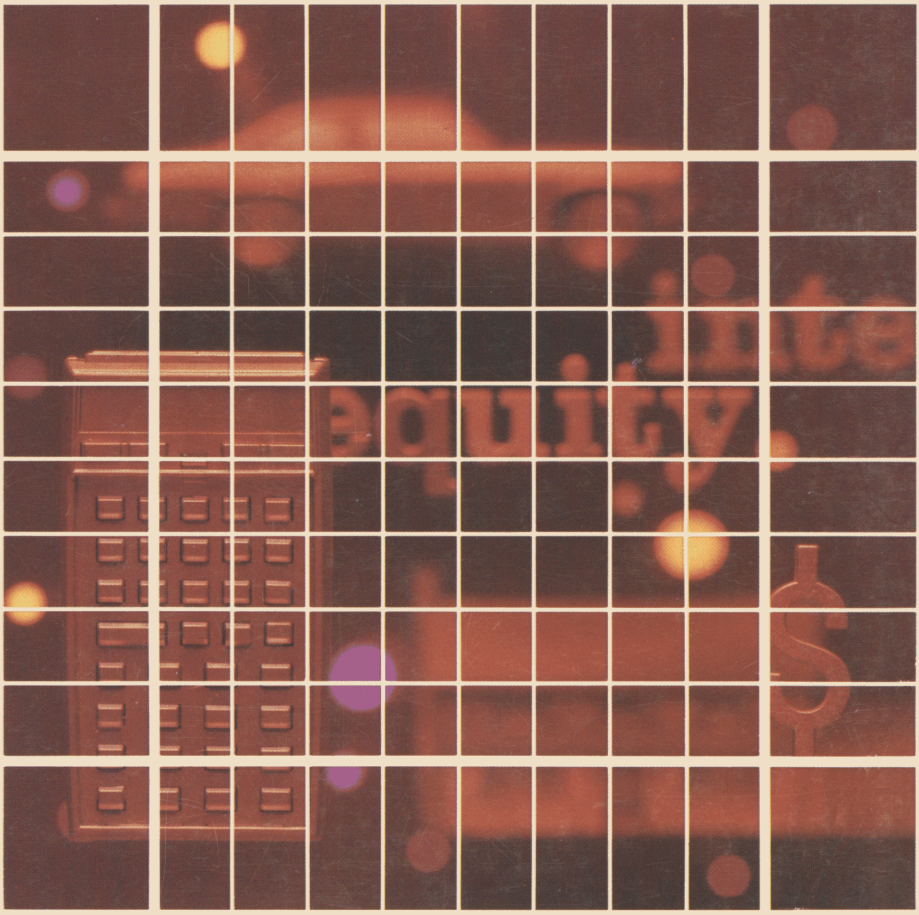
HEWLETT-PACKARD

HP-41C

HOME MANAGEMENT PAC



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HEWLETT hp PACKARD

HEWLETT-PACKARD LISTENS

To provide better calculator support for you, the Application Engineering group needs your help. Your timely inputs enable us to provide higher quality software and improve the existing application pacs for your calculator. Your reply will be extremely helpful in this effort.

1. Pac name _____

2. How important was the availability of this pac in making your decision to buy a Hewlett-Packard calculator?
   ☐ Would not buy without it. ☐ Important ☐ Not important

3. What is the major application area for which you purchased the pac?

_____

4. In the list below, please rate the usefulness of the programs in this pac.

PROGRAM NUMBER	ESSENTIAL	IMPORTANT BUT NOT REQUIRED	INFREQUENTLY USED	NEVER USED
1				
2				
3				
4				
5				
6				
7				
8				

PROGRAM NUMBER	ESSENTIAL	IMPORTANT BUT NOT REQUIRED	INFREQUENTLY USED	NEVER USED
9				
10				
11				
12				
13				
14				
15				
16				

5. Did you purchase a printer? ☐ YES ☐ NO
   If you did, is the printing format in this pac useful? ☐ YES ☐ NO

6. What programs would you add to this pac?

_____

7. What additional application pacs would you like to see developed?

_____

THANK YOU FOR YOUR TIME AND COOPERATION.

Name _____ Position _____

Company _____

Address _____

City _____ State _____

Zip _____ Phone _____

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INTRODUCTION

This Home Management Pac has been developed to provide you with useful programs for commonly encountered problems in personal finance, record-keeping and home ownership.

Each program in this pac represents a program in the Application Module and a section in the manual. The manual provides a description of the program, a set of instructions for using the program, and one or more example problems, each of which includes a list of the keystrokes required for its solution.

Three of the record-keeping programs, Home Budgeting, Travel Expense Record, and Stock Portfolio Evaluation, are greatly enhanced by the ability to permanently store data on magnetic cards. We recommend that you obtain an HP Model 82104A Card Reader to use with your HP-41C in order to get maximum value from these programs.

Before plugging in your Application Module, *turn the calculator off,* and be sure you understand the section Inserting and Removing Application Modules. And before using a particular program, take a few minutes to read Format of User Instructions and A Word About Program Usage.

You should first familiarize yourself with a program by running it once or twice while following the complete User Instructions in the manual. Thereafter, the program's prompting or the mnemonics on the overlays should provide the necessary instructions, including which variables are to be input, which keys are to be pressed, and which values will be output.

We hope that this Home Management Pac will be of value to you in many ways. We would appreciate knowing your reactions to the programs in this pac, and to this end we have provided a questionnaire inside the front cover of this manual. Would you please take a few minutes to give us your comments on these programs? It is from your comments that we learn how to increase the usefulness of our programs.

CONTENTS

INSERTING AND REMOVING APPLICATION MODULES

Before you insert an application module for the first time, familiarize yourself with the following information.

Up to four application modules can be plugged into the ports on the HP-41C. While plugged in, the names of all programs contained in the module can be displayed by pressing [shift] [CATALOG] 2.

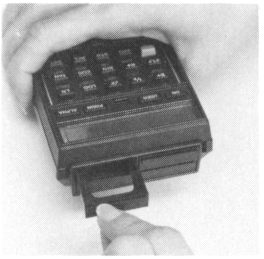
CAUTION

Always turn the HP-41C off before inserting or removing any plug-in extensions or accessories. Failure to turn the HP-41C off could damage both the calculator and the accessory.

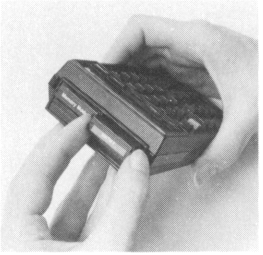
To insert Application Modules:

1. Turn the HP-41C off! Failure to turn the calculator off could damage both the module and the calculator.

2. Remove the port covers. Remember to save the port covers, they should be inserted into the empty ports when no extensions are inserted.



3. With the application module label facing downward as shown, insert the application module into any port **after** the last memory module presently inserted.



4. If you have additional application modules to insert, plug them into any port after the last memory module. For example, if you have a memory module inserted in port 1, you can insert application modules in any of ports 2, 3, or 4. **Never insert an application module into a lower numbered port than a memory module.** Be sure to place port covers over unused ports.

