

Programmable **TI 58/59**

Master Library

Quick Reference Guide

TEXAS INSTRUMENTS
INCORPORATED
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CALCULATING NOTES

Low Battery Indication

If the display flashes erratically, fades out, gives incorrect results or is inconsistent in any way, recharge the battery. Calculator operation can be resumed after several minutes of recharging.

Algebraic Hierarchy

Operations and functions are performed automatically in following order.

1. Math Functions (x^2 , cos, etc.)
2. Exponentiation (y^x) and Roots ($\sqrt[x]{y}$)
3. Multiplication, Division
4. Addition, Subtraction
5. Equals

Order applies to each set of parentheses. You can use up to 8 pending operations and 9 open parentheses, except where noted.

Flashing Display

A display flashing off and on indicates that an invalid key sequence has taken place or that the limits of the display have been exceeded. See Appendix B in *Personal Programming* for possible causes.

CONVERSIONS

Angle Formats

2nd **DMS** — DEGREES, MINUTES, SECONDS TO DECIMAL DEGREES — Converts an angle measured in degrees, minutes and seconds to its decimal degrees equivalent. **INV** **2nd** **DMS** reverses this conversion. Also used for time conversions. **Operates on display value only.** Submit 2 digits each for minutes and seconds. Entry and display format is DD.MMSSsss where DD is degrees, MM is minutes, SS is whole seconds and sss is fractional seconds.

Polar to Rectangular

R **[x:t]** **θ** **2nd** **P→R** → **y**; **[x:t]** → **x**

Rectangular to Polar

x **[x:t]** **y** **INV** **2nd** **P→R** → **θ**; **[x:t]** **R**

Only 4 pending operations are available for other uses when using D.MS or Polar/Rectangular conversions.

Angular Conversions

FROM \ TO	Degrees	Radians	Grads
Degrees		$\times \frac{\pi}{180}$	$\div 0.9$
Radians	$\times \frac{180}{\pi}$		$\times \frac{200}{\pi}$
Grads	$\times 0.9$	$\times \frac{\pi}{200}$	

STATISTICS

Initialize: **2nd** **Fix** **1** **SBR** **CLR**

Data Entry: x_1 **[x:t]** y_1 **2nd** **Σ+**

Data Entry Removal: x_1 **[x:t]** y_1 **INV** **2nd** **Σ+**

Trendline Data Entry: x_1 **[x:t]**, y_1 **2nd** **Σ+**, y_2 **2nd** **Σ+**, etc.

Trendline Point Removal: **[x:t]** **-** **1** **=** **[x:t]** y_1 **INV** **2nd** **Σ+**

Calculations

Key Sequence

Mean of y-array then x-array	2nd Σ_x [x:t]
Standard Deviation (N - 1 Weighting) of y-array then x-array (N Weighting) of y-array then x-array	INV 2nd Σ_s [x:t] 2nd σ_n 11 √x [x:t] √x
Variance (N Weighting) of y-array then x-array (N - 1 Weighting) of y-array then x-array	2nd σ_n 11 [x:t] INV 2nd Σ_s [x] [x²] [x:t] Σ_s
Y-Intercept	2nd σ_n 12
Slope after y-intercept	[x:t]
Correlation Coefficient	2nd σ_n 13
y' for new x	2nd σ_n 14
x' for new y	2nd σ_n 15

SPECIAL CONTROL OPERATIONS

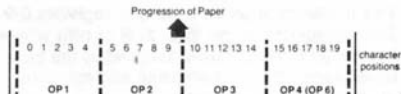
Each special control operation is called by pressing **2nd** **Op** **nn** where **nn** is the 2-digit code assigned to each operation (short form addressing can be used here). These operations use up to 4 pending operations and 1 sub-routine level.

Code nn	Function
00*	Initialize print register.
01*	Alphanumerics for far left quarter of print column.
02*	Alphanumerics for inside left quarter of print column.
03*	Alphanumerics for inside right quarter of print column.
04*	Alphanumerics for far right quarter of print column.
05*	Print the contents of the print register.
06*	Print last 4 characters of OP 04 with current display.
07*	Plot \div in column 0-19 as specified by the display.
08*	List the labels currently used in program memory.
09	Bring specified library program into program memory.
10	Apply signum function to display register value.
11	Calculate variances.
12	Calculate slope and intercept.
13	Calculate correlation coefficient.
14	Calculate new y prime (y') for an x in the display.
15	Calculate new x prime (x') for a y in the display.
16	Display current partition of memory storage area.
17	Repertition memory storage area.
18	If no error condition exists in a program, set flag 7.
19	If an error condition exists in a program, set flag 7.
20-29	Increment a data register 0-9 by 1.
30-39	Decrement a data register 0-9 by 1.

