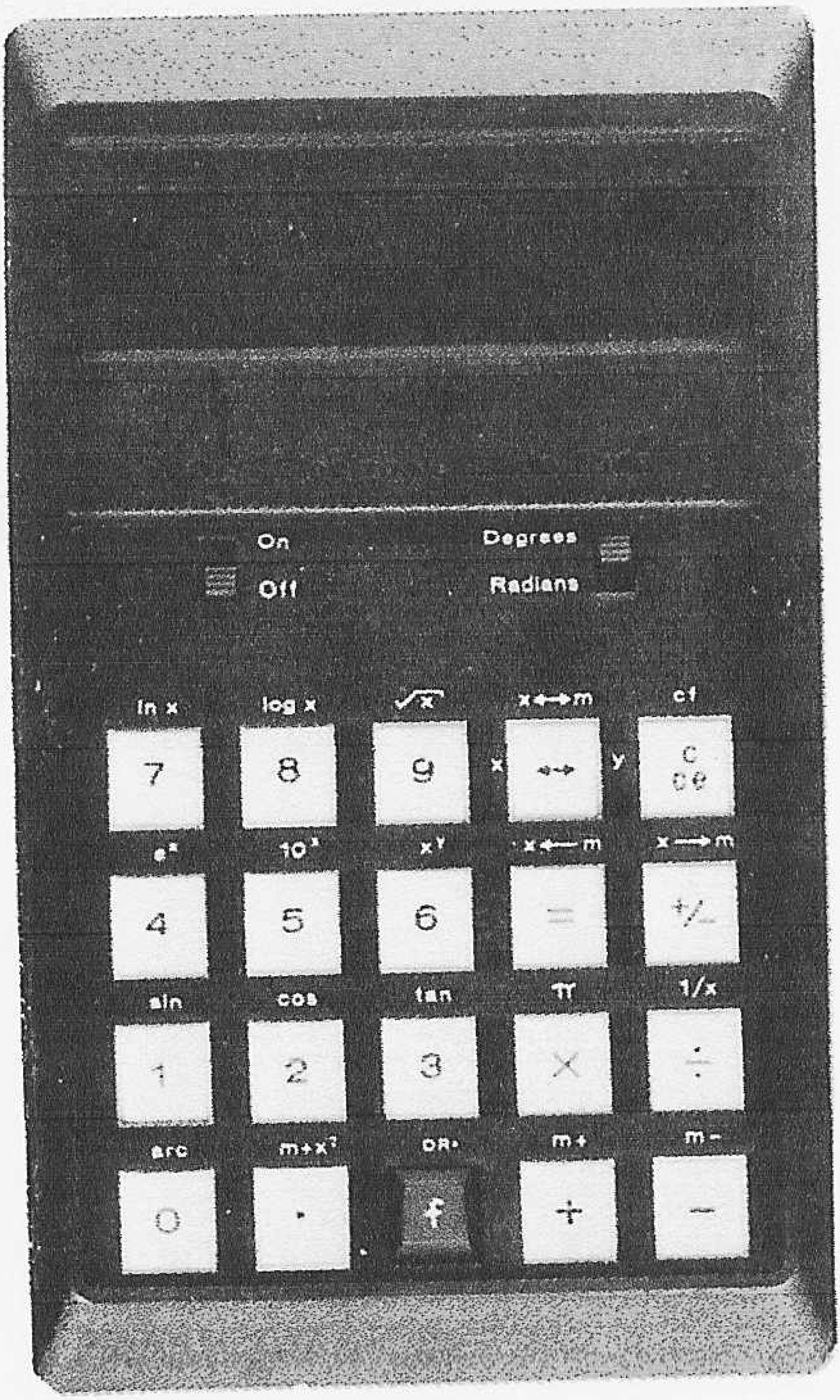
Sears

INSTRUCTION MANUAL

SEARS ELECTRONIC SLIDE RULE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I. INTRODUCTION

Congratulations! You've purchased a most powerful mathematical aid at a bargain price. Your Sears electronic slide rule will save your time and assure your accuracy in solving complex or simple mathematical problems.

Essentially, your Sears machine is an eight digit slide rule. And it has a fully addressable memory—you can "save" answers or entries and, as desired, use them in continuing operations.

Its logic approach to problem solving is purely mathematical. As a machine, its procedures are virtually human. There are very few "machine procedures" to be learned. The [f] key which accesses the functions written above the keys is one, but this double-key capability keeps the keyboard to shirt-pocket size.

Your Sears electronic slide rule has been recognized as a significant microelectronic engineering achievement. The evidence includes its power. Look at the 40 functions indicated by its keys. But that's only the beginning of its power. The organization of its constant and display "registers" (working memories); its built-in mathematical shortcuts; its accuracy; its time saving addressable memory; its ability to give answers to trigonometry problems in either degrees or in radians; and its mathematical (algebraic) logic are other reasons why your Sears machine is an unmatched bargain.

The power of your Sears Electronic Slide Rule will have instant appeal to professional mathematicians and to students of mathematics. In fact, professional mathematicians will find this machine is an extension of their trained thinking while it microelectronically performs calculations instantly and accurately.

However, this machine also has great usefulness for persons whose daily tasks include the need to calculate "formula" problems. For example, this machine can save the time and increase the accuracy of anybody using log, natural functions, exponential functions, interest or other tables.

Your Sears Electronic Slide Rule will reduce the time and effort required by machinists, surveyors and other journeymen who must refer to mathematical tables. It gives answers with six digit accuracy, whereas, most tables give answers with only four digit accuracy.

Your Sears Electronic Slide Rule will be found irreplaceable by the businessman who calculates interest rates, present worth, annuity and capital recovery.

Because of the extremely wide variety of applications for your Sears Electronic Slide Rule, this User's Manual has been written to conserve the learning time of all concerned. By reading only the sections headed "Basic Operations" and "The Function Key," you will have the full power of your Sears Electronic Slide Rule at your fingertips.

To realize fully the long useful life built into your Sears Electronic Slide Rule, it is suggested all owners read carefully the "General Information" section which includes operational information. Also, for your added convenience, this manual can be stored in the pocket located inside the carrying case for future reference.

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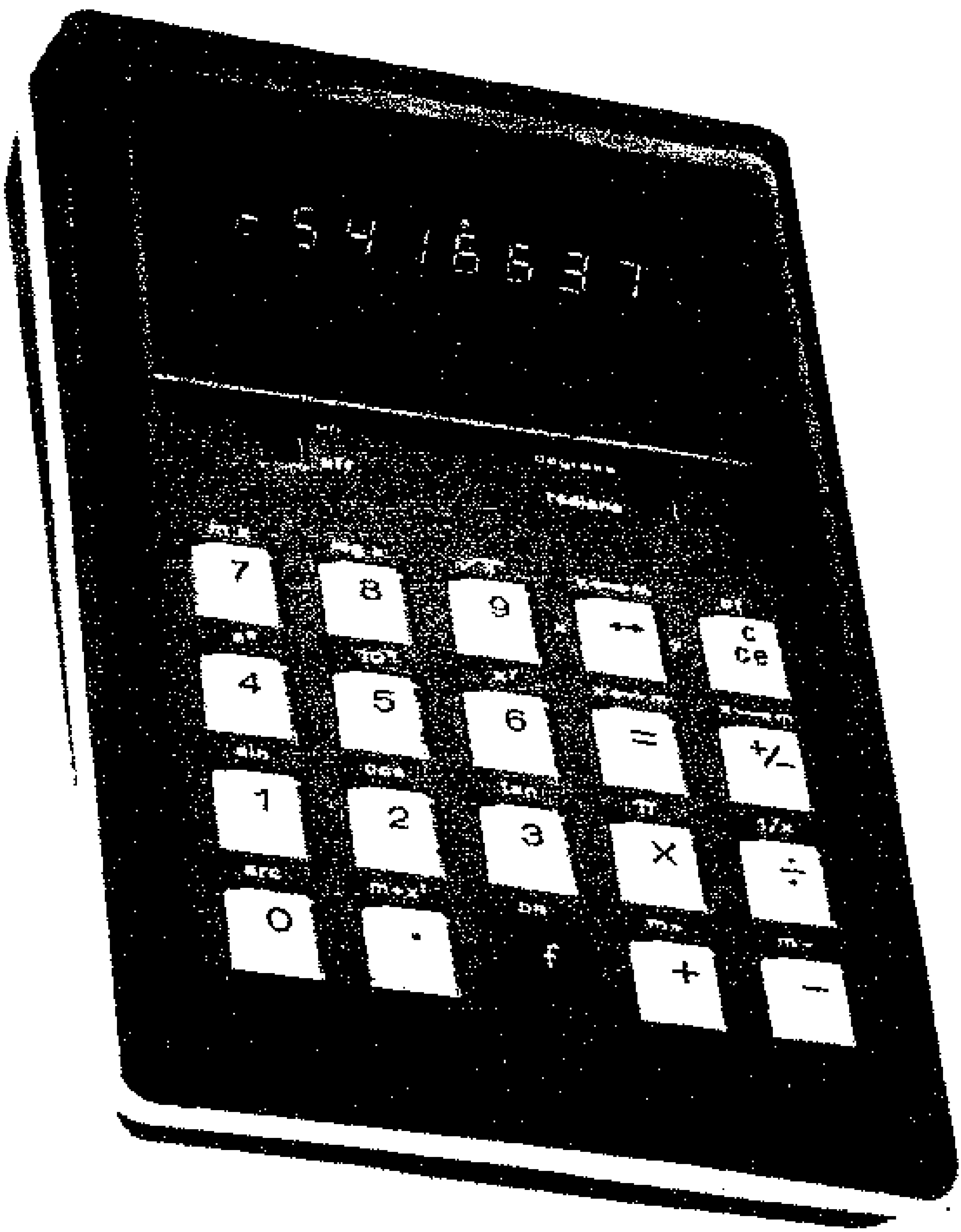
SECTION I
GENERAL INFORMATION



BEFORE OPERATING YOUR CALCULATOR:

Your calculator operates from 4 AA type nickel-cadmium (NiCad) rechargeable batteries or from regular household current (110-120 volt 60 Hertz). **DO NOT OPERATE YOUR CALCULATOR ON BATTERIES UNTIL YOU HAVE FULLY CHARGED THEM FOR THE FIRST TIME.** Attach the battery charger from your calculator to a conventional 110V AC outlet. With the calculator turned off, allow approximately 5 hours for the batteries to become fully charged. The calculator **CAN** be used during charging, but the time required for the batteries to become fully charged will increase.