5. Turn the calculator on and follow the instructions given in this book for the desired application functions.

To remove Application Modules:

1. Turn the HP-41C off! Failure to do so could damage both the calculator and the module.

2. Grasp the desired module handle and pull it out as shown.

3. Place a port cap into the empty ports.

Mixing Memory Modules and Application Modules

Any time you wish to insert other extensions (such as the HP 82104A Card Reader, or the HP 82143A Printer) the HP-41C has been designed so that the memory modules are in lower numbered ports.

So, when you are using both memory modules and application modules, the memory modules must always be inserted into the lower numbered ports and the application module into any port after the last memory module. When mixing memory and application modules, the HP-41C allows you to leave gaps in the port sequence. For example, you can plug a memory module into port 1 and an application module into port 4, leaving ports 2 and 3 empty.

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 column specifies the input data, the units of data if applicable, or the appropriate alpha response to a prompted question. Data Input keys consist of 0 to 9 and the decimal point (the numeric keys), [EEX] (enter exponent), and [CHS] (change sign).

The FUNCTION column specifies the keys to be pressed after keying in the corresponding input data.

Whenever a statement in the INPUT or FUNCTION column is printed in gold, the [ALPHA] key must be pressed before the statement can be keyed in. After the statement is keyed in, press [ALPHA] again to return the calculator to its normal operating mode, or to begin program execution. For example, [XEQ] IRA means press the following keys: [XEQ] [ALPHA] IRA [ALPHA] .

The DISPLAY column specifies prompts and intermediate and final answers and their units, where applicable.

Above the DISPLAY column is a box which specifies the minimum number of data registers necessary to execute the program. Refer to pages 73 and 117 in the Owner's Handbook for a complete description of how to size calculator memory.

The following illustrates a portion of the User Instruction Form for Tax Free Individual Retirement Account (IRA) or Keogh Planning.

				SIZE: 013
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module, execute Size and begin the IRA/ Keogh program.		[XEQ] SIZE 013 [XEQ] IRA	ANN PMT=?
2	Input the annual investment or payment.	PMT	[R/S]	YRS TO RET=?
3	Input the number of years till retirement.	YRS	[R/S]	% INT=?

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
4	Input the percent annual interest (or yield) on your investment and calculate the total amount you paid in, followed by the future value of the tax free (IRA or Keogh) invest- at the time of your retirement, followed by the total dividends earned by your investment.	INT(%)	R/S R/S * R/S *	TOT PAID IN= TAX FREE INV FV= TOT DIV=

The user should first allocate (at least) 13 data storage registers (SIZE: 013) for use during program execution. To do this the keys XEQ ALPHA SIZE ALPHA 013 are pressed.

Program execution is begun by pressing XEQ ALPHA IRA ALPHA . The calculator displays ***ANN PMT=?***, prompting for input of the annual investment or payment to the account. The user responds by inputting the annual payment and pressing R/S . The calculator then displays the prompt ***YRS TO RET=?***, asking for the number of years until retirement. The user keys in the number of years and presses R/S . The prompt ***% INT=?*** is responded to in like manner.

Calculation and display of ***TOT PAID IN***=, ***TAX FREE INV FV***= and ***TOT DIV***= are obtained by pressing R/S .

Prompting, inputs, and results continue in like manner until the program is completed.

When these programs are used with the HP 82143A printer attached to the calculator and turned on, the calculated results will be automatically printed without the necessity of pressing R/S after each output. In this case the R/S is marked with a *.

A WORD ABOUT PROGRAM USAGE

Catalog

When an Application Module is plugged into a port of the HP-41C, the contents of the Module can be reviewed by pressing [gold] CATALOG 2 (the Extension Catalog). Executing the CATALOG function lists the name of each program or function in the module, as well as functions of any other extensions which might be plugged in.

Overlays

Overlays have been included for some of the programs in this pac. To run the program, choose the appropriate overlay, and place it on the calculator. The mnemonics on the overlay are provided to help you run the program. The program's name is given vertically on the left side. When the overlay is in place and the calculator is in USER mode the blue mnemonics are directly below the key with which they are associated. Gold mnemonics are similar to blue mnemonics, except that they are above the appropriate key and the shift (gold) key must be pressed before the re-defined key. Once again, USER mode must be set.

ALPHA and USER Mode Notation

This manual uses a special notation to signify ALPHA mode. Whenever a statement on the User Instruction Form is printed in gold, the ALPHA key must be pressed before the statement can be keyed in. After the statement is input, press ALPHA again to return the calculator to its normal operating mode, or to begin program execution. For example, XEQ STOCKS means press the following keys: XEQ ALPHA STOCKS ALPHA .

In USER mode, when referring to the top two rows of keys (the keys having been re-defined), this manual will use the symbols A - J and [gold] A - [gold] E on the User Instruction Form and in the keystroke solutions to sample problems.

Using Optional Printer

When the optional printer is plugged into the HP-41C along with the Home Management Pac Applications Module, all results will be printed automatically. You may also want to keep a permanent record of the values input to a certain program. A convenient way to do this is to set the Print Mode switch to NORMAL before running the program. In this mode, all input values and the corresponding keystrokes will be listed on the printer, thus providing a record of the entire operation of the program.

Downloading Module Programs

If you wish to trace execution, to modify, to record on magnetic cards, or to print a program in this Application Module, it must first be copied into the HP-41C's program memory. For information concerning the HP-41C COPY function, see the Owner's Handbook. It is *not* necessary to copy a program in order to run it.

Program Interruption

These programs have been designed to operate properly when run from beginning to end, without turning the calculator off (remember, the calculator may turn itself off). If the HP-41C is turned off, it may be necessary to set flag 21 (SF 21) to continue proper execution.

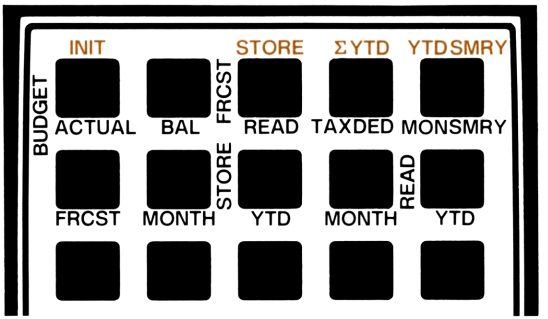
Use of Labels

You should generally avoid writing programs into the calculator memory that use program labels identical to those in your Application Module. In case of a label conflict, the label within program memory has priority over the label within the Application Pac program.

Assigning Program Names

Key assignments to keys [A] - [J] and [■] [A] - [■] [E] take priority over the automatic assignments of local labels in the Application Module. Be sure to clear previously assigned functions before executing a Module program.

HOME BUDGETING



This program is designed to assist in setting up and maintaining a monthly home budget. It stores anticipated and actual income and expenditures and provides the necessary calculations for review and record keeping.

Thirteen different categories of expenditures are available for the user. In addition, the total amount of designated tax deductible expenditures is recorded.

The program provides for display of the monthly budget status at any time. End-of-month and year-to-date status and summaries may also be obtained.