*Designed specifically for use with optional PC-100A Print Cradle

ALPHANUMERIC PRINT CODES

The first seven control operations allow you to create and print out alphanumeric messages. Twenty characters can be printed on each line. They are assembled and stored in groups of 5 characters at a time as shown below.



Each printed character is represented by a two-digit, row-column address code according to the following table:

	0	1	2	3	4	5	6	7
0		0	1	2	3	4	5	6
1	7	8	9	A	B	C	D	E
2	-	F	G	H	I	J	K	L
3	M	N	O	P	Q	R	S	T
4	.	U	V	W	X	Y	Z	+
5	x	*	√	π	e	()	,
6	↑	%	↓	/	=	'	×	∞
7	²	?	÷	∅	∏	∧	∏	Σ

For instance, A is code 13 and + is code 47

PROGRAMMING NOTES

Labels

Any key on the keyboard can be used as a label except **2nd**, **LRN**, **Ins**, **Del**, **SST**, **BST**, **Ind** and the numbers 0-9.

DSZ

This instruction can be used with registers 0-9. Entry sequence is **2nd** **DSZ** **X**, **N** or **nnn** where X is the data register used followed by the transfer address (label N or absolute address nnn).

Flags

Ten flags are available (0-9). Entry sequence for setting, resetting or testing flags is the flag instruction, flag number, then transfer address (testing only).

MEMORY PARTITIONING

Memory area is partitioned in sets of 10 registers where each register can hold a data value or 8 program instructions. To check placement of current partition, press **2nd** **Op** **16**. To repartition, enter number of sets (N) of 10 data registers needed and press **2nd** **Op** **17**.

N	Program/Data	
	TI-58	TI-59
N < 0 = N		
0	479/00	959/00
1	399/09	879/09
2	319/19	799/19
3	239/29*	719/29
4	159/39	639/39
5	079/49	559/49
6	000/59	479/59*
7	Flashing	399/69
8	Flashing	319/79
9	Flashing	239/89
10	Flashing	159/99
N > 10	Flashing	159/99

*Partition when calculator is turned on.

PROGRAM KEY CODES

Key Code	Key	Key Code	Key	Key Code	Key
00	0	39	cts	72*	STO Ind
09	9	40	Ind	73*	RCL Ind
10	F	42	STO	74*	SUM Ind
11	A	43	RCL	75	—
12	B	44	SUM	76	lbl
13	C	45	y*	77	x÷t
14	D	47	CMs	78	x+
15	E	48	Exc	79	x-
16	A	49	Prd	80	Grd
17	F	50	ExcI	81	RST
18	C	52	EE	83*	GTO Ind
19	F	53	L	84*	Op Ind
20	CLR	54)	85	+
22	INV	55	+	86	StNg
23	Inx	57	Eq	87	llNg
24	CE	58	fin	88	DMS
25	CLR	59	Int	89	rr
27	INV	60	Reg	90	Int
28	ng	61	GTO	91	R/S
29	CP	62*	Prm Ind	92*	INV SBR
30	tan	63*	Exc Ind	93	.
32	x÷t	64*	Prd Ind	94	+/-
33	x²	65	X	95	=
34	√	66	Pause	96	Write
35	1/x	67	x÷t	97	Disc
36	Prm	68	Ng	98	Adv
37	P=I	69	Op	99	Prt
38	on	70	Rad		
		71	SBR		

*Merged codes

RECORDING MAGNETIC CARDS (TI-59 Only)

Display When
Write Pressed,
Card Entered

1, 2, 3, 4

Calculator Response

Writes a card side with this number from the bank of this number (program and/or data) and records current partition on card.

-1, -2, -3, -4

Writes and protects card side with this number from the bank with this number. Also records current partition on card.

Any other
number

Card is passed but not recorded. Rightmost two integer digits of display are flashed.

If the display is flashing any value when trying to read or record a card, the card is passed but not read or recorded and the rightmost two integers in the display are flashed.

The calculator should be in standard display format when reading or recording cards.

Only the integer portion of the display is recognized, i.e., 1.234 = 1.

READING MAGNETIC CARDS (TI-59 Only)

Display When Card Entered	Calculator Response
0	Reads information into bank number listed on card if current partition matches that on card. If partition incorrect, card is passed, but not read — display flashes card side passed.
1, 2, 3, 4	Expects card with this side number to be read — displays that side number. If another side is entered or if partition is incorrect, card is passed but not read — display flashes card side passed.
-1, -2, -3, -4	Forces side to be read into this bank number regardless of the partition or the number on the card. A protected program cannot be forced into any bank or alternate partition.
Any other number	Card is passed but not read — rightmost two integers in display flash.

LIBRARY USER INSTRUCTIONS

The remainder of this booklet contains the User Instructions for each program of the library.

REMOVING AND INSTALLING MODULES.

The library module can easily be removed or replaced with another. It is a good idea to leave the module in place in the calculator except when replacing it with another module. Be sure to follow these instructions when you need to remove or replace a module.