BATTERY RECHARGING:

Your calculator can be operated from batteries for a minimum of 3 hours before recharging is required. When recharging is required, simply connect the battery charger from your calculator to a 110V AC outlet.

When the batteries become discharged, the calculator will become inoperative.

CAUTION!! To avoid permanent damage to the batteries, do not leave the calculator power switch in the "on" position after the calculator becomes inoperative.

A preliminary signal to battery discharge is a dimming of the display. To prolong battery life, it is recommended that the batteries be recharged when the dimming is first noticed. **TO AVOID POSSIBLE DAMAGE TO THE CALCULATOR, USE ONLY THE CHARGER FURNISHED WITH THE CALCULATOR.**

BATTERY REPLACEMENT:

To change batteries, make sure the calculator power switch is in the "off" position and the battery charger is disconnected. Remove the battery access cover from the back of the calculator by sliding it toward the bottom of the machine. Remove and discard the old batteries.

When inserting new batteries, observe the battery polarity. The (+) pole of the battery must correspond with the (+) indication in the battery compartment. **DAMAGE TO THE CALCULATOR CAN BE CAUSED BY INCORRECT PLACEMENT OF THE BATTERIES.** To insert the batteries, press the (−) pole of the batteries against the spring, push and snap the battery in place.

NOTE: The NiCad batteries supplied with your calculator can be recharged a minimum of 500 times before replacement is required. Battery replacement is necessary when the batteries fail to recharge.

SEARS ELECTRONIC SLIDE RULE CALCULATOR GUARANTEE

We guarantee this calculator to work properly. If it does not, simply return it to the nearest store, wherever you live in the United States, and we will:

During the first year, repair it free of charge.

SEARS, ROEBUCK AND CO.

KEYBOARD ORGANIZATION

The keyboard consists of twenty dual labeled keys. There is a number or function imprinted on each key cap and an additional function printed directly above each key. The function shown above each key is activated only after depression of the [f] key. Otherwise, the function imprinted on the key cap will be performed.

The functions shown above the keys and the [f] key will be discussed in Section III. A discussion of the functions imprinted on the key caps follows:

DIGIT ENTRY KEYS — [0] through [9]: Pressing one of these keys will enter that digit into the display (x) register.

DECIMAL POINT ENTRY KEY — [.] : Depression of this key will correctly position the decimal point in your entries.

ARITHMETIC FUNCTION KEYS — [+], [−], [×], [÷], : Depression of any one of these keys tells the machine what operation to perform with the next number entered. During calculations intermediate results are also displayed when these keys are depressed.

ANSWER KEY — [=] : Depression of this key displays the answer of the previous operations. The number entered immediately before this key is depressed is entered into the constant (y) register (refer to Section II Constant Operations).

CHANGE SIGN KEY — [+/−] : Depression of this key changes the sign of the display (x) register. When entering numbers with negative values, enter the number first, then depress the [+/−] key.

REGISTER EXCHANGE KEY — [⇆] : Depression of this key exchanges the contents of the display (x) register and the constant (y) register.

CLEAR AND CLEAR ENTRY KEY

[C/CE]: Depression of this key performs the following functions:

1. Resets overflow. This does not clear the number displayed or the number in memory, and does not disrupt previous calculations. Press [C/CE] key ONCE.
2. Clears the display (x) register. (wrong entry). Previous entries are not affected. Press [C/CE] key ONCE.
3. A SECOND depression of the [C/CE] key clears all the registers EXCEPT the memory register.
4. Clears the Function Key operation (refer to Section III). Press [C/CE] key ONCE.

NOTE: The [C/CE] key must be depressed ONCE before starting a new calculation if the last calculation was not concluded by depressing the [=] key.

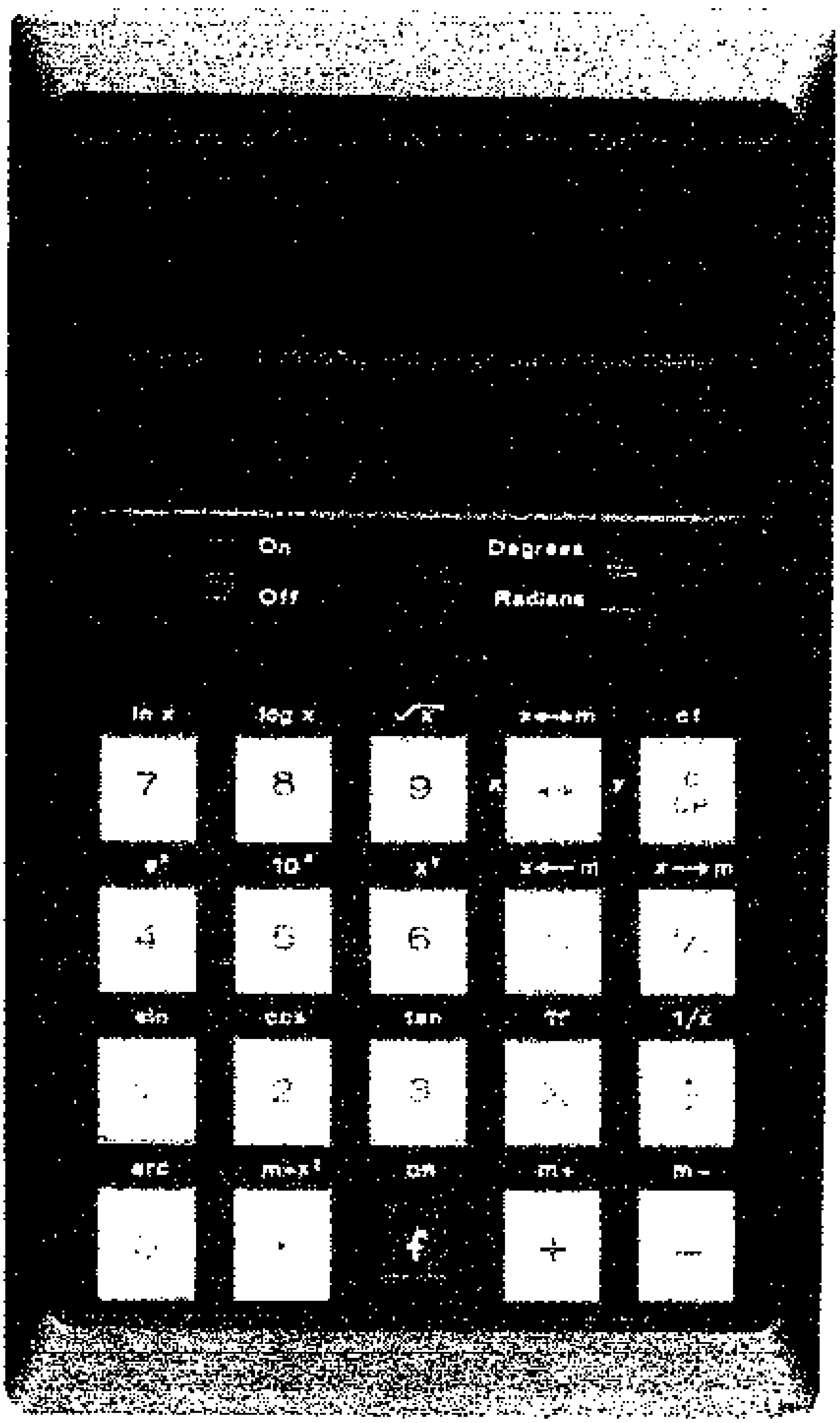
MACHINE CAPACITY

1. The capacity of all registers (x, y and memory) is eight digits.
2. Your calculator displays whole numbers up to eight digits.
3. Your calculator displays decimal numbers up to eight digits. For decimal answers exceeding eight digits, the least significant digits are automatically supressed to prevent overflow.
4. Your calculator displays numbers less than 1 up to seven digits. A zero always appears to the left of the decimal point if the number is less than 1.

NOTE: Computations using very large or very small numbers may be performed on your slide rule calculator utilizing scientific notation and the appropriate power of 10 determined as a second step. This method is explained in more detail in Sections II and III.

SECTION II

BASIC OPERATIONS



Learning the key and switch functions of your Sears calculator is easy. The following pages both tell you and show you so that you can learn in a few minutes. We suggest you practice the examples on your machine.

Your machine has a feature that automatically clears all registers when power is turned on. Place the power switch in the "on" position. A zero will appear at the right side of the display. You are ready to begin.

ADDITION

Example: 5 + 3 = 8

Key-in	Display	Comments
5	5.	
[+]	5.	5 duplicated in constant (y) register.
3	3.	5 still in y register.
[=]	8.	3 now in y register. Last number entered before [=] is entered into y register.

SUBTRACTION

Example: 5 − 3 = 2

Key-in	Display	Comments
5	5.	
[−]	5.	5 duplicated in y register.
3	3.	
[=]	2.	3 entered into y register.

NEGATIVE BALANCE

Example: 55.755 − 108.71 = -52.955

Key-in	Display	Comments
55.755	55.755	
[−]	55.755	
108.71	108.71	
[=]	52.955	NEGATIVE INDICATOR LIGHTS indicating a negative or credit balance.

MIXED ADDITION, SUBTRACTION

Example: 2 − 6 + 9 = 5

Key-in	Display	Comments
2	2.	
[−]	2.	
6	6.	
[+]	4.	NEGATIVE INDICATOR LIGHTS
9	9.	NEGATIVE INDICATOR GOES OUT
[=]	5.	

MULTIPLICATION

Example: 4.2 × 5.31 = 22.302

4.2	4.2	
[×]	4.2	Sets multiply mode.
5.31	5.31	
[=]	22.302	5.31 in y register, multiply mode is still set.