Provision is made for permanent storage of forecasts and monthly and year-to-date data on magnetic data cards, for calculators equipped with the Model 82104A Card Reader. Interim storage, on an additional Memory Module, is also possible.

Use of the Budget Program

At the beginning of each month the user initializes the program (this clears previously stored data) and inputs the name of the month, anticipated income (after income tax and FICA deductions) and forcasted expenditures in each category. The forecasts may be stored on a data card for future use.

Then on a daily or weekly basis, the budget is updated by inputting actual income and expenditures as they occur.

The thirteen expenditure categories provide for ready classification of all budget items. Expenditures which are tax deductible may be so designated when they are input. The program maintains a running total of this item.

The balance in each individual category or a summary of the entire budget status may be obtained at any time.

At the end of the month, year-to-date figures for the entire budget are updated and reviewed.

If a Model 82104A Card Reader is available; forecasts, monthly data and year-to-date status may be permanently recorded on data cards for future use or the monthly and year-to-date data may be stored on an additional Memory Module until needed. This frees data registers 00 thru 62 for other use and allows retention of the data while other programs in this pac are executed.

Notes:

- This program uses 63 data registers available in the basic HP-41C (or in one additional Memory Module). Be sure sufficient Memory Modules are available to store additional User programs you may wish to save.
- Execution of the initialization routine for this program clears data storage registers 00 through 62. Be sure you review and/or record any necessary data before performing initialization.
- Interim storage of the data on an additional Memory Module may be performed. For instructions and information on storing and reloading the data see Appendix B: Storage of Data. Note that an entire memory module is required for interim storage and is not available for storage of other programs, etc. during this period.

				SIZE:063
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module and place the overlay on the keyboard.			
2	Size the calculator for the proper number of data registers.		XEQ SIZE 063	
3	Begin the Home Budget program.		XEQ BUDGET	BUDGET
4	If beginning a new month go to step 5. If updating present budget go to steps 6 or 7. If storing data go to step 11.			
	New Month:			
5	Initialize program and input name of the month. (Caution: initialization destroys all data in registers 00 thru 62. Name of month must be limited to 6 characters maximum.) Go to step 6.	 month	■ A R/S	MONTH? month
	Forecasts:			
6	If new forecasts are being made go to step 6a, or, if previous forecasts were stored on data card, go to step 6e.			
6a	Begin forecast of monthly income and expenditures.		F	INCOME=?

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
6b	Input anticipated monthly income (after withholding tax, FICA, and other deductions).		R/S *	FRCST=
6c	The calculator will sequentially prompt for your forecast of monthly expenses in the following 13 categories: • Food (FOOD) • Shelter (SHELTER) • Household expenses (HSHLD) • Clothing (CLOTHE) • Transportation (TRANS) • Insurance (INSURE) • Education (EDUCATE) • Recreation (REC) • Investments and savings (INVEST) • Gifts or contributions (GIFT) • Medical expenses (MED) • Taxes (TAX) • Miscellaneous (MISC) Input forecast expenditures in each category as it appears. (No input is necessary for a zero forecast.)	 Forecast Forecast Forecast	R/S * R/S R/S * R/S : R/S * R/S	FOOD=? FRCST= SHELTER=? FRCST= : MISC=? FRCST=
	When all categories have been completed END will be displayed. Go to step 6d, 6f or 7.		R/S *	END
6d	Optional: Store forecasts on data card for future use. (Mount Model 82104A Card Reader on HP-41C.) Label card and save for next month. Go to step 6f or 7.		f C Input Side 1 and 2 of blank data card	RDY 01 OF 2 RDY 02 OR 02 1.03
6e	Optional: Read in previous forecasts from data card. Go to step 6f or 7.		C Input Sides 1 and 2 of data card	CARD RDY 02 OF 02 1.03
6f	To correct an erroneous input, repeat steps 6a thru 6c with correct data.			
	*This R/S not necessary if calculator is used with a printer.			

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	Recording Actual Income and Expenditures:			
7	Input actual income items.		[A]	INCOME=?
		Income	[R/S]	INCOME=?
7a	Input further income items or, if no further inputs, press [R/S], without prior data entry, for next category.	Income	[R/S]	INCOME=?
			[R/S]	FOOD=?
7b	Repeat step 7a for each category	Expense	[R/S]	FOOD=?
7c	To correct an erroneous input, access the proper category by performing step 7a without data entry until prompt appears.			(category)=?
	Re-input erroneous data and press [CHS] [R/S]. Then input correct data.	Error	[CHS] [R/S]	(category)=?
		Correct	[R/S]	(category)=?
	Tax Deductible Items:			
8	When expense is to be recorded as tax deductible, input item and press [D].	Expense	[D]	(category)=?
	Balances:			
9	To obtain present balance in each category. (Continue for all categories.)		[B]	INCOME=
			[R/S] *	SURPLUS=
			[R/S] *	FOOD=
			[R/S] *	BAL.=
			:	:
			[R/S] *	END
	Summary:			
10	To obtain a current summary of the month's budget.		[E]	(Month)
			[R/S] *	INCOME=
			[R/S] *	FORECAST=
			[R/S] *	ACTUAL=
			[R/S] *	SURPLUS=
			[R/S] *	TOT. EXP.=
			[R/S] *	(Month) NET=
	*This [R/S] not necessary if calculator used with printer.			

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	Following the month net each of the expenditure categories is displayed as follows:		R/S *	(Category Name)
			R/S *	FORECAST=
			R/S *	ACTUAL=
			R/S *	BALANCE=
			:	:
			(Output continues for each category)	
	Finally, the total of tax deductible expenditures is displayed.		R/S *	TAX DED.=
	Repeat step 10 at any time for current monthly status.		R/S *	END
	Storing monthly data:			
11	Mount card reader model 82104A on HP-41C.			
	To permanently record monthly data on a magnetic card, press G . Then input blank magnetic card, sides 1 and 2. Mark card with title and month and save for future use.		G Input side 1 and 2 of card	RDY 01 OF 02 RDY 02 OF 02 .03
12	To read in monthly status from magnetic card (use to restore monthly data whenever necessary).		I Input side 1 and 2 of card	CARD RDY 02 of 02 .03
	Generating and storing year-to-date data:			
13	Read in last month's year-to-date data from data card. (see step 16.) NOTE: This step not to be performed for first month of the budget year.			
13a	Generate new year-to-date data at end of each month's budget. (Caution: perform this step only after all data for the month has been entered and step 10 has been executed. Do not repeat this step until the end of the next month, otherwise incorrect totals will result.) Repeat step 13a at the end of each month to maintain current YTD data.		■ D	
	Calculator automatically continues to step 14.		R/S *	

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
14	To review YTD data at any time. (Repeat as desired.)		[f] [E] [R/S] * [R/S] * : [R/S] *	Display follows same format as monthly summary. See step 10 for details
	To store YTD data on magnetic cards:			
15	Mount card reader model 82104A on HP-41C. After performing step 13a, press [H], then input blank magnetic card, sides 1 and 2. Mark card with title and date. Save for future use.		[H] Input side 1 and 2 of card	RDY 01 of 02 RDY 02 of 02 33.06
16	To read in YTD data from magnetic card (use card to restore YTD data whenever necessary).		[J] Input side 1 and 2 of card	CARD RDY 02 of 02 33.06
	Interim Storage of Data:			
17	For interim storage of all data on an additional memory module: (see Appendix B, Storage of Data).		[XEQ] SIZE 126 [XEQ] STORE	SIZE 126 STORED
18	To reload data after interim storage.		[XEQ] RELOAD	RELOADED
	*This [R/S] not necessary if calculator used with printer.			

