MR or [F] [=/k] MEMORY RECALL—Recalls the contents of the memory to the display and leaves the contents of the memory unchanged.

M+ or [F] [+] MEMORY PLUS—Adds the number on the display to the memory.

M− or [F] [−] MEMORY MINUS—Subtracts the number on the display from the memory.

X⇄M or [F] [X]—Exchanges the contents of the display and memory.

TRIGONOMETRIC FUNCTIONS

Sin x or [F] [7]—computes the "Sine" of the displayed number.

Cos x or [F] [8]—computes the "Cosine" of the displayed number.

Tan x or [F] [9]—computes the "Tangent" of the displayed number.

NOTE: The angle x (i.e., the displayed number) will be treated as in radians or degrees depending upon the position of the selector switch.

Sin^{-1}x or [F] [4]—computes the "Arc Sine" of the displayed number.

Cos^{-1}x or [F] [5]—computes the "Arc Cosine" of the displayed number.

Tan^{-1}x or [F] [6]—computes the "Arc Tangent" of the displayed number.

NOTE: The result will be displayed in radians or degrees depending upon the position of the selector switch.

NATURAL LOGARITHM AND ANTILOGARITHM

lnx or [F] [2]—computes the natural logarithm of the displayed number.

e^{x} or [F] [3]—computes the natural antilogarithm of the displayed number.

RECIPROCAL, SQUARE ROOT, PI AND CONVERT FUNCTIONS

1/X or [F] [•] —Computes the reciprocal of the displayed number.

$\sqrt{x}$ or [F] [1] —Computes the square root of the displayed number.

NOTE: To calculate $\sqrt[y]{x}$ or x^y see page 19.

π or [F] [0]—enters the value of Pi to eight significant digits.

Conv or [F] [EE]—will convert the displayed number to scientific notation if in floating point mode or, convert a floating point number to scientific notation.

DISPLAY INDICATORS

All indicators always appear in the left most digit.

− MINUS SIGN—Arithmetic sign of the mantissa.

E ERROR

I MEMORY INDICATOR The memory in use indicator will light when any number except zero is in the memory.

L LOW BATTERY INDICATOR A warning indicator is provided to advise when the battery should be changed. After the indicator goes on there is approximately 1 hour of calculating time remaining.

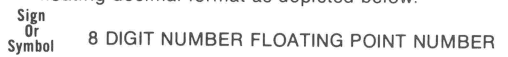
Note: When both a Low Battery and Memory in use condition occur simultaneously, an E will appear on the display.

F Indicates Shifted Function Mode. Note: The "F" indicator will flash while a shifted function calculation is in process. No keyboard entry can be made during this time.

II BASIC OPERATING INSTRUCTIONS

A. NUMBER ENTRY—Entered numbers or results can be displayed in the normal mode or the scientific mode.

1. NORMAL MODE
   This mode displays entries or results in an 8 digit floating decimal format as depicted below.



   Number entry will start in position D2, and each successive digit entered shall be to the right of the last entry.

NOTE: Always touch [CE/C] twice before starting a new calculation

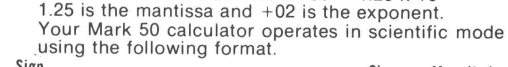
Example—Enter 12.3

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Touch	[1]		1.
Touch	[2]		12.
Touch	[.]		12.
Touch	[3]		12.3

2. SCIENTIFIC MODE
   Numbers can be represented by a series of digits (the mantissa) multiplied by 10 to a power (exponent).

   Example

   125. can be written as $1.25 \times 100 = 1.25 \times 10^2$
   1.25 is the mantissa and +02 is the exponent.
   Your Mark 50 calculator operates in scientific mode using the following format.



   The decimal point always is located between digits 2 and 3. To enter a number in scientific mode, perform the following steps.

1. Enter the sign of the mantissa (if negative)
2. Enter up to 8 digits of mantissa
3. Touch [EE] key
4. Enter the sign of the exponent (if negative)
5. Enter the exponent

Example—Enter 1.23×10^{-6}

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	1.23		1.23
Touch	[EE] [−]		1.23 -00
Enter	6		1.23 -06

3. NOTATION CONVERSION
   The sequence [F] [EE] will convert the displayed number to scientific mode, if it is in the "normal" mode, or it will display the 8 most significant digits of a scientific mantissa with the decimal point correctly located, and trailing zeros shall be blanked.

Example

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	12345		12345.
Touch	[F] CONV		1.2345 04
Touch	[F] CONV		12345.

B. SIMPLE ARITHMETIC

Your calculator uses "Algebraic" Logic. This means your calculator works the same way you think and entries are made the same way you write an algebraic equation.