DIVISION

Example: 22.302 ÷ 0.4 = 55.755

22.302	22.302	
[÷]	22.302	Sets divide mode.
.4	0.4	No need to key in leading zero.
[=]	55.755	0.4 in y register, divide mode is still set.

REPEATED OPERATIONS

ADDITION

Example: 2 + 3 + 3 + 3 = 11

2	2.	
[+]	2.	2 entered into the y register.
3	3.	
[+]	5.	3 entered into the y register.
[+]	8.	
[=]	11.	

REPEATED OPERATIONS (Continued)

SUBTRACTION

Example: 15 − 3 − 3 − 3 = 6

Key-in	Display	Comments
15	15.	
[−]	15.	15 entered into y register.
3	3.	
[−]	12.	3 entered into y register.
[−]	9.	
[=]	6.	

MULTIPLICATION

Example: 4^4 = 256

Key-in	Display	Comments
4	4.	
[×]	4.	4 entered into y register.
[×]	16.	
[×]	64.	
[=]	256.	

DIVISION

Example: 2 ÷ 2 ÷ 2 ÷ 2 = 0.25

Key-in	Display	Comments
2	2.	
[÷]	2.	2 entered into y register.
[÷]	1.	
[÷]	0.5	
[=]	0.25	

CONSTANT OPERATIONS

ADDITION

Example: 3 + 5 = 8
7 + 5 = 12
9 + 5 = 14

Key-in	Display	Comments
3	3.	
[+]	3.	3 entered into y register.
5	5.	
[=]	8.	5 entered into y register, becomes constant.
7	7.	
[=]	12.	
9	9.	
[=]	14.	Sequence terminated by [=]. No need to depress [C/CE] key *before beginning a new* operation.

SUBTRACTION

Example: 9 − 3 = 6
15 − 3 = 12
21 − 3 = 18

Key-in	Display	Comments
9	9.	
[−]	9.	
3	3.	
[=]	6.	3 entered into y register, becomes constant.
15	15.	
[=]	12.	
21	21.	
[=]	18.	

CONSTANT OPERATIONS (Continued)

MULTIPLICATION

Example:

$4 \times 5 = 20$
$7 \times 5 = 35$
$12 \times 5 = 60$

Key-in	Display	Comments
4	4.	
[×]	4.	4 entered into y register.
5	5.	
[=]	20.	5 entered into y register.
7	7.	
[=]	35.	
12	12.	
[=]	60.	

DIVISION

Example:

$20 \div 5 = 4$
$35 \div 5 = 7$
$60 \div 5 = 12$

20	20.	
[÷]	20.	20 entered into y register.
5	5.	
[=]	4.	5 entered into y register.
35	35.	
[=]	7.	
60	60.	
[=]	12.	

CHAIN OPERATIONS

The following example shows how the y register is used to solve complex mathematical problems with a minimum of key depressions. It illustrates how the Arithmetic Function keys perform previous operations and cause intermediate results to be displayed.

Example: $\frac{(3 + 4)\,2 - 6}{5} = 1.6$

Key-in	Display	y Register	Comments
3	3.		
[+]	3.	3.	
4	4.	3.	
[×]	7.	4.	(3 + 4) performed.
2	2.	7.	
[−]	14.	2.	(3 + 4) 2 performed.
6	6.	14.	
[÷]	8.	6.	(3 + 4) 2 − 6 performed.
5	5.	8.	
[=]	1.6	5.	Final result

REGISTER EXCHANGE

Another useful feature of your electronic slide rule calculator is the transfer key [↔]. Depression of this key exchanges the data contained in the two working registers: the display (x) and the constant (y).

Example: $\frac{20}{(4 + 6)} = 2$

4	4.		
[+]	4.	4.	
6	6.	4.	
[÷]	10.	6.	
20	20.	10.	
[↔]	10.	20.	Exchanges x and y registers.
[=]	2.	10.	

CHANGE SIGN

Example: $\frac{4^2(-3)}{8} = -6$

Key-in	Display	Comments
4	4.	
[×]	4.	
[×]	16.	
3	3.	
[+/-]	3.	NEGATIVE INDICATOR LIGHTS
[÷]	48.	
8	8.	NEGATIVE INDICATOR GOES OUT
[=]	6.	NEGATIVE INDICATOR LIGHTS

WRAP-AROUND DECIMAL

There are some cases when the answer obtained exceeds the capacity of the machine (10^8 or greater). However, due to the WRAP-AROUND DECIMAL feature of your calculator, the calculation can still proceed.

For example, if the overflowed display reads 1234.5678, the true position of the decimal point is eight places to the right of the position indicated in the display, or 123456780000. THIS SAME FEATURE APPLIES TO THE NUMBER IN MEMORY.

Example: $\frac{98000000 \times 2000}{0.04} = 49000 \times 10^8$

Key-in	Display	Comments
98000000	98000000.	
[×]	98000000.	
2000	2000.	
[÷]	1960.0000	ERROR INDICATOR LIGHTS
[C/CE]	1960.0000	ERROR INDICATOR GOES OUT. Displayed number times 10^8 equals true number.
.04	0.04	
[=]	49000.	This answer times 10^8 equals the true answer.

COMPUTATIONS WITH VERY LARGE OR VERY SMALL NUMBERS

Computations which may exceed the eight digit capacity of the machine can be expressed in scientific notation (or entered as if they were) and the appropriate power of 10 determined as a second step.

COMPUTATIONS WITH VERY LARGE OR VERY SMALL NUMBERS (Continued)

Example: 2198765 × 6328462 = 1.39148 × 10^{13}

Key-in	Display	Comments
2.198765	2.198765	Times 10^6
[×]	2.198765	
6.328462	6.328462	Times 10^6
[=]	13.9148	Times 10^{12} Answer is 1.39148 times 10^{13}

ENTRY CORRECTION

One of the functions of the [C/CE] key is to correct *erroneous entries.*

Example: 15 × 3 = 45

15	15.	
[×]	15.	
4	4.	ERROR!! WANTED TO ENTER 3.
[C/CE]	0.	
3	3.	
[=]	45.	

RECOVERY TECHNIQUES

Occasionally during long calculations, an undesired arithmetic function key may be depressed. Utilizing these simple recovery techniques makes it unnecessary to begin the calculation again.

For example, if the [×] or [÷] keys are inadvertently depressed, simply enter a 1, depress the intended arithmetic function key and continue with your calculation. If the [+] or [−] keys are inadvertently depressed, enter a 0, depress the intended arithmetic function key and continue with your calculation. However, there is one exception to this technique. If the calculation in progress involves a constant, the constant will be lost and will have to be re-entered.

ERROR INDICATIONS

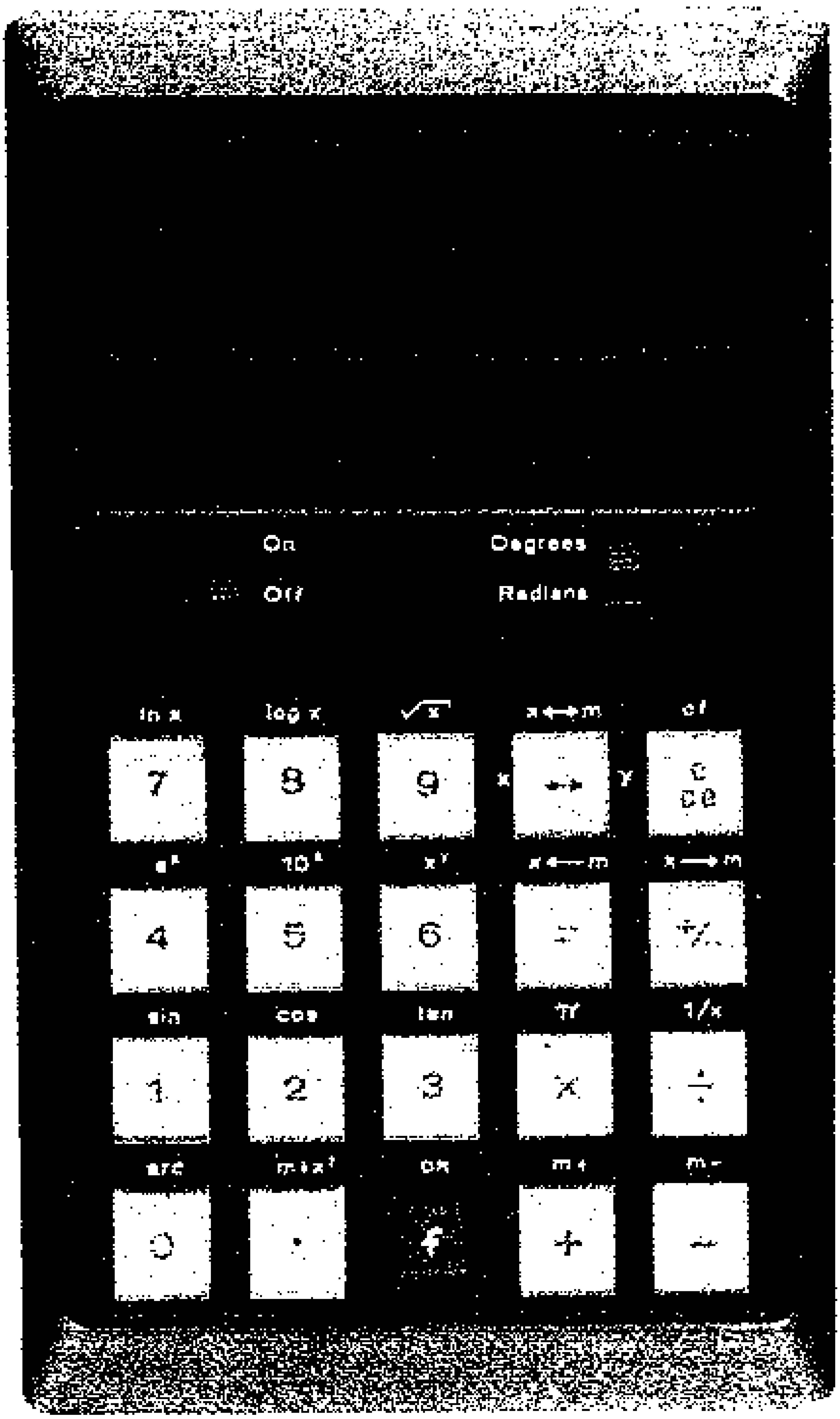
Whenever the capacity of the machine is exceeded or an impossible calculation is attempted, the "OVER" light at the upper left of the display window lights. The error conditions relevant to this section are:

1) Depressing [+], [−], [×], or [÷] when the magnitude of the result is greater than $10^8 - 1$ (99,999,999.).
2) Division by zero.