Example:

The following budget was prepared and the actual income and expenditures recorded for January. Record the data in the HP-41C Home Budgeting program and update the expenditures as indicated.

CATEGORY	FORECAST	WEEK 1	WEEK 2	WEEK 3	WEEK 4
INCOME	$1760.00	$865.92	$ 25.80	$872.10	$10.00
FOOD	220.00	45.00/60.32	35.20	72.35	16.56
SHELTER	350.00	14.50	245.00	25.84	62.50
HOUSEHOLD EXPENSES	180.00	102.50	15.28	40.00	25.00
CLOTHING	165.00	98.35	15.00	62.30	
TRANSPORTATION	110.00	78.10	8.35	10.50	5.00
INSURANCE	100.00		50.00		50.00
EDUCATION	40.00	31.62*			
RECREATION	160.00	32.00	12.00	110.00	
INVESTMENTS/SAVINGS	150.00	95.00	15.00		30.00
GIFTS/CONTRIBUTIONS	45.00	5.00*		35.00	
MEDICAL EXPENSES	65.00	32.85*		16.00*	10.00*
TAXES	130.00		110.00*		15.00*
MISCELLANEOUS	45.00	5.00	22.50		

*Denotes tax deductible expenditures.

Keystrokes	Display
XEQ ALPHA SIZE ALPHA 063	*SIZE 063*
XEQ ALPHA BUDGET ALPHA	*BUDGET*
f A	*MONTH?*
JAN R/S	*JAN*
F	*INCOME=?*
1760 R/S	*FRCST=1,760.00*
R/S	*FOOD=?*
220 R/S	*FRCST=220.00*
R/S	*SHELTER=?*
350 R/S	*FRCST=350.00*

Continue inputting forecasts for each category as above. When all forecasts have been input, store on data card for next month's entries.

f C	*RDY 01 OF 02*	Skip these steps if no card reader is available.
Input side 1 and side 2 of blank data card Label "FORECASTS".	*RDY 02 OF 02*	
	1.03	

Now input the actual expenditures under each category for week 1.

A	*INCOME=?*	
865.92 R/S	*INCOME=?*	
R/S	*FOOD=?*	
45 R/S	*FOOD=?*	
60.32 R/S	*FOOD=?*	
R/S	*SHELTER=?*	
14.5 R/S	*SHELTER=?*	
R/S	*HSHLD=?*	
102.5 R/S	*HSHLD=?*	
R/S	*CLOTHE=?*	
98.35 R/S	*CLOTHE=?*	
R/S	*TRANS=?*	
78.1 R/S	*TRANS=?*	
R/S	*INSURE=?*	
R/S	*EDUCATE=?*	
31.62 D	*EDUCATE=?*	(Tax deductible)
R/S	*REC=?*	
32 R/S	*REC=?*	

Keystrokes	Display	
R/S	*INVEST=?*	
95 R/S	*INVEST=?*	
R/S	*GIFT=?*	
5 D	*GIFT=?*	(Tax deductible)
R/S	*MED=?*	
32.85 D	*MED=?*	
R/S	*TAX=?*	
R/S	*MISC=?*	
5 R/S	*MISC=?*	
R/S	*END*	

Now obtain an overall summary of the month's budget through the first week.

E	*JAN*
R/S	*INCOME*
R/S	*FRCST=1,760.00*
R/S	*ACTUAL=865.92*
R/S	*SURPLUS=-894.08*
R/S	*TOT. EXP.=600.24*
R/S	*JAN NET=265.68*
R/S	*FOOD*
R/S	*FRCST=220.00*
R/S	*ACTUAL=105.32*
R/S	*BALANCE=114.68*
⋮	⋮

Summary continues in like manner through rest of categories ending with:

R/S	*TAX DED.=69.47*
R/S	*END*

Now store monthly data on a data card. (Be sure Card Reader is mounted on calculator.)

G	*RDY 01 OF 02*
Input side 1 of blank card	*RDY 02 OF 02*
Then side 2	*0.03*

At end of second week the program is updated again:

XEQ ALPHA SIZE ALPHA 063	*SIZE 063*
XEQ ALPHA BUDGET ALPHA	*BUDGET*
Read in the monthly data card	
I	*CARD*
Input side 1	*RDY 02 OF 02*
and side 2	*0.03*
of monthly data card	

Skip these steps if no card reader is available.

Continue as before, inputting actual expenditures or income for week 2. (Caution: *do not* reinitialize.) Repeat above sequence for weeks 3 and 4. At end of week 4 summary will show:

E	JAN
R/S	INCOME
R/S	FRCST=1,760.00
R/S	ACTUAL=1,773.82
R/S	SURPLUS=13.82
R/S	TOT. EXP.=1,714.62
R/S	JAN NET=59.20
⋮	⋮
R/S	TAX DED.=220.47

Now store the complete January data on a data card and retain as a permanent record.

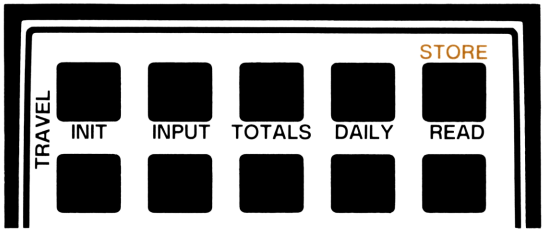
Next generate and store year-to-date data and store on data cards (or perform interim storage on an additional memory module) to preserve the data.

(Attach Card Reader)

f D	YTD
R/S	INCOME
R/S	FRCST=1,760.00
R/S	ACTUAL=1,773.82
⋮	⋮
R/S	END
H	RDY 01 OF 02
Input side 1 of blank	RDY 02 OF 02
card, then side 2	33.06
Then mark card and retain.	

} Skip these steps if no card reader is available.

TRAVEL EXPENSE RECORD



This program provides a convenient method of recording and totalling travel expenses. It records expenses, day-by-day and category-by-category, for seven days in seven commonly used, all-inclusive categories. Total expenses are displayed at anytime, as desired, by day and/or by category.

Provision is made for permanent storage of the week's data on magnetic cards when the calculator is equipped with a Model 82104A Card Reader.

Use of the Travel Expense Record

Whenever you wish to use the program, access it by pressing [XEQ] TRAVEL. The display shows ***TRAVEL EXP.*** and any of the various routines to update the record or display daily totals are available for use.

