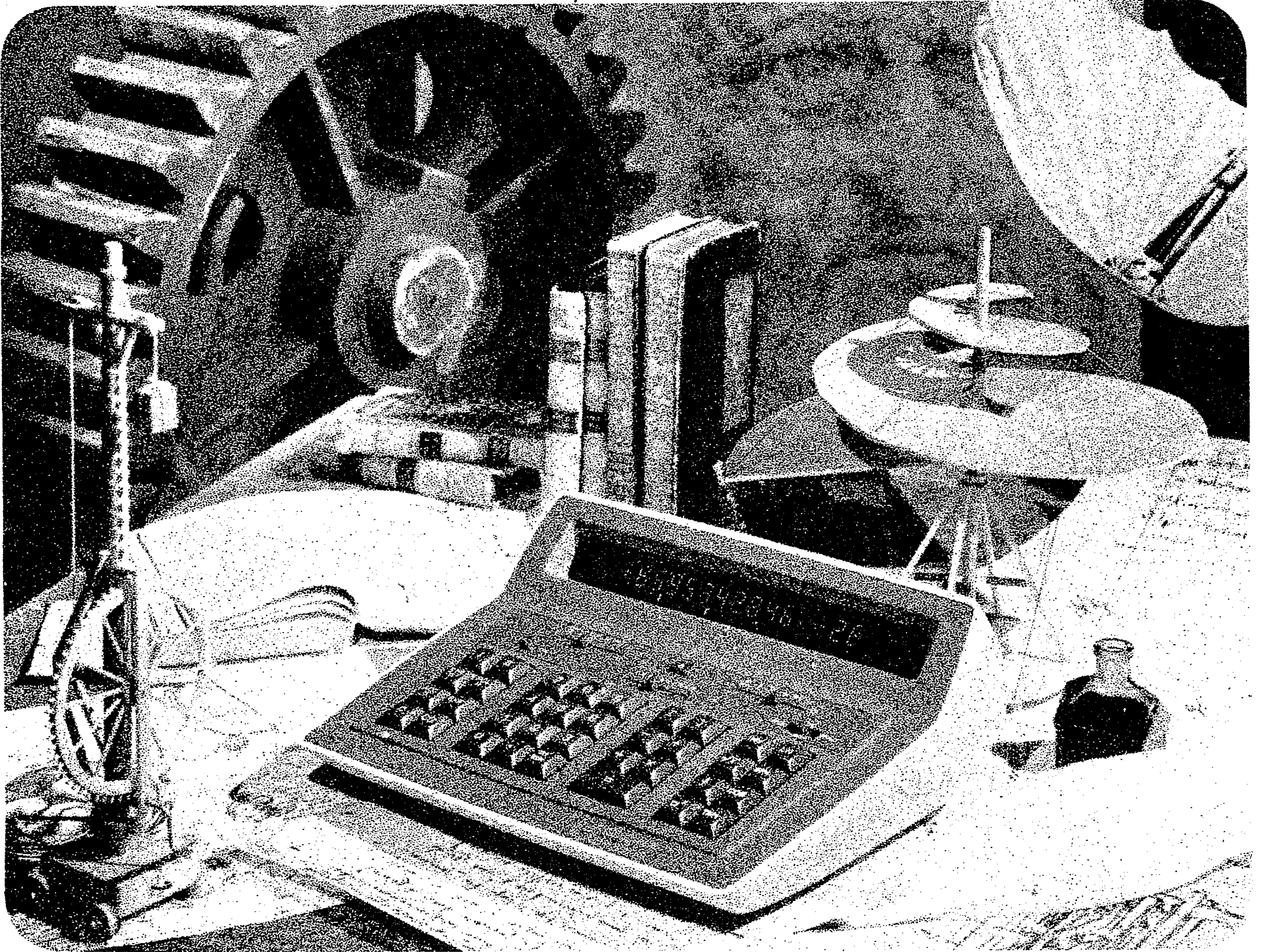


Model 1920



Electronic Display Calculator

Operating Instructions



MONROE

Litton

Monroe, The Calculator Company

BASIC SPECIFICATIONS

Electronic Display Calculator

Automatic Punctuation

Algebraic Sequential Calculating Operation

Full Arithmetic Capability in All 10 Storage Registers

Automatic Constants for $+$ $-$ \times \div a^x

Dynamic Range $\pm 9.999 \dots \times 10^{\pm 99}$

Display Reformating to Exponent

Floating Minus Sign

Leading and Trailing Zero Suppression

Electronic Keyboard Interlocks and Rollover

Functions

\sqrt{x} $1/x$ a^x Log_{10} Log_e 10^x e^x π

Degrees to Radians, Radians to Degrees

Rectangular to Polar and Polar to Rectangular Coordinate Conversions

SIN COS TAN SIN^{-1} COS^{-1} TAN^{-1}

Degrees-Minutes-Seconds to Decimal, Decimal to Degrees-Minutes-Seconds

Three (3) Levels of Parentheses

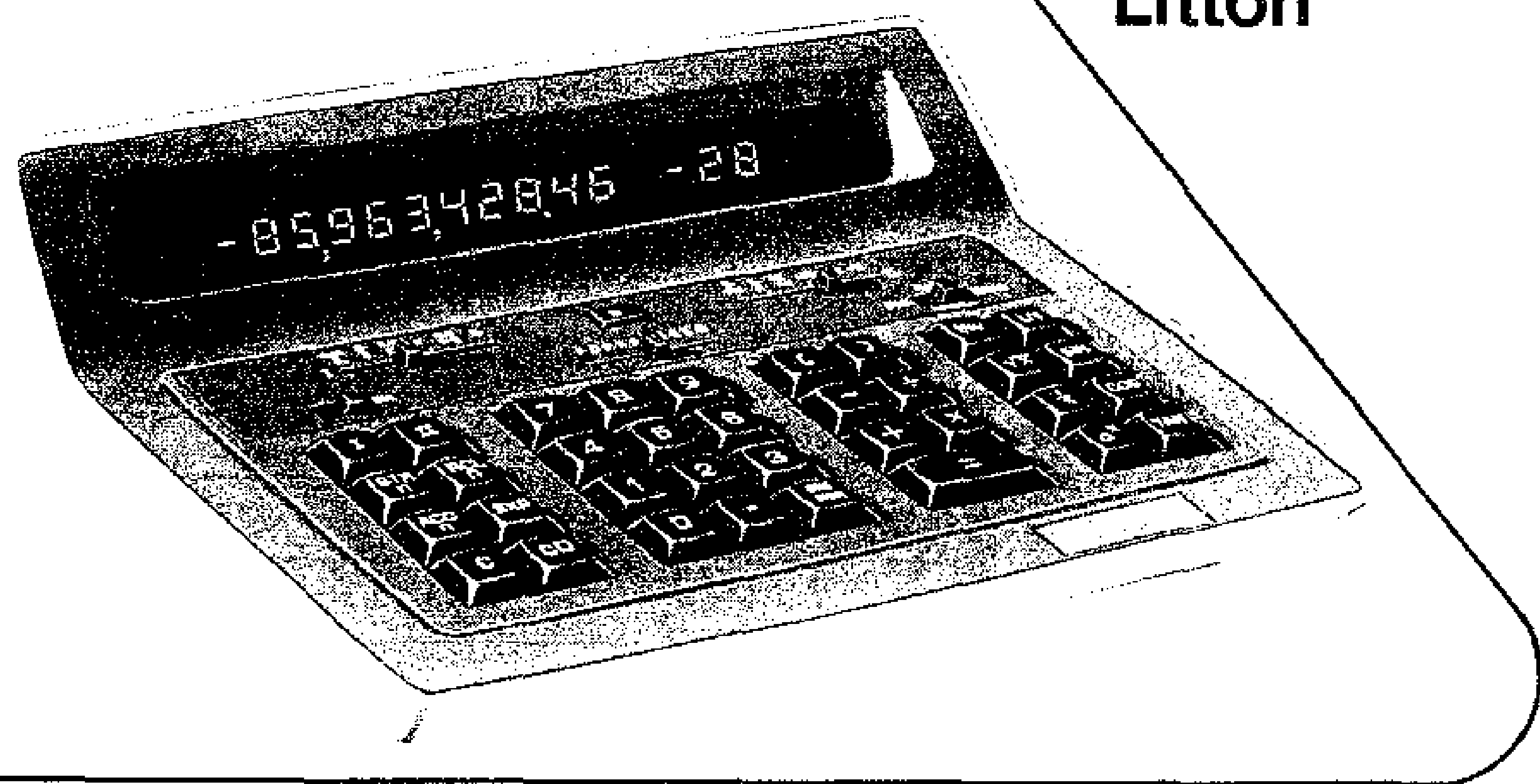
Σx , Σx^2 , n , Mean, Standard Deviation

The Model 1920 can be adjusted to provide U. S. or European punctuation at the user's option.
For further details consult your local Monroe office.



MONROE

Litton



Model 1920 Electronic Display Calculator Operating Instructions

INTRODUCTION

Speed . . . accuracy . . . efficiency — these were Monroe's objectives in developing a truly fine scientific and engineering calculator — the Model 1920.

Now, as always, Monroe's objectives are your advantages. As you become acquainted with the 1920's many problem-solving capabilities it will become evident that this new Monroe was designed with your unique calculating requirements in mind. But more than this, Monroe's 60-plus years of calculator experience taught us that no matter what the job, calculator users want a product that not only solves problems but provides ease, simplicity, and convenience. We are sure you will experience these sometimes-overlooked factors during the many years of long and dependable service your 1920 will give you.