CAUTION

Be sure to touch some metal object before handling a module to prevent possible damage by static electricity.

1. Turn the calculator OFF. Loading or unloading the module with the calculator ON may cause the keyboard or display to lock out. Also, shorting the contacts can damage the module or calculator.
2. Slide out the small panel covering the module compartment at the bottom of the back of the calculator.
3. Remove the module. You may turn the calculator over and let the module fall out into your hand.
4. Insert the module, notched end first with the labeled side up into the compartment. The module should slip into place effortlessly.
5. Replace the cover panel, securing the module against the contacts.

MASTER LIBRARY DIAGNOSTIC

ML-01

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
	Diagnostic/Module Check			
A1	Select Program		2nd 01	
A2	Run Diagnostic		SBR =	1. ¹
	or			
A3	Library Module Check		SBR 2nd R/S	1. ²
	Initialize Linear Regression			
B1	Select Program		2nd 01	
B2	Initialize Linear Regression		SBR CLR	0.
	Print Routine			
C1	Select Program		2nd 01	
C2	Set calculator to print input and output for user-defined keys of program numbered mm ³ . Now the User Instructions for that program can be followed except that the program need not be called.	mm	STD 00	mm

- NOTES:**
1. This output is obtained if the calculator is operating properly.
 2. The number 1 indicates the Master Library.
 3. The Master Library programs are numbered 1 through 25. Program number 0 is the calculator's program memory.

MATRIX INV, DETER, SIMUL EQ.

ML-02

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 02	
2	Enter order of matrix	n	A	n*
3	Enter elements of matrix A by columns starting with column 1. (To correct an entry in column j, simply enter j and press B . Then reenter the entire column using the R/S key)	1 a ₁₁ a ₂₁ . . . a _{n1} a ₁₂ a ₂₂ . . . a _{nn}	B R/S R/S . . . R/S R/S R/S . . . R/S	1. a ₁₁ * a ₂₁ * . . . a _{n1} * a ₁₂ * a ₂₂ * . . . a _{nn} * A *
4	Calculate determinant If A ≠ 0: Solve Ax = b (Perform Steps 1-4 first)		C	A *
5	Enter elements of column vector b starting with b ₁ . (To correct an entry error for b _i , simply enter i and press D . Then reenter b _i using the R/S key.)	1 b ₁ . . . b _n	D R/S . . . R/S	1. b ₁ * . . . b _n *
6	Calculate x		CLR E	1.
7	Display the elements of x, starting with x ₁	1	2nd F R/S	1. x ₁ *
8	To display x _i only To solve the system for a new vector b', repeat Steps 5-8 only.	i	R/S 2nd F R/S	x _n * i x _i *
9	If A ≠ 0: Find A ⁻¹ (Perform Steps 1-4 first)		CLR 2nd F	1.
10	Calculate A ⁻¹		2nd E R/S R/S . . . R/S R/S . . . R/S	1. -1* a ₁₁ -1* a ₂₁ -1* . . . a _{n1} -1* a ₁₂ -1* . . . a _{nn} -1* A *
11	Display the elements of A ⁻¹ by columns starting with column 1: (To display the elements of A ⁻¹ starting with column j, enter j before pressing 2nd F). Due to pivoting, A ⁻¹ may be stored with its columns permuted even though it is displayed in the correct order. Therefore, A ⁻¹ must be reentered for use in subsequent calculations. Note: A is lost once A ⁻¹ is calculated.	1	2nd F R/S R/S . . . R/S R/S . . . R/S	1. -1* a ₁₁ -1* a ₂₁ -1* . . . a _{n1} -1* a ₁₂ -1* . . . a _{nn} -1* A *
11	To compute A and A ⁻¹ simultaneously, perform Steps 1-3, then perform this step and continue with Step 10 to display A ⁻¹ if A ≠ 0.		2nd F R/S	A *

*These values are automatically printed when the PC-100A Print Cradle is connected.

- NOTES:**
- Because of round-off error, this program may not give exact answers for |A|. For example, $\begin{vmatrix} 3 & -2 \\ -9 & 6 \end{vmatrix}$ is evaluated as -9×10^{-12} instead of zero.
 - The inverse of a 3 X 3 matrix is found in approximately 1 minute while a 9 X 9 requires about 12 minutes for computation.
 - This program includes its own print commands and therefore should not be used with the print routine of program ML-01.