For the first day of the trip, initialize the program by pressing [A] and input the date and the first day's expenses as described in the User Instructions. (Caution: Initialization clears all data from registers 00 thru 62, so be sure you have reviewed and/or recorded any data of interest.)

The categories under which appropriate expenses may be recorded are: Auto, Fares, Lodging, Meals, Telephone, Entertainment and Other.

For succeeding days press [B] to access the expense input routine, then input the date and the day's expenses.

Expense summary and totals may be displayed whenever desired.

Storage of Data

You may record the expense record data on magnetic cards or on an additional Memory Module whenever the calculator storage registers are to be used for other data or programs.

Notes:

- This program uses all 63 storage registers available in the basic HP-41C (or in an additional Memory Module). Be sure sufficient Memory Modules are available to store additional user programs you may wish to save.

- Execution of the initialization routine for this program clears data storage registers 00 through 62. Be sure to review and/or record any necessary data before performing initialization.
- This program will not perform properly if the expense record dates occur over a month's end. Prepare two separate records, one ending on the last day of the month, the second beginning on the first day of the following month.
- Interim storage of the data on an additional Memory Module may be performed. For instructions and information on storing and reloading the data see Appendix B: Storage of Data. Note that an entire memory module is required for interim storage and is not available for storage of other programs, etc. during this period.

				SIZE: 063
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module, place the overlay on the keyboard execute Size and begin Travel Expense program. For a new record go to step 2, To update an existing record, go to step 3.		XEQ SIZE 063 XEQ TRAVEL	TRAVEL EXP.
	New Expense Record:			
2	Initialize the program. (Caution: Initialization destroys stored data in registers 00 thru 62. Go to step 4.		A	DATE?
	Updating Current Record:			
3	Begin undating routine.		B	DATE?
	Inputting Expenses:			
4	Input the date (in mm.ddyyyy format)	Date	R/S R/S *	DATE: (mm.ddyyyy) AUTO EXP=?
	Input auto expenses for the day.	Auto exp.	R/S	AUTO EXP=?
	Input further auto expenses if any. If no further auto expenses press R/S without prior data entry.		R/S	FARE EXP=?
	Input Fares, if any, as above. Continue for balance of expense categories. After all daily expenses are input display shows daily total.	Fare exp.	R/S	FARE EXP=?
			R/S R/S *	TOT. EXP.= END
	*This R/S not necessary if calculator is used with a printer.			

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	Correction of Erroneous Entries or Input Missing Entries: †			
5a	To correct an erroneous entry press [B], input the date of the entry and access the category (see steps 3 and 4). Then:	Entry date	[B] [R/S]	DATE? DATE:(mm.ddyyyy)
	• For a missing entry, input the item		:	
	or,	Expense	[R/S]	
	• To delete or replace an erroneous item, reinput the incorrect entry, press [CHS] [R/S], then input the correct entry.	Error Correct	[CHS] [R/S] [R/S]	(category)=?
5b	Reset to date of current entries and continue as desired.	Date	[B] [R/S]	DATE? DATE: (mm.ddyyyy)
	To Review Record:			
6	To recall total expenses in each category.		[C]	TOTALS
			[R/S] *	DATE: (Day 1)
			[R/S] *	TOT. EXP.=
			[R/S] *	AUTO=
			[R/S] *	FARES=
			[R/S] *	LODGING=
			[R/S] *	MEALS=
			[R/S] *	TELEPHONE=
			[R/S] *	ENTERTAIN=
			[R/S] *	OTHER=
			[R/S] *	END
7	To recall daily totals in each category.		[D]	DAILY
			[R/S] *	DATE (Day 1)
			[R/S] *	AUTO=
			[R/S] *	FARES=
			[R/S] *	LODGING=
			[R/S] *	MEALS=
			[R/S] *	TELEPHONE=
			[R/S] *	ENTERTAIN=
			[R/S] *	OTHER=
			[R/S] *	DATE (Day 2)
			[R/S] *	AUTO=
			[R/S] *	FARES=
			[R/S] *	LODGING=
			[R/S] *	MEALS=
			[R/S] *	TELEPHONE=
	[R/S] *		[R/S] *	ENTERTAIN=
			[R/S] *	OTHER=
	†This step must be performed before steps 6 or 7.			

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	Storing and Reloading Data:			
8	To permanently record the entire expense record on magnetic cards: Mount card reader model 82104A on the HP-41C. Then input 2 blank cards, sides 1, 2, 3 and 4. Mark cards with title and date and save for future use.		[■] [E] Input sides 1 thru 4	RDY 01 of 04 : 0.06
9	To reload stored data from magnetic card.		[E] Input sides 1 thru 4	CARD RDY 02 of 04 :
	Interim Storage of Data			
10	For interim storage of all data on an additional memory module: (see Appendix B: Storage of Data.)		[XEQ] SIZE 126 [XEQ] STORE	SIZE 126 STORED
11	To reload data after interim storage. *This [R/S] not necessary if calculator used with printer.		[XEQ] RELOAD	RELOADED

Example:

Prepare a travel expense record for the period September 17, 1979 through September 21, 1979 for the following expenses. Record the data on magnetic cards.

Category	Mon. Sept. 17	Tues. Sept. 18	Wed. Sept. 19	Thurs. Sept. 20	Fri. Sept. 21	Totals
Auto	9.00/4.50	3.44	10.75	9.67	8.35	45.71
Fares		6.50		2.75		9.25
Lodging	38.00	27.50	28.92	35.50		129.92
Meals	5.25/7.50	16.80	15.35	18.00	15.30	78.20
Telephone	3.55	.75	5.40		2.34	12.04
Entertainment		15.00		25.00		40.00
Other	3.25	5.75	2.35	.75		12.10
TOTALS	71.05	75.74	62.77	91.67	25.99	327.22

Keystrokes	Display
XEQ ALPHA SIZE ALPHA 063	*SIZE 063*
XEQ ALPHA TRAVEL ALPHA	*TRAVEL EXP.*
A	*DATE?*
9.171979 R/S	*AUTO EXP=?*
9 R/S	*AUTO EXP=?*
4.5 R/S	*AUTO EXP=?*
R/S	*FARE EXP=?*
R/S	*LODGING EXP=?*
38 R/S	*LODGING EXP=?*
R/S	*MEAL EXP=?*
5.25 R/S	*MEAL EXP=?*
7.5 R/S	*MEAL EXP=?*
R/S	*TELE EXP=?*
3.55 R/S	*TELE EXP=?*
R/S	*ENTERTAIN EXP=?*
R/S	*OTHER EXP=?*
3.25 R/S	*OTHER EXP=?*
R/S	*TOT. EXP.=71.05*
R/S	*END*

Now input expenses for second day:

B	*DATE?*
9.181979 R/S	*AUTO EXP=?*

Continue as with first day's data.

After data have been input obtain summary of expense record.