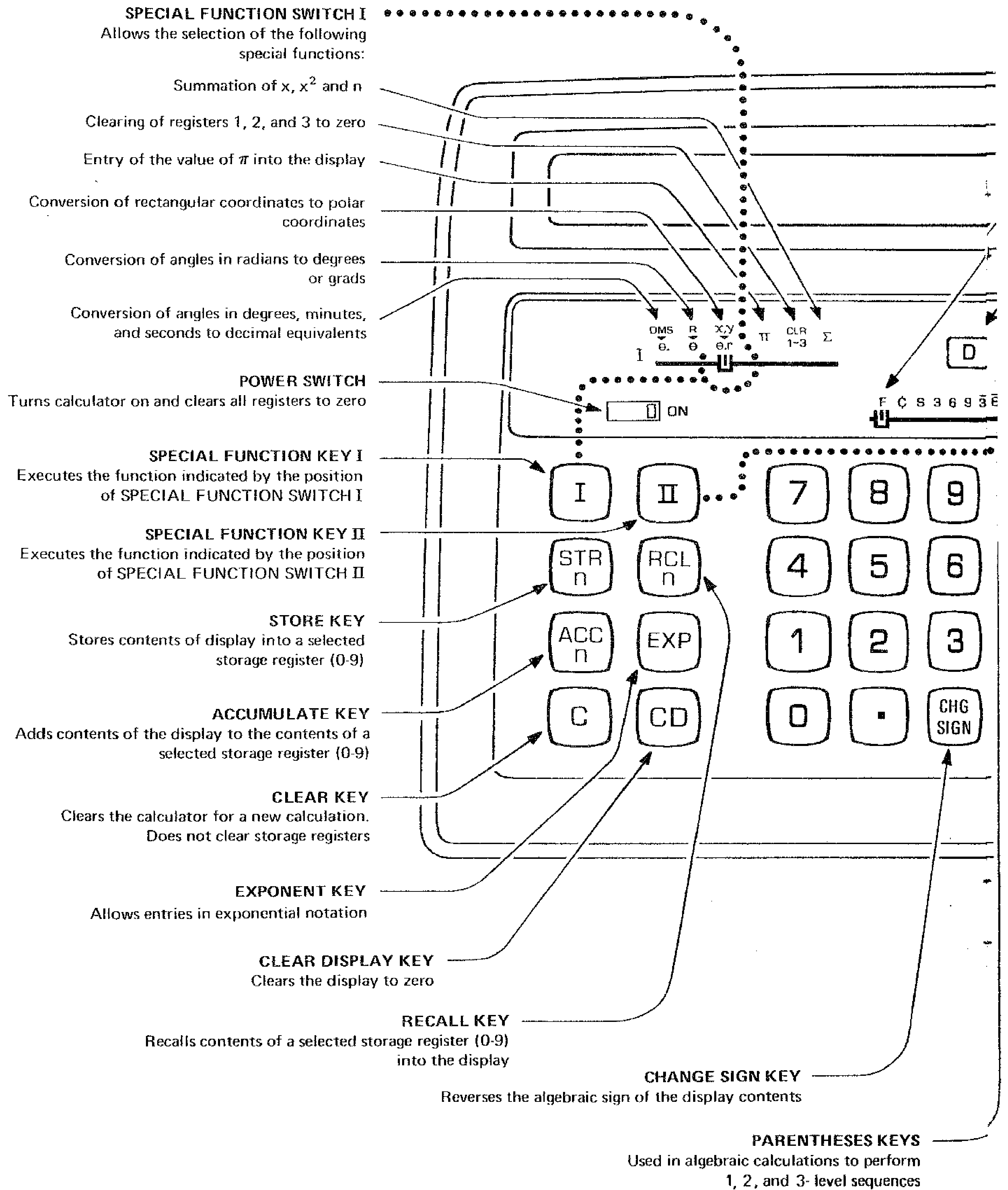
And, we're prepared to prove this in 365 cities throughout the United States and Canada. We'll do our utmost to make sure that owning and operating a Monroe will be a most rewarding experience, today and tomorrow.

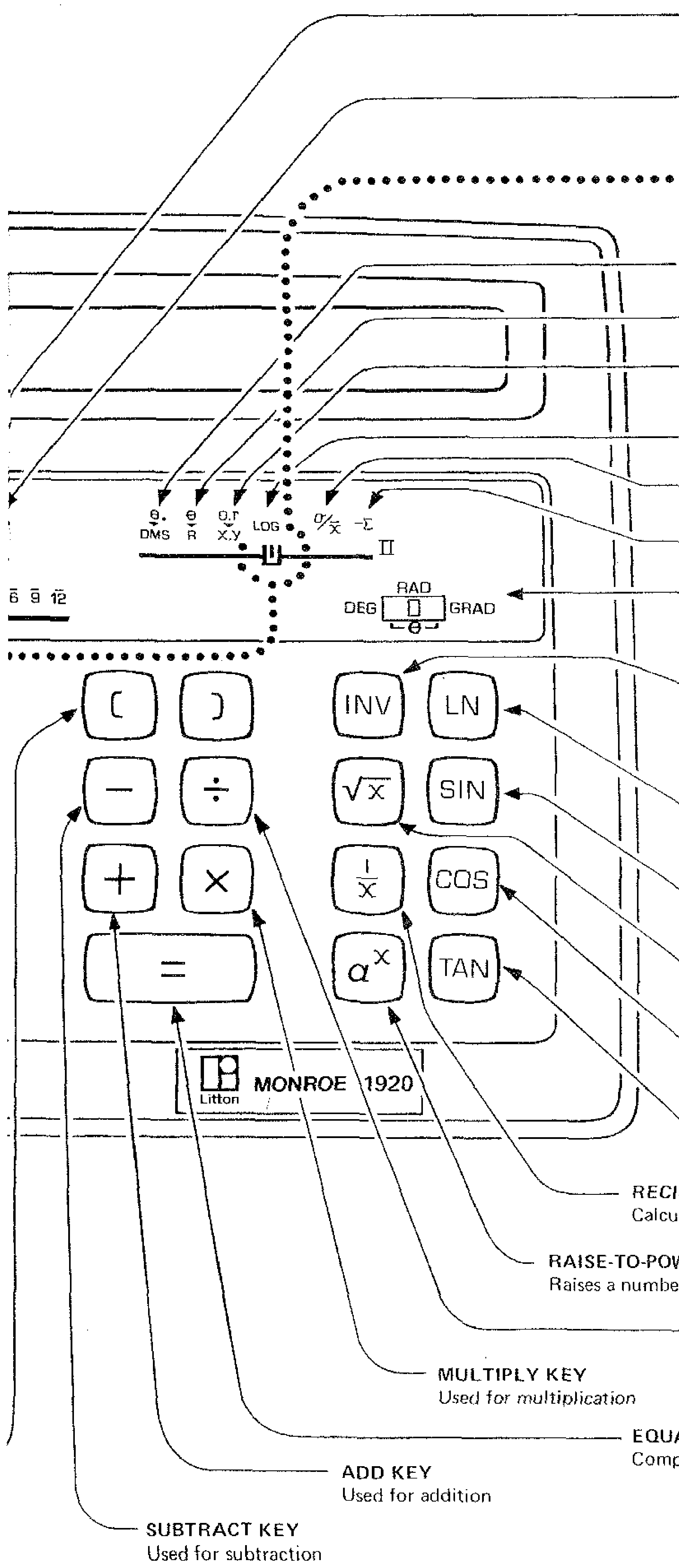
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Monroe, The Calculator Company

operating controls





- DISPLAY FORMAT SWITCH**
Selects floating decimal, scientific notation or fixed exponent
- REFORMAT DISPLAY KEY**
Reformats display to the setting of the Display Format Switch
- SPECIAL FUNCTION SWITCH II**
Allows the selection of the following special functions:
 - Conversion of angles in decimal format to degrees, minutes and seconds
 - Conversion of angles in degrees (or grads) to radians
 - Conversion of polar coordinates to rectangular coordinates
 - Calculation of the common (base 10) logarithm
 - Calculation of mean and standard deviation
 - Deletion of data from n , Σx and Σx^2
- DEG-RAD-GRAD SWITCH**
Used to select the units (degrees, radians, grads) in which angular entries and results are expressed
- INVERSE KEY**
Used with LOG_e , SINE, COSINE, and TANGENT keys to calculate the antilog_e (e^x), arc sine, arc cosine, and arc tangent. Also used to find antilog₁₀ (10^x)
- LOG_e KEY**
Calculates the natural (base e) logarithm of the display register contents
- SINE KEY**
Calculates the sine of the display contents
- SQUARE ROOT KEY**
Calculates the square root of the display contents
- COSINE KEY**
Calculates the cosine of the display contents
- TANGENT KEY**
Calculates the tangent of the display contents
- RECIPROCAL KEY**
Calculates the reciprocal of the display contents
- RAISE-TO-POWER KEY**
Raises a number (a) to a power (x)
- DIVIDE KEY**
Used for division
- MULTIPLY KEY**
Used for multiplication
- EQUALS KEY**
Completes a calculation
- ADD KEY**
Used for addition
- SUBTRACT KEY**
Used for subtraction

GENERAL INFORMATION

C Clears display and any algebraic sequence in progress.

Does not clear storage registers, 0-9.

CD Clears display only.

CHG SIGN Reverses the algebraic sign of the number in the display.

For example, to enter -12, depress **CHG SIGN** **1** **2** or **1** **2** **CHG SIGN**.

EXP Permits entry of power-of-ten exponent (to ± 99).

For example, to enter 2.3×10^{-19} , depress **2** **.** **3** **EXP** **CHG SIGN** **1** **9**.

ERROR Appears in the display when an incorrect mathematical operation is attempted. To clear, depress **C** or **CD**.

Operations causing **ERROR**

Division by 0	Decimal to DMS conversion $\theta \geq 10,000^\circ$
Square root of -x	Close parenthesis without a prior open parenthesis
For a^x : 0^{-x} , 0° or $a < 0$ and noninteger x	Equals key depression before close parenthesis
Standard deviation with $n \leq 1$	More than 3 open parentheses without a close parenthesis
Arc sine of x Arc cosine of x } $-1 > x > 1$	For \log_{10} , \log_e : $x \leq 0$

DFLO appears in the display when an entry or result lies outside the dynamic range of the calculator: $\pm 9.999 \dots \times 10^{\pm 99}$.

To clear, depress **C** or **CD**.

The examples in this manual are based on the floating point setting of the Display Format Switch (**F C S 3 6 9 3 6 9 12**) unless otherwise specified. Therefore, set your Display Format Switch to F.