Example 1: to calculate 9.2 − 2.1 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	9.2		9.2
Touch	[−]		9.2
Enter	2.1		2.1
Touch	[=/K]	Answer	7.1

Example No. 2: to calculate 9 + 17 + 32.5 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	9		9.
Touch	[+]		9.
Enter	17		17.
Touch	[+]		26.
Enter	32.5		32.5
Touch	[=/k]	answer	58.5

NOTE: Each time an operation key [+, −, ×, ÷,] is touched, the result of the previous calculation is displayed.

Example No. 3: to calculate 3 x 4 x 1.05 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	3		3.
Touch	[x]		3.
Enter	4		4.
Touch	[x]		12.
Enter	1.05		1.05
Touch	[=/k]	Answer	12.6

Example No. 4: to calculate 196 ÷ 7 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	196		196.
Touch	[÷]		196.
Enter	7		7.
Touch	[=/k]	Answer	28.

C. TO CLEAR AN INCORRECT ENTRY, USE THE [CE/C] KEY.

Example: To calculate 12 x 7 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	12		12.
Touch	[X]		12.
In error you enter 8			8.
"MISTAKE"		"MISTAKE"	
Touch	[CE/C]		0.
Enter	7		7.
Touch	[=/K]	Answer	84.

D. CHAIN CALCULATIONS

Example: To calculate 15.3 x 13.7 ÷ 4 + 19 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	15.3		15.3
Touch	[X]		15.3
Enter	13.7		13.7
Touch	[÷]		209.61
Enter	4		4.
Touch	[+]		52.4025
Enter	19		19.
Touch	[=/K]	Answer	71.4025

E. CALCULATIONS USING A CONSTANT

CONSTANT MULTIPLICATION

For multiplication the FIRST number entered is the Constant

example	operation	display
3.72 is a constant		
3.72 X 15	3.72 [X] 15 [=/k]	55.8
3.72 X 30	30 [=/k]	111.6
3.72 X 215	215 [=/k]	799.8

CONSTANT DIVISION

For division the SECOND number entered is the Constant

example	operation	display
12 is a constant		
48 ÷ 12	48 [÷] 12 [=/k]	4.
180 ÷ 12	180 [=/k]	15.
756 ÷ 12	756 [=/k]	63.

CONSTANT ADDITION

For addition the SECOND number entered is the Constant

example	operation	display
17 is a constant		
15 + 17	15 [+] 17 [=/k]	32.
27.5 + 17	27.5 [=/k]	44.5
92.8 + 17	92.8 [=/k]	109.8

CONSTANT SUBTRACTION

For subtraction the SECOND number entered is the Constant

example	operation	display
25.5 is a constant		
57 − 25.5	57 [−] 25.5 [=/k]	31.5
32 − 25.5	32 [=/k]	6.5
12 − 25.5	12 [=/k]	− 13.5

NOTE: Since the constant operation is automatic do not push the [=/k] key more than once for any operation.

F. REPEAT ADDITION OR SUBTRACTION

If during a calculation, you require adding or subtracting a number repeatedly, simply press the [=/K] key the desired number of times after entering the number.

Example: 2 + 4 + 4 + 4 − 3 − 3 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	2		2.
Touch	[+]		2.
Enter	4		4.

NOTE: you wish to add the number 4 three times

Touch	[=/K]		6.
Touch	[=/K]		10.
Touch	[=/K]		14.
Touch	[−]		14.
Enter	3		3.
Touch	[=/K]		11.
Touch	[=/K]	Answer	8.

REPEAT MULTIPLICATION

(POWER CALCULATION)

Example: 9^4 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	9		9.
Touch	[X]		9.
Touch	[=/K]		81.
Touch	[=/K]		729.
Touch	[=/K]	Answer	6561.

G. MEMORY OPERATIONS

The Memory is a place to store a number for future use. All memory functions (M+, M−, MR, MC, X↗M) are used in shifted mode.

PRODUCT OF SUM AND DIFFERENCE

NOTE: Before starting any calculation clear the Memory and the Display. F MC [CE/C] [CE/C]

Problem: (12 + 34) × (98 − 76) = ?

KEY SEQUENCE		DISPLAY	MEMORY
Touch [F] MC		0.	0.
Touch [CE/C]	Twice	0.	0.
12		12.	0.
[+]		12.	0.
34		34.	0.
[=/k]		46.	0.
[F] M+		46.	46.
98		98.	46.
[−]		98.	46.
76		76.	46.
[X]		22.	46.
[F] MR		46.	46.
[=/k]	Answer	1012.	46.