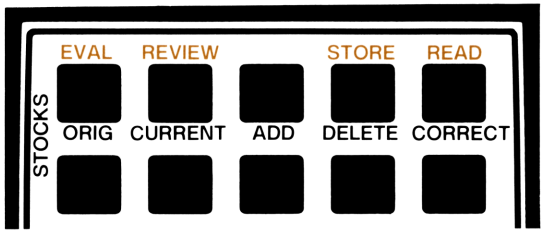
C	*TOTALS*
R/S	*DATE:9.171979*
R/S	*TOT. EXP.=327.22*
R/S	*AUTO=45.71*
R/S	*FARES=9.25*
R/S	*LODGING=129.92*
R/S	*MEALS=78.20*
R/S	*TELEPHONE=12.04*
R/S	*ENTERTAIN=40.00*
R/S	*OTHER=12.10*
R/S	*END*
D	*DAILY*
R/S	*DATE:9.171979*

Keystroke	Display
R/S	AUTO=13.50
R/S	FARES=0.00
R/S	LODGING=38.00
R/S	MEALS=12.75
R/S	TELEPHONE=3.55
R/S	ENTERTAIN=0.00
R/S	OTHER=3.25
R/S	TOTAL=71.05
⋮	⋮ ⋮
R/S	DATE:9.211979
R/S	AUTO=8.35
R/S	FARES=0.00
R/S	LODGING=0.00
R/S	MEALS=15.30
R/S	TELEPHONE=2.34
R/S	ENTERTAIN=0.00
R/S	OTHER=0.00
R/S	TOTAL=25.99
R/S	END

Now, record entire record on data cards: (optional)

f E Input both sides of two cards and label them.	RDY 01 OF 04 0.06

STOCK PORTFOLIO EVALUATION



This program is designed to record and, with the use of the HP Model 82104A Card Reader, store on data cards the names, number of shares and purchase price of up to 18 different stocks, comprising an investment portfolio. One may correct, add to or review the portfolio at any time.

In addition, by inputting current market price, stock Beta* coefficient and current annual dividends per share, the program calculates the percent change in value for each stock and, for the portfolio as a whole, the original value, total commission and total cost, current value, percent change in value, total dividends, current dividend yield and weighted Beta coefficient.

Provision is made for easy storage of stock data on magnetic data cards for permanent records. Interim storage of the data on an additional Memory Module is also possible.

Notes:

- Stock prices are input and output in the format XXX.YZ where XXX represents the integer portion of the price, Y represents the numerator of the fractional portion and Z represents the denominator of the fractional portion. (For instance, a price of $115⅜ would be input or displayed as 115.38, a price of 25½ would be input or displayed as 25.12).
- The price per share must be less than $1,000.
- One may add to or delete from the portfolio at will and corrections for erroneous inputs are readily made.
- This program uses 63 data registers available in the basic HP-41C (or in one additional Memory Module). Be sure sufficient Memory Modules are available to store additional user programs you may wish to save.

*The Beta coefficient is a measure of volatility (or risk) of a stock as compared to the market as a whole (Beta = 1.00). A Beta larger than 1.00 means a greater risk, less than 1.00 a lower risk.

- Execution of the routine to load portfolio data clears data storage registers 00 through 62. Be sure you review and/or record any necessary data before performing this step.

- Interim storage of the data on an additional Memory Module may be performed. For instructions and information on storing and reloading the data see Appendix B: Storage of Data. Note that an entire memory module is required for interim storage and is not available for storage of other programs, etc. during this period.

				SIZE: 063
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module, place the overlay on the keyboard execute Size and begin the Stock Portfolio program.		XEQ SIZE 063 XEQ STOCKS	STOCKS
	Loading Portfolio Data:			
2	Press A and input the number of different stocks to be recorded. (Caution: this operation clears data storage registers.)	Number	A R/S	NO. STOCKS=? NAME=?
3	Input the following for each stock: • Name of the stock (max. of 6 letters). • Number of shares owned. • Purchase price per share. (Remember: input price in format XXX.YZ.) • Commission paid upon purchase.	Name No. of Shares Price/share Comm.	R/S R/S R/S R/S	NO. SHS (name)=? PRC(name)=? COMM=? NAME=?
4	Repeat step 3 until all stocks have been recorded.		R/S *	END
	Correcting or Changing Data:			
5	If an error was made in inputting the historical data of a stock, press E and repeat step 3 for the single stock that is to be corrected.	Name	E R/S :	NAME=? NO. SHS (name)=? :
5a	Repeat Step 5 for any other errors.			
	Adding New Stock:			
6	To add one or more new stocks to the portfolio press C and go to Step 3.		C	NAME=?
7	After all the new stocks have been added press R/S without prior data entry to end the input routine.		R/S	NAME=? END

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	To Delete a Stock:			
8	(as when it has been sold): Input the name of the stock.	Name	D R/S	NAME=? END
	To Review Historical Data:			
9	Press [orange] B to obtain the name of the first stock, continue by pressing R/S for the number of shares, the purchase price, the commission and the total cost.		[orange] B R/S * R/S * R/S * R/S * R/S *	STOCKS (NAME) NO. SHS= PRC= COMM= TOT. COST=
10	Continue pressing R/S for the rest of the recorded stocks. When data for all stocks has been displayed the calculator displays END.		R/S * : R/S *	(Name) : END
	To Calculate Percent Change and Current Value of the Portfolio:			
11	Press B and input the current price of the stock, (XXX.YZ format); the Beta coefficient; and the annual dividend per share. The % change in value is displayed.	Price/share Beta Div.	B R/S * R/S R/S R/S R/S :	%CHANGE PRC(name)=? BETA=? DIV=? %CH= PRC (name)=? :
12	Continue to next stock. Repeat for each stock in the portfolio. (When end of portfolio is reached calculator displays END.)			
13	(Optional): Prepare a summary and display portfolio value: • Display original value of portfolio. • Display current value of portfolio. • Calculate % change, from original, in portfolio value. • Calculate total current annual dividend. • Calculate current dividend yield of portfolio. • Calculate weighted average Beta coefficient of the portfolio. • Display total commission and total cost.		[orange] A R/S * R/S * R/S * R/S * R/S * R/S * R/S * R/S *	ANALYSIS ORIG= NEW= %CH= DIV= YLD= BETA= TOT. COMM= TOT. COST=
	*This R/S not necessary if calculator is used with a printer.			

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	To Store Portfolio Data on a Data Card: (Mount card reader model 82104A on the HP-41C.)			
14	Press [f] [D] . Input blank magnetic card(s) sides 1 through n. Mark cards with title of data and save for future use.		[f] [D]	RDY 01 of 0n RDY 02 of 0n etc.
	To Read Portfolio Data From a Data Card:			
15	Press [f] [E] . Input data cards, sides 1 and 2 of each.		[f] [E]	CARD RDY 02 of 0n etc.
	Interim Storage of Data:			
16	For interim storage of all data on an additional memory module: (See Appendix B: Storage of Data.)		[XEQ] SIZE 126 [XEQ] STORE	SIZE 126 STORED
17	To reload data after interim storage.		[XEQ] RELOAD	RELOADED
	*This [R/S] not necessary when calculator is used with a printer.			