ADDITION/SUBTRACTION

Examples	Enter	Depress	Read
$8 + 4 - 3$	8	+	8
	4	-	12
	3	=	9
$36 + 60 \times 10^5 - .002$	36	+	36
	60×10^5	-	6,000,036
	.002	=	6,000,035.998

MULTIPLICATION

Example	Enter	Depress	Read
$-8 \times 4 \times 10^{-15}$	-8	×	-8
	4×10^{-15}	=	-32 -14

Numbers can be multiplied by a constant multiplier without re-entry of the multiplier.

Example	Enter	Depress	Read
$2 \times 3 =$	2	×	2
$2 \times 4 =$	3	=	6
$2 \times 5 =$	4	=	8
	5	=	10

Numbers can be squared without re-entering the number, by depressing **×** **=**, or **×** followed by another algebraic key such as **+** or **-**.

Examples	Enter	Depress	Read
2.5^2	2.5	× =	6.25
$2.5^2 + 6$	2.5	× +	6.25
	6	=	12.25

DIVISION

Example	Enter	Depress	Read
$\frac{8.05 \times .333}{9 \times 1.08}$	8.05	\times	805
	.333	\div	268065
	9	\div	029785
	1.08	$=$	0275787037

Numbers can be divided by a constant divisor without re-entry of the divisor.

Example	Enter	Depress	Read
$\frac{180.6 \times 10^{12}}{6.02 \times 10^{23}}$	180.6×10^{12}	\div	1806 14
	Constant Divisor 6.02×10^{23}	$=$	3 -10
$\frac{18.06 \times 10^{12}}{6.02 \times 10^{23}}$	18.06×10^{12}	$=$	3 -11

EXPRESSIONS BETWEEN PARENTHESES

$[$ and $]$ permit calculation of terms within parentheses up to three levels. More than three $[$ without a $]$ causes **ERROR**

Example	Enter	Depress	Read
$\frac{3.5 + 7.2}{8.3 - 2.7}$	3.5	$+$	35
	7.2	\div $[$	107
	8.3	$-$	83
	2.7	$]$	56
		$=$	1910714286

Continued

Example

$$\frac{9.2 + 4.5}{6.3 + 7.1} - \frac{4.9}{1.7}$$

Enter

Depress

Read

9.2

+

92

4.5

÷ C

137

6.3

+

63

7.1

)

134

- C

1.02238806

4.9

÷

49

1.7

)

2.882352941

=

-1.859964881

SEQUENTIAL CALCULATIONS

Depression of **+**, **-**, **×**, **÷**, or **a^x** completes any prior operation in progress exactly as if **=** were depressed. The intermediate result is displayed.

Examples

Enter

Depress

Read

$$2 + 3 \times .5 =$$

2

+

2

3

×

5

.5

=

2.5

$$[2 + 3 \times .5]^4 =$$

2

+

2

3

×

5

.5

a^x

2.5

4

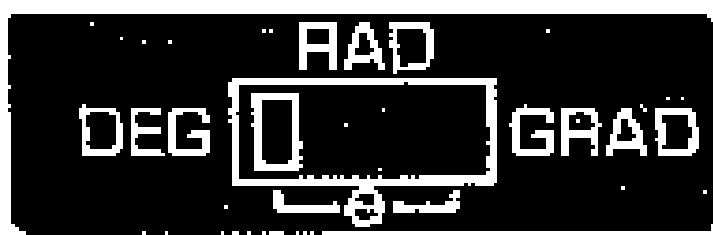
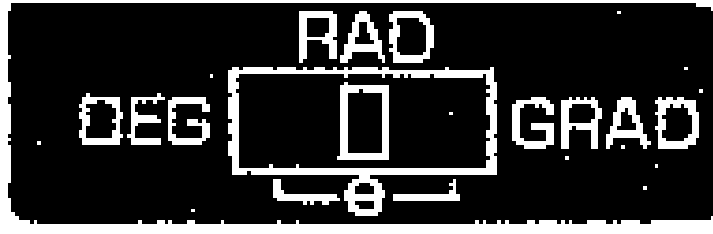

=

39.0625

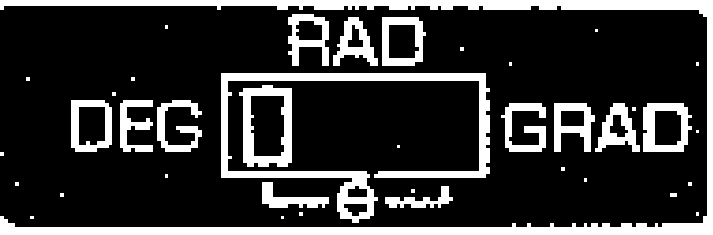


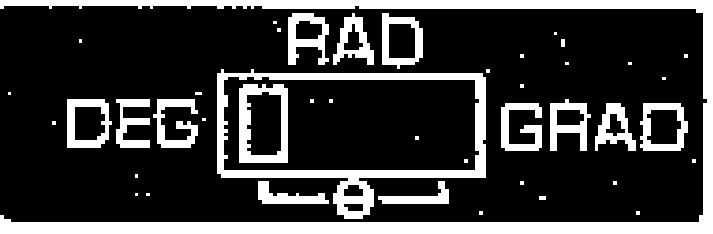
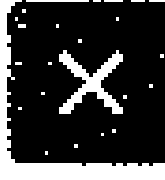





TRIGONOMETRIC FUNCTION KEYS

These keys are used to generate sine, cosine, and tangent.







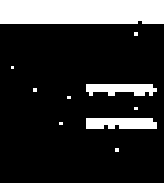



DEG-RAD-GRAD Switch

Examples	Set
Set to degrees	
Set to radians	
Set to grads	




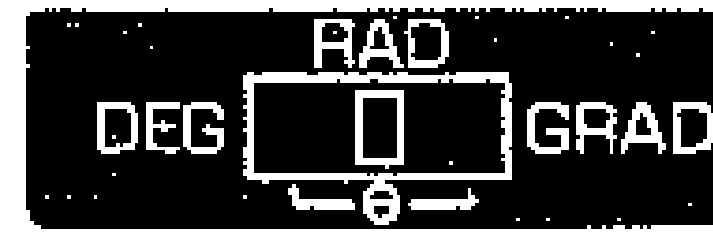


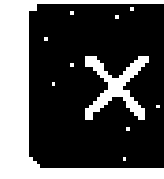


SIN Key

Examples	Set	Enter	Depress	Read
Sin 30.8°		30.8		
100 x sin 89.9°		100		
		89.9		
				





COS Key

Examples	Set	Enter	Depress	Read
Cos 17.4°		17.4		
Cos $\frac{63.1}{3}$		63.1	  	
				

TAN Key

Examples	Set	Enter	Depress	Read
Tan .73 radians		.73		
Tan ² .34 radians		.34		
			 	

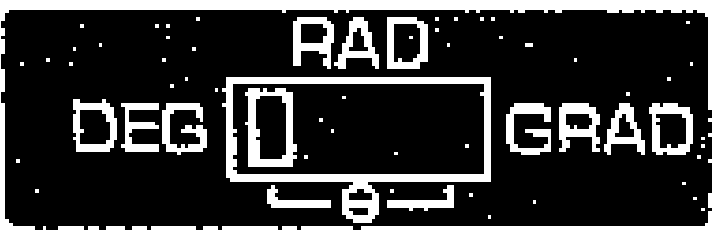




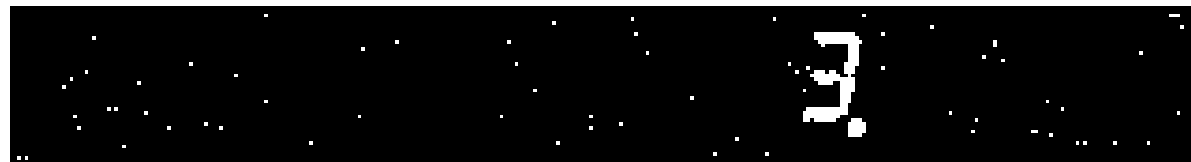


NATURAL LOGARITHM (BASE e)

Examples	Enter	Depress	Read
Log _e 17.2	17.2		
Log _e 0.00123	.00123		

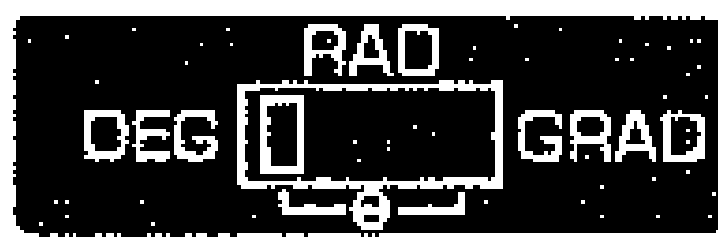
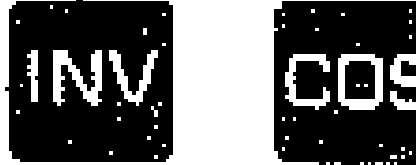




INVERSE KEY

When used with the trigonometric keys, finds arc sine, arc cosine, and arc tangent.
When used with the LN key, finds e^x (antilog_e).








Sin⁻¹

Examples	Set	Enter	Depress	Read
$\text{Sin}^{-1} .67$		.67		
$3 \times \text{sin}^{-1} .92$		3 .92		  



Cos⁻¹

Examples	Set	Enter	Depress	Read
$\text{Cos}^{-1} 0.5$		0.5		
$\text{Cos}^{-1} (-0.5)$		-0.5		

Tan⁻¹

Examples	Set	Enter	Depress	Read
$\text{Tan}^{-1} .13$		.13		
$\frac{\text{Tan}^{-1} .62}{4.9}$		.62 4.9		 

(e^x) Antilog_e

Example	Enter	Depress	Read
Antilog _e 1.76473	1.76473		

ALGEBRAIC FUNCTION KEYS

These keys are used to raise numbers to powers, and to calculate reciprocals and roots of numbers.