Other error conditions caused from using the functions printed above the key caps will be discussed in the next section.

SECTION III

THE FUNCTION KEY



Depression of the Function Key, [f], activates the function printed above each key. These functions include:

Scientific Functions:	
Trigonometric	(sin), (cos), (tan)
Arc Trigonometric	(arc) (sin), (arc) (cos), (arc) (tan)
Logarithms	(ln x), (log x)
Antilogarithms	(e^x), (10^x)
Powers of Numbers	($\sqrt{x}$), ($1/x$), (x^y)
Constant	(π)
Memory Functions	(m+), (m−), (x→m), (x←m), (x↔m), (m+x^2)
Special Functions	(DR) Data Recovery (CF) Clear Function

All the scientific functions except ($\sqrt{x}$), (π) and ($1/x$) use both the x and y registers in performance of their functions. Therefore, chain operations with these functions are not directly possible. However, chain operations using these functions can be easily accomplished by using the fully addressable memory. This will be explained in more detail later in this section (refer to Memory Operation Keys).

DEGREE/RADIAN SWITCH

A Degree/Radian switch is located at the upper right of the keyboard. This switch allows you to obtain the results to your trigonometric problems either in degrees or in radians.

BEFORE BEGINNING THE FOLLOWING EXAMPLES, PLACE THE DEGREE/RADIAN SWITCH IN THE "DEGREE" POSITION.

TRIGONOMETRIC FUNCTIONS

(sin), (cos), (tan)

Example: sin 45° = 0.707107

Key-in	Display
45	45.
[f] (sin)	0.707107

> **NOTE: For many operations using scientific function keys, the display will be blanked momentarily. No keyboard entries should be attempted before the display turns back on.**

Example: cos 300° = 0.5

300	300.

Example: tan 1 radian = 1.557407

PLACE DEGREE/RADIAN SWITCH IN "RADIAN" POSITION.

Key-in	Display
1	1.
[f] (tan)	1.557407

NOTE: Some chain operations using scientific and arithmetic functions can be accomplished without the use of memory by simply re-ordering the problem.

Example: (1 + tan 30°)4 = 6.3094

PLACE THE DEGREE/RADIAN SWITCH IN THE "DEGREE" POSITION

30	30.
[f] (tan)	0.57735
[+]	0.57735
1	1.
[×]	1.57735
4	4.
[=]	6.3094

INVERSE TRIGONOMETRIC FUNCTIONS

(arc) (sin), (arc) (cos), (arc) (tan)

The (arc) function, activated after depression of the [f] key, sets a special mode which initiates the Arc function of (sin), (cos) and (tan). For example, the key sequence [f] (arc) (sin) generates the $\sin^{-1}x$. The function mode is not reset until the (sin) key is depressed.

Example: $\cos^{-1} 0.5 = 60$

.5	0.5
[f] (arc) (cos)	59.99999

NOTE: The algorithm used to solve this problem causes the displayed answer to differ slightly from the correct answer. **However,** 59.99999 ≃ 60.

INVERSE TRIGONOMETRIC FUNCTIONS (Continued)

Example: $\phi = \tan^{-1}(WRC)$ **where:** $R = 1200\,\Omega$
$C = 2 \times 10^{-6} f$
$W = 377$

Key-in	Display	y Register
1200	1200.	
[×]	1200.	1200.
.000002	0.000002	1200.
[×]	0.0024	0.000002
377	377.	0.0024
[=]	0.9048	377.
[f](arc) (tan)	42.13879	0.

NATURAL LOGARITHMS

(ln x)

Example: $\ln 44^3 = 3 \ln 44 = 11.35257$

44	44.
[f](ln x)	3.78419
[×]	3.78419
3	3.
[=]	11.35257

COMMON LOGARITHMS

(log x)

Example: $\log_{10} 1000 = 3$

1000	1000.
[f](log x)	3.

EXPONENTIAL FUNCTIONS

(e^x), (10^x)

Example: $e^{-4} = 0.018316$

		Comments
4	4.	
[+/-]	4.	NEGATIVE INDICATOR LIGHTS
[illegible]	[illegible]	NEGATIVE INDICATOR GOES OUT

Example: $10^3 = 1000$

Key-in	Display
3	3.
[f](10^x)	1000.

SQUARE ROOT

($\sqrt{x}$)

Example: $\sqrt{\sqrt{4096}} = 8$

4096	4096.
[f]($\sqrt{x}$)	64.
[f]($\sqrt{x}$)	8.

This function does not require the y register to perform its function. Therefore, chain operations with this function are directly possible.

Example: $(6 + \sqrt{8})3 = 26.485281$

6	6.
[+]	6.
8	8.
[f]($\sqrt{x}$)	2.8284271
[×]	8.8284271
3	3.
[=]	26.485281

RECIPROCALS

($1/x$)

This function, as the ($\sqrt{x}$) function, uses only the display register and can be used in chain operations.

Example: Calculate $1/x$, $x = 625$

625	625.
[f]($1/x$)	0.0016

Example: $\csc 60° = \frac{1}{\sin 60°} = 1.154701$

60	60.
[f](sin)	0.866025
[f]($1/x$)	1.154701

RECIPROCALS (Continued)

Example: $R_t = \dfrac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$ where $R^1 = 5$, $R_2 = 20$, $R_3 = 4$

Key-in	Display	y Register
5	5.	0.
[f] (1/x)	0.2	0.
[+]	0.2	0.2
20	20.	0.2
[f] (1/x)	0.05	0.2
[+]	0.25	0.05
4	4.	0.25
[f] (1/x)	0.25	0.25
[=]	0.50	0.25
[f] (1/x)	2.	0.25

x^y

The function (x^y) is accomplished in two parts according to the formula $x^y = e^{y \ln x}$. You first enter x and perform the function [f] (x^y). Ln x will be displayed in the x register. Next you enter y and depress the answer key [=] or any arithmetic function key [+], [−], [×] or [÷], to complete the function.

Example: $x^y = 8$ when: x = 2 and y = 3

2	2.
[f] (x^y)	0.693147
3	3.
[=]	7.999993

Example: $125^{1/3} = 5$

125	125.
[f] (x^y)	4.828314
3	3.
[f] (1/x)	0.3333333
[=]	4.999998

NOTE: The algorithm used to solve these problems causes the displayed answers to be slightly different than the correct π may be entered into the x register at any time by simply depressing [f] (π).

Example: The area of a circle 8 feet in diameter is 50.265481 square feet.

Formula: $A = \pi r^2$

Key-in	Display
4	4.
[×]	4.
[×]	16.
[f](π)	3.1415926
[=]	50.265481

MEMORY OPERATION KEYS

(m+), (m−), (m+x²), (x←m), (x→m), (x↔m)

Your electronic slide rule has a completely independent memory which is unaffected by arithmetic or scientific operations. Through the use of this memory, you will be able to perform chain operations involving complex mathematical problems with a minimum of key depressions. All the memory operation keys are activated by depressing the [f] key. The memory operation keys are described below.

[f](m+) This function adds the contents of the display (x) register to the contents of memory. The x register and all previous operations are unaffected by this operation.

[f](m−) This function subtracts the contents of the x register from the contents of memory. The x register and all previous operations are unaffected by this operation.

[f](m+x²) This function squares the number in the x register and adds it to the contents of memory. The x register and all previous operations are unaffected by this operation.

[f](x←m) This function copies the contents of memory into the x register.

[f](x→m) This function copies the contents of the x register into memory. The original number in memory is lost.

[f](x↔m) This function exchanges the contents of the x register and the contents of memory.

OPERATIONS USING MEMORY

This example is used to illustrate the use of the memory operation keys and the memory clearing procedure.

Key-in	Display	Memory
[c/ce]	0.	
[f] (x→m)	0.	0.
4	4.	0.
[f] (m+)	4.	4.
[f] (m+x²)	4.	20.
[×]	4.	20.
3	3.	20.
[f] (m−)	3.	17.
[=]	12.	17.
[+]	12.	17.
[f] (x←m)	17.	17.
[=]	29.	17.
[f] (x↔m)	17.	29.
[c/ce]	0.	29.
[f] (x→m)	0.	0.

SQUARE ROOT OF SUM OF SQUARES

Example: $\sqrt{3^2 + 4^2} = 5$

3	3.	0.
[f] (m+x²)	3.	9.
4	4.	9.
[f] (m+x²)	4.	25.
[f] (x←m)	25.	25.
[f] (√x)	5.	25.

CHAINING SCIENTIFIC FUNCTIONS

The following example is used to show how intermediate results can be stored in the memory, allowing scientific functions to be chained.

Example: (sin 20) (cos 30) = 0.2961982

Key-in	Display	Memory
20	20.	25.
[f] (sin)	0.34202	25.
[f] (x→m)	0.34202	0.34202
30	30.	0.34202
[f] (cos)	0.866026	0.34202
[×]	0.866026	0.34202
[f] (x←m)	0.34202	0.34202
[=]	0.2961982	0.34202

SPECIAL FUNCTION KEYS

(CF), (DR)

Two more function keys complete the electronic slide rule, the (CF), and (DR) functions. These two keys are activated by depressing the [f] key and perform the following functions:

[f] (CF)	This function clears the function mode without disturbing any previous calculations. It is used when the [f] key is inadvertently depressed.
[f] (DR)	This function allows data to be recovered when the [f] key is not depressed before a desired scientific function.

Example: (CF) Clear Function

		Comments
3	3.	
[×]	3.	
4	4.	
[f]	4.	ERROR!! Did not want to press [f]
(CF)	4.	
[+]	12.	
5	5.	
[=]	17.	