Example:

Record and store the following stock portfolio data:

COMPANY	SYMBOL	# SHARES	PURCHASE PRICE	COMMISSION
American Electric	AMELC	20	50⅜	25
Northwest Marine	NWM	120	13¼	32
World Wide Insurance	WWI	100	125½	50
Petroleum Southern	PETS	150	67¾	65
Allied Radiofrequency	ARF	75	36	35.50

Then analyze the performance of the portfolio given the following current information:

COMPANY	MARKET PRICE	BETA	DIVIDEND/SH
AMELC	42½	1.15	1.80
NWM	16	1.2	.80
WWI	132	.85	6.60
PETS	88⅛	1.05	2.25
ARF	34¾	1.5	1.00

Keystrokes	Display
XEQ ALPHA SIZE ALPHA 063	*SIZE 063*
XEQ ALPHA STOCKS ALPHA	*STOCKS*
A	*NO. STOCKS=?*
5 R/S	*NAME=?*
AMELC R/S	*NO. SHS AMELC=?*
20 R/S	*PRC AMELC=?*
50.38 R/S	*COMM=?*
25 R/S	*NAME=?*
NWM R/S	*NO. SHS NWM=?*
120 R/S	*PRC NWM=?*
13.14 R/S	*COMM=?*
32 R/S	*NAME=?*
WWI R/S	*NO. SHS WWI=?*
100 R/S	*PRC WWI=?*
125.12 R/S	*COMM=?*
50 R/S	*NAME=?*

Continue as above for the remaining stocks. When all data has been entered "END" will appear in the display.

Now input current data and analyze the portfolio:

B	*% CHANGE*
R/S	*PRC AMELC=?*
42.12 R/S	*BETA=?*
1.15 R/S	*DIV=?*
1.80 R/S	*%CH=-15.63*
R/S	*PRC NWM=?*
16 R/S	*BETA=?*
1.2 R/S	*DIV=?*
.8 R/S	*%CH=20.75*
R/S	*PRC WWI=?*
132	*BETA=?*
.85 R/S	*DIV=?*
6.6 R/S	*%CH=5.18*
R/S	*PRC PETS=?*
88.18 R/S	*BETA=?*
1.05 R/S	*DIV=?*
2.25 R/S	*%CH=30.07*

Keystroke	Display
R/S	*PRC ARF=?*
34.34 R/S	*BETA=?*
1.5 R/S	*DIV=?*
1 R/S	*%CH=-3.47*

To prepare Portfolio summary:

A	*ANALYSIS*
R/S	*ORIG=28,010.00*
R/S	*NEW=31,795.00*
R/S	*%CH=13.51*
R/S	*DIV=1,204.50*
R/S	*%YLD=3.79*
R/S	*BETA=1.02*
R/S	*TOT. COMM=207.50*
R/S	*TOT. COST=28,217.50*

We see that the portfolio has increased in value by $3,785.00 or 13.51%. The dividends are currently $1,204.50 per year, yielding 3.79% of the portfolio value. Based on the weighted Beta coefficient the portfolio bears slightly more risk than the market (1.02 compared to 1.00).

Now store the portfolio information for future use: (optional).

(Attach card reader)

D	*RDY 01 OF 02*

Insert both sides of data card.

Mark card for future reference.

CHECKING ACCOUNT RECONCILIATION

This program is designed as an aid to reconciling one's checking account.

The user inputs the balance shown on the bank statement and the balance shown in his check book record. Service charges (or interest) if any, are input followed by each outstanding check (checks drawn by the user but not cleared by the bank, as of the statement date). Outstanding deposits (deposits made since the statement was processed) are then input.

The program displays the adjusted bank balance (statement balance less outstanding checks plus outstanding deposits) and adjusted check book balance (check book balance less service charges or plus interest). The difference between the adjusted bank balance and adjusted check book balance is then displayed. If this difference is zero your account has been reconciled. If the difference is negative you may have less money than you thought in the account, or, if positive, more money. In either case you should examine your check book records or the bank statement to identify and correct the discrepancy.

SIZE: 007

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Insert the application module, execute Size and begin the program.		XEQ SIZE 007 XEQ CHECK	BANK BAL=?
2	Input the balance from the bank statement	BANK BAL	R/S	CHECK BOOK BAL=?
	and the balance from your check book.	BOOK BAL	R/S	SERV CHG=?
3	Input the service charge, if any. (if there was no service charge press R/S *without inputting data.*)	SERV CHG	R/S	INT=?
4	Input interest paid on the account if any. (If none, press R/S *without inputting data.*)	INT	R/S	CHECKS OUT CHECK≠1=?
5	Input the amount of the first outstanding check.	CHECK	R/S	CHECK≠2=?
5a	Repeat step 5 for each outstanding check. When all checks have been input press R/S *without prior data entry* and display the total of outstanding checks.		R/S	TOTAL=
6	Input the amount of the first outstanding deposit.		R/S *	DPSTS OUT DPST≠1=?
		DPST	R/S	DPST≠2=?

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
6a	Repeat step 6 for each outstanding deposit. When all have been input press [R/S] *without prior data entry* and display total outstanding deposits.		[R/S] *	TOTAL=
7	Calculate the adjusted bank and check book balance and the difference, if any. (A negative difference means you have less money in your account than shown in your check book, a positive difference means you have more).		[R/S] * [R/S] * [R/S] *	ADJ BANK BAL= ADJ CHECK BAL= DIFF=
8	Go to step 1 for a new case.			
	*This [R/S] not necessary if calculator is used with a printer.			

Example:

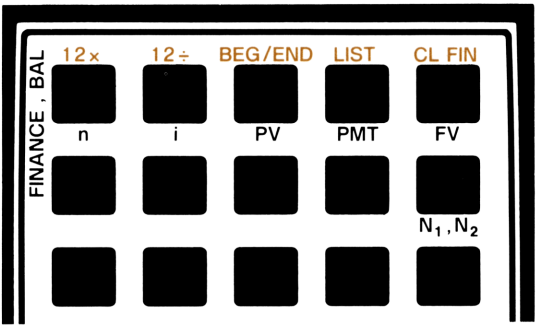
Your check book balance at the end of June was $577.00. The bank statement showed a balance of $432.96 with a service charge of $1.25. You had outstanding checks of $47.82, $5.63, $25.00, $36.47 and $96.02 and outstanding deposits of $100.00 and $256.03. Reconcile your account.

Keystrokes	Display
[XEQ] [ALPHA] SIZE [ALPHA] 007	*SIZE 007*
[XEQ] [ALPHA] CHECK [ALPHA]	*BANK BAL=?*
432.96 [R/S]	*CHECK BOOK BAL=?*
577 [R/S]	*SERV CHG=?*
1.25 [R/S]	*INT=?*
[R/S]	*CHECKS OUT*
	CHECK≠1=?
47.82 [R/S]	*CHECK≠2=?*
5.63 [R/S]	*CHECK≠3=?*
25 [R/S]	*CHECK≠4=?*
36.47 [R/S]	*CHECK≠5=?*
96.02 [R/S]	*CHECK≠6=?*
[R/S]	*TOTAL=210.94*
[R/S]	*DPSTS OUT*
	DPST≠1=?
100 [R/S]	*DPST≠2=?*
256.03 [R/S]	*DPST≠3=?*

Keystroke	Display
R/S	TOTAL=356.03
R/S	ADJ BANK
	BAL=578.05
R/S	ADJ CHECK
	BAL=575.75
R/S	DIFF=2.30

You appear to have $2.30 more in your account than your check book indicates. Check your book for a discrepancy.

