

HEWLETT  PACKARD

**HP-65**

**STANDARD PAC**

The program material contained herein is supplied without representation or warranty of any kind. Hewlett-Packard Company therefore assumes no responsibility and shall have no liability, consequential or otherwise, of any kind arising from the use of this program material or any part thereof.

## CONTENTS

	<b>Page</b>
Introduction . . . . .	3
Format of User Instructions . . . . .	4
Entering a Program . . . . .	7
1. Personal Investment . . . . .	8
2. Mean, Standard Deviation, Standard Error . . . . .	12
3. Great Circle Navigation . . . . .	14
4. Integer Base Conversion . . . . .	17
5. Body Surface Area (Boyd) . . . . .	18
6. PI Network Impedance Matching . . . . .	20
7. EDM Slope Reduction—Given $\Delta$ Elevation . . . . .	24
8. Temperature Conversion . . . . .	26
9. Weight-Mass Conversion . . . . .	28
10. Volume Conversions . . . . .	30
11. Compound Interest . . . . .	32
12. Loan Repayment . . . . .	34
13. Reconcile Checking Account . . . . .	38
14. Iterative Solution of $f(x) = 0$ . . . . .	42
15. Quadratic Equation . . . . .	46
16. Areas and Solution of Right Triangle . . . . .	48
17. NIMB . . . . .	52
18. User Diagnostic Program I . . . . .	54
19. User Diagnostic Program II . . . . .	56
Program Listings . . . . .	59



## INTRODUCTION

The HP-65 Standard Pac is your introduction to using programs which are prerecorded on magnetic cards. Knowledge of programming the HP-65 is not required to use the pac, however, familiarity with the introduction of the Owner's Handbook will aid your understanding.

The Standard Pac is comprised of programs which demonstrate the simplicity of operation, the versatility and the computational power of your HP-65 Programmable Pocket Calculator. It contains programs of interest to engineers, scientists, statisticians, navigators, surveyors, doctors, businessmen, and people in many other technical and professional fields. The pac is only intended to show a sampling in these areas.

For each program the Standard Pac provides a description, general user instructions, user instructions specifically for the example problem(s), a prerecorded magnetic card (in the plastic card case) and program listings (at the back of the Pac). There are also two diagnostic programs for checking calculator operations, a head cleaning card which is used occassionally to clean the HP-65 magnetic card read/write head, and twenty blank magnetic cards which may be used to record programs that you write. For your convenience 20 blank pocket instruction cards are included to hold your favorite programs.

Six programs in this pac are representative examples of programs in "Application Pacs" which may be purchased from Hewlett-Packard. These are *Mean*, *Standard Deviation*, *Standard Error* (Statistics Pac I); *Quadratic Equation* (Mathematics Pac I); *Integer Base Conversion* (Mathematics Pac II); *Body Surface Area* (Medical Pac I); *PI Network Impedance Matching* (Electrical Engineering Pac I) and *EDM Slope Reduction-Given Δ Elevation* (Surveying Pac I). Additional pacs in various fields will be made available as they are developed. Each application pac includes prerecorded magnetic cards, a card case, 20 blank pocket instruction cards, and an instruction booklet with program descriptions, formulas, example problems, user instructions and program listings.

Individual listings and documentation of all programs in HP-65 application pacs are available through the HP-65 Users' Library which is a collection of programs from many disciplines submitted by HP-65 users. Through the Users' Library and application pac development, Hewlett-Packard hopes to provide HP-65 programs useful in a great variety of applications. Your inputs, both comments and Users' Library contributions, will be of great help to us in our endeavor to provide you with high quality programs for your HP-65 Calculator.

## FORMAT OF USER INSTRUCTIONS

The completed User Instruction Form—which accompanies each program—is your guide to operating the programs in this Pac.

The form is composed of five labeled columns. Reading from left to right, the first column, labeled STEP, gives the instruction step number.

The INSTRUCTIONS column gives instructions and comments concerning the operations to be performed.

The INPUT-DATA/UNITS column specifies the input data, and the units of data if applicable. Data input keys consist of **0** to **9** and decimal point (the numeric keys), **EEX** (enter exponent), and **CHS** (change sign).

The KEYS column specifies the keys to be pressed after keying in the corresponding input data. Where the **ENTER↑** key is used, it is indicated by **↑**. All other key designations are identical to those appearing on the HP-65. Ignore any blank spaces in the KEYS columns.

The OUTPUT-DATA/UNITS column specifies intermediate and final outputs and their units where applicable.

The following illustrates the User Instruction Form for Program STD-13A, *Reconcile Checking Account*.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		D	0.00
3	Input statement balance	SB	A	SB
4	Repeat 4 for out checks	C <sub>1</sub> ...C <sub>n</sub>	B	C <sub>1</sub> ...C <sub>n</sub>
5	Repeat 5 for each outstanding deposit	D <sub>1</sub> ...D <sub>m</sub>		
6	Compute final balance		E A	FB
7	Recall statement balance and/or sum of out checks and number of checks and/or sum of out deposit and number of deposits		R/S E B R/S C R/S C	SB Σ C <sub>i</sub> n <sub>c</sub> Σ D <sub>i</sub> m <sub>D</sub>
8	To add additional checks go to 4, to add additional deposits go to 5.			
9	For new case go to 2.			

STEP 1: Step 1 of the example is "Enter program". This calls for the entry of the prerecorded magnetic card into the HP-65 (See *Entering a Program*, on page 7).

STEP 2: This step "initializes" or prepares the calculator for proper program execution. Pressing the **D** key would perform the initialization in this case.

STEP 3: This step stores the statement balance. Press the applicable data input keys then press **A**. The statement balance is displayed after program execution ends.

STEP 4: This step is a repetition instruction as signified by the bold border enclosing the instructions. To perform Step 4, press the applicable data input keys to input the first outstanding check value. Press **B** to initiate program execution. The check value is still displayed after execution ends. Repeat the procedure for all outstanding checks. When all outstanding checks have been input, go to Step 5.

STEP 5: This step is also a repetition instruction. Outstanding deposits are the inputs. To perform Step 5 press applicable data input keys and press **C**. Repeat the procedure for all outstanding deposits. When all outstanding deposits have been input, go to Step 6.

STEP 6: This step computes the final balance. Press **E**, then **A** to display the final balance.

STEP 7: This step recalls values. Press **R/S** to display bank statement balance. Press **E**, then **B** to compute and display the sum of checks outstanding. Press **R/S** to display the number of checks outstanding. Press **E**, then **C** to compute and display the sum of deposits outstanding. Press **R/S** to display the number of deposits outstanding.

STEP 8: This step provides for the inclusion of additional checks and deposits outstanding: for checks start at Step 4, for deposits start at Step 5.

STEP 9: This step gives instructions on starting a new case. In this program, go to Step 2 and initialize.

In addition to the General User Instruction Form, each example problem in the Standard Pac is accompanied by Example User Instructions. The Example User Instructions differ from the General User Instructions in that they include numeric values instead of variable names. Also, each step number in the Example User Instructions corresponds to the step executed in the General User Instructions. Example User Instructions are included in the Standard Pac to help you become familiar with the HP-65 and the use of prerecorded magnetic cards. They are not generally included in HP-65 Application Pacs.



## ENTERING A PROGRAM

From the card case supplied with this application pac, select a program card.

Set W/PRGM-RUN switch to RUN.

Turn the calculator ON. You should see 0.00

Gently insert the card (printed side up) in the right, lower slot as shown. When the card is part way in, the motor engages it and passes it out the left side of the calculator. Sometimes the motor engages but does not pull the card in. If this happens, push the card a little farther into the machine. Do not impede or force the card; let it move freely. (The display will flash if the card reads improperly. In this case, press **CLX** and reinsert the card.)

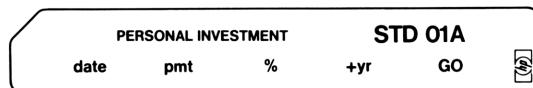


When the motor stops, remove the card from the left side of the calculator and insert it in the upper "window slot" on the right side of the calculator.

The program is now stored in the calculator. It remains stored until another program is entered or the calculator is turned off.



## PERSONAL INVESTMENT



Starting with

- an initial amount (PV)
- a declared regular monthly investment (PMT)
- a declared annual rate of return compounded monthly  
(r expressed in %)

this program calculates the total accumulation (T) over an interval of time defined by a start date (mm.yyyy) and a stop date (MM.YYYY). During this interval, the payment is assumed to be at the beginning of each month, and interest is compounded for the previous month.

At the end of the calculation, the start date parameter is reset to the previous stop date, so that the user need not key it in again to perform another calculation starting with that date. Similarly, the accumulated amount (T) is left in the proper register so that it can be used as an initial amount (PV) in the next calculation. Also, PMT and r are unchanged in case either or both are to apply to the next calculation (they *can* be changed by keying in the appropriate parameter). Thus the program is very useful for calculating compound growth over successive intervals, particularly where one or more growth parameters vary from one time interval to another.

At the end of each calculation, the monthly earnings (*iT*) can be displayed by merely pressing the **R/S** key, after which the accumulation (T) can be redisplayed by again pressing **R/S**.

**Formulas:**

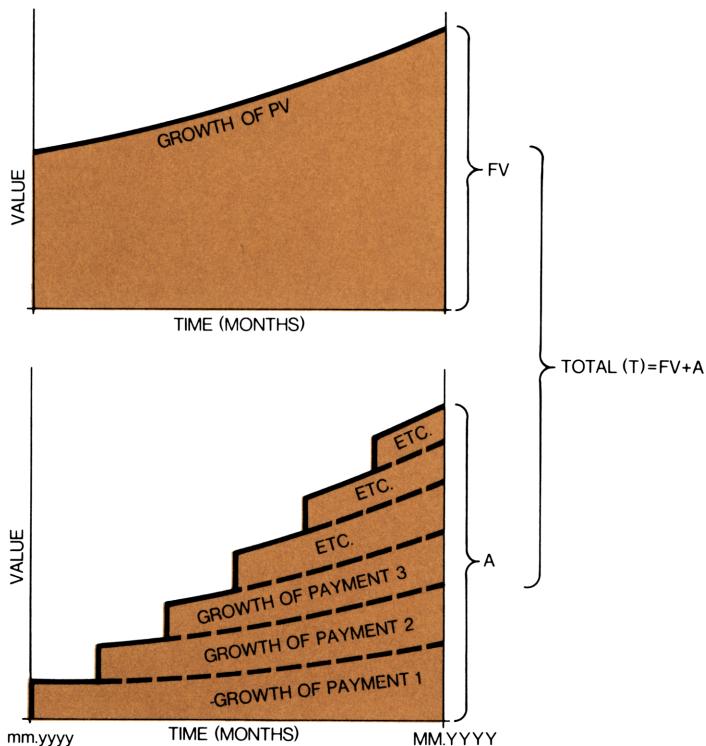
$$T = FV + A$$

$$FV = PV (1 + i)^n$$

$$A = PMT \frac{(1 + i)^n - 1}{i} (1 + i)$$

$$i = \frac{r}{1200}$$

$$n = (MM - mm) + 12 (YYYY - yyyy)$$

**Notes:**

Steps 2–5 in the general instructions prepare the way for calculating (steps 6 or 7). Steps 8 and 9 are optional. To calculate a second stage, it is unnecessary to reenter a start date or a present value. Also, PMT and r need be entered only if they are changed.

**GENERAL USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Input start date	mm.yyyy	A	
3	Input present value	PV	↑	PV
4	Input monthly saving	PMT	B	PV
5	Input annual rate	r	C	PV
6	Calculate to stop date	MM. YYYY	E	T
7	Calculate 1 more year ahead		D	T
8	Compute monthly earning		R/S	iT
9	Restore total		R/S	T
10	For a new plan go to 2.			

**Example:**

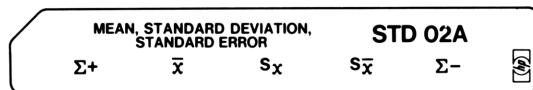
Starting with \$2000 (present value, PV) in May 1973 (start date, mm.yyyy), save \$100/month (PMT) at 12% annually (r) until December 1980 (stop date, MM.YYYY), then withdraw \$3000 (lump sum) and continue saving \$200/month at 18% annually until January of 1985. Calculate the total as of (a) that date and (b and c) the following two anniversaries.