Raising a Number to a Power

Examples	Enter	Depress	Read
3.2^5	3.2	a^x	32
	5	=	335.54432
$7.4^{1.2} + 8.6^{-1.2}$	7.4	a^x	7.4
	1.2	+ C	11.04277094
	8.6	a^x	86
	-1.2)	0.075613938
		=	11.11838488

A constant base a can be raised to different powers, x.

3^2	3	a^x 2 =	9
3^3		3 =	27
3^4		4 =	81

Reciprocal

Examples	Enter	Depress	Read
$1/47.3$	47.3	$\frac{1}{x}$	0.021141649
$\frac{1}{5+3}$	5	+	5
	3	=	8
		$\frac{1}{x}$	0.125

Root of a Number

Example	Enter	Depress	Read
$\sqrt[5]{32}$	32	a^x	32
	5	$\frac{1}{x}$	0.2
		=	2

Continued

Square Root

Examples

Examples	Enter	Depress	Read
$\sqrt{25}$	25	\sqrt{x}	5
$\sqrt{4^2 - (4 \times 2.1 \times 1.21)}$	4	\times $-$ \square	16
	4	\times	4
	2.1	\times	8.4
	1.21	\square	10.164
		$=$	5.836
		\sqrt{x}	2.415781447

STORAGE REGISTERS

The Model 1920 contains ten storage registers, numbered 0 through 9, for storing data. All ten registers are cleared to zero when the calculator is turned on. Individual registers can be cleared by storing a zero in the register.

Storing a Number

Numbers can be stored in a register by depressing STR_n followed by n, the register number. The previous contents of the register are automatically replaced.

Example	Enter	Depress	Read	Registers	
				No.	Contents
Store 128.4 into register 6	128.4	STR_n 6	128.4	6	128.4
Store the result of 3.1 x 123 in register 0	3.1	\times	3.1		
	123	$=$ STR_n 0	381.3	0	381.3

Recalling a Number

Numbers can be recalled from a register by depressing RCL_n followed by n, the register number.

Example	Depress	Read	Registers	
			No.	Contents
Recall contents of register 6	RCL_n 6	128.4	6	128.4
Recall contents of register 0	RCL_n 0	381.3	0	381.3

Storing and Recalling Numbers

Store and recall may be executed as often as necessary to aid in the solution of a problem.

Example

Find
$$\frac{28(2.12469^{1.203})}{14(2.12469^{1.203}) - \text{LN}(2.12469^{1.203})}$$

Method: Since $2.12469^{1.203}$ appears in three places, it may be calculated once and stored as a constant.

Enter	Depress	Read
2.12469	a^x	2.12469
1.203	=	2475919814
	STR 1	2475919814
	×	2475919814
28	÷ C	6932575473
14	× RCL 1 -	346628774
	RCL 1 LN)	3379626543
	=	2053715182

Accumulating Numbers

Accumulate numbers in a register by depressing ACC_n followed by the register number.

Example

Accumulate 10, 25 and -6 in register 2

Enter	Depress	Read	Register 2 Contents
10	STR 2	10.	10
25	ACC 2	25.	35
-6	ACC 2	-6.	29
	RCL 2	29.	29

REGISTER ARITHMETIC

Addition, subtraction, multiplication and division can be performed with the contents of any one of the ten registers and display as follows:

Results Stored

Operation

Depress

Add displayed number to register contents

STR
n +

Subtract displayed number from register contents

STR
n -

Multiply register contents by displayed number

STR
n ×

Divide register contents by display number

STR
n ÷

Result In Register n

Examples

Enter

Depress

Read

Register 2 Contents

ADDITION

Add 7 to 29 in register 2
(Store 29 into register 2 if it isn't already stored from the prior example)

7

STR
n + 2
RCL
n 2

7.
36.

36

36

SUBTRACTION

Subtract 14 from 36 in register 2

14

STR
n - 2
RCL
n 2

14.
22.

22

22

MULTIPLICATION

Multiply 22 in register 2 by 4

4

STR
n × 2
RCL
n 2

4.
88.

88

88

DIVISION

Divide 88 in register 2 by 8

8

STR
n ÷ 2
RCL
n 2

8.
11.

11

11

Results Displayed

Operation

Depress

Add register contents to display number

RCL
n +

Subtract register contents from display number

RCL
n -

Multiply displayed number by register contents

RCL
n ×

Divide displayed number by register contents

RCL
n ÷

Result In Display

Examples

Enter

Depress

Read

ADDITION

Add 11 in register 2
(from prior example) to
17 in the display.

17

SUBTRACTION

Subtract 11 (in register 2) from
28 in display register.

MULTIPLICATION

Multiply 17 in the display register
by 11 in register 2.

DIVISION

Divide 187 in the display register
by 11 in register 2.

**SPECIAL FUNCTION SWITCH I
SPECIAL FUNCTION KEY I**

Use of Special Function Switch I with Special Function Key I provides six additional functions. (Σ and CLR 1-3 are discussed under Statistics Functions on page 17.)

- Degree/Minute/Second (DMS) to Decimal Angle (θ) Conversion
- Radians to Degrees or Grads Conversion
- Rectangular Coordinates (x, y) to Polar Coordinates (θ, r) Conversion
- π Constant

DMS format is DDD.MMSS_fS_f . . . where DDD are whole degrees, MM are minutes, SS are seconds, and S_fS_f . . . are fractional seconds.

DMS to Decimal Angle Conversion

Converts an angle in degrees/minutes/seconds to decimal degrees, radians or grads depending on the position of the DEG-RAD-GRAD and the Special Function Switch I.

Example

Set

Enter

Depress

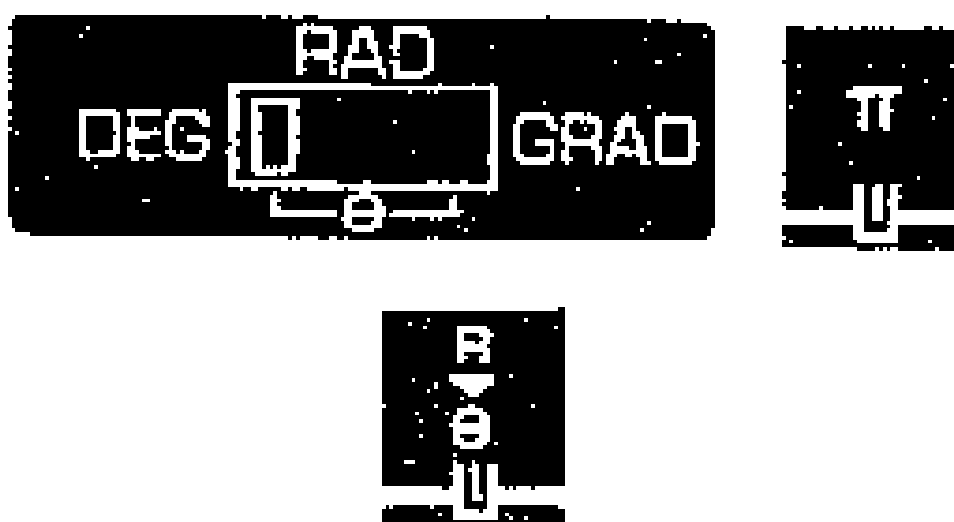
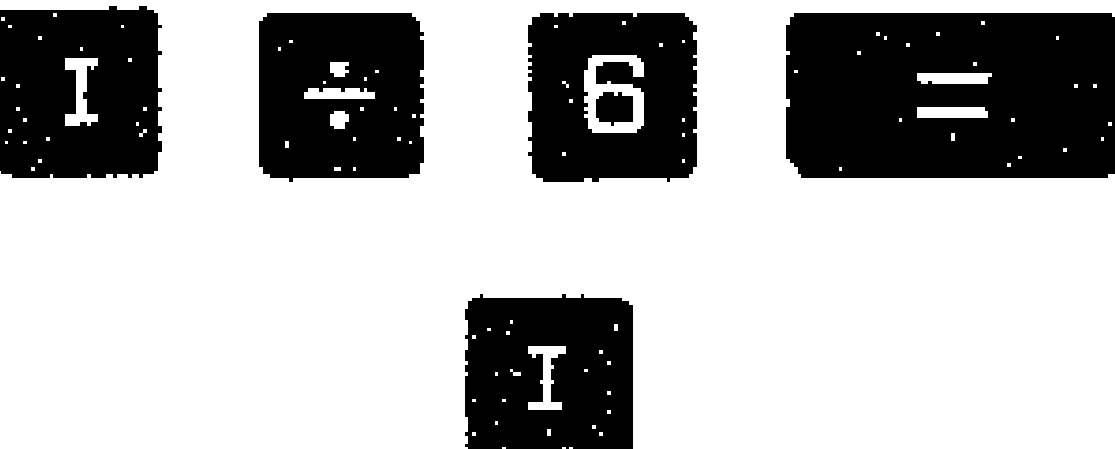


Read

Convert 30°
30'15" to
decimal
degrees

30.3015

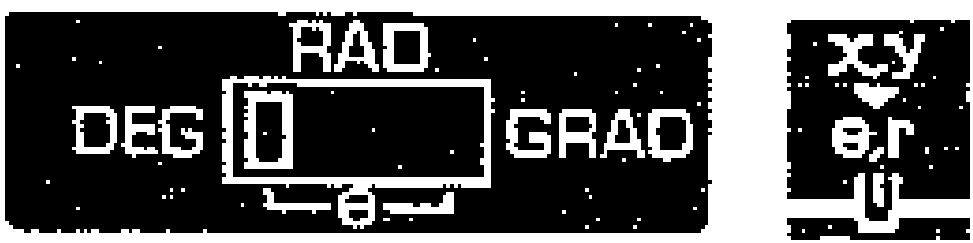
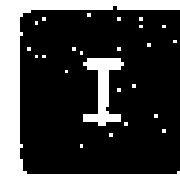

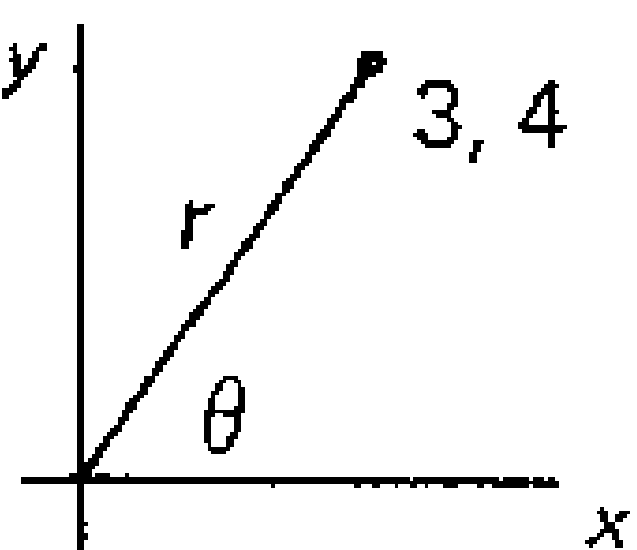


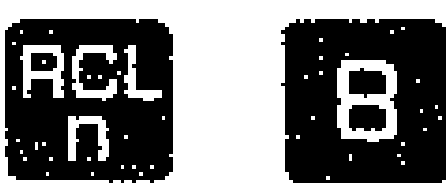

Radians to Degrees or Grads Conversion

Converts an angle in radians to decimal degrees or grads depending on the position of the DEG-RAD-GRAD switch.