MATRIX ADDITION AND MULTIPLICATION

ML-03

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 03	
2a	Enter number of rows in A	m	A	m*
2b	Enter number of columns in A (Steps 2a and 2b must be performed in sequence)	n	A	n*
3	Enter the elements of matrix A starting with column 1. (To correct an entry error in column j, simply enter j and press B . Then reenter the entire column using the R/S key)	1 a ₁₁ a ₂₁ : : a _{m1} a ₁₂ a ₂₂ : : a _{mn}	B R/S R/S : : R/S R/S R/S : : R/S	1. a ₁₁ * a ₂₁ * : : a _{m1} * a ₁₂ * a ₂₂ * : : a _{mn} *
	For Matrix Addition:			
4	First Then enter the elements of matrix B using the R/S key as in Step 3. (To correct an entry error in column j, simply enter j and press C). Then reenter the entire column using the R/S key.	1	C	1.
5a	Enter λ_1	λ_1	D	λ_1 *
5b	Enter λ_2 (Steps 5a and 5b must be performed in sequence. These steps are required even if $\lambda_1 = 1$ and/or $\lambda_2 = 1$)	λ_2	D	λ_2 *
6	Calculate $C = \lambda_1 A + \lambda_2 B$		CLR E	1.
7	Display the elements of C starting with column 1: To display the elements of C starting with column j, enter j before pressing 2nd I . (To use C as the new A, repeat Steps 4-7. For a new case go to Step 2.)	1	2nd I R/S R/S : : R/S R/S R/S : : R/S	1. c ₁₁ * c ₂₁ * : : c _{m1} * c ₁₂ * c ₂₂ * : : c _{mn} *
	For Matrix Multiplication (Perform Steps 1-3 first)			
8	Enter the elements of column j of matrix B starting with b _{1j} . (To correct an entry error for b _{ij} , enter i, press 2nd F and reenter b _{ij} using the R/S key.)	1 b _{1j} : : b _{nj}	2nd F R/S : : R/S	1. b _{1j} * : : b _{nj} *
9	Calculate column j of matrix C		2nd C	1.
10	Display the elements of column j of matrix C, starting with c _{1j}	1	2nd B R/S : : R/S	1. c _{1j} * : : c _{mj} *
11	To display c _{ij} only	i	2nd F R/S	i* c _{ij} *
12	To compute AB = C, repeat Steps 8-10 for j = 1 to j = p			

NOTE: 1. This program includes its own print commands and should not be used with program ML-01.

*These values are printed automatically if the PC-100A is connected.

COMPLEX ARITHMETIC

ML-04

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 04	04
2a	Enter real part of X	a	A	a
2b	Enter imaginary part of X (2a and 2b must be performed in sequence)	b	A	b
3a	Enter real part of Y	c	2nd I	c
3b	Enter imaginary part of Y (3a and 3b must be performed in sequence)	d	2nd I	d
	Perform either Step 4, 5, 6, 7, 8, 9, or 10.			
4	Calculate $X + Y$		B ↵	real part imaginary part
5	Calculate $X - Y$		2nd + ↵	real part imaginary part
6	Calculate $X \times Y$		C ↵	real part imaginary part
7	Calculate $X \div Y$		2nd ÷ ↵	real part imaginary part
8	Calculate Y^X		D ↵	real part imaginary part
9	Calculate $\log_v X$		2nd log ↵	real part imaginary part
10	Calculate $\sqrt[y]{X}$		E ↵	real part imaginary part
11	After a calculation, the result becomes the new X. To swap X and Y		2nd ↵	0.

COMPLEX FUNCTIONS

ML-05

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 7/m 05	
2a	Enter real part of X	a	A	a
2b	Enter imaginary part of X (2a and 2b must be performed in sequence)	b	A	b
3	Calculate polar form of X, if desired		B x<math>^{-1}</math>	r θ
4	Perform either Step 4, 5, 6, 7, or 8 Calculate X^2		C x<math>^{-1}</math>	real part imaginary part
5	Calculate \sqrt{X}		D x<math>^{-1}</math>	real part imaginary part
6	Calculate $1/X$		E x<math>^{-1}</math>	real part imaginary part
7	Calculate $\ln X$		2nd I x<math>^{-1}</math>	real part imaginary part
8	Calculate e^X		2nd I x<math>^{-1}</math>	real part imaginary part
After a calculation, the result becomes the new X.				

COMPLEX TRIG FUNCTIONS

ML-06

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 7/m 06	
2a	Enter real part of X	a	A	a
2b	Enter imaginary part of X (2a and 2b must be performed in sequence)	b	A	b
3	Perform either Step 3, 4, 5, 6, 7, or 8 Calculate $\sin X$		B x<math>^{-1}</math>	real part imaginary part
4	Calculate $\cos X$		C x<math>^{-1}</math>	real part imaginary part
5	Calculate $\tan X$		D x<math>^{-1}</math>	real part imaginary part

- NOTES:**
1. After a calculation, the result becomes the new X.
 2. X is expressed in radians. Program leaves calculator in radian mode.