EXAMPLE: SUM AND DIFFERENCE OF PRODUCTS AND QUOTIENTS

Problem: (78×96) − (41×23) + (40÷5) = ?

KEY SEQUENCE			DISPLAY	MEMORY
Touch	[CE/C]	Twice	0.	0.
Touch	[F] MC		0.	0.
Enter	78		78.	0.
Touch	[X]		78.	0.
Enter	96		96.	0.
Touch	[=/K]		7488.	0.
Touch	[F] M+		7488.	7488.
Enter	41		41.	7488.
Touch	[X]		41.	7488.
Enter	23		23.	7488.
Touch	[=/K]		943.	7488.
Touch	[F] M−		943.	6545.
Enter	40		40.	6545.
Touch	[÷]		40.	6545.
Touch	5		5.	6545.
Touch	[=/k]		8.	6545.
Touch	[F] M+		8.	6553.
Touch	[F] MR	Answer	6553.	6553.

III EXAMPLE OF ALGEBRAIC FUNCTIONS $\sqrt{x}$, 1/x.

To calculate: $\dfrac{1}{\sqrt{36-11}+15}$ =?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	36		36.
Touch	[−]		36.
Enter	11		11.
Touch	[=/K]		25.
Touch	[F] $\sqrt{x}$		5.
Touch	[+]		5.
Enter	15		15.
Touch	[=/K]		20.
Touch	[F] 1/x	Answer	0.05

I V TRANSCENDENTAL FUNCTIONS

A. TRIGONOMETRIC FUNCTIONS

Depressing the F Key and the **Sin**, **Cos** or **Tan** key causes the calculator to compute and display the trigonometric function for the value of the angle (in radians or degrees) that was displayed.

Example 1 Sin 30°=?

KEY SEQUENCE			DISPLAY
Set Degree/ Radian to Degrees			
Touch	[CE/C]	Twice	0.
Enter	30		30.
Touch	[F] Sin	Answer	0.5

Example 2 Cos π/6 = ?

KEY SEQUENCE			DISPLAY
Set Degree/ Radians to Radians			
Touch	[CE/C]	Twice	0.
Touch	[F] π		3.1415926
Touch	[÷]		3.1415926
Enter	6		6.
Touch	[=/K]		0.5235987
Touch	[F] Cos	Answer	0.86603

Example 3 6 + (3 Tan 15°) = ?

KEY SEQUENCE			DISPLAY
Set Degree/ Radian to Degrees			
Touch	[CE/C]	Twice	0.
Enter	15		15.
Touch	[F] Tan		0.26795
Touch	[×]		0.26795
Enter	3		3.
Touch	[+]		0.80385
Enter	6		6.
Touch	[=/K]	Answer	6.80385

NOTE: To calculate sine, cosine, or tangent of angles outside the first quadrant (0° to 90°) use the following:

Range of Angle x	Sine x	Cos x	Tan x
$90°<x\leq 180°$	Sin(180−x)	−Cos(180−x)	−Tan(180−x)
$180<x\leq 270°$	−Sin(x−180)	−Cos(x−180)	Tan(x−180)
$270<x\leq 360°$	−Sin(360−x)	Cos(360−x)	−Tan(360−x)

B. INVERSE TRIGONOMETRIC FUNCTIONS

Depressing the [F] key and then the **Sin^{-1}**, **Cos^{-1}** or **Tan^{-1}** key causes the calculator to compute the inverse trigonometric angle.

Example 1 $\sin^{-1}(.5)$ = ?

KEY SEQUENCE			DISPLAY
Set Degree/Radian to Degrees			
Touch	[CE/C]	Twice	0.
Enter	.5		0.5
Touch	[F] Sin^{-1}	Answer	30.

Example 2 π+Tan $^{-1}$ (1)=?

KEY SEQUENCE			DISPLAY
Set Degree/ Radian to Radians			
Touch	[CE/C]	Twice	0.
Enter	1		1.
Touch	[F] Tan^{-1}		0.7854
Touch	[+]		0.7854
Touch	[F] π		3.1415926
Touch	[=/K]	Answer	3.9269926

C. NATURAL LOG AND ANTILOG FUNCTIONS

Example 1 Ln 20 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	20		20.
Touch	[F] Ln	Answer	2.9957

Example 2 $Ln(18^3)$ = ?