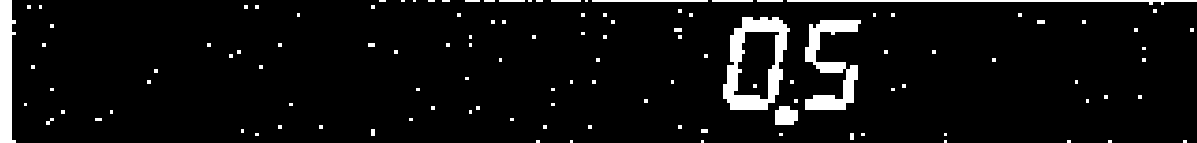
Example	Set	Depress	Read
Convert $\pi/6$ radians to degrees			 

Rectangular to Polar Conversion

Converts rectangular coordinates (x, y) to polar coordinates (θ, r) . The angle θ is displayed in decimal degrees, radians or grads, depending on the position of the DEG-RAD-GRAD switch, and is also in register 9. The radius (r) is stored in register 8.

Example	Set	Enter	Depress	Read	Registers	
					No.	Contents
Find r, θ		3				
		4		(θ) 	9	53.13010235
				(r) 	8	5

π Entry Enters π into display register.

Example	Set	Depress	Read
$\sin \frac{\pi}{6}$			 

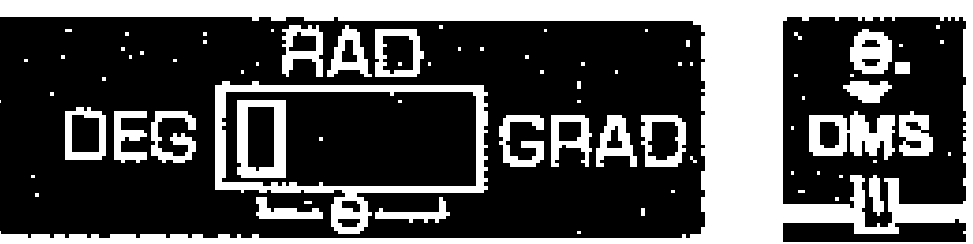
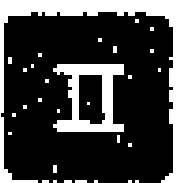

SPECIAL FUNCTION SWITCH II SPECIAL FUNCTION KEY II

Use of Special Function Switch II with Special Function Key II provides six additional functions. ($-\Sigma$ and σ/\bar{x} are discussed under Statistics Functions on page 17.)

- Decimal Angle to Degree/Minute/Second (DMS) Conversion
- Degrees or Grads to Radians Conversion
- Polar Coordinates (θ, r) to Rectangular Coordinates (x, y) Conversion
- \log_{10}
- Antilog_{10} (Using INV Key)

Decimal Angle to DMS Conversion

Converts an angle in decimal degrees, radians or grads, depending on the position of the DEG-RAD-GRAD switch, to degrees/minutes/seconds.

Example	Set	Enter	Depress	Read
Convert 2.5125° to DMS		2.5125		

Displayed result is read as $2^\circ 30' 45''$.

Degrees or Grads to Radians Conversion

Converts an angle in decimal degrees or grads, depending on the position of the DEG-RAD-GRAD switch to radians.

Example	Set	Enter	Depress	Read
Convert 30° to radians		30		

Polar to Rectangular Conversion

Converts polar coordinates (θ, r) to rectangular coordinates (x, y). The angle θ may be in degrees, radians or grads depending on the position of the DEG-RAD-GRAD switch. The x coordinate is displayed and is also in register 9. The y coordinate is in register 8.

Example	Set	Enter	Depress	Read	Registers	
					No.	Contents
Find x, y:		45				
		10		(x)	9	7.071067812
					(y)	8

Log₁₀ Calculates the common log of a number.

Example	Set	Enter	Depress	Read
Find log ₁₀ 32		32		

Antilog₁₀ Calculates antilog₁₀ of a number.

Example	Set	Enter	Depress	Read
Find antilog ₁₀ of 1.55		1.55		

DISPLAY FORMAT

The Display Format Switch and the Reformat key **D**, may be used to display numbers in any selected format.

Display Format Switch

The Display Format Switch permits final results (results following depression of **=**) to be displayed in any selected format. In the \mathcal{C} position, final results will be displayed with two digits to the right of the decimal point; the final result is rounded to two decimal places.

D Key

Depressing **D** reformats any displayed number according to the position of the Display Format Switch.

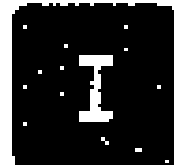
Examples	Set	Enter	Depress	Read
123,456 x .789		123,456 x .789	=	97,406.784
			D	97406784 4
\$2.735/unit x 60 units		2.735 x 60	=	164.10
0.000000456 x 1.2x10 ³		.000000456	x	0.000000456
		1.2 x 10 ³	=	0.0005472
			D	547.2 - 6

STATISTICS FUNCTIONS

Statistics functions (summation, summation removal, mean, and standard deviation) are found on the two special function switches.

Clear Registers 1, 2, 3

Set **CLR 1-3** Depress **I**



Prior to beginning new statistical summations, registers 1, 2 and 3 should always be cleared to zero. See Summation example for usage of **CLR 1-3**.



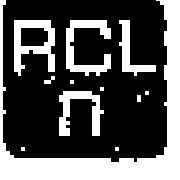

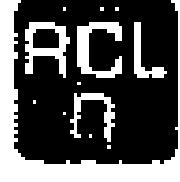
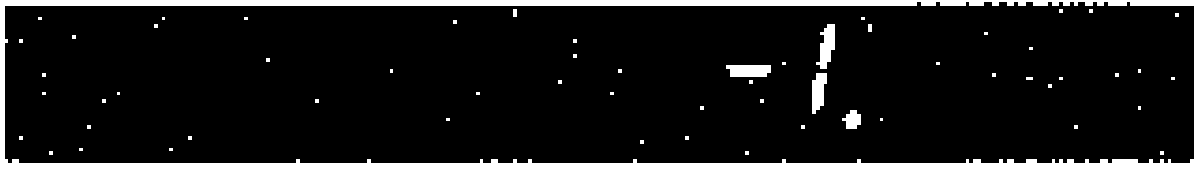
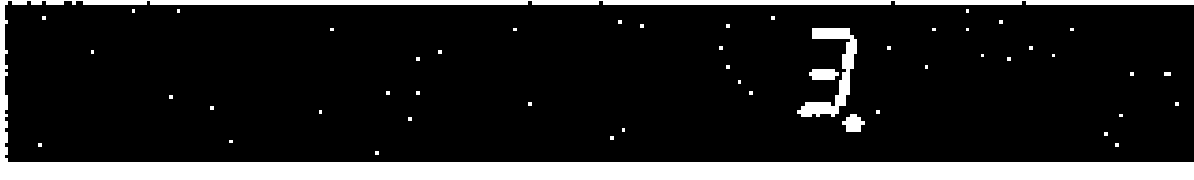
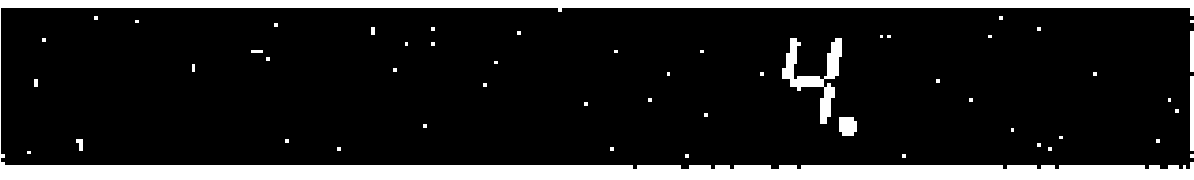
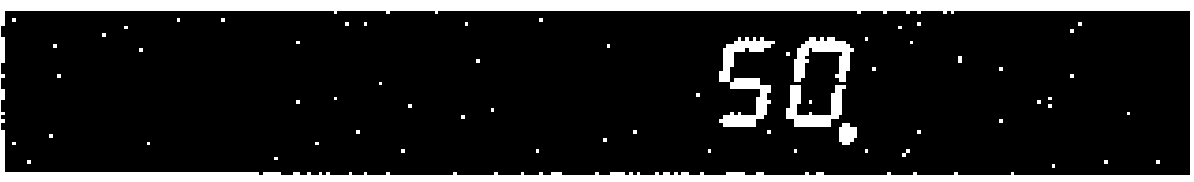


Summation (Σ)

The function Σ maintains an n count in register 1, sums x in register 2, and x² in register 3.