6	Calculate $\sin^{-1} X$		2nd i x⁻¹	real part imaginary part
6a	If imaginary part (b) of input X is negative		+/- STO 02	imaginary part (with sign changed)
7	Calculate $\cos^{-1} X$		2nd c	real part
7a	If imaginary part (b) of input X is negative		+/- STO 01	real part (with sign changed)
7b			x⁻¹	imaginary part
8	Calculate $\tan^{-1} X$		2nd t x⁻¹	real part imaginary part

- NOTES: 1. After a calculation, the result becomes the new X.
2. X is expressed in radians. Program leaves calculator in radian mode.

POLYNOMIAL EVALUATION

ML-07

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 07	
2	Enter n^1	n	A	n*
3	Enter all coefficients ² starting with a_0 (To correct a_i , enter i, press B and reenter a_i with the R/S key.)	0 a_0 a_1 : a_n	B R/S R/S : R/S C	0. a_0 a_1 : a_n P(x)*
4	Enter x and compute P(x)	x		
5	For a new value of x repeat Step 4			

- NOTES: 1. Number of data registers available $\geq n + 6$.
2. Even if a coefficient is zero, it must be entered.
3. This program contains print commands and should not be used with program ML-01.

*These values are printed automatically if the calculator is connected to the PC-100A Print Cradle.

ZEROS OF FUNCTIONS

ML-08

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Initialize		RST	0.
2	Select learn mode		LRN	000 00
3	Use A' as label		2nd 1: 2nd A	001 00 002 00
4	Enter f(x) as a series of keystrokes. Do not use = or CLR . Do not use registers 0-8.			
5	End f(x) with INV SBR		INV SBR	xxx 00
6	Leave learn mode		LRN	0.
7	Select program		2nd 7/8 08	
8	Enter lower limit	a	A	a
9	Enter upper limit	b	B	b
10	Enter sampling increment ¹	Δx	C	Δx
11	Enter maximum error ²	ϵ	D	ϵ
12	Calculate roots. Repeat this step until flashing 9's display is obtained which indicates all roots in [a,b] have been found.		E	root
13	To use a different interval, Δx , or ϵ , repeat Steps 8-12.			

- NOTES:**
1. If Δx is not entered, $b - a$ is assumed.
 2. If ϵ is not entered, .01 is assumed.
 3. Evaluate expressions using parentheses only.
 4. [a,b) is a notation which means that a is included in the interval but b is not.
 5. Program may run for several minutes, depending on input data.

SIMPSON'S APPROXIMATION (CONTINUOUS)

ML-09

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Initialize		RST	0.
2	Select learn mode		LRN	000 00
3	Use A' as label		2nd f() 2nd A	001 00 002 00
4	Enter f(x) as a series of keystrokes. Do not use = or CLR . Do not use registers 0-5.			
5	End f(x) with INV SBR		INV SBR	xxx 00
6	Leave learn mode		LRN	0.
7	Select program		2nd f() 09	
8	Enter lower limit	x_0	A	x_0
9	Enter upper limit	x_n	B	x_n
10	Enter n (n = 2, 4, 6, ...), display flashes if not legal entry)	n	C	h
11	Compute integral		D	I
12	For a new interval or a new n, repeat Steps 7-11.			

- NOTE:**
1. Evaluate expressions using parentheses only.
 2. Running time is dependent on input data.

SIMPSON'S APPROXIMATION (DISCRETE)

ML-10

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd f() 10	
2	Enter n (n = 2, 4, 6, ...), display flashes if not a legal entry). See note 2.	n	A	n^*
3	Enter h	h	B	h^*
4	Enter function values starting with f_0	0 f_0 f_1 : f_n	C R/S R/S : R/S	0. f_0^* f_1^* : f_n^*
5	Calculate integral		D	I^*

- NOTES:**
1. This program contains print commands, and should not be used with program ML-01.
 2. $n + 7 \leq$ No. of data registers.

*These values are printed automatically if the calculator is connected to the PC-100A Print Cradle.

TRIANGLE SOLUTION (1)

ML-11

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 7 11	
2	Initialize		2nd F	0.
3	Select degree, grad, or radian mode			
	Knowing SSS			
4	Enter a	a	A	a
5	Enter b	b	B	b
6	Enter c	c	C	c
7	Calculate $\angle A$		2nd F	$\angle A'$
8	Calculate $\angle B$		2nd F	$\angle B'$
9	Calculate $\angle C$		2nd C	$\angle C'$
	Knowing SSA			
10	Enter a	a	A	a
11	Enter b	b	B	b
12	Enter $\angle A$	$\angle A$	C	$\angle A$
13	Calculate c		D	c'
14	Calculate $\angle B$		2nd F	$\angle B'$
15	Calculate $\angle C$		2nd C	$\angle C'$
—————				
	Knowing SAS			
16	Enter a	a	A	a
17	Enter b	b	B	b
18	Enter $\angle C$	$\angle C$	C	$\angle C$
19	Calculate c		E	c'
20	Calculate $\angle B$		2nd F	$\angle B'$
21	Calculate $\angle A$		2nd C	$\angle A'$

- NOTES:**
- Input data must be reentered following each set of calculations.
 - A flashing display indicates there is no triangle satisfying the input data.
 - All inputs should be entered in the sequence shown, all outputs should be calculated in the order shown. Do not omit any steps except output steps which follow the last part in question.