Rewrite this as 3Ln 18

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	18		18.
Touch	[F] Ln		2.8903
Touch	[X]		2.8903
Enter	3		3.
Touch	[=/K]	Answer	8.6709

Example 3 Calculate e^4 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	4		4.
Touch	[F] e^x	Answer	54.598

V PRACTICAL EXAMPLES

A. MATHEMATICS

1. Common Log

The common Log X can be computed using the following

Log X = Ln X ÷ 2.30259

Example: Log 55 = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	55		55.
Touch	[F] Ln		4.0073
Touch	[÷]		4.0073
Enter	2.30259		2.30259
Touch	[=/K]	Answer	1.7403445

2. Powers X^y

Using the relationship $X^y = e^{yLnx}$

Example: $6.2^{1.625}$

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	6.2		6.2
Touch	[F] Ln		1.8245
Touch	[X]		1.8245
Enter	1.625		1.625
Touch	[=/K]		2.9648125
Touch	[F] e^x	Answer	19.391

3. Roots $\sqrt[y]{x}$

Using the relationship $\sqrt[y]{x} = e^{Lnx/Y}$

Example: To calculate $\sqrt[3]{30}$ = ?

KEY SEQUENCE			DISPLAY
Touch	[CE/C]	Twice	0.
Enter	30		30.
Touch	[F] Ln		3.4014
Touch	[÷]		3.4014
Enter	3		3.
Touch	[=/K]		1.1338
Touch	[F] e^x	Answer	3.1074

4. Hyperbolic Functions

To calculate Sinh 2.1 = ?

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

KEY SEQUENCE			DISPLAY	MEMORY
Touch	[CE/C]	Twice	0.	0
Enter	2.1		2.1	0
Touch	[F] e^x		8.1661	0
Touch	[F] M+		8.1661	8.1661
Touch	[F] 1/x		0.1224574	8.1661
Touch	[F] M−		0.1224574	8.0436425
Touch	[F] MR		8.0436425	8.0436425
Touch	[÷]		8.0436425	8.0436425
Enter	2		2.	8.0436425
Touch	[=/K]	Answer	4.0218212	8.0436425

To calculate other Hyperbolic and Inverse Hyperbolic functions, use the following relationships:

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

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

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

B. PROBLEMS IN ENGINEERING

1. To calculate R_{eq} of 3 parallel Resistors:
   $R_1 = 100$ Ohms, $R_2 = 200$ Ohms, $R_3 = 400$ Ohms

   Using $R_{eq} = \dfrac{1}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}}$

KEY SEQUENCE			DISPLAY	MEMORY
Touch	[F] [MC]		0.	0.
Touch	[CE/C]	Twice	0.	0.
Enter	100		100.	0.
Touch	[F] [1/x]		0.01	0.
Touch	[F] [M+]		0.01	0.01
Enter	200		200.	0.01
Touch	[F] [1/x]		0.005	0.01
Touch	[F] [M+]		0.005	0.015
Enter	400		400.	0.015
Touch	[F] [1/x]		0.0025	0.015
Touch	[F] [M+]		0.0025	0.0175
Touch	[F] [MR]		0.0175	0.0175
Touch	[F] [1/x]	Answer	57.142857	0.0175

2. A step voltage (V_1) of 35 volts is applied across a series RC network with R=50K ohm and C=.2 microfarad. What is Vc across the capacitor after 100 miliseconds?
   Using $V_c = V(1-e^{-t/RC}) = ?$

KEY SEQUENCE			DISPLAY	
Touch	[CE/C]	Twice	0.	
Enter	50		50.	
Touch	[EE] 3		50.	03
Touch	[x]		50000.	
Enter	.2		0.2	
Touch	[EE] [−] 6		0.2	−06
Touch	[=/K]		0.01	
Touch	[F] [1/x]		100.	
Touch	[x]		100.	
Enter	100		100.	
Touch	[EE] [−] 3		100.	−03
Touch	[=/K]		10.	
Touch	[F] [e^x]		22026.	
Touch	F [1/x]		4.5400	−05
Touch	[−] [=/K]	[=/K]	−4.5400	−05
Touch	[+]		−4.5400	−05
Enter	1		1.	
Touch	[x]		0.9999546	
Enter	35		35.	
Touch	[=/K]	Answer	34.998411	

3. A shaft 3 inches in diameter (d) has a 3000 inch-pounds bending moment (M) and a 4000 inch-pounds torque (T). What is the maximum stress?