SPECIAL FUNCTIONS KEYS (Continued)

Example 1: (DR) Data Recovery

Key-in	Display	Comments
30	30.	
(sin)	301.	ERROR!! Forgot to press [f].
[f](DR)	30.	
(sin)	0.5	

Example 2: (DR) Data Recovery

10	10.	
[+]	10.	
4	4.	
[=]	14.	
(cos)	2.	ERROR!! Forgot to press [f].
[f](DR)	14.	
(cos)	0.970296	

WRAP-AROUND DECIMAL

There are some cases when the answer obtained exceeds the capacity of the machine (10^8 or greater). However, due to the WRAP-AROUND DECIMAL feature of your slide rule calculator, the calculation can still proceed. For example, if the overflowed display reads 45.768239, the true position of the decimal point is eight places to the right of the position indicated in the display, or 4576823900. THIS SAME FEATURE APPLIES TO THE NUMBER IN MEMORY.

Computations which may exceed the eight digit capacity of the machine can be expressed in scientific notation (or entered as if they were) and the appropriate power of 10 determined as a second step.

Example: Calculate the volume (in cubic meters) of the space viewed by telescopes with a viewing range of 5 billion light years.

Radius (meters) = 3×10^8 meters/sec × 60 sec/min × 60 min/hr × 24 hr/day × 365.25 days/yr × 5,000,000,000 yrs.

$$\text{Volume} = \frac{4\pi r^3}{3}$$

WRAP-AROUND DECIMAL (Continued)

Key-in	Display	Comments
3	3.	Times 10^8
[×]	3.	
6	6.	Times 10^1
[×]	18.	
6	6.	Times 10^1
[×]	108.	
2.4	2.4	Times 10^1
[×]	259.2	
3.6525	3.6525	Times 10^2
[×]	946.728	
5	5.	Times 10^9
[=]	4733.64	Times 10^{22}
[÷]	4733.64	
1000	1000.	
[=]	4.73364	Times 10^{25}
[×]	4.73364	
[×]	22.407347	Times 10^{50}
[×]	106.06831	Times 10^{75}
4	4.	
[÷]	424.27324	Times 10^{75}
3	3.	
[×]	141.42441	Times 10^{75}
[f] (π)	3.1415926	
[÷]	444.29787	Times 10^{75}
100	100.	
[=]	4.4429787	Times 10^{77} cubic meters (answer)

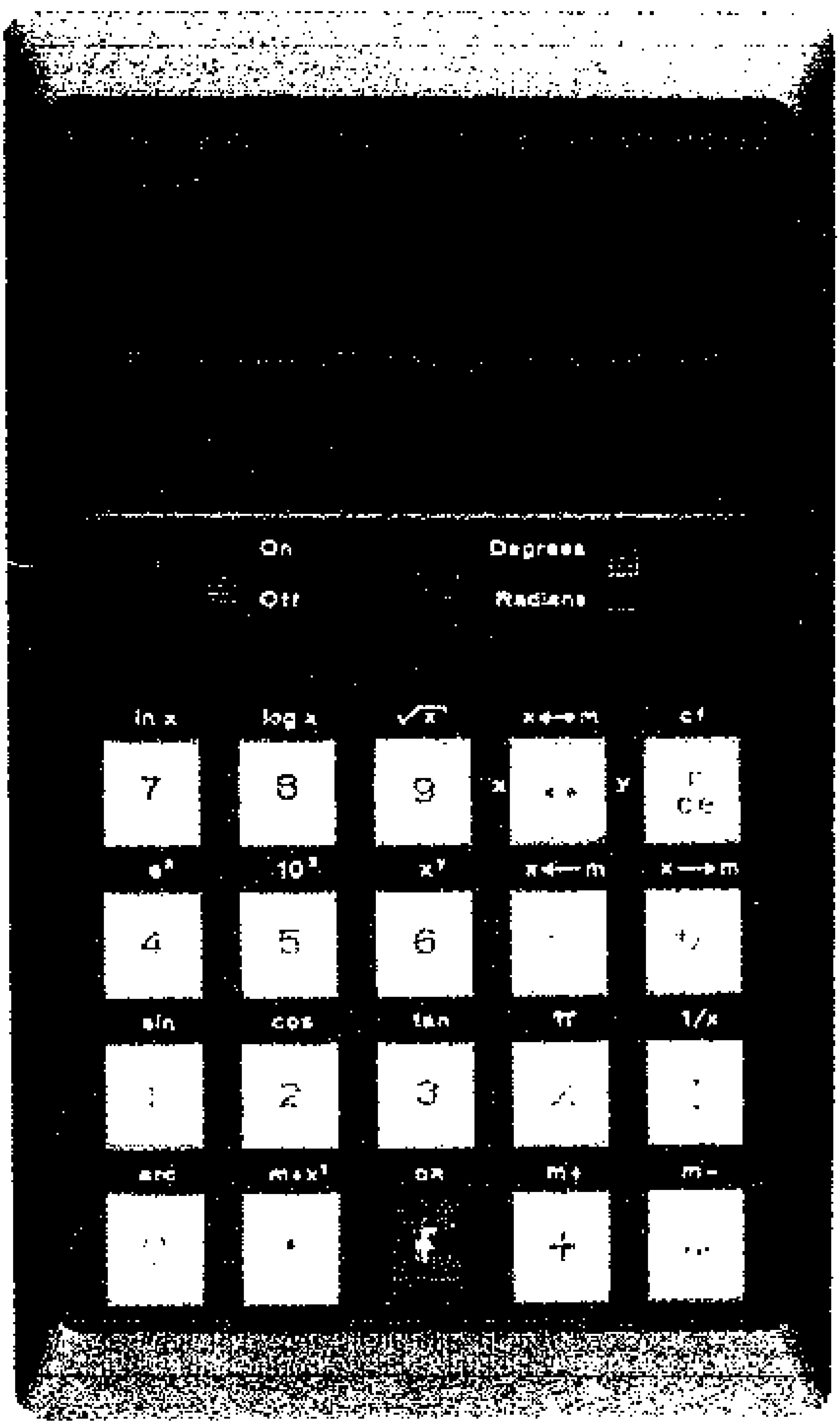
ERROR INDICATIONS

The following conditions will cause the error indicator to light and the calculator will become inoperative:

1. Any operation with a result larger than $10^8 - 1$ (99,999,999).
2. Division by zero.
3. Taking the square root of a negative number.
4. (arc) (sin) x and (arc) (cos) x operations when /x/ is greater than 1.
5. (ln x) and (log x) operations when $x < 0$.
6. (e^x) operations when $x > \ln 99999999$.
7. (10^x) operations when $x \geq 8$.
8. (x^y) operations when $x \leq 0$ or $y \geq \frac{\ln 99999999}{\ln x}$

These error conditions can be cleared by ONE depression of the [C/CE] key.

SECTION IV
ADVANCED OPERATIONS



QUADRATIC EQUATION $ax^2 + bx + c = 0$

Standard Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{b}{2(-a)} \pm \sqrt{\left[\frac{b}{2(-a)}\right]^2 + \frac{c}{(-a)}}$

Example: $3x^2 + 9x + 6 = 0$ **where:** $a = 3$

$(3x + 3)(x + 2) = 0$ $b = 9$

$x = -1$ or -2 $c = 6$

Part I $\frac{b}{2(-a)}$

Key-in	Display	Comments
9	9.	Enter b term.
[÷]	9.	
2	2.	
[÷]	4.5	
3	3.	Enter a term.
[+/−]	3.	NEGATIVE INDICATOR LIGHTS.
[=]	1.5	b/2(−a) term
[f](x→m)	1.5	b/2(−a) term entered into memory.

PART II $\sqrt{\left[\frac{b}{2(-a)}\right]^2 + \frac{c}{(-a)}}$

Key-in	Display	Comments
6	6.	Enter c term. −a term is in y register as a constant divisor. NEGATIVE INDICATOR GOES OUT.
[=]	2.	c/(−a) term. NEGATIVE INDICATOR LIGHTS.
[f] (x↔m)	1.5	b/2(−a) term displayed, c/(−a) term in memory.
[f](m+x²)	1.5	[b/2(−a)]² + c/(−a) term in memory.
[f] (x↔m)	0.25	b/2(−a) term into memory. NEGATIVE INDICATOR GOES OUT. If, for other quadratic calculations, this number is negative, refer to Part IV.

PART III Root 1 and 2

Key-in	Display	Comments
[f](√x)	0.5	$\sqrt{\left[\frac{b}{2(-a)}\right]^2 + \frac{c}{(-a)}}$ term
[f](x↔m)	1.5	b/2(−a) term. NEGATIVE INDICATOR LIGHTS.
[+]	1.5	
[f](x←m)	0.5	NEGATIVE INDICATOR GOES OUT.
[illegible]	[illegible]	Root #1. NEGATIVE INDICATOR LIGHTS

PART IV IMAGINARY ROOTS

If the $\left[\left[\frac{b}{2(-a)}\right]^2 + \frac{c}{(-a)}\right]$ term of Part II is negative, refer to the following procedure to determine the imaginary roots of the equation.

Key-in	Display	Comments
	$\left[\left[\frac{b}{2(-a)}\right]^2 + \frac{c}{(-a)}\right]$	Negative Term.
[+/-]		Positive Term.
[f] ($\sqrt{x}$)	$\sqrt{\left[\frac{b}{2(-a)}\right]^2 + \frac{c}{(-a)}}$	Record this value with ± i for imaginary part.
[f] (x←m)	$\frac{b}{2(-a)}$	Record this value as real part of solution.