TRIANGLE SOLUTION (2)

ML-12

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 7 12	
2	Select degree, grad, or radian mode			
Knowing ASA				
3	Enter a	a	A	a
4	Enter $\angle B$	$\angle B$	B	$\angle B$
5	Enter $\angle C$	$\angle C$	C	$\angle C$
6	Calculate $\angle A$		2nd I	$\angle A$
7	Calculate b		D	b
8	Calculate c		E	c
Knowing SAA				
9	Enter a	a	A	a
10	Enter $\angle A$	$\angle A$	B	$\angle A$
11	Enter $\angle C$	$\angle C$	C	$\angle C$
12	Calculate $\angle B$		2nd I	$\angle B$
13	Calculate b		D	b
14	Calculate c		E	c
Calculate Area				
15	Calculate area of triangle. Sides b, c, a must have been previously computed and consequently reside in R_{01} , R_{02} , and R_{07} , respectively. If not, they can be manually placed there.		2nd F	Area

- NOTES:**
- Input data must be reentered after each set of calculations.
 - For a triangle solution in program ML-11, the area may be calculated by pressing **2nd** **7** **12**, **RCL** **06**, **STO** **07**, **2nd** **F** without reentering the data.
 - All inputs should be entered in the sequence shown, all outputs should be calculated in the order shown. Do not omit any steps except those which follow the last part in question.

CURVE SOLUTION

ML-13

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 13	
2	Enter one pair from the following			
	a. Enter θ	θ	A	θ
	a. Enter r	r	B	r
	or			
	b. Enter θ	θ	A	θ
	b. Enter s	s	C	s
	or			
	c. Enter θ	θ	A	θ
	c. Enter c	c	D	c
	or			
	d. Enter r	r	B	r
	d. Enter s	s	C	s
	or			
	e. Enter r	r	B	r
	e. Enter c	c	D	c
3	See Note 1			
4	Calculate θ'		2nd F	θ'
5	Calculate r'		2nd F	r'
6	Calculate s'		2nd C	s'
7	Calculate c'		2nd F	c'
8	Calculate A		E	A'
9	Calculate a		2nd F	a'

- NOTES:**
- All steps 4 through 9 must be performed in sequence. Values entered in Step 2 may be omitted.
 - θ is expressed in radians. Program leaves calculator in radian mode.

1	1. Select program			
2	2. Enter one pair from the following			
3	3. See Note 1			
4	4. Calculate θ'		2nd F	θ'
5	5. Calculate r'		2nd F	r'
6	6. Calculate s'		2nd C	s'
7	7. Calculate c'		2nd F	c'
8	8. Calculate A		E	A'
9	9. Calculate a		2nd F	a'

NORMAL DISTRIBUTION

ML-14

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 7 14	
2	Enter data and calculate Z(x)	x^1	A	Z(x)
3	Calculate Q(x)		B	Q(x)

- NOTES:**
1. $|x| \leq 15.11$, display will flash for x outside this range.
 2. Z(x) must be calculated before Q(x).
 3. $Z(-x) = -Z(x)$ and $Q(-x) = 1 - Q(x)$.
 4. $P(x) = 1 - Q(x)$.

RANDOM NUMBER GENERATOR

ML-15

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd MTR 15	
2	Initialize		2nd LT	0.
3	Enter random number seed ($0 \leq \text{seed} \leq 199017$)	seed	E	seed
For Uniform Distribution				
4	Enter lower limit	A	A	A
5	Enter upper limit	B	B	B
6	Generate random number (Repeat as needed)		C	Random No.
For Normal Distribution				
7	Enter desired mean	\bar{x}	A	Desired \bar{x}
8	Enter desired standard deviation	σ	B	Desired σ
9	Generate random number (Repeat as needed)		2nd C	Random No.
For Either Distribution				
10	Compute actual mean of generated numbers		2nd x	Actual \bar{x}
11	Compute actual standard deviation of generated numbers		INV 2nd x	Actual σ
12	Display number of generated numbers		RCL 03	N
For Range of (0,1)				
13	Generate random number (Repeat as needed)		SBR 2nd RM	Random No.

NOTE: 1. Five significant digits of the originally generated number are retained for further calculations. Therefore, no more than the first five significant digits of the generated numbers may be considered to be random.