EXAMPLE USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Personal Investment; as shown on page 7 of this manual)			
2	Input date (May 1973)	5.1973	A	
3	Input present savings	2000	↑	2000.00
4	Input monthly savings	100	B	2000.00
5	Input interest	12	C	2000.00
6	Input future date (Dec. 1980)	12.1980	E	19824.74
3	Withdraw \$3000	3000	—	16824.74
4	Change monthly savings to \$200	200	B	16824.74
5	Change interest rate to 18%	18	C	16824.74
6	Input future date (Jan. 1985)	1.1985	E	49433.27
7	Look one more year ahead		D	61750.68
7	Look one more year ahead		D	76477.60
8	What are monthly earnings		R/S	1147.16
9	Return to previous answer		R/S	76477.60

## Notes

## **MEAN, STANDARD DEVIATION, STANDARD ERROR**



Given a set of data points:

$$\{x_1, x_2, x_3, \dots, x_n\}$$

the program calculates the mean, the standard deviation (by either of two methods) and the standard error of the mean (by either of two methods).

## **Formulas:**

$$\text{Mean} \quad \bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

### Standard deviation

#### Alternate method

$$s_x = \sqrt{\frac{\sum x_i^2 - n \bar{x}^2}{n-1}}$$

$$s_x' = \sqrt{\frac{\sum x_i^2 - n \bar{x}^2}{n}}$$

## Standard error of the mean

### Alternate method

$$s_{\bar{x}} = \frac{s_x}{\sqrt{n}}$$

$$S_{\bar{x}}' = \frac{S_x'}{\sqrt{n}}$$

## **GENERAL USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		RTN R/S	0.00
3	Repeat 3 for each x	$x_1 \dots x_n$	A	1...n
	(Eliminate any x values entered in error—x error)	x error	E	
4	Compute $\bar{x}$		B	$\bar{x}$
5	Compute $s_x$ and		C	$s_x$
6	$s_x'$		R/S	$s_x'$
7	Compute $s_{\bar{x}}$ and		D	$s_{\bar{x}}$
8	$s_{\bar{x}}'$		R/S	$s_{\bar{x}}'$
9	For a new case, go to 2			

**Example:**

In a recent survey to determine the average age of the wealthiest people in the U.S., the following data were obtained:

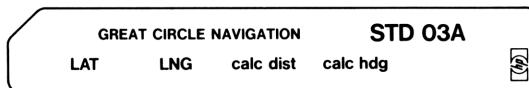
62    84    47    58    68    60    62    59    71    73

Of the ages given what is the mean, the standard deviation, and the standard error of the mean? Simply follow the keystep instructions to obtain the answers.

EXAMPLE USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Mean, Standard Deviation; as shown on page 7 of this manual)			
2	Initialize		RTN R/S	0.00
3	Input ages	62	A	1.00
		84	A	2.00
		47	A	3.00
		58	A	4.00
		68	A	5.00
		60	A	6.00
		62	A	7.00
		59	A	8.00
		71	A	9.00
		73	A	10.00
4	Compute $\bar{x}$		B	64.40
5	Compute $s_x$		C	10.10
6	Compute $s_x'$		R/S	9.58
7	Compute $s_{\bar{x}}$		D	3.19
8	Compute $s_{\bar{x}}'$		R/S	3.03

## GREAT CIRCLE NAVIGATION



This program accepts the coordinates of two points on the globe and calculates the great circle distance between them as well as the initial heading.

The program inputs are latitude and longitude of the source ( $LAT_S$ ,  $LNG_S$ ) and latitude and longitude of the destination ( $LAT_D$ ,  $LNG_D$ ), (the above are expressed in the notation degrees  $\square$  minutes, i.e., 15.30 means  $15^{\circ} 30'$ ).

Northern latitudes are entered as positive values while southern ones are entered as negative values.

Western longitudes are entered as positive values while eastern ones are entered as negative values.

The outputs are great circle distance (Dist) in nautical miles and initial great circle heading (Hdg) in decimal degrees. (You may convert back to degrees, minutes, seconds by pressing **f** **+D.MS**.)

Any number of consecutive legs may be linked together without any reentry of data. Short legs are recommended since only the initial course heading is given and intermediate heading changes may well be desirable.

**Notes:**

1. No point on a leg should be at either North or South pole nor should any leg pass more than half way around the earth.
2. After program execution the machine is set in degree mode.

**Formulas:**

$$\text{Dist} = \cos^{-1} [\sin(LAT_S) \sin(LAT_D) + \cos(LAT_S) \cos(LAT_D) \cos(LNG_D - LNG_S)] \times 60$$

$$\text{Hdg} = \cos^{-1} \left[ \frac{\sin(LAT_D) - \cos(Dist/60) \sin(LAT_S)}{\sin(Dist/60) \cdot \cos(LAT_S)} \right]$$

**Note:**

If  $\sin(LNG_S - LNG_D) < 0$  then  $Hdg = 360 - Hdg$

## GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		RTN R/S	0.00
3	Input starting latitude and input starting longitude	(deg . min)	A B	(dec. deg.)
4	Input destination latitude and input destination longitude	(deg . min)	A B	(dec. deg.)
5	Calc. Great Circle Dist and/or calc. initial heading		C D	(naut. miles) (dec. deg.)
6	next leg			
7	To reinitialize go to step 2.			

**Example:**

A navigator wishes to follow great circle courses from Chicago to St. Louis to New Orleans. Find the great circle distances and initial courses.

	LAT	LNG
Chicago	41° 50' N	87° 36' W
St. Louis	38° 38' N	90° 12' W
New Orleans	29° 56' N	90° 04' W

**Note:**

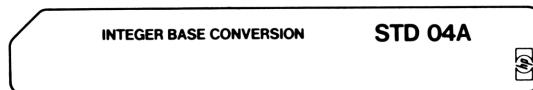
After entries, the angle in decimal degrees is displayed.

**Answers:**  $\text{Dist}_1 = 225.91$  Nautical miles  $\text{Hdg}_1 = 212.66^\circ$   
 $\text{Dist}_2 = 522.04$  Nautical miles  $\text{Hdg}_2 = 179.24^\circ$

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Great Circle Navigation; as shown on page 7 of this manual)			
2	Initialize		RTN R/S	0.00
3	Input LAT Chicago	41.50	A	41.83
	Input LNG Chicago	87.36	B	87.60
4	Input LAT St. Louis	38.38	A	38.63
	Input LNG St. Louis	90.12	B	90.20
5	Calc. Great Circle Distance		C	225.91
	Calc. initial heading		D	212.66
4	Input LAT New Orleans	29.56	A	29.93
	Input LNG New Orleans	90.04	B	90.07
5	Calc. Great Circle Distance		C	522.04
	Calc. initial heading		D	179.24

## INTEGER BASE CONVERSION



This program can be used to convert an integer  $n$  in base  $B_1$  to an equivalent integer in base  $B_2$ , where  $B_1, B_2$  are integers such that  $2 \leq B_i \leq 10$  ( $i = 1, 2$ ).

$n$  is first converted to a decimal integer then the decimal integer is converted to an integer in base  $B_2$ .

**Note:** A non-integer entry is truncated to an integer which then is converted to its equivalent integer in the specified base.

### GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program		<input type="text"/> <input type="text"/>	
2	Input $n$	$n$	<input type="text"/> ↑ <input type="text"/>	
3	Input the base $B_1$ of $n$	$B_1$	<input type="text"/> ↑ <input type="text"/>	
4	Input desired base $B_2$	$B_2$	<input type="text"/> A <input type="text"/>	
5	For new case, go to 2		<input type="text"/> <input type="text"/>	

### Example:

$$110_2 = 6_8$$

### EXAMPLE USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Integer Base Conversion; as shown on page 7 of this manual.)		<input type="text"/> <input type="text"/>	
2	Input $n$	110	<input type="text"/> ↑ <input type="text"/>	110.00
3	Input the base $B_1$ of $n$	2	<input type="text"/> ↑ <input type="text"/>	2.00
4	Input desired base $B_2$	8	<input type="text"/> A <input type="text"/>	6.00

**BODY SURFACE AREA (BOYD)**

BODY SURFACE AREA (Boyd)			STD 05A	
HEIGHT (cm, -in)	WEIGHT (kg, -lb)	BSA (m <sup>2</sup> )	CO (l/min)	CI (l/min/m <sup>2</sup> )

This program calculates the body surface area in square meters from the patient's height (in inches or centimeters) and weight (in pounds or kilograms). If height is in inches, enter it as a negative number and it will be converted to centimeters. Enter centimeters as a positive number. If weight is in pounds, enter as a negative number, and it will be converted to kilograms. Enter kilograms as a positive number.

Also, the cardiac index (a normalized measure of cardiac blood output which removes the influence of patient size) is calculated from the height, weight, and cardiac output. The formula used for the body surface area calculation is that of Edith Boyd (*The Growth of the Surface Area of the Human Body*, U. of Minn. Press, 1935), and is claimed to be valid throughout the life span.

**Formulas:**

$$\text{BSA} = (3.20W^{0.7285} - .0188 \log W H^{0.3}) \div 10^4$$

$$\text{CI} = \text{CO}/\text{BSA}$$

$$W = 1000 W_t$$

**BSA** = Body surface area (square meters)

**W** = Body weight (grams)

**W<sub>t</sub>** = Body weight (kilograms)

**H** = Height (centimeters)

**CI** = Cardiac index (liters/min/m<sup>2</sup>)

**CO** = Cardiac output (liters/min)

## GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Input height (cm)	Ht (cm)	A	Ht (cm)
	or input height (in.)	Ht (in)	CHS A	Ht (cm)
3	Input weight (kg)	Wt (kg)	B	Wt (kg)
	or input weight (lb.)	Wt (lb)	CHS B	Wt (kg)
4	Calculate BSA		C	BSA ( $m^2$ )
5	Input cardiac output	CO (l/min.)	D	CO(l/min)
6	Calculate cardiac index		E	CI(l/min/ $m^2$ )
7	For new case go to 2			

**Example:**

Height = 70 inches, weight = 170 pounds, cardiac output = 8 liters/minute. Height is entered as (-70) and weight is entered as (-170), giving:

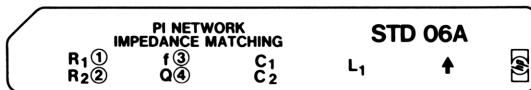
$$\text{Body Surface Area (BSA)} = 1.96 \text{ square meters}$$

$$\text{Cardiac Index} = 4.08 \text{ liters/minute/square meter}$$

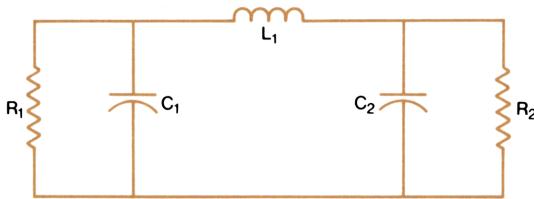
## EXAMPLE USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Body Surface			
	Area; as shown on page 7 of			
	this manual)			
2	Input height in inches	70	CHS A	177.80
3	Input weight in lbs.	170	CHS B	77.27
4	Calculate BSA		C	1.96
5	Input cardiac output	8	D	8.00
6	Calculate cardiac index		E	4.08

## PI NETWORK IMPEDANCE MATCHING



A lossless network is often used to match between two resistive impedances,  $R_1$  and  $R_2$ , as shown.



Given the values of  $R_1$  and  $R_2$ , the frequency ( $f$ ), and the desired circuit  $Q$  (center frequency/desired half-power bandwidth), the values of  $C_1$ ,  $C_2$ , and  $L_1$  can be found from the following formulas.