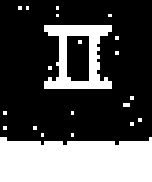
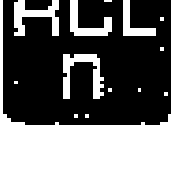


Example	Set	Enter	Depress	Read	Register Contents		
					No.1 (n)	No.2 (Σx)	No.3 (Σx^2)
Perform a summation for terms -1, -4, 3, 5.			C I	0.			
		-1	I	-1.	1	-1	1
		-4	I	-4.	2	-5	17
		3	I	3.	3	-2	26
		5	I	5.	4	3	51
			RCL n 1	4.			
			RCL n 2	3.			
		RCL n 3	51.				

Summation Removal (-Σ)

Example	Set	Enter	Depress	Read	Register Contents		
					No.1 (n)	No.2 (Σx)	No.3 (Σx ²)
Remove -1 from previous summation.		-1	  1  2  3	   	3	4	50

Standard Deviation/Mean (σ/ \bar{x})

Finds the standard deviation and mean, for the summation data in registers 1, 2 and 3. Standard deviation is displayed and is also stored in register 9. The mean is in register 8. The standard deviation is based on n-1 degrees of freedom.

Example	Set	Depress	Read	Registers	
				No.	Contents
σ & \bar{x} of previous summation with -1 removed.		  8	 	8	1.333333333
				9	4.725815626

SAMPLE PROBLEMS

Summation of Reciprocals

Example

$$\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \dots + \frac{1}{x_n}$$

$$\frac{1}{3.72} + \frac{1}{4.87} + \frac{1}{23.21}$$

Instructions:	Enter	Depress	Read
	3.72	$\frac{1}{x}$ +	0.268817204
	4.87	$\frac{1}{x}$ +	0.474156013
	23.21	$\frac{1}{x}$ =	0.517240891
		$\frac{1}{x}$	1.93333516

Root Mean Square (RMS) Value

Example

$$RMS = \sqrt{\frac{\sum x^2}{n}}$$

Find RMS value for the following terms:
0.026, 0.019, 0.032, 0.047, 0.026.

Instructions:

Set	Enter	Depress	Read	Register	
				No.	Contents
$\frac{CLR}{1-3}$		C I	0	1	0
$\frac{\Sigma}{\Sigma}$				3	0
	.026	I	0026	1	1 (n)
				3	0.000676 ($\sum x^2$)
	.019	I	0019	1	2
				3	0.001037
	.032	I	0032	1	3
				3	0.002061
	.047	I	0047	1	4
				3	0.00427
	.026	I	0026	1	5
				3	0.004946
		RCL n 3	0004946		
		\div RCL n 1	5		
		=	00009892		
		\sqrt{x}	003145155		

Expression Containing $\sqrt{a^2 + b^2}$

$$\frac{dx}{\sqrt{x^2 + p^2}} = \log_e (x + \sqrt{x^2 + p^2})$$


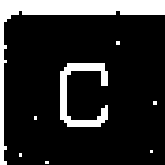

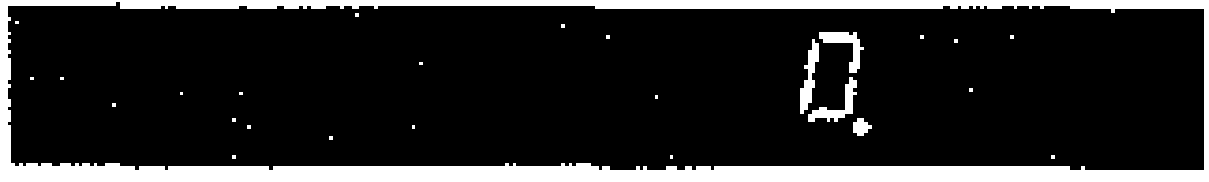
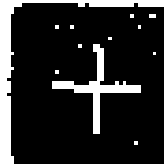
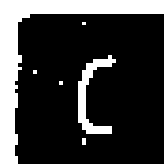
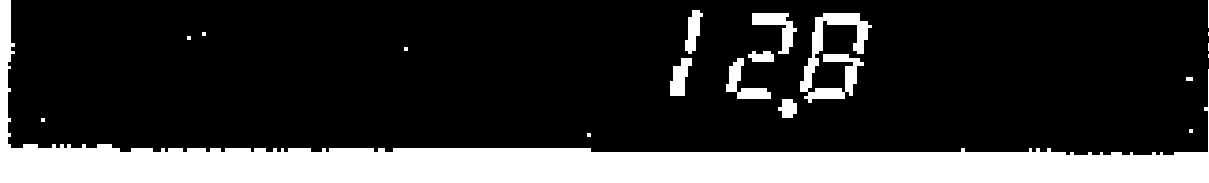
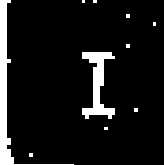










Example

Find $\log_e (x + \sqrt{x^2 + p^2})$

for $x = 12.8, p = 7:3$

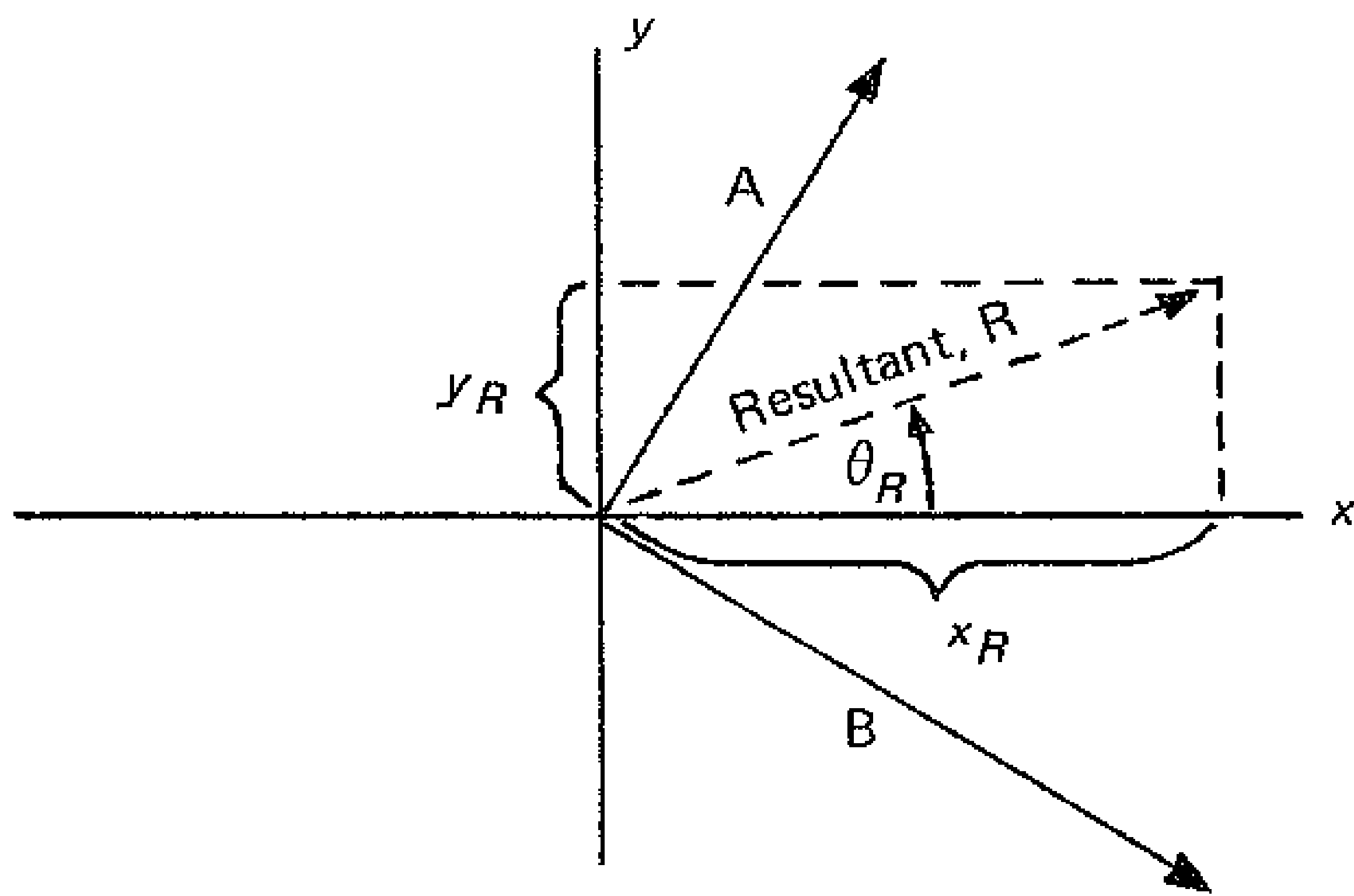
Hint: Use  to find $\sqrt{x^2 + p^2}$

Instructions:

Set	Enter	Depress	Read	Registers	
				No.	Contents
		 			
	12.8	 			
		 *			
	7.3*			9	29.69665254
		 		8	14.73533169
					
					

*Note that in executing  12.8  7.3  ... 12.8 did not have to be re-entered since it was already in the display register.