   Maximum Stress $= \dfrac{16(M + \sqrt{T^2+m^2})}{\pi d^3}$

KEY SEQUENCE			DISPLAY	MEMORY
Touch	[CE/C]	Twice	0.	0.
Touch	[F] [MC]		0.	0.
Enter	4000		4000.	0.
Touch	[x] [=/K]		16000000.	0.
Touch	[F] [M+]		16000000.	16000000.
Enter	3000		3000.	16000000.
Touch	[x] [=/K]		9000000.	16000000.
Touch	[+] [F] [MR]		16000000.	16000000.
Touch	[=/K]		25000000.	16000000.
Touch	[F] [$\sqrt{x}$]		5000.	16000000.
Touch	[+]		5000.	16000000.
Enter	3000		3000.	16000000.
Touch	[x]		8000.	16000000.
Enter	16		16.	16000000.
Touch	[=/K]		128000.	16000000.
Touch	[F] [X⇄M]		16000000.	128000.
Enter	3		3.	128000.
Touch	[x] [=/K]	[=/K]	27.	128000.
Touch	[x]		27.	128000.
Touch	[F] [π]		3.1415926	128000.
Touch	[=/K]		84.823	128000.
Touch	[F] [X⇄M]		128000.	84.823
Touch	[÷] [F] [MR]		84.823	84.823
Touch	[=/K]	Answer	1509.0246	84.823

C. PROBLEMS IN FINANCE

Monthly payments for a 30 year mortgage with a principal of $35,000 and yearly interest rate of 9% using the formula:

$$\text{Payment} = \frac{P \times I}{1 - \frac{1}{(1+I)^n}}$$

P = Principal
N = Number of Payments
I = Monthly Interest Rate

KEY SEQUENCE			DISPLAY	MEMORY
Touch	[F] MC		0.	0.
Touch	[CE/C]	Twice	0.	0.
Enter	.09		0.09	0.
Touch	[÷]		0.09	0.
Enter	12		12.	0.
Touch	[+]		0.0075	0.
Enter	[1]		1.	0.
Touch	[=/K]		1.0075	0.
Touch	[F] Ln		0.007472	0.
Touch	[x]		0.007472	0.
Enter	360		360.	0.
Touch	[=/K]		2.68992	0.
Touch	[F] e^x		14.73	0.
Touch	[F] 1/x		0.0678886	0.
Touch	[F] M−		0.0678886	−0.0678886
Enter	1		1.	−0.0678886
Touch	[F] M+		1.	0.9321113
Enter	.09		0.09	0.9321113
Touch	[÷]		0.09	0.9321113
Enter	12		12.	0.9321113
Touch	[x]		0.0075	0.9321113
Enter	35000		35000.	0.9321113
Touch	[=/K]		262.5	0.9321113
Touch	[÷]		262.5	0.9321113
Touch	[F] MR		0.9321113	0.9321113
Touch	[=/K]	Answer	281.61871	0.9321113

METRIC CONVERSION CONSTANTS

From	Multiply by	To
Millimeters	.03937	Inches
Meters	39.37	Inches
Cubic Centimeter (cc)	.061025	Cubic inches
Kilometers	.621377	Miles
Liters	.26418	Gallons
Grams	.03527	Ounces
Kilograms	2.2046	Pounds

For reciprocal constants (such as inches to millimeter) use reciprocal of constant as multiplier (1 divided by .03937 = 25.4)

Conversions of temperature
Fahrenheit/Centigrade
Temp°F [−] 32 [X] 5 [÷] 9 = Temp.°C.
Temp°C [X] 9 [÷] 5 + 32 = Temp.°F.

ERROR CONDITIONS

An error symbol will occur if:

1. A calculation is performed which produces an intermediate or final result outside the range of the calculator, (greater than 99999999×10^{99} or less than $0.0000001 \times 10^{-99}$).
2. Attempt to execute a scientific function outside it's permitted range. The error ranges for the scientific functions are as follows:

FUNCTION	ERROR RANGE
$\sqrt{x}$	$x<0$
Ln X	$x\leq 0$
e^x	$x\geq 100\text{Ln}10$
Sin x, Cos x	$x<0$, or $x>90°$
Tan x	$x\geq 90°$, or $x<0$
$\text{Sin}^{-1}x$, $\text{Cos}^{-1}x$	$x>1$, or $x<0$
$\text{Tan}^{-1}x$	$x<0$, or $x>\tan 89.999999$

ACCURACY

FUNCTION	MAXIMUM MANTISSA ERROR
+, −, x, ÷	1 Count in the 8th Digit
$\sqrt{x}$	1 Count in the 8th Digit
Ln x, e^x	1 Count in the 4th Digit
Sin x, Cos x	1 Count in the 4th Digit
$\text{Sin}^{-1}x$, $\text{Cos}^{-1}x$, $\text{Tan}^{-1}x$	1 Count in the 4th Digit
Tan x [$0°<x<89.99°$]	1 Count in the 4th Digit
Tan x [$89.999°<x<89.9999°$]	2 Count in the 4th Digit