TRIGONOMETRIC FUNCTIONS

The following two examples illustrate the procedure for calculating secants and arccosecant:

Example: sec 43° = 1.3673269

43	43.
[f] (cos)	0.731354
[f] (1/x)	1.3673269

Example: csc⁻¹ = 1.11262 radians

PLACE THE DEGREE/RADIAN SWITCH IN THE "RADIAN" POSITION

1.115	1.115
[f] (1/x)	0.8968609
[f] (arc) (sin)	1.11262

COMBINED TRIGONOMETRIC FUNCTIONS

Example: $\frac{(\sin 20)}{3} + 4(\cos 30) + 5 = 8.5781106$

PLACE THE DEGREE/RADIAN SWITCH IN THE "DEGREE" POSITION

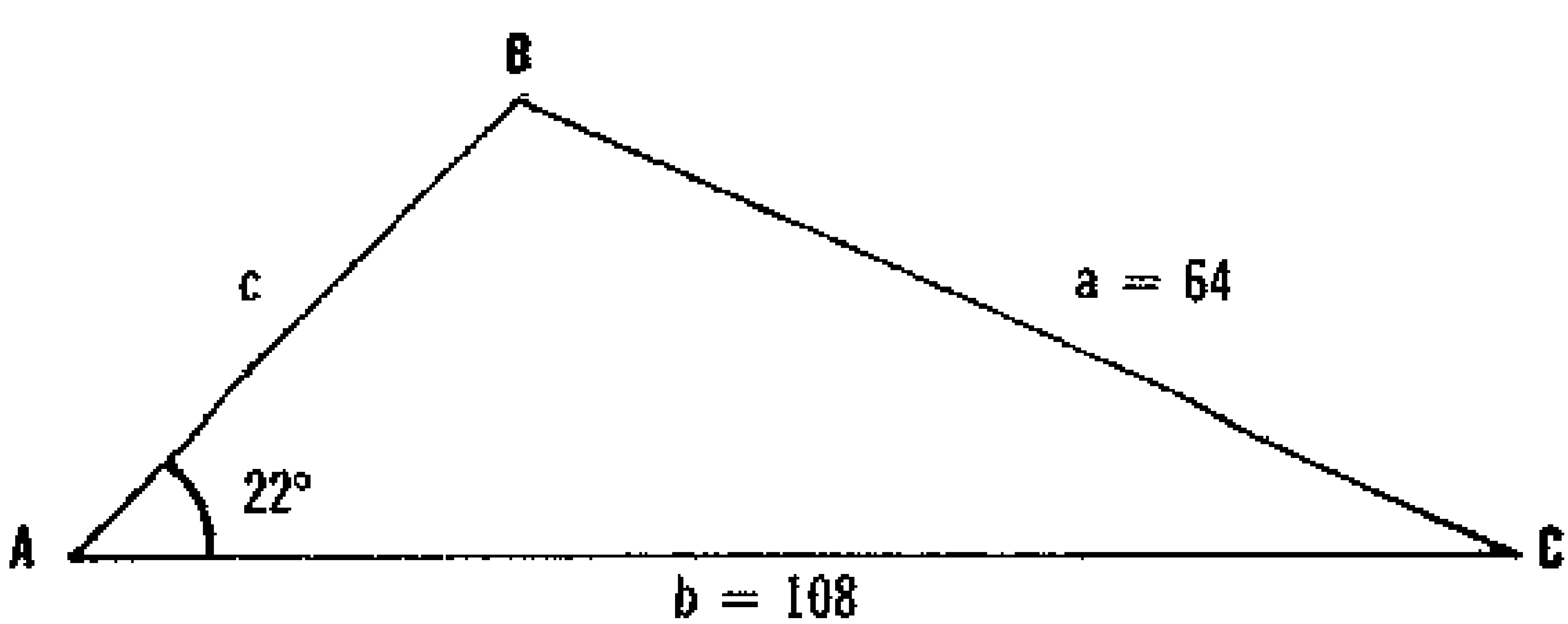
COMBINED TRIGONOMETRIC FUNCTIONS (Continued)

Key-in	Display
20	20.
[f] (sin)	0.34202
[÷]	0.34202
3	3.
[=]	0.1140066
[f] (x→m)	0.1140066
30	30.
[f] (cos)	0.866026
[×]	0.866026
4	4.
[=]	3.464104
[f] (m+)	3.464104
[f] (x←m)	3.5781106
[+]	3.5781106
5	5.
[=]	8.5781106

SINE LAW

The laws of sines can be used to calculate values of triangles other than right triangles. Given: $\frac{a}{\text{Sin A}} = \frac{b}{\text{Sin B}} = \frac{c}{\text{Sin C}}$, if one side and two angles or two sides and one angle are known, the remaining unknowns can be solved.

Example:



PART I $B = \sin^{-1}\left(\frac{b}{a}\sin A\right) = 129.20875°$

Key-in	Display	Comments
22	22.	
[f] (sin)	0.374606	
[×]	0.374606	
108	108.	
[÷]	40.457448	
64	64.	
[=]	0.6321476	
[f] (x→m)	0.6321476	
[f] (arc) (sin)	39.20875	
[+]	39.20875	Must add 90° because angle is obtuse.
90	90.	
[=]	129.20875	

PART II $C = 180 - (B + A) = 28.79125°$

Key-in	Display	Comments
[−]	129.20875	NEGATIVE INDICATOR LIGHTS.
[−]	129.20875	
22	22.	NEGATIVE INDICATOR GOES OUT.
[+]	151.20875	NEGATIVE INDICATOR LIGHTS.
180	180.	NEGATIVE INDICATOR GOES OUT.
[=]	28.79125	

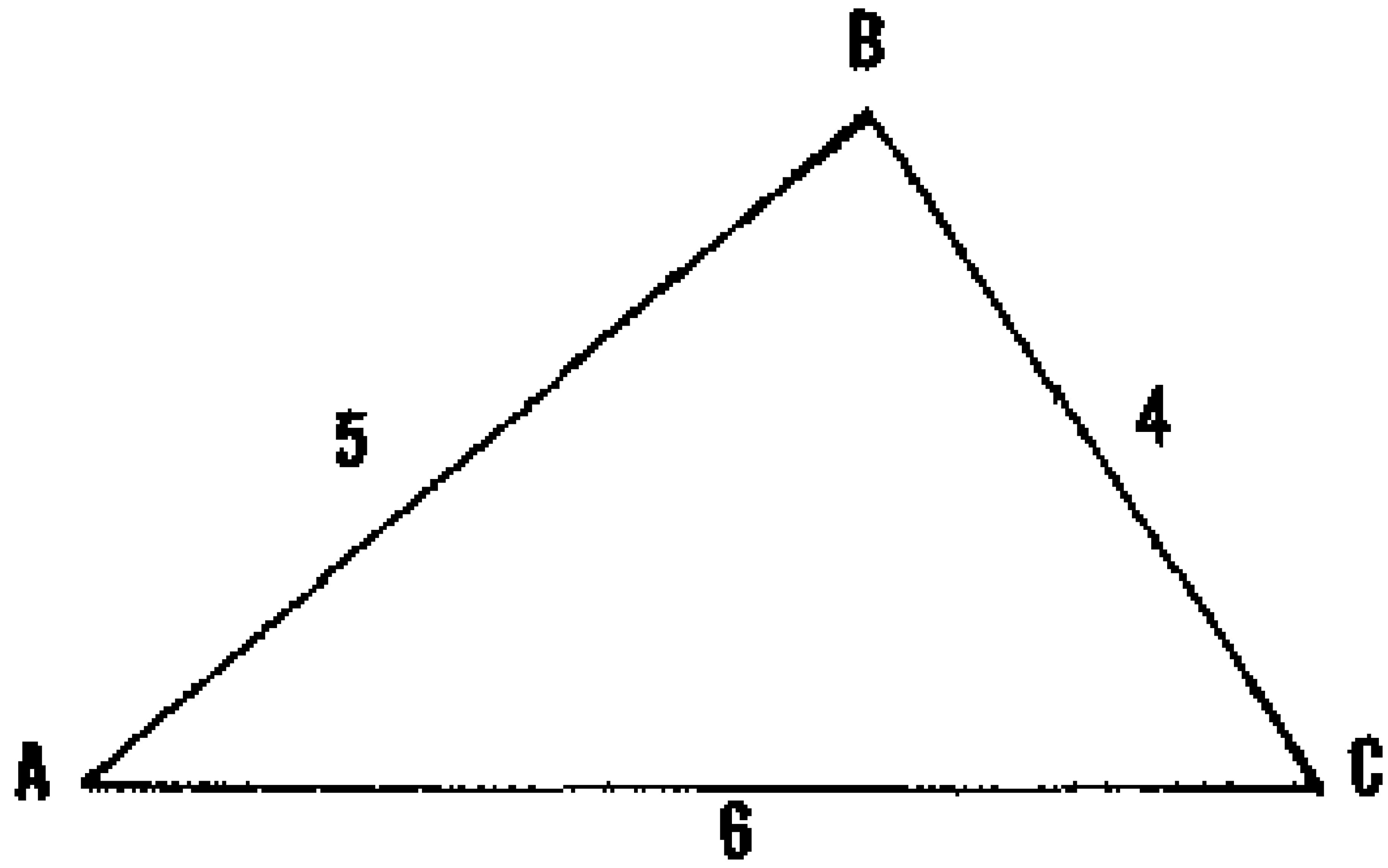
PART III $\frac{(b \sin C)}{\sin B} = c = 82.282935$

Key-in	Display	Comments
[f] (sin)	0.48162	
[×]	0.48162	
108	108.	
[÷]	52.01496	
[f] (x←m)	0.6321476	
[=]	82.282935	

COSINE LAW

The law of cosines can be used to calculate the angles of a given triangle when the magnitude of the three sides is known.

Example:



$$B = \cos^{-1}\frac{(a^2 + c^2 - b^2)}{2ac} = 82.81928°$$

Key-in	Display	Comments
[C/CE]	0.	
[f](x→m)	0.	Clear memory
4	4.	
[f](m+x²)	4.	
5	5.	
[f](m+x²)	5.	
6	6.	
[f](x^y)	1.79176	
2	2.	
[=]	36.00002	
[f](m−)	36.00002	
[f](x←m)	4.99998	
[÷]	4.99998	
2	2.	
[÷]	2.49999	
4	4.	
[÷]	0.6249975	
5	5.	
[illegible]	0.1249995	

POLAR TO RECTANGULAR TRANSFORMATION

The simplest process for converting r ∠∝ to A + iB is solving for the two projections using the equations [A = rcos∝] and [B = rsin ∝].