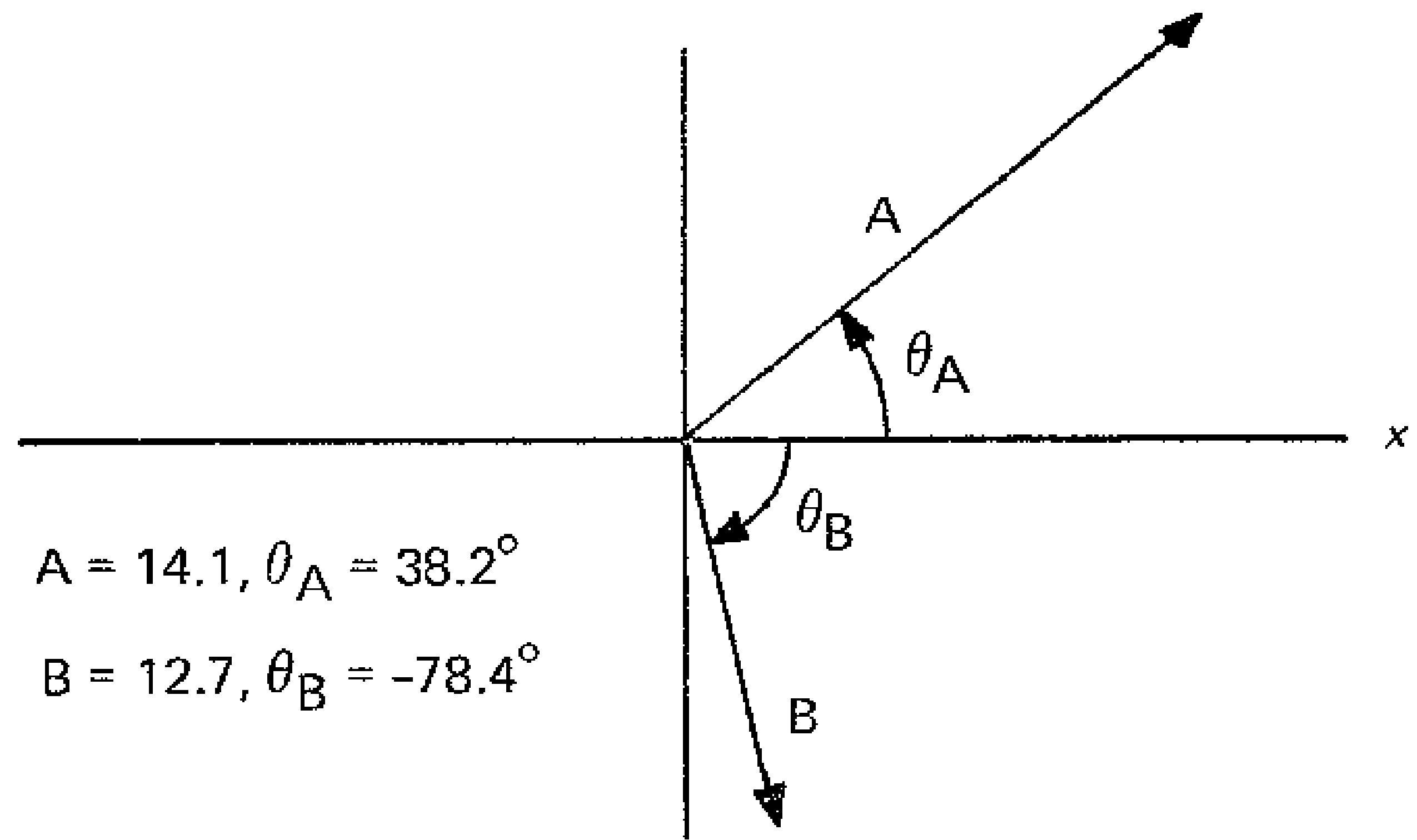
Resultant of Vectors



Instructions:

Example

Find the resultant of vectors A and B



$$A = 14.1, \theta_A = 38.2^\circ$$

$$B = 12.7, \theta_B = -78.4^\circ$$

Set	Enter	Depress	Read	Registers	
				No.	Contents
DEG \square RAD \square GRAD		Π	38.2		
$\frac{x}{y}$ $\frac{e}{i}$ $\frac{e}{j}$	38.2	Π	38.2		
$\frac{e}{i}$ $\frac{e}{j}$	14.1	=	11.08058219	(x _A)	9 11.08058219
					8 8.719558375
		STR 0	11.08058219		0 11.08058219
		RCL 8 STR 1	8.719558375	(y _A)	1 8.719558375
	-78.4	Π	-78.4		
	12.7	=	2.553689599	(x _B)	9 2.553689599
					8 -12.44060567
		RCL 0 ACC 9	11.08058219		9 13.63427179(x _R)
		RCL 1 ACC 8	8.719558375		8 -3.721047295(y _R)
		RCL 9 I	13.63427179	(x _R)	
		RCL 8 =	-15.26532515	(θ _R)	9 -15.26532515(θ _R)
					8 14.13292469(R)
		RCL 8	14.13292469	(R)	

Answer:

$$\theta_R = -15.27$$




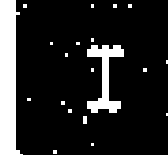
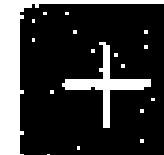


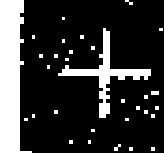

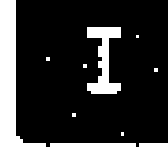
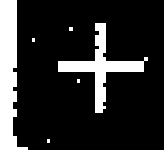

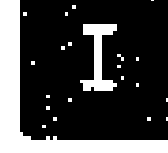


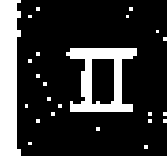

$$R = 14.13$$

Addition of Angles in Degrees-Minutes-Seconds

Example

Find the sum of: $23^{\circ} 17' 42''$
 $8^{\circ} 49' 33.2''$
 $71^{\circ} 08' 01.4''$
 $12^{\circ} 00' 49''$

Instructions:

Set	Enter	Depress	Read
  	23.1742	 	
	8.49332	 	
	71.08014	 	
	12.0049	 	
			




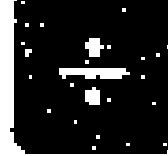



















Answer: $115^{\circ} 16' 5.6''$

Solution of Algebraic Expression

Example:

$$\log_{10} \left[\frac{17.3^{1.2}}{12.3^{1.5} + \cos \frac{28.43}{3}} \right]$$

Instructions:

Set	Enter	Depress	Read
	17.3		
	1.2	 	
	12.3		
	1.5	 	
	28.43		
	3		
			
			
			
			

Division of Complex Numbers

Example

$$Z_1 = x_1 + iy_1 = \sqrt{x_1^2 + y_1^2}, \theta_1 = r_1, \theta_1$$

$$Z_2 = x_2 + iy_2 = \sqrt{x_2^2 + y_2^2}, \theta_2 = r_2, \theta_2$$

$$\frac{Z_1}{Z_2} = Z_3 = r_3, \theta_3 = \frac{r_1}{r_2}, (\theta_1 - \theta_2) = x_3 + iy_3$$

Given: $Z_1 = 4.1 + 6.4i$

$Z_2 = 2.0 + 1.7i$

Find: $Z_3 = \frac{Z_1}{Z_2}$

Instructions:

Set	Enter	Depress	Read	Registers	
				No.	Contents
	4.1				
	6.4			(θ_1)	9 57.35535986 (θ_1) 8 7.600657866 (r_1)
					0 57.35535986 (θ_1)
				(r_1)	1 7.600657866 (r_1)
	2.0				
	1.7			(θ_2)	9 40.36453657 (θ_2) 8 2.62488095 (r_2)
				(θ_2)	0 16.99082329 ($\theta_3 = \theta_1 - \theta_2$)
				(r_2)	
					1 2.895620035 ($r_3 = \frac{r_1}{r_2}$)
				(θ_3)	
				(r_3)	
				(x_3)	9 2.769230769 (x_3) 8 0.846153846 (y_3)
				(y_3)	

Answer: $Z_3 = \frac{Z_1}{Z_2} = 2.769 + 0.846i$

Power Series

$$y = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 \dots + a_nx^n$$

Example

$$y = 12.178 + 3.164x + 4.836x^2 + .0577x^3$$

Find y, for x = 2.2 and for x = 3.6

Instructions:

Enter	Depress	Read	Registers	
			No.	Contents
12.178	STR _n 6 STR _n 7	12.178	6	12.178
			7	12.178
3.164	STR _n 1	3.164	1	3.164
4.836	STR _n 2	4.836	2	4.836
.0577	STR _n 3	0.0577	3	0.0577
x = 2.2	X	2.2		
	RCL _n 1 = ACC _n 6	6.9608	6	19.1388
2.2	a ^x 2 X	4.84		
	RCL _n 2 = ACC _n 6	23.40624	6	42.54504
2.2	a ^x 3 X	10.648		
	RCL _n 3 = ACC _n 6	0.6143896	6	43.1594296
	RCL _n 6 (y)	43.1594296		
x = 3.6	X	3.6		
	RCL _n 1 = ACC _n 7	11.3904	7	23.5684
3.6	a ^x 2 X	12.96		
	RCL _n 2 = ACC _n 7	62.67456	7	86.24296
3.6	a ^x 3 X	46.656		
	RCL _n 3 = ACC _n 7	2.6920512	7	88.9350112
	RCL _n 7 (y)	88.9350112		