**Formulas:**

$$X_{C1} = \frac{R_1}{Q}$$

$$C_1 = \frac{1}{2\pi f X_{C1}}$$

$$X_{C2} = \frac{R_2}{\left[ \frac{R_2}{R_1} (Q^2 + 1) - 1 \right]^{1/2}}$$

$$C_2 = \frac{1}{2\pi f X_{C2}}$$

$$X_{L1} = \frac{QR_1}{Q^2 + 1} \left[ 1 + \frac{R_2}{QX_{C1}} \right]$$

$$L_1 = \frac{X_{L1}}{2\pi f}$$

**Notes:**

1.  $R_1$  must always be greater than  $R_2$  and

$$Q > \sqrt{\frac{R_1}{R_2} - 1} .$$

2. Circled numbers on the magnetic card designate the register in which a variable is stored.

**GENERAL USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		RTN R/S	0.0000x10 <sup>0</sup>
3	Input R <sub>1</sub>	R <sub>1</sub> (ohms)	E A	R <sub>1</sub> (ohms)
	and R <sub>2</sub>	R <sub>2</sub> (ohms)	A	R <sub>2</sub> (ohms)
	and f	f(Hz)	E B	f(Hz)
	and Q	Q	B	Q
4	Compute C <sub>1</sub>		E C	C <sub>1</sub> (farads)
5	Compute C <sub>2</sub>		C	C <sub>2</sub> (farads)
6	Compute L <sub>1</sub>		D	L <sub>1</sub> (henrys)
7	Recall inputs (optional)			
	R <sub>1</sub>		RCL 1	R <sub>1</sub> (ohms)
	and/or R <sub>2</sub>		RCL 2	R <sub>2</sub> (ohms)
	and/or f		RCL 3	
	and/or Q		RCL 4	Q
8	For new case change appropriate			
	input in step 3.			

**Example:**

$$\begin{array}{llll}
 R_1 = 500 & R_2 = 50 & Q = 10 & 4 \times 10^6 \text{ (4MHz)} \\
 \text{Calculate } C_1 = 7.9577 \times 10^{-10} & & & \approx 796 \text{ pF} \\
 C_2 = 2.4006 \times 10^{-9} & & & \approx 2400 \text{ pF} \\
 L_1 = 2.5639 \times 10^{-6} & & & \approx 2.56 \mu\text{H}
 \end{array}$$

**EXAMPLE USER INSTRUCTIONS**

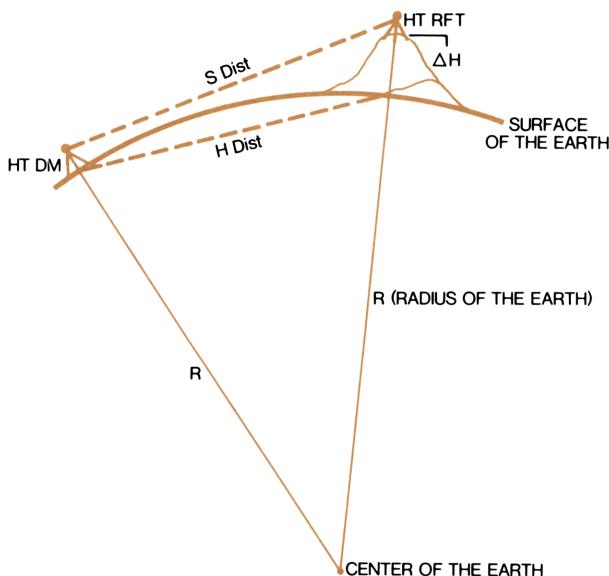
STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
	(PI Network Impedance			
	Matching; as shown on page 7			
	of this manual)			
2	Initialize		RTN R/S	$0.0000 \times 10^0$
3	Input $R_1$	500	E A	$5.0000 \times 10^2$
	and $R_2$	50	A	$5.0000 \times 10^1$
	and $f$	$4 \times 10^6$	E B	$4.0000 \times 10^6$
	and $Q$	10	B	$1.0000 \times 10^1$
4	Compute $C_1$		E C	$7.9577 \times 10^{-10}$
5	Compute $C_2$		C	$2.4006 \times 10^{-9}$
6	Compute $L_1$		D	$2.5639 \times 10^{-6}$
7	Recall inputs (optional)			
	$R_1$		RCL 1	$5.0000 \times 10^2$
	and/or $R_2$		RCL 2	$5.0000 \times 10^1$
	and/or $f$		RCL 3	$4.0000 \times 10^6$
	and/or $Q$		RCL 4	$1.0000 \times 10^1$

## Notes

**EDM SLOPE REDUCTION - GIVEN  $\Delta$  ELEVATION**

EDM SLOPE REDUCTION GIVEN $\Delta$ ELEVATION			<b>STD 07A</b>
S DIST (ft)	S DIST (m)	HI DM- HT RFT	$\Delta$ ELEV
			H DIST SOLN

Taking into consideration the curvature of the earth, this program reduces slope distance to horizontal distance at the instrument point elevation. The program assumes the slope distance between two points having a known difference in elevation was measured using an Electronic Distance Measuring instrument. A positive elevation is used when the reflector is above the instrument and a negative elevation is used when the reflector is below the instrument. As an option, this distance may be corrected for the difference between the heights of the instrument and the reflector.



**Formulas used:**

$$\Delta = \text{HT RFT} - \text{HI DM}$$

$$H \text{ Dist} = \sqrt{\frac{(S \text{ Dist})^2 - (\Delta H + \Delta)^2}{1 + (\Delta H + \Delta)/R}} \left[ \frac{R}{R + \text{HI DM}} \right]$$

## GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Input S Dist			
	in feet	S Dist(ft)	A	S Dist(ft)
	or in meters	S Dist(m)	B	S Dist(m)
3	Input HI DM	HI DM(ft or m)	C	HI DM(ft or m)
4	Input HT RFT	HT RFT(ft or m)	C	HT RFT(ft or m)
5	Input $\Delta H$	$\Delta H$ (ft or m)	D	$\Delta H$ (ft or m)
6	Calculate H Dist		E	H Dist(ft or m)

**Example:**

Slope Distance	S Dist	10,000 ft
Instrument Height	HI DM	5.12 ft.
Reflector Height	HT RFT	5.75 ft.
Elevation Difference	$\Delta H$	500 ft.
Horizontal Distance	H Dist	9987.341 ft.

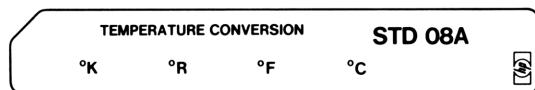
## EXAMPLE USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (EDM Slope			
	Reduction—Given $\Delta$ Elevation;			
	as shown on page 7 of this			
	manual)			
2	Input S Dist	10000	A	10000.00
3	Input HI DM	5.12	C	5.12
4	Input HT RFT	5.75	C	5.75
5	Input $\Delta H$	500	D	500.00
6	Calculate H Dist		E	9987.34

**Note:**

Programs in Surveyor Pac I are generally not compatible with metric units.

## TEMPERATURE CONVERSION



This program converts temperature interchangeably between degrees Celsius (Centigrade), Kelvin, Fahrenheit and Rankine. The following standard relationships are used in the conversions:

$$^{\circ}\text{C} = \frac{5}{9} (\text{ }^{\circ}\text{F} - 32)$$

$$\text{ }^{\circ}\text{F} = \text{ }^{\circ}\text{R} - 459.67$$

$$\text{ }^{\circ}\text{R} = \frac{9}{5} \text{ K}$$

$$\text{K} = \text{ }^{\circ}\text{C} + 273.15$$

### GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		RTN R/S	
3	Input either			
	K	K	A	0.00*
	or $^{\circ}\text{R}$	$^{\circ}\text{R}$	B	0.00*
	or $^{\circ}\text{F}$	$^{\circ}\text{F}$	C	0.00*
	or $^{\circ}\text{C}$	$^{\circ}\text{C}$	D	0.00*
4	Then convert to either			
	K	K	A	K
	or $^{\circ}\text{R}$	$^{\circ}\text{R}$	B	$^{\circ}\text{R}$
	or $^{\circ}\text{F}$	$^{\circ}\text{F}$	C	$^{\circ}\text{F}$
	or $^{\circ}\text{C}$	$^{\circ}\text{C}$	D	$^{\circ}\text{C}$
5	For new case go to 3			
	*Note: If display is not zero			
	go to 2.			

**Example:**Convert  $212^{\circ}\text{F}$  to K**Answer:** 373.15K**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Temperature Conversion; as shown on page 7 of this manual)			
2	Initialize		RTN R/S	
3	Input $^{\circ}\text{F}$	$212^{\circ}\text{F}$	C	0.00
4	Convert to K		A	373.15 K

**WEIGHT-MASS CONVERSION**

WEIGHT-MASS CONVERSION			STD 09A	
lbs	oz	kg	gm	slugs

This program converts weight and/or mass interchangeably between pounds, ounces, kilograms, grams and slugs. Combinations of the following equalities are used to perform conversions:

- 1 pound = 16 ounces
- 1 ounce = 28.349523 grams
- 1 kilogram = 1000 grams
- 1 slug = 32.174 pounds mass

**Note:**

Zero is an invalid input.

**GENERAL USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program		<input type="text"/> <input type="text"/>	
2	Input either		<input type="text"/> <input type="text"/>	
	pounds	lbs	<input type="text"/> A <input type="text"/>	0.00
	or ounces	oz	<input type="text"/> B <input type="text"/>	0.00
	or kilograms	kg	<input type="text"/> C <input type="text"/>	0.00
	or grams	gm	<input type="text"/> D <input type="text"/>	0.00
	or slugs	slugs	<input type="text"/> E <input type="text"/>	0.00
3	Then convert to either		<input type="text"/> <input type="text"/>	
	pounds		<input type="text"/> A <input type="text"/>	lbs
	or ounces		<input type="text"/> B <input type="text"/>	oz
	or kilograms		<input type="text"/> C <input type="text"/>	kg
	or grams		<input type="text"/> D <input type="text"/>	gm
	or slugs		<input type="text"/> E <input type="text"/>	slugs
4	For new case go to 2.		<input type="text"/> <input type="text"/>	

**Example:**

Convert 10 pounds to kilograms

**Answer:** 4.54 kg

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Weight—Mass Conversion; as shown on page 7 of this manual)			
2	Input pounds	10	A	0.00
3	Convert to kilograms		C	4.54

## VOLUME CONVERSIONS

VOLUME CONVERSIONS			STD 10A	
US gal	IMP gal	liters	cc	cu in

This program converts volume interchangeably between U.S. gallons, imperial gallons, liters, cubic centimeters and cubic inches. Combinations of the following equalities are used to perform conversions:

- 1 U.S. gallon = 3.7854 liters
- 1 Imperial gallon = 1.20095 U.S. gallons
- 1 liter = 1000 cubic centimeters
- 1 cubic inch = 16.387064 cubic centimeters

**Note:**

Zero is an invalid input.

**GENERAL USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program		<input type="text"/> <input type="text"/>	
2	Input either		<input type="text"/> <input type="text"/>	
	U.S. gallons	U.S. gal.	<input type="text"/> A <input type="text"/>	0.00
	or Imperial gallons	Imp. gal.	<input type="text"/> B <input type="text"/>	0.00
	or liters	l	<input type="text"/> C <input type="text"/>	0.00
	or cubic centimeters	cc	<input type="text"/> D <input type="text"/>	0.00
	or cubic inches	in <sup>3</sup>	<input type="text"/> E <input type="text"/>	0.00
3	Then convert to either		<input type="text"/> <input type="text"/>	
	U.S. gallons		<input type="text"/> A <input type="text"/>	U.S. gal.
	or Imperial gallons		<input type="text"/> B <input type="text"/>	Imp. gal.
	or liters		<input type="text"/> C <input type="text"/>	l
	or cubic centimeters		<input type="text"/> D <input type="text"/>	cc
	or cubic inches		<input type="text"/> E <input type="text"/>	in <sup>3</sup>

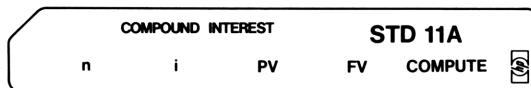
**Example:**

Convert 2400 cubic centimeters to cubic inches

**Answer:** 146.46 cubic inches

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Volume Conversions; as shown on page 7 of this manual)		<input type="text"/> <input type="text"/>	
2	Input cubic centimeters	2400	D <input type="text"/>	0.00
3	Convert to cubic inches		E <input type="text"/>	146.46

**COMPOUND INTEREST**

This program computes the answers to compound interest problems using the formulas below:

$$1. \quad n = \frac{\ln(FV/PV)}{\ln(1 + i/100)}$$

$$2. \quad i = [ (FV/PV)^{1/n} - 1 ] \times 100$$

$$3. \quad PV = FV (1 + i/100)^{-n}$$

$$4. \quad FV = PV (1 + i/100)^n$$

**Note:** Formulas 1, 2 and 3 are derived from 4

where:

n = Number of time (compounding) periods.

i = Interest rate per time period (in percent).

PV = Present value (value at the beginning of the first time period).