Example: A + iB = 5 ∠53.13°

Key-in	Display	Comments
53.13	53.13	
[f](x→m)	53.13	
[f](sin)	0.799999	
[×]	0.799999	
5	5.	
[=]	3.999995	Value of B
[⇆]	5.	
[f] (x↔m)	53.13	
[f](cos)	0.600002	
[×]	0.600002	
[f](x←m)	5.	
[=]	3.00001	Value of A

RECTANGULAR TO POLAR TRANSFORMATION

Example: A + iB = r ∠B where $r^2 = A^2 + B^2$ and B = $\tan^{-1} \frac{B}{A}$
where B = 4   A = 3

Key-in	Display	Comments
[C/CE]	0.	
[f](x→m)	0.	Clear memory.
4	4.	
[f](m+x²)	4.	
[÷]	4.	
3	3.	
[f](m+x²)	3.	Memory now contains [4² + 3²]
[=]	1.3333333	
[f](arc) (tan)	53.13009	Value of angle.
[f] (x↔m)	25.	
[f](√x)	5.	Magnitude. Value of angle is in memory.

EXPONENTIALS (POSITIVE POWERS)

Example: $5e^{4\sqrt{0.25}} = 36.945265$

Key-in	Display	Comments
4	4.	
[×]	4.	
.25	0.25	
[f] ($\sqrt{x}$)	0.5	
[=]	2.	
[f] (e^x)	7.389053	
[×]	7.389053	
5	5.	
[=]	36.945265	

Example: AntiLog$_{10}$ of 2.3 or $10^{2.3} = 199.5262$

Key-in	Display	Comments
2.3	2.3	
[f] (10^x)	199.5262	

Example: $A^{\sqrt{B+C^2}}$ Let A = 4, B = 5, C = 2 $4^{\sqrt{5+2^2}} = 64.0001$

Key-in	Display	Comments
4	4.	
[f] (x^y)	1.386295	
5	5.	
[f] (x→m)	5.	
2	2.	
[f] ($m+x^2$)	2.	
[f] (x←m)	9.	
[f] ($\sqrt{x}$)	3.	
[=]	64.0001	

EXPONENTIALS (NEGATIVE POWERS)

Example: $e^{-1/\sqrt{4}} = 0.606531$

Key-in	Display	Comments
4	4.	
[f] ($\sqrt{x}$)	2.	
[f] ($^1/x$)	0.5	
[+/-]	0.5	NEGATIVE INDICATOR LIGHTS
[illegible]	0.606531	NEGATIVE INDICATOR GOES OUT

Example: $(3.5)10^{-4} = 0.00035$

Key-in	Display	Comments
4	4.	
[+/-]	4.	NEGATIVE INDICATOR LIGHTS
[f] (10^x)	0.0001	NEGATIVE INDICATOR GOES OUT
[×]	0.0001	
3.5	3.5	
[=]	0.00035	

Example: $x^{-\sqrt{a}}$ Let $x = 5$ $5^{-\sqrt{9}}$
$a = 9$

NOTE: This example also demonstrates the entry correction capability of the machine.

Key-in	Display	Comments
5	5.	
[f] (x^y)	1.609438	
6	6.	ERROR!! ENTERED WRONG NUMBER.
[C/CE]	0.	
9	9.	
[f] ($\sqrt{x}$)	3.	
[+/-]	3.	NEGATIVE INDICATOR LIGHTS.
[+]	0.008	Depression of [+] key completes an x^y function. NEGATIVE INDICATOR GOES OUT.

HYPERBOLIC FUNCTIONS

The three hyperbolic functions are defined as:

$$\sinh a = \frac{(e^a - e^{-a})}{2}, \quad \cosh a = \frac{(e^a + e^{-a})}{2}, \quad \tanh a = \frac{(e^a - e^{-a})}{(e^a + e^{-a})}$$

Example: tanh 3 = 0.9950547

Key-in	Display
3	3.
[f] (e^x)	20.08553
[f] (x→m)	20.08553
[−]	20.08553
[f] (1/x)	0.049787
[f] (m+)	0.049787
[÷]	20.035743
[f] (x←m)	20.135317
[=]	0.9950547

INVERSE HYPERBOLIC FUNCTIONS

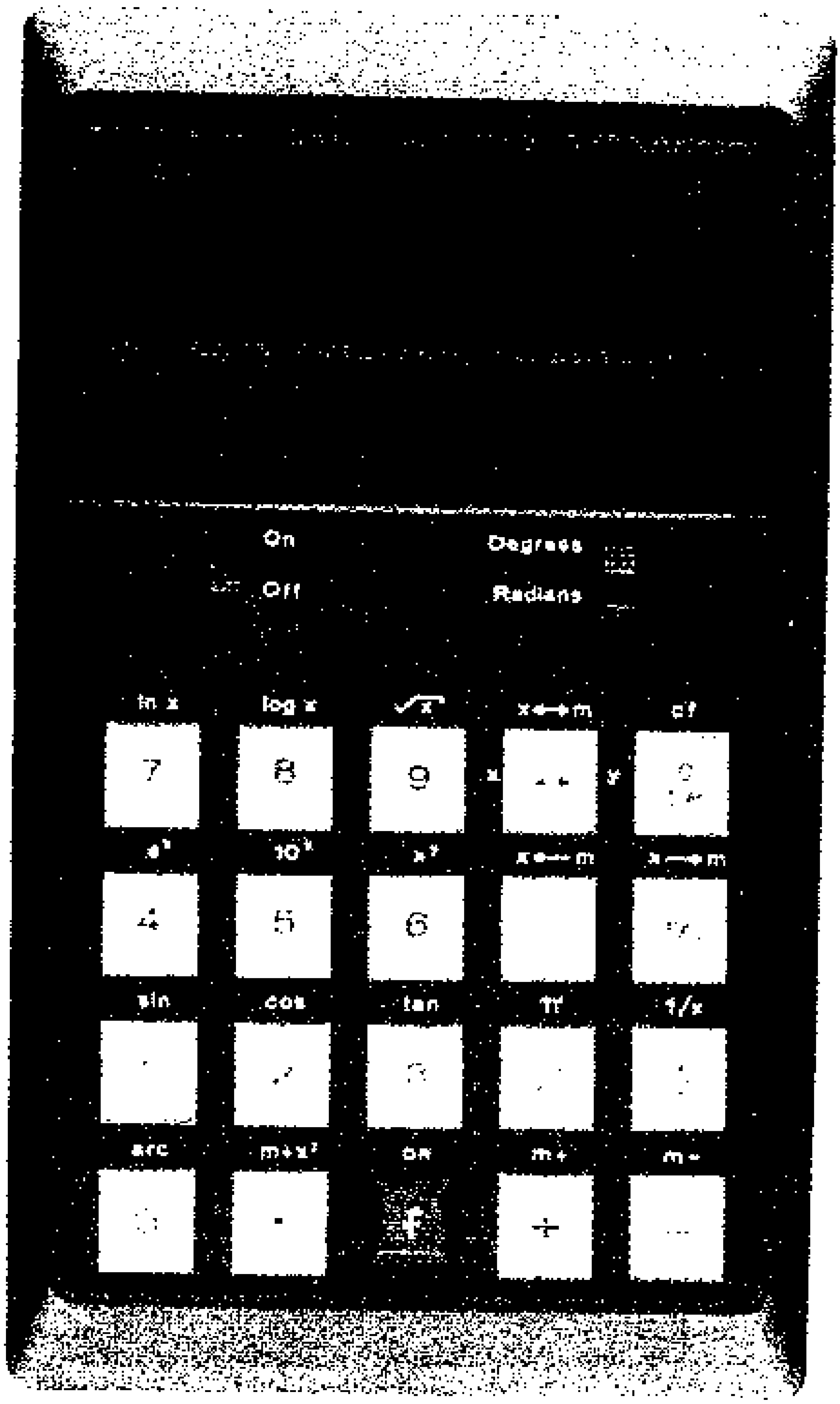
The three inverse hyperbolic functions are defined as:

$\sinh^{-1} b = \ln(b + \sqrt{b^2 + 1})$, $\cosh^{-1} b = \ln(b + \sqrt{b^2 - 1})$, $\tanh^{-1} b = \frac{1}{2} \ln\left[\frac{(1 + b)}{(1 - b)}\right]$

Example: $\tanh^{-1} 0.8 = 1.0986125$

Key-in	Display
1	1.
[f] (x→m)	1.
[+]	1.
.8	0.8
[f] (m−)	0.8
[÷]	1.8
[f] (x←m)	0.2
[=]	9.
[f] (ln x)	2.197225
[÷]	2.197225
2	2.
[=]	1.0986125

SECTION V
APPLIED FIELDS



MACHINING

Example: Milling Machine

A 2 inch milling cutter with 14 teeth is turning at 240 r.p.m. The table is feeding towards the cutter at 8 inches per minute. Find the cutting speed and the feed per tooth.

Formula: Cutting Speed:

$$S = \left[\frac{\pi D}{12}\right] N = \left[\frac{\pi 2}{12}\right] 240 = 125.66368 \text{ feet/minute}$$

Feed per Tooth:

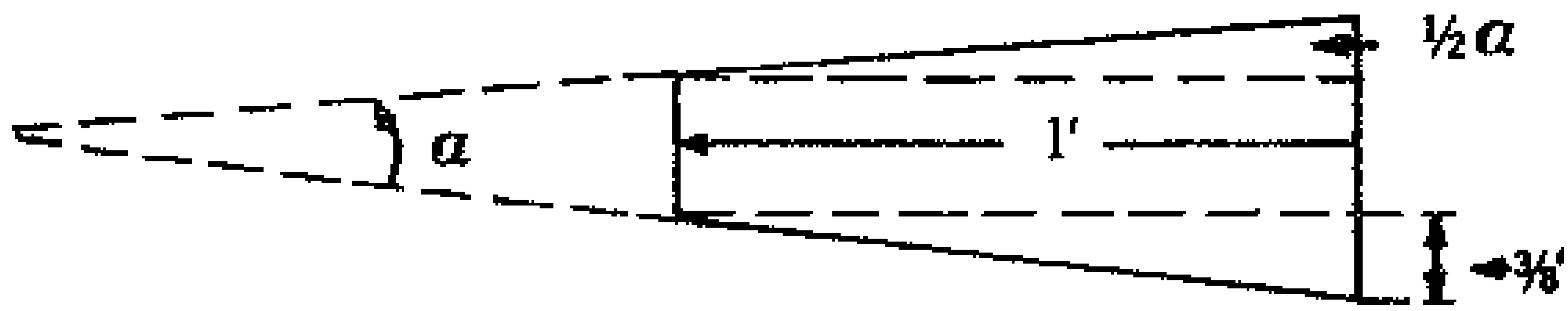
$$f_t = \frac{f}{Nn} = \frac{8}{(240)(14)} = 0.0023809 \text{ inches}$$

Where:
- S = Cutting speed in feet/minute
- N = cutter speed
- D = diameter of cutter
- f_t = feed per tooth
- f = table feed
- n = number of teeth

Key-in	Display	Comments
[f] (π)	3.1415926	
[×]	3.1415926	
2	2.	
[÷]	6.2831852	
12	12.	
[×]	0.5235987	
240	240.	
[=]	125.66368	Cutting speed.
8	8.	
[÷]	8.	
14	14.	
[÷]	0.5714285	
240	240.	
[=]	0.0023809	Feed per tooth.