COMBINATIONS, PERMUTATIONS, FACTORIALS

ML-16

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 16	
2a	Enter n	n	A	Integer n
2b	Enter r (0 < r < n) (2a must precede 2b)	r	B	Integer r
	Factorial			
3	Calculate factorial of n (0 < n < 69)		C	n!
	Permutations			
4	Calculate number of possible permutations		D	P_r^n
	Combinations			
5	Calculate number of possible combinations		E	C_r^n

- NOTES:**
- For $r > n$ the display flashes 9.9999999 99.
 - The display flashes 9.9999999 99 for overflow in the calculation.
 - For negative entries of either n or r, the absolute values are used and the display flashes the result.
 - For non-integer values of either n or r, only the integer values are used and the display flashes the results.
 - Step 2 must be repeated for each calculation.
 - Running time is dependent upon input data.

MOVING AVERAGES

ML-17

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 17	
2	Initialize		2nd 1	0.
3	Enter number of values to be averaged	n^1	A	n
4	Enter value to be averaged Repeat for each value.	m	B	average ²

- NOTES:**
- Error conditions:
For $n < 0$ or n non-integer, the display will flash 9.9999999 99.
 - An average will be taken for all values entered below the nth value. Once the nth value is entered, the concept of moving averages begins.
 - The number of data registers available must be greater than or equal to $n + 5$.

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
	U.S. Method			
1	Select program		2nd F 18	
2	Initialize		2nd I	0.00
3	Enter three of the following four variables in any order:			
	Number of periods	N	A	N
	Interest rate (percent per period)	%I	B	%I
	Present value	PV	C	PV
	Future value	FV	D	FV
4	Calculate the remaining variable			
	Number of periods	0	A	N
	Interest rate (percent per period)	0	B	%I
	Present value	0	C	PV
	Future value	0	D	FV
	Annuity Formulas (See Note 1 below and Notes on Annuity Formulas)			
5	Solve for $S_{\overline{n} i}$		2nd I	$S_{\overline{n} i}$
6	Solve for $(1+i)S_{\overline{n} i}$		2nd I	$(1+i)S_{\overline{n} i}$
7	Solve for $a_{\overline{n} i}$		2nd C	$a_{\overline{n} i}$
8	Solve for $(1+i)a_{\overline{n} i}$		2nd C	$(1+i)a_{\overline{n} i}$

- NOTE:** 1. Steps 5-8 assume the following:
 N is stored in R_{01}
 $I \div 100$ is stored in R_{02}
 $(I \div 100) + 1$ is stored in R_{09}

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
	European Method			
1	Select program		2nd 10B 18	
2	Initialize		2nd 1	0.00
	If annual interest rate is known			
3	Solve for i_{eff} per period			
3A	Enter periods per year	N_c	A	N_c
3B	Enter 1 as PV	1	C	1.00
3C	Enter $(1 + i_{\text{ann}}/100)$ as FV	$1 + i/100$	D	FV
3D	Solve for i_{eff} per period	0	B	i_{eff}
4	Enter two of the following three variables in any order:			
	Number of periods	N	A	N
	Present value	PV	C	PV
	Future value	FV	D	FV
5	Calculate the remaining variable:			
	Number of periods	0	A	N
	Present value	0	C	PV
	Future value	0	D	FV
	To solve for i_{ann}, given PV, FV, N			
6	Number of periods	N	A	N
7	Present value	PV	C	PV
8	Future value	FV	D	FV
9	Solve for i per period	0	B	$i(\text{period})$
10	Solve for annual interest rate (i_{ann})			
10A	Periods per year (N_c)	N_c	A	N_c
10B	Enter 1 for PV	1	C	1.00
10C	$FV = 1 + i_{\text{ann}}/100$	0	D	$1 + i_{\text{ann}}/100$
10D	Subtract 1 and multiply by 100	1	= X	
		100	=	i_{ann}

ANNUITIES

ML-19

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 1/19 19	
2	Initialize		2nd 1	0.
3	Select type of routine: Sinking Fund Annuity Due/FV Ordinary Annuity/PV Annuity Due/PV		2nd 1 2nd F 2nd C 2nd F	0. 0. 0. 0.
4	Enter the known variables in any order Number of Periods Interest Rate (percent per period) Payment per Period PV or FV Balloon Payment ¹	N %I PMT PV or FV BAL	A B C D E	N %I PMT PV or FV BAL
5	Solve for the unknown variable Number of Periods Interest Rate (percent per period) Payment per Period PV or FV Balloon Payment	0 0 0 0 0	A B C D E	N %I PMT PV or FV BAL
6	To solve another problem of the same type, go to Step 4 (See Note 2). For a problem of a different type, go to Step 2.			

- NOTES:**
- If balloon payment does not apply, **DO NOT** enter zero. Merely skip the step.
 - If balloon payment was non-zero in the previous problem and is zero in the new problem, go to Step 2.