FV = Future value (value at the end of n time periods).

## GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		RTN R/S	
3	Input 3 of the following			
	n	n	A	n
	and/or i	i(%)	B	i(%)
	and/or PV	PV	C	PV
	and/or FV	FV	D	FV
4	Compute the remaining variable			
	n		E A	n
	or i		E B	i(%)
	or PV		E C	PV
	or FV		E D	FV
5	To modify problem go to 3			
	and change appropriate input(s).			

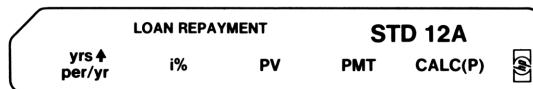
**Example:**

What amount must be invested today to have \$15,000 at the end of 20 years if the interest rate is 7% compounded quarterly?

**Answer:** \$3744.02

## EXAMPLE USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Compound			
	Interest; as shown on page 7			
	of this manual)			
2	Initialize		RTN R/S	0.00
3	Input			
	n (n = 20 × 4)	80	A	80.00
	and i (i = 7 ÷ 4)	1.75	B	1.75
	and FV	15000	D	15000.00
4	Compute PV		E C	3744.02

**LOAN REPAYMENT**

Given the term for a direct reduction loan in years, the number of periodic payments per year, and the annual interest rate in percent this program computes:

1. Periodic payment amount, if the principal value borrowed is given.

or

2. The principal value if the periodic payment is given.

A one half cent round-off routine is incorporated so that the answers are correct to the nearest cent.

**Formulas:**

$$PV = PMT \left[ \frac{\left(1 + \frac{i}{100n}\right)^{yn} - 1}{\frac{i}{100n} \left(1 + \frac{i}{100n}\right)^{yn}} \right]$$

where:

PV = Principal value

PMT = Periodic payment

i = Annual interest rate in percent

y = Number of years

n = Number of payment periods per year

## GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Input number of years	y	↑	y
3	Input payment periods/year	n	A	yn
4	Input annual interest	i(%)	B	100
5	Input either principal value or payment	PV	C	PV PMT
6	Calculate either payment or principal value	PMT	D	
			E	D
			E	C
7	Perform steps 2 and 3, or step 4 or step 5 for new values.			
	Note: Unrounded values for PMT or PV calculations are stored in register 8 after calculation.			

**Example:**

Find the quarterly payment for a thirty year mortgage at 8.75% with principal amount of \$37,500.

**Answer:** \$886.36

What principal value corresponds exactly to the periodic payment calculated?

**Answer:** 37,499.86

What would the payment be if the interest is 9.25%

**Answer:** \$926.83

At the higher interest what would the monthly payments be?

**Answer:** \$308.50

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Loan Repayment ; as shown on page 7 of this manual)			
2	Input number of years	30	↑	30.00
3	Input payment periods/year	4	A	120.00
4	Input annual interest	8.75	B	100.00
5	Input principal value	37500	C	37500.00
6	Calculate payment		E D	886.36
5	Input payment		D	886.36
6	Calculate principal value (the difference is due to accumulated ½ cent roundoff)		E C	37499.86
4	Input new interest	9.25	B	100.00
6	Calculate payment		E D	926.83
2	Input number of years	30	↑	
3	Input payment periods/year	12	A	360.00
6	Calculate payment		E D	308.50

## Notes

## RECONCILE CHECKING ACCOUNT

RECONCILE CHECKING ACCOUNT				STD 13A
F BAL	SUM STATE BAL	SUM OUT CHK	CLEAR	COMPUTE
				

This program serves as an aid in reconciling personal checkbook tallies to bank statements. Inputs are outstanding checks (check which have not cancelled), outstanding deposits (deposits after the statement closing date), and bank statement balance. Outputs are final balance (this should agree with the personal checkbook tally), sum and total number of outstanding checks, and sum and number of outstanding deposits. All statement service charges should be subtracted from the checkbook tally before reconciling.

**Formula:**

$$FB = SB + \sum_{i=1}^{m_D} D_i - \sum_{i=1}^{n_c} C_i$$

where:

FB = Final Balance

SB = Bank Statement Balance

$D_i$  = Outstanding Deposit Number i

$C_i$  = Outstanding Check Number i

$m_D$  = Number of Outstanding Deposits

$n_c$  = Number of Outstanding Checks

Expressed differently, the current checkbook balance (FB) equals the bank statement balance (SB) plus deposits made after the statement closing date

$$\sum_{i=1}^{m_D} D_i$$

minus checks not received at the bank before the closing date

$$\sum_{i=1}^{n_c} C_i .$$

## GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		D	0.00
3	Input statement balance	SB	A	SB
4	Repeat 4 for out checks	C <sub>1</sub> ...C <sub>n</sub>	B	C <sub>1</sub> ...C <sub>n</sub>
5	Repeat 5 for each outstanding deposit			
	deposit	D <sub>1</sub> ...D <sub>m</sub>	C	D <sub>1</sub> ...D <sub>m</sub>
6	Compute final balance		E A	FB
7	Recall statement balance and/or sum of out checks and number of checks and/or sum of out deposit and number of deposits		R/S	SB $\Sigma C_i$ $n_c$ $\Sigma D_i$ $m_D$
8	To add additional checks go to 4, to add additional deposits go to 5.			
9	For new case go to 2.			

**Example:**

**SB = \$432.96 (Bank Statement Balance)**

Outstanding checks are as follows:

\$47.82

\$ 5.63

\$25.00

\$36.47

\$96.02

Outstanding deposits are as follows:

\$100.00

\$256.03

What should be the checkbook current balance?

**Answer: \$578.05**

What is the dollar total of outstanding check?

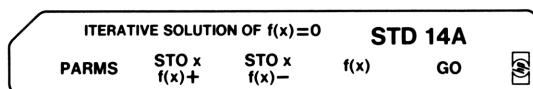
**Answer: \$210.94**

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Reconcile			
	Checking Account; as shown on			
	page 7 of this manual)			
2	Initialize		D	0.00
3	Input statement balance	432.96	A	432.96
4	Input outstanding checks			
		47.82	B	47.82
		5.63	B	5.63
		25.00	B	25.00
		36.47	B	36.47
		96.02	B	96.02
5	Input outstanding deposits			
		100.00	C	100.00
		256.03	C	256.03
6	Compute final balance		E A	578.05
7	Recall statement balance		R/S	432.96
	and/or sum of out checks		E B	210.94
	and number of out checks		R/S	5.00
	and/or sum of out deposits		E C	356.03
	and number of out deposits		R/S	2.00

## Notes

## ITERATIVE SOLUTION OF $f(x)=0$



This program performs an iterative solution for the zeros of continuous functions (written in 32 or less program steps) that cross the x axis. To solve a given function, key it in under label D. In addition, provide a value  $x_1$ , such that  $f(x_1) > 0$ , and another value  $x_2$  such that  $f(x_2) < 0$ . Your function is then used by the iterating routine, "E", to repeatedly evaluate the function using progressively better approximations. The process continues until a value of  $x_i$  is found such that  $|f(x_i)| < 10^{-6}$  (in which case  $x_i$  is the answer). The program is especially valuable for solving equations that are not reducible to the form

$$x = f \text{ (known values)}$$

An example of such an irreducible equation is

$$\ln(x) = ax + b$$

If it is necessary to store the x value so that it can be recalled at several points in the  $f(x)$  subroutine, use storage register 5. The parameter a is stored in register 6, b is stored in register seven, and c is stored in register 8. If you do not intend to vary the a, b and c parameters it may be convenient to include them as constants in  $f(x)$ . If this is the case, step six of the General User Instructions may be omitted.

**Note:**

If a function crosses the x axis more than once in the interval between  $x_1$  and  $x_2$ , this program will find only one of the zero values. Also, if a function crosses the x axis an infinite number of times between  $x_1$  and  $x_2$  the iterative routine may not converge.

## GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Switch to W/PRGM mode			00 00
3	Single step twice		SST SST	14
4	Input f(x)			
5	Switch to RUN mode			
6	Input parameters if required by			
	f(x)	c	↑	c
	then	b	↑	b
	then	a	A	c
7	Input $x_1$ guess	$x_1$	B	$f(x_1)$
	If $f(x_1)$ is negative repeat 7 and			
	choose new $x_1$			
8	Input $x_2$ guess	$x_2$	C	$f(x_2)$
	If $f(x_2)$ is positive repeat 8 and			
	choose new $x_2$			
9	Compute x		E	x

**Example:**

Find the solution to the equation

$$\ln(x) = ax + b$$

where

$$a = -1 \text{ and } b = 3.$$

First re-write the equation in the form

$$\ln(x) - ax - b = 0$$

Now transform the equation into HP-65 code as is shown in step four of the example user instructions.

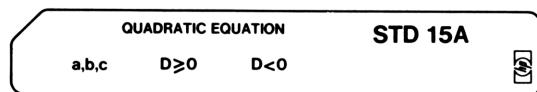
**Answer:** 2.21

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Iterative Solution of $f(x) = 0$ ; as shown on page 7 of this manual)			
2	Switch to W/PRGM mode			00 00
3	Single step twice		SST SST	14
4	Input $f(x)$ ( $\ln(x) - ax - b = 0$ )		f LN g LST X RCL 6 x - RCL 7	31 07 35 00 34 06 71 51 34 07 51
5	Switch to RUN mode			
6	Input parameters			
	b	3	↑	
	and a	-1	A	
7	Guess $x = 2$	2	B	-0.31
	answer is not positive			
	Guess $x = 3$	3	B	1.10
8	Guess $x = 2$	2	C	-0.31
9	Compute x		E	2.21

**Notes**

## QUADRATIC EQUATION



The roots  $x_1, x_2$  of

$$ax^2 + bx + c = 0 \quad (a \neq 0)$$

are

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If

$$D = (b^2 - 4ac)/4a^2$$

is positive or zero, the roots are real. Otherwise, they are complex, being

$$u \pm iv = \frac{-b}{2a} \pm \frac{\sqrt{4ac - b^2}}{2a} i$$

### GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Input coefficients			
	a	a	↑	a
	and b	b	↑	b
	and c	c	A	D
3	If $D \geq 0$ roots are real		B	root 1
			R/S	root 2
4	If $D < 0$ roots are complex		C	u
			R/S	v

**Examples:**

$$1. \ 2x^2 + 5x + 3 = 0$$

$$(D = 0.06 > 0)$$

$$\text{Answers: } x_1 = -1.00$$

$$x_2 = -1.50$$

**EXAMPLE 1 USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Quadratic Equation; as shown on page 7 of this manual)			
2	Input coefficients a and b and c	2 5 3	↑ A	2.00 5.00 0.06
3	Compute root 1 Compute root 2		B R/S	-1.00 -1.50

$$2. \ 2x^2 + 3x + 4 = 0$$

$$(D = -1.44 < 0)$$

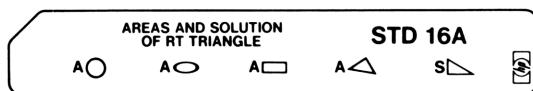
$$\text{Answers: } x_1 = -0.75 + 1.20i$$

$$x_2 = -0.75 - 1.20i$$

**EXAMPLE 2 USER INSTRUCTIONS**

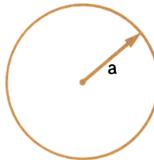
STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Quadratic Equation; as shown on page 7 of this manual)			
2	Input coefficients a and b and c	2 3 4	↑ A	2.00 3.00 -1.44
4	Compute u Compute v		C R/S	-0.75 1.20

## AREAS AND SOLUTION OF RIGHT TRIANGLE



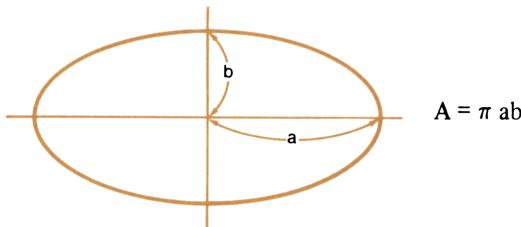
This program finds:

1. The area of a circle given a



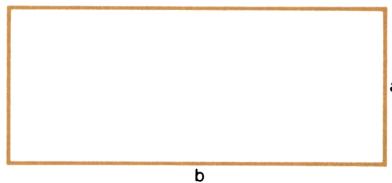
$$A = \pi a^2$$

2. The area of an ellipse given a and b



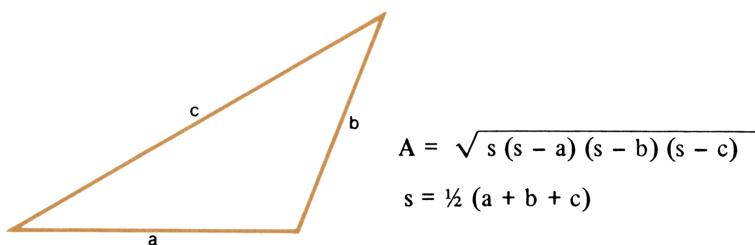
$$A = \pi ab$$

3. The area of a rectangle given a and b



$$A = ab$$

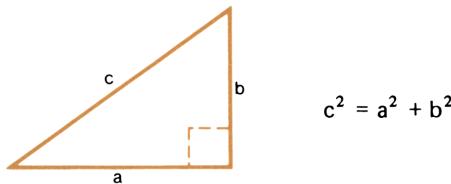
4. The area of a triangle given a, b, and c



$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

$$s = \frac{1}{2}(a+b+c)$$

5. The third side of a right triangle given the other two. (If the hypotenuse is one of the known legs it must be entered as a negative value.)