Example: Tapers

Find the tapers angle, if the taper per foot is ¾ inch.



Formula: $\text{Tan}\ \frac{\alpha}{2} = \frac{\frac{1}{2}(\text{taper per foot})}{12\ \text{in/ft}}$ or $= 2\tan^{-1}\frac{\frac{1}{2}(\frac{3}{4})}{12} =$

$$2\tan^{-1}\frac{3}{(8)(12)}$$

Key-in	Display	Comments
3	3.	
[÷]	3.	
8	8.	
[÷]	0.375	
12	12.	
[=]	0.03125	
[f] (arc) (tan)	1.789909	α/2 term.
[×]	1.789909	
2	2.	
[=]	3.579818	Taper angle.

COMPOUND INTEREST

If P is the principal placed at interest compounded q times per year at a rate i (expressed as a decimal), for a period of n years

The amount is: $A = P\left[1 + \frac{i}{q}\right]^{nq}$

Example: Calculate the amount of $6,385.15 invested for 15 years at 6% per annum compounded quarterly.

Key-in	Display	Comments
15	15.	
[×]	15.	
4	4.	
[=]	60.	nq term.
[f] (x→m)	60.	
.06	0.06	i term.
[÷]	0.06	
4	4.	
[+]	0.015	
1	1.	
[=]	1.015	
[f] (x^y)	0.014888	
[f] (x←m)	60.	
[=]	2.443129	
[×]	2.443129	
6385.15	6385.15	
[=]	15599.745	Amount at the end of 15 years.

PRESENT VALUE

What is the present value of a sum S due in n periods at i rate per period converted m times per year?

Formula: $PV = \frac{S}{\left[1 + \frac{i}{m}\right]^{mn}}$

Example: Find the present value of $8,695.70 due in 12 years at 5½% per annum compounded quarterly.

Key-in	Display	Comments
4	4.	
[×]	4.	
12	12.	
[=]	48.	
[f] (x→m)	48.	mn term.
.055	0.055	
[÷]	0.055	
4	4.	
[+]	0.01375	i/m term.
1	1.	
[=]	1.01375	
[f] (x^y)	0.013656	
[f] (x←m)	48.	
[=]	1.926082	$(1 + i/m)^{MN}$ term.
[÷]	1.926082	
8695.70	8695.70	S term.
[↔]	1.926082	
[=]	4514.7091	Present value.

MORTGAGE AMORTIZATION

What is the number of periods necessary (j) to reduce an original mortgage (B) at an interest (i) per period with period payments (P) to a desired level (B)?

Formula:

$$j = \frac{\ln\left[\dfrac{P - B_j i}{P - B_0 i}\right]}{\ln(1 + i)}$$

Example: How many years will it take to reduce a $60,000 mortgage at 7% interest per annum to $22,000 with monthly payments of $399.18?

Key-in	Display	Comments
.07	0.07	
[÷]	0.07	
12	12.	
[×]	0.0058333	i term per period.
60000	60000.	B_0 term.
[+]	349.998	
[+/-]	349.998	NEGATIVE INDICATOR LIGHTS
399.18	399.18	P term. NEGATIVE INDICATOR GOES OUT
[+=]	49.182	
[f] (x→m)	49.182	
.07	0.07	
[÷]	0.07	
12	12.	
[×]	0.0058333	
22000	22000.	B_i term.
[+]	128.3326	
[+/-]	128.3326	NEGATIVE INDICATOR LIGHTS
399.18	399.18	NEGATIVE INDICATOR GOES OUT
[÷]	270.8474	
[f] (x←m)	49.182	
[=]	5.5070432	
[f] (ln x)	1.706028	
[f] (x→m)	1.706028	
.07	0.07	
[÷]	0.07	
12	12.	
[+]	0.0058333	
1	1.	
[+=]	1.0058333	
[f] (ln x)	0.005816	
[÷]	0.005816	
[f] (x←m)	1.706028	
[↔]	0.005816	
[+=]	293.33356	j term.
[÷]	293.33356	
12	12.	
[=]	24.444463	Number of years required.

[redacted]

STATISTICS

MEAN AND STANDARD DEVIATION

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad S = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}{n-1}}$$

Using the second equation for calculating standard deviation requires the values of x to be entered only once.

Example: The results of throwing a die are:

Number of Spots	1	2	3	4	5	6
Frequency	31	28	30	30	39	42

What is the standard deviation for frequency?

Key-in	Display	Comments
[C/CE]	0.	
[f] (x→m)	0.	Clears memory.
31	31.	↑
[f] (m+x²)	31.	
[+]	31.	
28	28.	
[f] (m+x²)	59.	
[+]	59.	
30	30.	
[f] (m+x²)	30.	
[+]	89.	These steps form $\sum x_i$ in the x register and $\sum (x_i)^2$ in the memory.
30	30.	
[f] (m+x²)	30.	
[+]	119.	
39	39.	
[f] (m+x²)	39.	
[+]	158.	
42	42.	
[f] (m+x²)	42.	↓
[÷]	200.	Display shows $\sum x_i = 200$

Key-in	Display	Comments
6	6.	
[×]	33.333333	Display shows x_i = 33.333333
[=]	199.99999	
[×]	199.99999	
[÷]	39999.996	
6	6.	
[=]	6666.666	
[f](m−)	6666.666	Subtracts $\frac{(\sum x_i)^2}{n}$ from x_i^2 in memory.
[f](x←m)	163.334	
[÷]	163.334	
5	5.	
[=]	32.6668	
[f](√x)	5.7154877	Display shows S = 5.7154877

EVALUATION OF X^2 WHEN EXPECTED VALUES ARE EQUAL (E_i = E)

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E)^2}{E} = \frac{\sum_{i=1}^{n} O_i^2 - \frac{(\sum O_i)^2}{n}}{\frac{(\sum O_i)}{n}}$$

O_i = observed frequency

E = expected frequency

$$E = \frac{\sum_{i=1}^{n} O_i}{n}$$

Example: Use the die example used for the previous problem.

Key-in	Display	Comments
[C/CE]	0.	
[f](x→m)	0.	Clears memory.
31	31.	
[f](m+x²)	31.	
[+]	31.	
28	28.	
[f](m+x²)	28.	
[+]	59.	
30	30.	
[f](m+x²)	30.	
[+]	89.	

EVALUATION OF χ^2 (Continued)

Key-in	Display	Comments
30	30.	
[f] (m+x²)	30.	
[+]	119.	
39	39.	
[f] (m+x²)	39.	
[+]	158.	
42	42.	
[f] (m+x²)	42.	
[÷]	200.	Display shows $\sum 0_i$
6	6.	
[×]	33.333333	Display shows $E = \bar{x}$
[=]	199.99999	
[×]	199.99999	
[÷]	39999.996	
6	6.	
[=]	6666.666	
[f] (m−)	6666.666	
[f] (x←m)	163.334	
[÷]	163.334	
33.333333	33.333333	
[=]	4.90002	

ELECTRONICS

CHARGE ON A CAPACITOR

Formula: $V_c = V_i\left(1 - e^{-\frac{t}{RC}}\right)$

V_i = Initial voltage
t = Time in seconds
R = Resistance in ohms
C = Capacity in farads

Example: Determine V_c (t) if R = 47 kiloohms, C = 0.1 microfarads, t = 14 msec., and V_i = 20 volts.

Key-in	Display	Comments
.014	0.014	
[÷]	0.014	
.0000001	0.0000001	
[÷]	140000.	
47000	47000.	
[=]	2.9787234	
[+/-]	2.9787234	NEGATIVE INDICATOR LIGHTS.
[f] (e^x)	0.050858	NEGATIVE INDICATOR GOES OUT.
[+/-]	0.050858	NEGATIVE INDICATOR LIGHTS.
[+]	0.050858	
1	1.	NEGATIVE INDICATOR GOES OUT.
[×]	0.949142	
20	20.	
[=]	18.98284	

ADMITTANCE

Formula: $Y = \frac{(R - j2\pi fL)}{(R^2 + 4\pi^2 f^2 L^2)}$

where: Y = Admittance in mhos
R = Resistance in ohms
f = Frequency in hertz
L = Inductance in henries

Example: Determine the admittance of a coil whose inductance is 0.2 henries and whose resistance is 1.2 kiloohms at a frequency of 1 kilohertz.

ADMITTANCE (Continued)

Key-in	Depress	Comments
[C/CE]	0.	
[f](x→m)	0.	Clears memory.
1200	1200.	
[f](m+x^2)	1200.	R^2 into memory.
2	2.	
[×]	2.	
[f](π)	3.1415926	
[×]	6.2831852	
1000	1000.	
[×]	6283.1852	
.2	0.2	
[=]	1256.637	2πfL term.
[f](m+x^2)	1256.637	$R^2 + (2\pi fL)^2$ into memory.
[÷]	1256.637	
[f](x←m)	3019136.5	
[=]	0.0004162	Imaginary term: −j.
1200	1200.	
[÷]	0.0003974	Real term: answer.

CAUTION:
Read Rules for Safe Operation and Instructions Carefully. Use only the Charger Supplied.

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