USEFUL FORMULAS AND TABLES

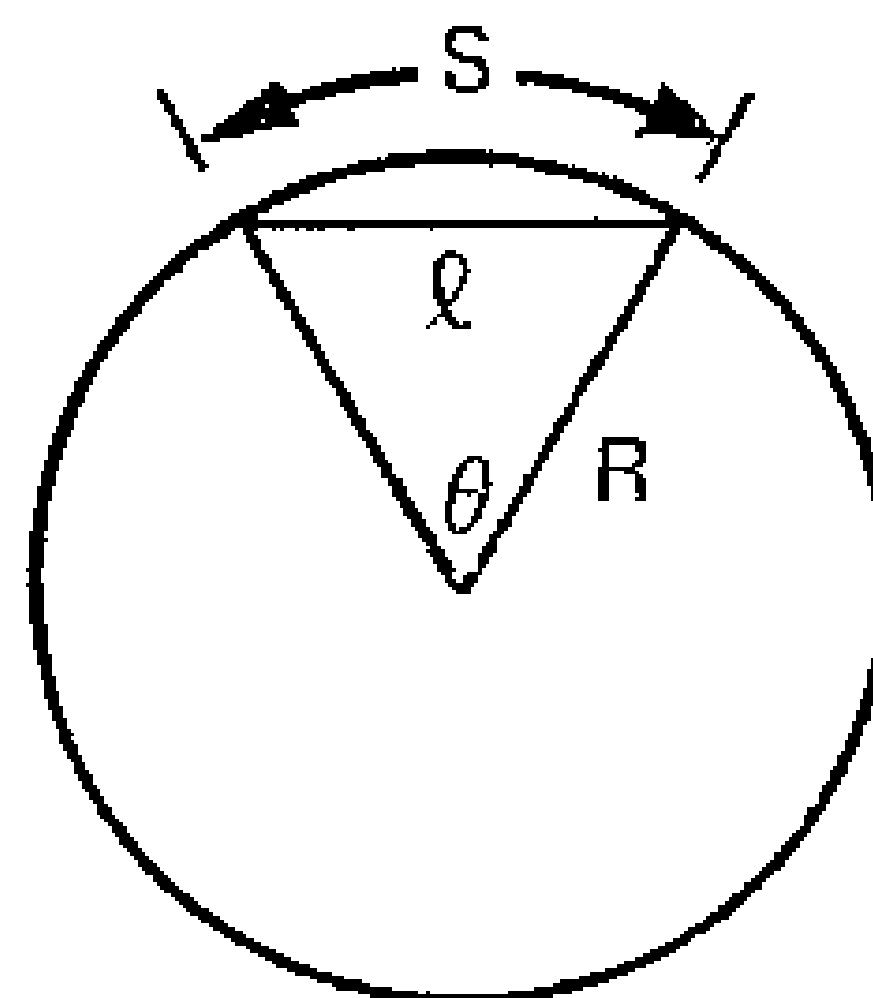
U. S. TO METRIC CONVERSION FACTORS

To Convert	To	Multiply By
Inches	Centimeters	2.540
Feet	Meters	0.3048
Yards	Meters	0.9144
Miles (nautical)	Kilometers	1.852
Miles (statute)	Kilometers	1.6094
Acres	Square meters	4,046.849
Cubic inches	Cubic centimeters	16.387
Cubic feet	Cubic meters	0.02832
Cubic feet	Liters	28.32
Gallons	Liters	3.7853
Pounds	Kilograms	0.4535
Pounds	Dynes	44.4823x10 ⁴
BTU	Joules	1,054.8
BTU	Calories	251.98

USEFUL FORMULAS

$a^{-x} = 1/a^x$ $a^x a^y = a^x \cdot a^y$ $a^x/a^y = a^{x-y}$ $(ab)^x = a^x \cdot b^x$ $(a^x)^y = a^{xy}$ $a^x/y = y\sqrt{a^x}$	$\log_b xy = \log_b x + \log_b y$ $\log_b x/y = \log_b x - \log_b y$ $\log_b x^p = p \cdot \log_b x$ $\log_b q\sqrt{x} = (1/q)\log_b x$ $\log_b 1/x = \log_b x$ Change of base logarithms: $\log_b x = (\log_c x)/(\log_c b)$
$\sinh x = \frac{1}{2}(e^x - e^{-x})$ $\cosh x = \frac{1}{2}(e^x + e^{-x})$ $\tanh x = \sinh x/\cosh x$ $\operatorname{csch} x = 1/\sinh x$	$\sec \theta = 1/\cos \theta$ $\csc \theta = 1/\sin \theta$ $\operatorname{ctn} \theta = 1/\tan \theta$

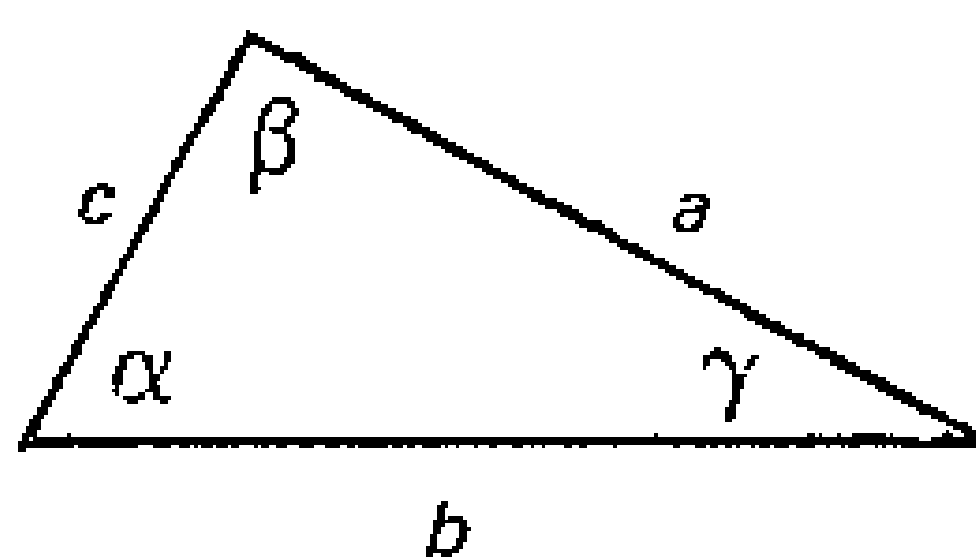
GEOMETRY



Circle

Areas: circle $\bigcirc = \pi R^2$
 sector $\nabla = \frac{1}{2}R^2\theta$
 segment $\frown = \frac{1}{2}R^2(\theta - \sin \theta)$

Lengths: circumference = $2\pi R$
 arc $S = R\theta$
 chord $l = 2R \sin (\theta/2)$

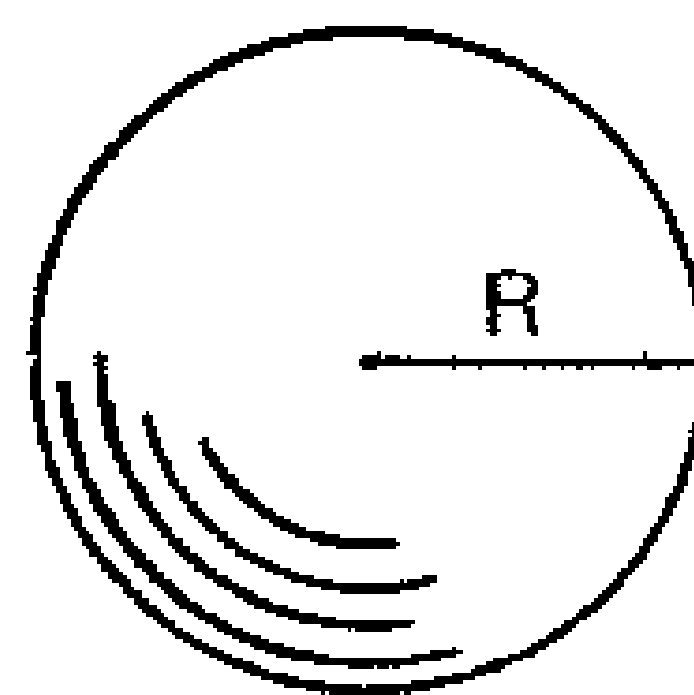


Oblique Triangle

Area = $\frac{1}{2} ab \sin \gamma$; $\frac{1}{2} bc \sin \alpha$; $\frac{1}{2} ac \sin \beta$
 Angle, Side Relationships:

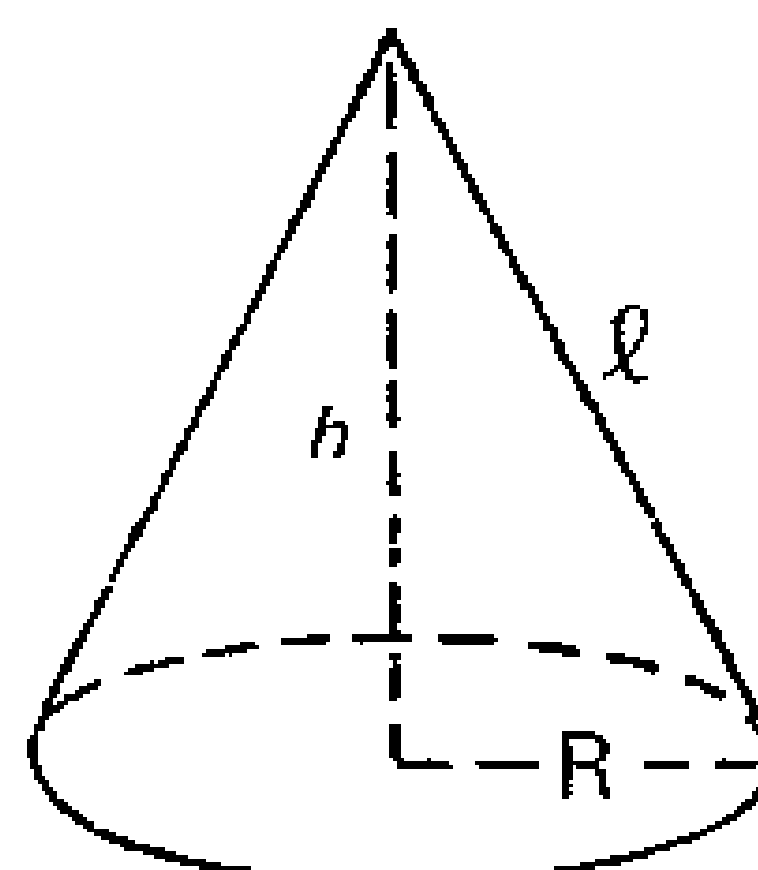
$$\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} = \frac{c}{\sin \gamma} \quad (\text{Law of Sines})$$

$$a^2 = b^2 + c^2 - 2bc \cos \alpha \quad (\text{Law of Cosines})$$



Sphere

Surface Area: $4\pi R^2$
 Volume: $(4/3)\pi R^3$



Right Circular Cone

Surface Area: $\pi R l$
 Volume: $\pi R^2 h/3$

CARE AND SERVICE

Care of Calculator Using the dust cover when the calculator is not in use helps to protect the keyboard and electronic components from dirt and dust. Articles should not be placed on top of the calculator which may cover the air vents through which heat escapes. Always be sure the calculator is off before putting the dust cover in position.

Service Always expect superior after-sale service from Monroe because you'll receive nothing less than that. With over 1,400 factory-trained service personnel in the United States and Canada, Monroe enjoys a well-deserved reputation for prompt and expert service. Our service includes free personal instruction to help you achieve maximum performance; it's always available to you through your local Monroe branch office.

We know you'll enjoy working with your new Model 1920. And remember, Monroe is always at your service.



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