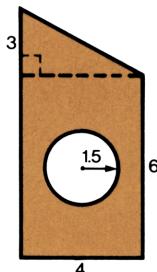
The program also keeps a running total of the areas it has computed. Areas computed using only positive inputs are added to this total. To subtract an area from this total make the last dimension entered negative. Using this feature it is possible to find the area of combinations of circles, ellipses, rectangle and triangles.

#### GENERAL USER INSTRUCTIONS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Initialize		RTN R/S	0.00
3	To find the area of a circle or an ellipse	$\pm *a$ $a$ $\pm *b$	A $\uparrow$ B $\uparrow$ C $\uparrow$ D	Area
	or a rectangle	$\pm *b$		
	or a triangle	$a$ $b$ $\pm *c$	$\uparrow$ $\uparrow$ E	Area
	or to find the third side of a right triangle	$a$ b or -c	$\uparrow$ E	side 3
4	For next area go to 3.			
5	For total of areas previously computed		R/S	$\Sigma$ Areas
6	To start new sum go to 2. *Note: Input as a negative num- ber if the area is to be subtracted from the total being accumulated.			

**Example:**

Find the area of this figure (the circle is to be subtracted from the total area).

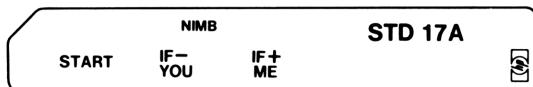


**Answer:** 22.93

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Areas and Solution of Right Triangles; as shown on page 7 of this manual)			
2	Initialize		RTN R/S	0.00
3-4	Compute third side of triangle			
	Input side	3	↑	3.00
	Input side	4	E	5.00
	Compute area of triangle			
	Input side	3	↑	3.00
	Input side	4	↑	4.00
	Input side	5	D	6.00
	Compute area of rectangle			
	Input side	6	↑	6.00
	Input side	4	C	24.00
	Delete area of circle			
	Input radius	-1.5	A	7.07
5	Display total area		R/S	22.93

## Notes

**NIMB**

Nimb is a game virtually every computer knows and loves. The HP-65 is no exception. The rules are quite simple. Starting with a total of fifteen objects (or in this case the number fifteen) each player alternately subtracts one, two, or three, until only one is left. The player forced to take the last one is the loser. A negative sign indicates that it is the users move while a positive display indicates it is the HP-65's turn.

As the challenger you are allowed to make the first move. It is possible to win but you must remember that your HP-65 is a master at this game and will not allow you to make an error and win.\* Simply follow the user instruction form to play the game.

**Notes:** The algorithm used in this game is general. Any positive integer value may be used for a starting value. Simply store it in register 1 after pressing A.

\*The HP-65 expects only chivalrous opponents. You could cheat by selecting numbers other than one, two or three.

**GENERAL USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Start game		A	-15
3	User moves	1, 2, or 3	B	
4	HP-65 moves		C	
5	Go to 3 until game is over			
6	Turn machine around to see message.			
7	For new case go to 2.			

**EXAMPLE USER INSTRUCTIONS**

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program (Nimb; as shown on page 7 of this manual)			
2	Start game		A	-15
3	User takes 3	3	B	12
4	HP-65 moves		C	-9
3	User takes 2	2	B	7
4	HP-65 moves		C	-5
3	User takes 3	3	B	2
4	HP-65 moves		C	-1
3	User takes last 1	1	B	55178
	HP-65 has won			
6	Turn machine around for message (BLISS).			

## USER DIAGNOSTIC PROGRAM I

USER DIAGNOSTIC PROGRAM I

STD 18A



This program is designed to locate malfunctions in the operations of flags, relational operators, decrement and skip on zero, subroutine calls and tangent. In case calculator malfunctions are suspected, this program can be run as a check. In this way malfunctions can be specifically identified.

**Examples:**

To operate, turn the calculator OFF, then ON, enter the program as shown on page 7, and press **R/S**. You should see **-8.888888888 -88**. If not, the digit displayed corresponds to the calculator malfunction in the following listing e.g., a halt with 2 displayed means a stop after "f" "TF 2."

DISPLAY	CALCULATOR MALFUNCTION
0	g, $x \neq y$
1	f, TF 1 (with flag clear)
2	f, TF 2 (With flag clear)
3	g, $x \leq y$
4	$f^{-1}$ , TF 1 (with flag set)
5	$f^{-1}$ , TF 2 (with flag set)
6	g, $x = y$
7	$f^{-1}$ , SF 1
8	$f^{-1}$ , SF 2
9	g, $x > y$
-1	DSZ

## Notes

## USER DIAGNOSTIC PROGRAM II



This program is designed to locate malfunctions in

$-$ ,  $+$ ,  $x$ ,  $\div$ ,  $f$  0–9,  $f^{-1}$  0–9,  $f \cdot$ ,  $f^{-1} \cdot$ ,  $g \cdot$ ,

STO + 6, STO 8, RCL 8, RCL 6, CHS, EEX and R/S.

In case calculator malfunctions are suspected this program can be run as a check. In this way malfunctions can be specifically identified.

To operate, turn the calculator OFF, then ON, enter program as shown on page 7, and press **R/S**. You should see  $-8.888888888 -88$ . If not, turn the calculator OFF, then ON, reload the card, and step through the program **SST**, comparing displayed answers to the numbers in the display column of the following list. If answers do not match there is an error in the specified calculator function or operation.

DISPLAY	CALCULATOR FUNCTION CHECKED
0.00	
0.000000000 00	DSP 9
7.	
7.000000000 00	Lift Enable
1.945910149 00	$f$ , LN
2.891227832 -01	$f$ , LOG
5.377013885 -01	$f$ , $\sqrt{x}$
9.384521785 -03	$f$ , SIN
9.999999866 -01	$f$ , COS
1.745506463 -02	$f$ , TAN
1.000152325 00	$f^{-1}$ , SIN
9.998476982 -01	$g$ , $1/x$
9.999900006 -01	$f^{-1}$ , COS
4.499971354 01	$f^{-1}$ , TAN
2.222236368 -02	$g$ , $1/x$
1.022471120 00	$f^{-1}$ , LN, ( $e^x$ )
1.053103655 01	$f^{-1}$ , LOG ( $10^x$ )
1.109027308 02	$f^{-1}$ , $\sqrt{x}$ ( $x^2$ )
1.053103655 01	$g$ , LST X

DISPLAY	CALCULATOR FUNCTION CHECKED
1.114016087 02	f, R→P
1.112406000 02	f, →D.MS
1.051581606 01	f, $^{-1}$ R→P
1.086615556 01	f, $^{-1}$ →D.MS
1.224126000 02	f,D.MS+
2.	
-2.	CHS
-2.000000000 00	
2.000000000 00	g, ABS
1.498484464 04	g, $y^x$
3.141592654 00	g, $\pi$
4.769824191 03	$\div$
4.769000000 03	f, INT
1.124100000 04	f, $\rightarrow$ OCT
5.	
5.000000000 00	
1.200000000 02	g, n!
1.112100000 04	—
4.689000000 03	$f^{-1}$ , $\rightarrow$ OCT
4.688000000 03	STO 8, RCL 8, DSZ
1.000000000 00	$f^{-1}$ , D.MS+
4.688000000 03	g, LST X
9.376000000 03	STO + 6
9.	
-9.	CHS
-9.4	Program constant definition
-9.48	
-9.480	
-9.4804	
-9.48047	
-9.480470	
-9.4804702	
-9.48047023	
-9.480470230	
-9.480470230 -00	EEX CHS
-9.480470230 -09	Read exponent into X register from memory
-9.480470230 -92	x
-8.888888888 -88	$f^{-1}$ , INT
-8.888888888 -88	g, R↓
0.000000000 00	g, x $\not\sim$ y
0.000000000 00	g, R↑
-8.888888888 -88	g, NOP
-8.888888888 -88	R/S
-8.888888888 -88	



**PROGRAM LISTINGS**

	Page
1. Personal Investment . . . . .	60
2. Mean, Standard Deviation, Standard Error . . . . .	61
3. Great Circle Navigation . . . . .	62
4. Integer Base Conversion . . . . .	63
5. Body Surface Area (Boyd) . . . . .	64
6. PI Network Impedance Matching . . . . .	65
7. EDM Slope Reduction—Given $\Delta$ Elevation . . . . .	66
8. Temperature Conversion . . . . .	67
9. Weight-Mass Conversion . . . . .	68
10. Volume Conversions . . . . .	69
11. Compound Interest . . . . .	70
12. Loan Repayment . . . . .	71
13. Reconcile Checking Account . . . . .	72
14. Iterative Solution of $f(x) = 0$ . . . . .	73
15. Quadratic Equation . . . . .	74
16. Areas and Solution of Right Triangle . . . . .	75
17. NIMB . . . . .	76
18. User Diagnostic Program I . . . . .	77
19. User Diagnostic Program II . . . . .	78

## PERSONAL INVESTMENT

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	42	CHS	71	x
11	A	61	+	35 00	g LST X
33 01	STO 1	15	E	01	1
35 08	g R↓	24	RTN	51	—
24	RTN	23	LBL	34 08	RCL 8
23	LBL	15	E	81	÷
12	B	33 02	STO 2	23	LBL
33 03	STO 3	31	f	01	1
35 08	g R↓	83	INT	34 03	RCL 3
24	RTN	34 01	RCL 1	71	x
23	LBL	31	f	34 04	RCL 4
13	C	83	INT	71	x
32	f <sup>-1</sup>	51	—	61	+
51	SF 1	34 01	RCL 1	33 05	STO 5
01	1	32	f <sup>-1</sup>	34 02	RCL 2
02	2	83	INT	33 01	STO 1
00	0	34 02	RCL 2	35 08	g R↓
00	0	32	f <sup>-1</sup>	23	LBL
81	÷	83	INT	02	2
33 08	STO 8	35 07	g x↔y	84	R/S
01	1	51	—	34 08	RCL 8
61	+	01	1	71	x
33 04	STO 4	02	2	84	R/S
01	1	43	EEX	34 05	RCL 5
35 23	g x=y	04	4	22	GTO
31	f	71	x	02	2
51	SF 1	61	+	35 01	g NOP
35 08	g R↓	31	f	35 01	g NOP
35 08	g R↓	61	TF 1	35 01	g NOP
24	RTN	22	GTO	35 01	g NOP
23	LBL	01	1		
14	D	34 04	RCL 4		
34 01	RCL 1	35 07	g x↔y		
43	EEX	35	g		
04	4	05	y <sup>x</sup>		

<b>R<sub>1</sub></b>	mm.yyyy	<b>R<sub>4</sub></b>	1 + i	<b>R<sub>7</sub></b>	
<b>R<sub>2</sub></b>	MM.YYYY	<b>R<sub>5</sub></b>	T	<b>R<sub>8</sub></b>	i
<b>R<sub>3</sub></b>	PMT	<b>R<sub>6</sub></b>		<b>R<sub>9</sub></b>	Used