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 1/19 19	
2	Initialize		2nd 1	0.
3	Select type of routine: Sinking Fund Annuity Due/FV Ordinary Annuity/PV Annuity Due/PV		2nd 1 2nd F 2nd C 2nd F	0. 0. 0. 0.
4	Enter the known variables in any order Number of Periods Interest Rate (percent per period) Payment per Period PV or FV Balloon Payment ¹	N %I PMT PV or FV BAL	A B C D E	N %I PMT PV or FV BAL
5	Solve for the unknown variable Number of Periods Interest Rate (percent per period) Payment per Period PV or FV Balloon Payment	0 0 0 0 0	A B C D E	N %I PMT PV or FV BAL
6	To solve another problem of the same type, go to Step 4 (See Note 2). For a problem of a different type, go to Step 2.			

DAY OF THE WEEK, DAYS BETWEEN DATES

ML-20

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program Days Between Dates		[2nd] [F1] 20	
2	Enter first date	MMDD.YYYY	[A]	0.
3	Enter second date	MMDD.YYYY	[B]	0.
4	Calculate number of days between given dates		[C]	No. of days
5	Day of the Week Enter date and calculate day of week * 0 - Sat 4 - Wed 1 - Sun 5 - Thurs 2 - Mon 6 - Fri 3 - Tues	MMDD.YYYY	[D]	Day of week*

- NOTES:**
1. Date must be entered in the order: month day year
 2. Error conditions
 - a. negative inputs
 - b. DD > 31
 - c. MM > 12
 - d. YYYY < 1582

MAD OYWE

ML-20

HI-LO GAME

ML-21

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd 1/P 21	
	You Guess			
2	Key in a number (0 to 1)*	Number	A	0.
3	Generate secret number		B	0.
4	Enter your guess (1 to 1023) Clue: -1, if guess was low 1, if guess was high flashing 0, if your guess was correct	Guess	C	Clue
5	Repeat Step 4 as required			
6	Display score		D	Score
7	For a new number, go to Step 3			
	Calculator Guesses			
8	Select a number (1 to 1023)			
9	Display calculator's first guess		2nd I	Calc. guess
10	If calculator's guess is: Low High Correct		2nd I 2nd C 2nd E	Calc. guess Calc. guess Calc. guess
11	Repeat Step 10 as required			
12	For a new game, go to Step 8			

Each number you select will produce a different game.

CHECKING/SAVINGS ACCOUNT MANAGEMENT

ML-22

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd F 22	
2	Load data registers from card ¹ or Enter checking balance Enter savings balance	C. Bal S. Bal	2nd F E 2nd F E	C. Bal. S. Bal.
3	Select checking mode		2nd F	
4	Enter deposit amount	Dep. amt.	B	New Bal.
5	Enter check amount	Chk. amt.	C	New Bal.
6	Repeat 4 and 5 as necessary			
7	Select savings mode		2nd F	
8	To add interest: Enter annual interest rate (%) Enter compounding periods per year Enter number of periods	%/yr P N	2nd C 2nd F D	%/yr %/per. New Bal.
9	To add savings deposit	Dep. amt.	B	New Bal.
10	To subtract savings withdrawal	Withdr. amt.	C	New Bal.
11	To display checking balance		2nd F A	Chk. Bal.
12	To display savings balance		2nd F A	Sav. Bal.
13	Optional: Record data registers on card ¹			

NOTE: 1. For TI Programmable 59 only.

DMS OPERATIONS

ML-23

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd F 23	
2	Enter number n (dd.mmss)	n	A	n(dec. deg.)
3	For Addition or Subtraction			
3	For addition, enter number p(dd.mmss)	p	B	(n + p)
4	For subtraction, enter number p(dd.mmss)	p	+/- B	(n - p)
4	For Multiplication or Division			
5	For multiplication, enter scalar a	a	C	(n X a)
6	For division, enter scalar a	a	D	(n ÷ a)

- NOTES:
- Display is in Fix 4 format after any of the four operations is performed.
 - For chained operations, the result of an operation should be used directly as the entered number in Step 2. This will minimize rounding errors.

UNIT CONVERSIONS (1)

ML-24

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd PRG 24	
2	To convert: inches to centimeters centimeters to inches feet to meters meters to feet yards to meters meters to yards miles to kilometers kilometers to miles miles to nautical miles nautical miles to miles	inches cm feet meters yards meters miles km miles nau. miles	A 2nd F B 2nd F C 2nd C D 2nd D E 2nd F	cm inches meters feet meters yards km miles nau. miles miles

UNIT CONVERSIONS (2)

ML-25

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd PRG 25	
2	To convert: °F to °C °C to °F fluid ounces to liters liters to fluid ounces U.S. gallons to liters liters to U.S. gallons ounces to grams grams to ounces pounds to kilograms kilograms to pounds	°F °C fl. oz. liters gallons liters ounces grams pounds kg	A 2nd F B 2nd F C 2nd C D 2nd F E 2nd F	°C °F liters fl. oz. liters gallons grams ounces kg pounds