## MEAN, STANDARD DEVIATION, STANDARD ERROR

CODE	KEYS	CODE	KEYS	CODE	KEYS
00	0	71	x	02	2
33 01	STO 1	51	-	32	f <sup>-1</sup>
33 02	STO 2	34 01	RCL 1	09	$\sqrt{x}$
33 03	STO 3	81	$\div$	33	STO
84	R/S	31	f	51	-
23	LBL	09	$\sqrt{x}$	03	3
11	A	34 01	RCL 1	34 01	RCL 1
33	STO	34 01	RCL 1	01	1
61	+	01	1	51	-
02	2	51	-	33 01	STO 1
32	f <sup>-1</sup>	81	$\div$	24	RTN
09	$\sqrt{x}$	31	f	35 01	g NOP
33	STO	09	$\sqrt{x}$	35 01	g NOP
61	+	71	x	35 01	g NOP
03	3	24	RTN	35 01	g NOP
34 01	RCL 1	35 07	g x $\leftrightarrow$ y	35 01	g NOP
01	1	84	R/S	35 01	g NOP
61	+	23	LBL	35 01	g NOP
33 01	STO 1	14	D	35 01	g NOP
24	RTN	13	C	35 01	g NOP
23	LBL	34 01	RCL 1	35 01	g NOP
12	B	31	f	35 01	g NOP
34 02	RCL 2	09	$\sqrt{x}$	35 01	g NOP
34 01	RCL 1	81	$\div$	35 01	g NOP
81	$\div$	35 07	g x $\leftrightarrow$ y	35 01	g NOP
24	RTN	35 00	g LST X	35 01	g NOP
23	LBL	81	$\div$	35 01	g NOP
13	C	35 07	g x $\leftrightarrow$ y	35 01	g NOP
34 03	RCL 3	84	R/S	35 01	g NOP
34 02	RCL 2	35 07	g x $\leftrightarrow$ y	35 01	g NOP
34 01	RCL 1	24	RTN		
81	$\div$	23	LBL		
32	f <sup>-1</sup>	15	E		
09	$\sqrt{x}$	33	STO		
34 01	RCL 1	51	-		

<b>R<sub>1</sub></b>	n	<b>R<sub>4</sub></b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	$\Sigma x_i$	<b>R<sub>5</sub></b>	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	$\Sigma x_i^2$	<b>R<sub>6</sub></b>	<b>R<sub>9</sub></b>

## GREAT CIRCLE NAVIGATION

CODE	KEYS	CODE	KEYS	CODE	KEYS
32	f <sup>-1</sup>	35 24	g x>y	23	LBL
51	SF 1	31	f	14	D
31	f	51	SF 1	03	3
43	REG	61	+	06	6
44	CLX	44	CLX	00	0
35	g	61	+	13	C
41	DEG	31	f	35 08	g R↓
84	R/S	05	COS	41	↑
23	LBL	34 02	RCL 2	31	f
11	A	31	f	05	COS
32	f <sup>-1</sup>	05	COS	34 08	RCL 8
03	→D.MS	33 06	STO 6	71	x
34 01	RCL 1	71	x	34 07	RCL 7
33 02	STO 2	34 01	RCL 1	35 07	g x↔y
35 07	g x↔y	31	f	51	—
33 01	STO 1	05	COS	35 07	g x↔y
84	R/S	71	x	31	f
23	LBL	34 01	RCL 1	04	SIN
12	B	31	f	81	÷
32	f <sup>-1</sup>	04	SIN	34 06	RCL 6
03	→D.MS	33 07	STO 7	81	÷
34 03	RCL 3	34 02	RCL 2	32	f <sup>-1</sup>
33 04	STO 4	31	f	05	COS
35 07	g x↔y	04	SIN	31	f
33 03	STO 3	33 08	STO 8	61	TF 1
84	R/S	71	x	51	—
23	LBL	61	+	35 01	g NOP
13	C	32	f <sup>-1</sup>	32	f <sup>-1</sup>
34 04	RCL 4	05	COS	51	SF 1
34 03	RCL 3	41	↑	84	R/S
51	—	41	↑		
41	↑	06	6		
31	f	00	0		
04	SIN	71	x		
00	0	24	RTN		

<b>R<sub>1</sub></b>	LAT <sub>D</sub>	<b>R<sub>4</sub></b>	LNG <sub>S</sub>	<b>R<sub>7</sub></b>	Used
<b>R<sub>2</sub></b>	LAT <sub>S</sub>	<b>R<sub>5</sub></b>	0	<b>R<sub>8</sub></b>	Used
<b>R<sub>3</sub></b>	LNG <sub>D</sub>	<b>R<sub>6</sub></b>	Used	<b>R<sub>9</sub></b>	Used

## INTEGER BASE CONVERSION

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	81	÷	34 06	RCL 6
11	A	41	↑	34 04	RCL 4
33 03	STO 3	31	f	81	÷
35 08	g R↓	83	INT	33 06	STO 6
33 02	STO 2	51	—	71	x
35 08	g R↓	35 00	g LST X	33	STO
71	x	34 05	RCL 5	61	+
00	0	34 02	RCL 2	02	2
33 01	STO 1	81	÷	00	0
01	1	33 05	STO 5	34 05	RCL 5
33 05	STO 5	71	x	35 21	g x≠y
83	·	33	STO	22	GTO
01	1	61	+	03	3
33 04	STO 4	01	1	34 02	RCL 2
33 06	STO 6	44	CLX	24	RTN
23	LBL	35 07	g x≥y	35 01	g NOP
01	1	35 21	g x≠y	35 01	g NOP
35 00	g LST X	22	GTO	35 01	g NOP
34 04	RCL 4	02	2	35 01	g NOP
71	x	33 02	STO 2	35 01	g NOP
34 02	RCL 2	34 01	RCL 1	35 01	g NOP
33	STO	31	f	35 01	g NOP
71	x	83	INT	35 01	g NOP
05	5	23	LBL	35 01	g NOP
35 08	g R↓	03	3	35 01	g NOP
35	g	41	↑	35 01	g NOP
06	ABS	41	↑	35 01	g NOP
01	1	34 03	RCL 3	35 01	g NOP
35 22	g x≤y	81	÷	35 01	g NOP
22	GTO	31	f	35 01	g NOP
01	1	83	INT	35 01	g NOP
35 00	g LST X	33 05	STO 5	35 01	g NOP
23	LBL	34 03	RCL 3	35 01	g NOP
02	2	71	x	35 01	g NOP
34 04	RCL 4	51	—		

<b>R<sub>1</sub></b>	Used	<b>R<sub>4</sub></b>	Used	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	Used	<b>R<sub>5</sub></b>	Used	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	Used	<b>R<sub>6</sub></b>	Used	<b>R<sub>9</sub></b> Used

## BODY SURFACE AREA (BOYD)

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	05	5	23	LBL
11	A	41	↑	14	D
00	0	83	.	43	EEX
35 07	g x↔y	00	0	02	2
35 24	g x>y	01	1	71	x
33 06	STO 6	08	8	33	STO
24	RTN	08	8	09	9
42	CHS	34 05	RCL 5	35 00	g LST X
02	2	43	EEX	81	÷
83	.	03	3	24	RTN
05	5	71	x	23	LBL
04	4	41	↑	15	E
71	x	35 08	g R↓	13	C
33 06	STO 6	31	f	34	RCL
24	RTN	08	LOG	09	9
23	LBL	71	x	35 07	g x↔y
12	B	51	—	81	÷
00	0	35	g	43	EEX
35 07	g x↔y	05	y <sup>x</sup>	02	2
35 24	g x>y	34 06	RCL 6	81	÷
33 05	STO 5	83	•	24	RTN
24	RTN	03	3	35 01	g NOP
02	2	35	g	35 01	g NOP
83	.	05	y <sup>x</sup>	35 01	g NOP
02	2	71	x	35 01	g NOP
42	CHS	03	3	35 01	g NOP
81	÷	83	•	35 01	g NOP
33 05	STO 5	02	2	35 01	g NOP
24	RTN	00	0	35 01	g NOP
23	LBL	07	7	35 01	g NOP
13	C	71	x	35 01	g NOP
83	.	43	EEX	35 01	g NOP
07	7	04	4	35 01	g NOP
02	2	81	÷	35 01	g NOP
08	8	24	RTN	35 01	g NOP

<b>R<sub>1</sub></b>	<b>R<sub>4</sub></b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	<b>R<sub>5</sub></b>	Wt. (kg) <b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	<b>R<sub>6</sub></b>	Ht. (cm) <b>R<sub>9</sub></b> 100 CO(l/min)

## PI NETWORK IMPEDANCE MATCHING

CODE	KEYS	CODE	KEYS	CODE	KEYS
31	f	22	GTO	81	÷
42	STK	00	0	71	x
21	DSP	34 02	RCL 2	23	LBL
04	4	34 01	RCL 1	00	0
23	LBL	81	÷	35	g
01	1	34 04	RCL 4	02	π
32	$f^{-1}$	41	↑	02	2
51	SF 1	71	x	71	x
24	RTN	01	1	34 03	RCL 3
84	R/S	61	+	71	x
23	LBL	33 05	STO 5	81	÷
11	A	71	x	22	GTO
32	$f^{-1}$	01	1	01	1
61	TF 1	51	—	23	LBL
33 02	STO 2	31	f	15	E
84	R/S	09	$\sqrt{x}$	31	f
33 01	STO 1	34 02	RCL 2	51	SF 1
22	GTO	81	÷	84	R/S
01	1	33 06	STO 6	35 01	g NOP
23	LBL	22	GTO	35 01	g NOP
12	B	00	0	35 01	g NOP
32	$f^{-1}$	23	LBL	35 01	g NOP
61	TF 1	14	D	35 01	g NOP
33 04	STO 4	13	C	35 01	g NOP
84	R/S	34 02	RCL 2	35 01	g NOP
33 03	STO 3	34 06	RCL 6	35 01	g NOP
22	GTO	71	x	35 01	g NOP
01	1	34 04	RCL 4	35 01	g NOP
23	LBL	81	÷	35 01	g NOP
13	C	01	1	35 01	g NOP
34 04	RCL 4	61	+	35 01	g NOP
34 01	RCL 1	34 04	RCL 4	35 01	g NOP
81	÷	34 01	RCL 1	35 01	g NOP
31	f	71	x	35 01	g NOP
61	TF 1	34 05	RCL 5	35 01	g NOP

<b>R<sub>1</sub></b>	<b>R<sub>1</sub></b>	<b>R<sub>4</sub></b>	<b>Q</b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	<b>R<sub>2</sub></b>	<b>R<sub>5</sub></b>	Used	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	<b>f</b>	<b>R<sub>6</sub></b>	Used	<b>R<sub>9</sub></b>

EDM SLOPE REDUCTION—GIVEN  $\Delta$  ELEVATION

CODE	KEYS	CODE	KEYS	CODE	KEYS
	23 LBL	24 RTN		24 RTN	
	11 A	23 LBL		35 01 g NOP	
33 01	STO 1	14 D		35 01 g NOP	
02	2	33 05 STO 5		35 01 g NOP	
83	.	24 RTN		35 01 g NOP	
00	0	23 LBL		35 01 g NOP	
09	9	15 E		35 01 g NOP	
00	0	34 04 RCL 4		35 01 g NOP	
06	6	34 03 RCL 3		35 01 g NOP	
43	EEX	51 —		35 01 g NOP	
07	7	34 05 RCL 5		35 01 g NOP	
33 02	STO 2	61 +		35 01 g NOP	
35 07	g x $\leftrightarrow$ y	41 ↑		35 01 g NOP	
24	RTN	41 ↑		35 01 g NOP	
23	LBL	71 x		35 01 g NOP	
12	B	34 01 RCL 1		35 01 g NOP	
33 01	STO 1	41 ↑		35 01 g NOP	
06	6	71 x		35 01 g NOP	
83	.	35 07 g x $\leftrightarrow$ y		35 01 g NOP	
03	3	51 —		35 01 g NOP	
07	7	35 07 g x $\leftrightarrow$ y		35 01 g NOP	
08	8	34 02 RCL 2		35 01 g NOP	
02	2	81 ÷		35 01 g NOP	
43	EEX	01 1		35 01 g NOP	
06	6	61 +		35 01 g NOP	
33 02	STO 2	81 ÷		35 01 g NOP	
35 07	g x $\leftrightarrow$ y	31 f		35 01 g NOP	
24	RTN	09 $\sqrt{x}$		35 01 g NOP	
23	LBL	34 02 RCL 2		35 01 g NOP	
13	C	41 ↑		35 01 g NOP	
33 03	STO 3	41 ↑		35 01 g NOP	
24	RTN	34 03 RCL 3			
23	LBL	61 +			
13	C	81 ÷			
33 04	STO 4	71 x			

<b>R<sub>1</sub></b>	S Dist	<b>R<sub>4</sub></b>	HT Rft	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	R	<b>R<sub>5</sub></b>	$\Delta H$	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	HI DM	<b>R<sub>6</sub></b>		<b>R<sub>9</sub></b>

## TEMPERATURE CONVERSION

CODE	KEYS	CODE	KEYS	CODE	KEYS
32	f <sup>-1</sup>	51	—	31	f
51	SF 1	05	5	61	TF 1
84	R/S	71	x	22	GTO
23	LBL	09	9	02	2
12	B	81	÷	61	+
41	↑	22	GTO	22	GTO
31	f	14	D	11	A
61	TF 1	23	LBL	23	LBL
22	GTO	02	2	02	2
00	0	01	1	33	STO
05	5	83	•	51	—
71	x	08	8	01	1
09	9	33	STO	23	LBL
81	÷	71	x	11	A
22	GTO	01	1	32	f <sup>-1</sup>
11	A	04	4	61	TF 1
23	LBL	05	5	22	GTO
00	0	09	9	06	6
01	1	83	•	34	01 RCL 1
83	•	06	6	32	f <sup>-1</sup>
08	8	07	7	51	SF 1
33	STO	33	STO	24	RTN
71	x	51	—	23	LBL
01	1	01	1	06	6
22	GTO	22	GTO	33	01 STO 1
11	A	11	A	00	0
23	LBL	23	LBL	31	f
13	C	14	D	51	SF 1
41	↑	41	↑	24	RTN
31	f	02	2	35	01 g NOP
61	TF 1	07	7		
22	GTO	03	3		
02	2	83	•		
03	3	01	1		
02	2	05	5		

<b>R<sub>1</sub></b>	Temp K	<b>R<sub>4</sub></b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>		<b>R<sub>5</sub></b>	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>		<b>R<sub>6</sub></b>	<b>R<sub>9</sub></b>

## WEIGHT-MASS CONVERSION

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	14	D	04	4
11	A	34 06	RCL 6	35 08	g R↓
00	0	33	STO	13	C
35 23	g x=y	81	÷	23	LBL
22	GTO	04	4	15	E
00	0	35 08	g R↓	03	3
35 08	g R↓	14	D	02	2
01	1	23	LBL	83	•
06	6	13	C	01	1
71	x	00	0	07	7
12	B	35 23	g x=y	04	4
23	LBL	34 04	RCL 4	33 06	STO 6
00	0	84	R/S	71	x
01	1	35 08	g R↓	00	0
06	6	33 04	STO 4	35 21	g x≠y
33	STO	00	0	35 08	g R↓
81	÷	41	↑	11	A
04	4	84	R/S	34 06	RCL 6
35 08	g R↓	23	LBL	33	STO
23	LBL	14	D	81	÷
12	B	00	0	04	4
02	2	35 23	g x=y	35 08	g R↓
08	8	22	GTO	11	A
83	•	02	2	35 01	g NOP
03	3	35 08	g R↓	35 01	g NOP
04	4	43	EEX	35 01	g NOP
09	9	03	3	35 01	g NOP
05	5	81	÷	35 01	g NOP
02	2	13	C	35 01	g NOP
03	3	23	LBL	35 01	g NOP
33 06	STO 6	02	2	35 01	g NOP
71	x	43	EEX		
00	0	03	3		
35 21	g x≠y	33	STO		
35 08	g R↓	71	x		

<b>R<sub>1</sub></b>	<b>R<sub>4</sub></b>	Mass Kg	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	<b>R<sub>5</sub></b>		<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	<b>R<sub>6</sub></b>	Used	<b>R<sub>9</sub></b>

## VOLUME CONVERSIONS

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	34 06	RCL 6	35 08	g R↓
11	A	33	STO	13	C
03	3	81	÷	23	LBL
83	.	05	5	15	E
07	7	35 08	g R↓	01	1
08	8	11	A	06	6
05	5	23	LBL	83	•
04	4	13	C	03	3
33 06	STO 6	00	0	08	8
71	x	35 23	g x=y	07	7
00	0	34 05	RCL 5	00	0
35 21	g x≠y	84	R/S	06	6
35 08	g R↓	35 08	g R↓	04	4
13	C	33 05	STO 5	33 06	STO 6
34 06	RCL 6	00	0	71	x
33	STO	41	↑	00	0
81	÷	84	R/S	35 21	g x≠y
05	5	23	LBL	35 08	g R↓
35 08	g R↓	14	D	14	D
13	C	00	0	34 06	RCL 6
23	LBL	35 23	g x=y	33	STO
12	B	22	GTO	81	÷
01	1	02	2	05	5
83	.	35 08	g R↓	35 08	g R↓
02	2	43	EEX	14	D
00	0	03	3	35 01	g NOP
00	0	81	÷	35 01	g NOP
09	9	13	C	35 01	g NOP
05	5	23	LBL	35 01	g NOP
33 06	STO 6	02	2	35 01	g NOP
71	x	43	EEX		
00	0	03	3		
35 21	g x≠y	33	STO		
35 08	g R↓	71	x		
11	A	05	5		

<b>R<sub>1</sub></b>	<b>R<sub>4</sub></b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	<b>R<sub>5</sub></b> Volume (liters)	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	<b>R<sub>6</sub></b> Used	<b>R<sub>9</sub></b> Used

## COMPOUND INTEREST

CODE	KEYS	CODE	KEYS	CODE	KEYS
00	0	01	1	83	DSZ
33 08	STO 8	51	—	33 04	STO 4
84	R/S	43	EEX	24	RTN
23	LBL	02	2	34 03	RCL 3
11	A	71	x	34 02	RCL 2
35	g	24	RTN	34 01	RCL 1
83	DSZ	23	LBL	35	g
33 01	STO 1	02	2	05	$y^x$
24	RTN	41	↑	71	x
34 04	RCL 4	41	↑	33 04	STO 4
34 03	RCL 3	43	EEX	24	RTN
81	÷	02	2	23	LBL
31	f	81	÷	15	E
07	LN	01	1	41	↑
34 02	RCL 2	61	+	01	1
31	f	33 02	STO 2	33 08	STO 8
07	LN	35 07	$g \times \bar{y}$	35 07	$g \times \bar{y}$
81	÷	24	RTN	24	RTN
33 01	STO 1	23	LBL	35 01	g NOP
24	RTN	13	C	35 01	g NOP
23	LBL	35	g	35 01	g NOP
12	B	83	DSZ	35 01	g NOP
35	g	33 03	STO 3	35 01	g NOP
83	DSZ	24	RTN	35 01	g NOP
22	GTO	34 04	RCL 4	35 01	g NOP
02	2	34 02	RCL 2	35 01	g NOP
34 04	RCL 4	34 01	RCL 1	35 01	g NOP
34 03	RCL 3	35	g	35 01	g NOP
81	÷	05	$y^x$	35 01	g NOP
34 01	RCL 1	81	÷	35 01	g NOP
35	g	33 03	STO 3	35 01	g NOP
04	$\frac{1}{x}$	24	RTN		
35	g	23	LBL		
05	$y^x$	14	D		
33 02	STO 2	35	g		

<b>R<sub>1</sub></b>	n	<b>R<sub>4</sub></b>	FV	<b>R<sub>7</sub></b>	
<b>R<sub>2</sub></b>	$1 + i/100$	<b>R<sub>5</sub></b>		<b>R<sub>8</sub></b>	DSZ
<b>R<sub>3</sub></b>	PV	<b>R<sub>6</sub></b>		<b>R<sub>9</sub></b>	

## LOAN REPAYMENT

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	31	f	22	GTO
11	A	71	SF 2	04	4
33 07	STO 7	24	RTN	23	LBL
71	x	23	LBL	03	3
33 01	STO 1	01	1	34 04	RCL 4
24	RTN	32	f <sup>-1</sup>	71	x
23	LBL	51	SF 1	23	LBL
12	B	34 02	RCL 2	04	4
33 02	STO 2	34 07	RCL 7	33 08	STO 8
43	EEX	81	÷	21	DSP
02	2	34 05	RCL 5	83	.
33 05	STO 5	81	÷	02	2
24	RTN	01	1	34 05	RCL 5
23	LBL	61	+	71	x
13	C	34 01	RCL 1	83	.
32	f <sup>-1</sup>	35	g	05	5
71	SF 2	05	y <sup>x</sup>	61	+
31	f	33 06	STO 6	31	f
61	TF 1	01	1	83	INT
22	GTO	51	—	34 05	RCL 5
01	1	34 06	RCL 6	81	÷
33 03	STO 3	81	÷	84	R/S
24	RTN	34 07	RCL 7	35 01	g NOP
23	LBL	71	x	35 01	g NOP
14	D	34 02	RCL 2	35 01	g NOP
31	f	81	÷	35 01	g NOP
61	TF 1	34 05	RCL 5	35 01	g NOP
22	GTO	71	x	35 01	g NOP
01	1	32	f <sup>-1</sup>	35 01	g NOP
33 04	STO 4	81	TF 2	35 01	g NOP
24	RTN	22	GTO		
23	LBL	03	3		
15	E	34 03	RCL 3		
31	f	35 07	g x $\leftrightarrow$ y		
51	SF 1	81	÷		

<b>R<sub>1</sub></b>	yn	<b>R<sub>4</sub></b>	PMT	<b>R<sub>7</sub></b>	n
<b>R<sub>2</sub></b>	i	<b>R<sub>5</sub></b>	100	<b>R<sub>8</sub></b>	PV or PMT
<b>R<sub>3</sub></b>	PV	<b>R<sub>6</sub></b>	(1 + i/100) $y^x n$	<b>R<sub>9</sub></b>	

## RECONCILE CHECKING ACCOUNT

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	34 03	RCL 3	31	f
11	A	01	1	43	REG
35	g	61	+	31	f
83	DSZ	33 03	STO 3	42	STK
22	GTO	35 07	g x↔y	21	DSP
01	1	33	STO	83	.
34 01	RCL 1	61	+	02	2
34 01	RCL 1	02	2	24	RTN
34 02	RCL 2	22	GTO	23	LBL
51	-	09	9	15	E
34 04	RCL 4	23	LBL	41	↑
61	+	13	C	01	1
23	LBL	35	g	33 08	STO 8
09	9	83	DSZ	35 08	g R↓
84	R/S	22	GTO	24	RTN
35 07	g x↔y	03	3	35 01	g NOP
22	GTO	34 05	RCL 5	35 01	g NOP
09	9	34 04	RCL 4	35 01	g NOP
23	LBL	22	GTO	35 01	g NOP
01	1	09	9	35 01	g NOP
33 01	STO 1	23	LBL	35 01	g NOP
24	RTN	03	3	35 01	g NOP
23	LBL	41	↑	35 01	g NOP
12	B	34 05	RCL 5	35 01	g NOP
35	g	01	1	35 01	g NOP
83	DSZ	61	+	35 01	g NOP
22	GTO	33 05	STO 5	35 01	g NOP
02	2	35 07	g x↔y	35 01	g NOP
34 03	RCL 3	33	STO	35 01	g NOP
34 02	RCL 2	61	+	35 01	g NOP
22	GTO	04	4		
09	9	22	GTO		
23	LBL	09	9		
02	2	23	LBL		
41	↑	14	D		

<b>R<sub>1</sub></b> STATE. BAL.	<b>R<sub>4</sub></b> Σ OUT DEPOSITS	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b> Σ OUT CHECKS	<b>R<sub>5</sub></b> # OUT DEPOSITS	<b>R<sub>8</sub></b> DSZ
<b>R<sub>3</sub></b> # OUT CHECKS	<b>R<sub>6</sub></b>	<b>R<sub>9</sub></b>

ITERATIVE SOLUTION OF  $f(x) = 0$ 

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	51	-	35 01	g NOP
14	D	81	÷	35 01	g NOP
24	RTN	51	-	35 01	g NOP
23	LBL	33 05	STO 5	35 01	g NOP
11	A	14	D	35 01	g NOP
31	f	41	↑	35 01	g NOP
43	REG	35	g	35 01	g NOP
33 06	STO 6	06	ABS	35 01	g NOP
35 08	g R↓	43	EEX	35 01	g NOP
33 07	STO 7	06	6	35 01	g NOP
35 08	g R↓	42	CHS	35 01	g NOP
33 08	STO 8	35 24	g x>y	35 01	g NOP
24	RTN	34 05	RCL 5	35 01	g NOP
23	LBL	24	RTN	35 01	g NOP
12	B	35 08	g R↓	35 01	g NOP
33 01	STO 1	44	CLX	35 01	g NOP
14	D	35 24	g x>y	35 01	g NOP
33 02	STO 2	22	GTO	35 01	g NOP
24	RTN	09	9	35 01	g NOP
23	LBL	35 08	g R↓	35 01	g NOP
13	C	33 02	STO 2	35 01	g NOP
33 03	STO 3	34 05	RCL 5	35 01	g NOP
14	D	33 01	STO 1	35 01	g NOP
33 04	STO 4	22	GTO	35 01	g NOP
24	RTN	15	E	35 01	g NOP
23	LBL	23	LBL	35 01	g NOP
15	E	09	9	35 01	g NOP
34 01	RCL 1	35 08	g R↓	35 01	g NOP
34 02	RCL 2	33 04	STO 4	35 01	g NOP
34 01	RCL 1	34 05	RCL 5	35 01	g NOP
34 03	RCL 3	33 03	STO 3	35 01	g NOP
51	-	22	GTO	35 01	g NOP
71	x	15	E	35 01	g NOP
34 02	RCL 2	35 01	g NOP	35 01	g NOP
34 04	RCL 4	35 01	g NOP		

<b>R<sub>1</sub></b>	+ guess	<b>R<sub>4</sub></b>	-f(x)	<b>R<sub>7</sub></b>	b
<b>R<sub>2</sub></b>	+f(x)	<b>R<sub>5</sub></b>	x	<b>R<sub>8</sub></b>	c
<b>R<sub>3</sub></b>	- guess	<b>R<sub>6</sub></b>	a	<b>R<sub>9</sub></b>	Used

## QUADRATIC EQUATION

CODE	KEYS	CODE	KEYS	CODE	KEYS
23	LBL	24	RTN	35 01	g NOP
11	A	23	LBL	35 01	g NOP
33 03	STO 3	13	C	35 01	g NOP
35 08	g R↓	42	CHS	35 01	g NOP
33 02	STO 2	31	f	35 01	g NOP
35 08	g R↓	09	$\sqrt{x}$	35 01	g NOP
41	↑	35 07	g $x \leftrightarrow y$	35 01	g NOP
61	+	84	R/S	35 01	g NOP
33 01	STO 1	35 07	g $x \leftrightarrow y$	35 01	g NOP
34 02	RCL 2	24	RTN	35 01	g NOP
35 07	g $x \leftrightarrow y$	35 01	g NOP	35 01	g NOP
81	÷	35 01	g NOP	35 01	g NOP
42	CHS	35 01	g NOP	35 01	g NOP
41	↑	35 01	g NOP	35 01	g NOP
32	$f^{-1}$	35 01	g NOP	35 01	g NOP
09	$\sqrt{x}$	35 01	g NOP	35 01	g NOP
34 03	RCL 3	35 01	g NOP	35 01	g NOP
41	↑	35 01	g NOP	35 01	g NOP
61	+	35 01	g NOP	35 01	g NOP
34 01	RCL 1	35 01	g NOP	35 01	g NOP
81	÷	35 01	g NOP	35 01	g NOP
51	—	35 01	g NOP	35 01	g NOP
24	RTN	35 01	g NOP	35 01	g NOP
23	LBL	35 01	g NOP	35 01	g NOP
12	B	35 01	g NOP	35 01	g NOP
31	f	35 01	g NOP	35 01	g NOP
09	$\sqrt{x}$	35 01	g NOP	35 01	g NOP
33 01	STO 1	35 01	g NOP	35 01	g NOP
61	+	35 01	g NOP	35 01	g NOP
35 07	g $x \leftrightarrow y$	35 01	g NOP	35 01	g NOP
34 01	RCL 1	35 01	g NOP	35 01	g NOP
51	—	35 01	g NOP	35 01	g NOP
35 07	g $x \leftrightarrow y$	35 01	g NOP	35 01	g NOP
84	R/S	35 01	g NOP	35 01	g NOP
35 07	g $x \leftrightarrow y$	35 01	g NOP	35 01	g NOP

<b>R<sub>1</sub></b>	Used	<b>R<sub>4</sub></b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	b	<b>R<sub>5</sub></b>	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	c	<b>R<sub>6</sub></b>	<b>R<sub>9</sub></b>

## AREAS AND SOLUTION OF RIGHT TRIANGLE

CODE	KEYS	CODE	KEYS	CODE	KEYS
31	f	02	2	24	RTN
43	REG	81	÷	23	LBL
00	0	33 05	STO 5	15	E
84	R/S	41	↑	33 02	STO 2
23	LBL	41	↑	35 08	g R↓
11	A	34 02	RCL 2	33 03	STO 3
41	↑	51	—	35 09	g R↑
35	g	71	x	71	x
06	ABS	34 05	RCL 5	00	0
23	LBL	34 03	RCL 3	35 24	g x>y
12	B	51	—	31	f
71	x	71	x	51	SF 1
35	g	34 05	RCL 5	34 03	RCL 3
02	π	34 04	RCL 4	41	↑
23	LBL	51	—	71	x
13	C	71	x	34 02	RCL 2
22	GTO	31	f	41	↑
06	6	09	$\sqrt{x}$	71	x
23	LBL	31	f	31	f
14	D	61	TF 1	61	TF 1
00	0	42	CHS	42	CHS
35 24	g x>y	35 01	g NOP	35 01	g NOP
31	f	32	$f^{-1}$	61	+
51	SF 1	51	SF 1	35	g
35 08	g R↓	01	1	06	ABS
35	g	23	LBL	31	f
06	ABS	06	6	09	$\sqrt{x}$
33 02	STO 2	71	x	32	$f^{-1}$
35 08	g R↓	33	STO	51	SF 1
33 03	STO 3	61	+	24	RTN
35 08	g R↓	01	1		
33 04	STO 4	35	g		
61	+	06	ABS		
61	+	84	R/S		
61	+	34 01	RCL 1		

<b>R<sub>1</sub></b>	$\Sigma$ Area	<b>R<sub>4</sub></b>	Used	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	Used	<b>R<sub>5</sub></b>	Used	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	Used	<b>R<sub>6</sub></b>		<b>R<sub>9</sub></b> Used

## NIMB

CODE	KEYS	CODE	KEYS	CODE	KEYS
	23 LBL		04 4		23 LBL
	11 A		81 ÷		08 8
	21 DSP		31 f		05 5
	83 ·		83 INT		05 5
	00 0	35 00	g LST X	01 1	
	01 1		51 —	07 7	
	05 5		00 0	08 8	
33 01	STO 1	35 21	g x≠y	84 R/S	
31	f	22	GTO	23 LBL	
51	SF 1	02	2	15 E	
15	E	34 03	RCL 3	34 01	RCL 1
23	LBL	23	LBL	31	f
13	C	12	B	61	TF 1
31	f	33	STO	42	CHS
51	SF 1	51	—	35 01	g NOP
00	0	01	1	32	f <sup>-1</sup>
33 03	STO 3	34 01	RCL 1	51	SF 1
23	LBL	00	0	84	R/S
02	2	35 21	g x≠y	35 01	g NOP
34 03	RCL 3	22	GTO	35 01	g NOP
03	3	15	E	35 01	g NOP
35 23	g x=y	32	f <sup>-1</sup>	35 01	g NOP
01	1	61	TF 1	35 01	g NOP
12	B	22	GTO	35 01	g NOP
23	LBL	08	8	35 01	g NOP
01	1	21	DSP	35 01	g NOP
01	1	83	·	35 01	g NOP
33	STO	01	1	35 01	g NOP
61	+	03	3	35 01	g NOP
03	3	05	5	35 01	g NOP
34 01	RCL 1	00	0	35 01	g NOP
01	1	07	7		
51	—	83	·		
34 03	RCL 3	01	1		
51	—	84	R/S		

<b>R<sub>1</sub></b>	Total	<b>R<sub>4</sub></b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>		<b>R<sub>5</sub></b>	<b>R<sub>8</sub></b>
<b>R<sub>3</sub></b>	n	<b>R<sub>6</sub></b>	<b>R<sub>9</sub></b> Used

## USER DIAGNOSTIC PROGRAM I

CODE	KEYS	CODE	KEYS	CODE	KEYS
11	A	84	R/S	24	RTN
35 21	g $x \neq y$	14	D	23	LBL
00	0	35 24	g $x > y$	12	B
84	R/S	09	9	34 08	RCL 8
31	f	84	R/S	31	f
61	TF 1	15	E	51	SF 1
01	1	05	5	31	f
84	R/S	42	CHS	71	SF 2
31	f	83	.	22	GTO
81	TF 2	00	0	15	E
02	2	09	9	23	LBL
84	R/S	02	2	13	C
12	B	09	9	32	$f^{-1}$
35 22	g $x \leq y$	05	5	51	SF 1
03	3	08	8	32	$f^{-1}$
84	R/S	01	1	71	SF 2
32	$f^{-1}$	07	7	22	GTO
61	TF 1	08	8	15	E
04	4	43	EEX	23	LBL
84	R/S	42	CHS	14	D
32	$f^{-1}$	08	8	44	CLX
81	TF 2	06	6	23	LBL
05	5	31	f	15	E
84	R/S	06	TAN	35	g
13	C	21	DSP	83	DSZ
35 23	g $x = y$	09	9	35 01	g NOP
06	6	21	DSP	24	RTN
84	R/S	09	9	01	1
31	f	84	R/S	42	CHS
61	TF 1	23	LBL	84	R/S
07	7	11	A		
84	R/S	05	5		
31	f	33 08	STO 8		
81	TF 2	31	f		
08	8	42	STK		

<b>R<sub>1</sub></b>	<b>R<sub>4</sub></b>	<b>R<sub>7</sub></b>
<b>R<sub>2</sub></b>	<b>R<sub>5</sub></b>	<b>R<sub>8</sub></b> DSZ
<b>R<sub>3</sub></b>	<b>R<sub>6</sub></b>	<b>R<sub>9</sub></b> Used

## USER DIAGNOSTIC PROGRAM II

CODE	KEYS	CODE	KEYS	CODE	KEYS
31	f	01	R→P	33	STO
43	REG	31	f	61	+
21	DSP	03	→D.MS	06	6
09	9	32	f <sup>-1</sup>	34 06	RCL 6
07	7	01	R→P	61	+
31	f	32	f <sup>-1</sup>	71	x
07	LN	03	→D.MS	09	9
31	f	31	f	42	CHS
08	LOG	02	D.MS+	83	.
31	f	02	2	04	4
09	√x	42	CHS	08	8
31	f	35	g	00	0
04	SIN	06	ABS	04	4
31	f	35	g	07	7
05	COS	05	y <sup>x</sup>	00	0
31	f	35	g	02	2
06	TAN	02	π	03	3
32	f <sup>-1</sup>	81	÷	00	0
04	SIN	31	f	43	EEX
35	g	83	INT	42	CHS
04	1/x	31	f	09	9
32	f <sup>-1</sup>	00	→OCT	02	2
05	COS	05	5	71	x
32	f <sup>-1</sup>	35	g	32	f <sup>-1</sup>
06	TAN	03	n!	83	INT
35	g	51	—	35 08	g R↓
04	1/x	32	f <sup>-1</sup>	35 07	g x↔y
32	f <sup>-1</sup>	00	→OCT	35 09	g R↑
07	LN	33 08	STO 8	35 01	g NOP
32	f <sup>-1</sup>	35	g	84	R/S
08	LOG	83	DSZ		
32	f <sup>-1</sup>	34 08	RCL 8		
09	√x	32	f <sup>-1</sup>		
35 00	g LST X	02	D.MS+		
31	f	35 00	g LST X		

R <sub>1</sub>	0	R <sub>4</sub>	0	R <sub>7</sub>	0
R <sub>2</sub>	0	R <sub>5</sub>	0	R <sub>8</sub>	DSZ
R <sub>3</sub>	0	R <sub>6</sub>	Used	R <sub>9</sub>	Used









Sales, service and support in 172 centers in 65 countries  
19310-19320 Pruneridge Ave., Cupertino, CA 95014  
Offices in principal cities throughout the United States