YOUR FINANCIAL CALCULATOR



This program, commonly described as annuities and compound amounts, converts your HP-41C to a financial calculator, giving you the ability to solve complex and confusing problems involving loans, savings, mortgages, annuities and other calculations in a simple and straightforward manner. It duplicates the convenient and powerful built-in functions of the "top row keys" found on HP financial calculators.

Calculations of this type involve the relationships between five values:

n: the number of payments or compounding periods

i: the interest rate per period

PV: the Present Value, or amount of money involved at the start of the transaction

PMT: the periodic Payment or deposit

FV: the Future Value of the money, or the amount you will obtain (or pay) at the end of the term.

By inputting three (or four) of the financial variables you can automatically solve for the fourth (or fifth) as long as n and i are included. (Both n and i are involved in all financial calculations.) You may enter the values in any order and then merely press the key denoting the unknown value you wish to calculate.

Remarks:

- Because of the complex way in which the interest rate is determined, solving for i takes longer than solving for the other variables (up to 20 or 30 seconds or longer). The calculation works best for interest rates between 0 and 100%.
- It is quite possible to define problems which cannot be solved by the techniques used here. Such problems usually result in an error message but may simply continue to run indefinitely.

- When solving for i, problems with more than one sign change may have more than one mathematically correct answer. While this program may find one of the answers it has no way of finding or indicating other possibilities.

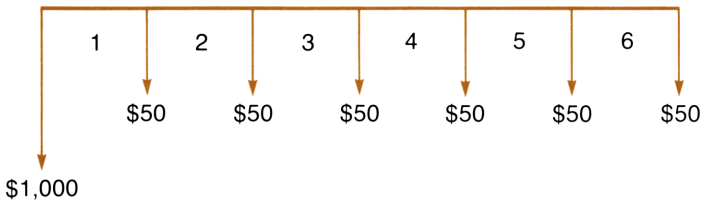
Compound Interest and the Cash Flow Diagram

The concept of compound interest is not difficult. The computations involved, however, can become exceedingly complex. Problems encountered often involve numerous payments and receipts before the transaction is concluded. This program solves many of the most complicated calculations, but it requires a precise format for describing the problem. Such a format can be represented pictorially in the form of a cash flow diagram. The diagram is nothing more than a description of the timing and direction in which cash changes hands using terms that correspond to your calculator's top row keys. As long as you can picture your problem with a cash flow diagram and label it, your program can find the answers.

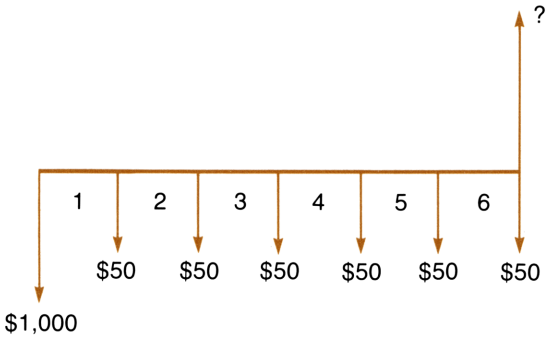
The diagram starts with a horizontal line called the time line. It represents the duration of a financial problem and is divided into compounding periods. For example a financial problem that transpires over 6 months with monthly compounding would look like this:

The exchange of money in a problem is pictured with vertical arrows; money received is represented with an arrow pointing up from the time line where the transaction occurred and money paid out is represented by an arrow pointing down.

For example, if you deposited (paid out) $1,000 at the beginning of the time period and then deposited an additional $50 at the end of each month for the remaining 6 months, you would label the diagram like this:



At the end of the period your account would have a balance that included the initial deposit, the subsequent payments, and any interest paid. This balance could be withdrawn (received), if desired, and would represent a final cash exchange, completing the problem and the cash flow diagram.

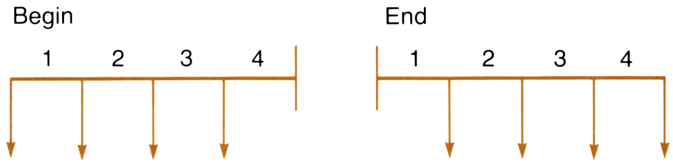


The following financial functions on your keyboard overlay correspond exactly with our cash flow diagram: n, i, PV, PMT, and FV. The number of compounding periods* in a financial problem is represented by n: n would be 6 in our example. Interest rate *per compounding period* is denoted by i on the over-

* Some financial problems involve a portion of a payment period as well as a series of whole payment periods. This occurs whenever a transaction begins on a date that does not correspond to the beginning of the usual payment period. Although there is no standard convention that applies to every problem of this kind, certain problems—such as purchasing a house in the middle of the month when regular payments are made at the beginning of each month—must be separated into two parts: one with the fractional portion of a payment period and one with the remaining whole number of payment periods. The payments made during the whole number of payment periods are calculated using *compound* interest, while the interest accumulated during the fractional portion of a payment period is often calculated using *simple* interest. Be sure that you partition problems when necessary, and calculate accordingly.

lay. (The interest rate must correspond with the compounding interval. Don't mix monthly interest with quarterly periods or daily interest with semiannual compounding periods.) The different cash flows are represented by PV, PMT, and FV. PV *(present value)* represents the cash flow at the start of the time line. In our example PV would be the $1,000 initial deposit. FV stands for future value and represents the cash flow at the end of the time line; the amount that could be withdrawn at the end of six months, indicated by the question mark in the above cash flow diagram. PMT *(payment)* represents a series of cash exchanges of the same direction and amount, i.e., annuities. In our example $50 payments are deposited at the end of each month.

Payments can either start at the beginning of each period (BEGIN), or start at the end of each period (END). There are always the same number of payments as periods.



Whenever payments (PMT) are involved, it is necessary to specify which of the alternatives is applicable by setting the payment mode toggle , [C] (BEG/END), found above the financial keys, to the proper position. BEGIN is for payments in advance and END is for payments in arrears. Or BEGIN is for annuities due and END is for ordinary annuities. The payment toggle setting *does* make a difference in your calculated results. That's because interest accumulates on different amounts depending on whether payments are made at the beginning or the end of a compounding period. In our example, the payments occur at the end of each period, so the payment toggle must be in the END position before starting calculations.

The program is automatically set to END when it is initiated (by pressing [XEQ] FINANCE). A convenient way to check the status is to look at the Flag Status Annunciators at the lower center of the HP-41C display (see pages 36 and 37 of the HP-41C Owner's Handbook and Programming Guide). If 0 is displayed the payment toggle is set to BEGIN. If 0 is not displayed it is in END mode.

The Sign Convention: Cash received (arrow pointing up) is represented by a positive value (+), and cash paid out (arrow pointing down) is represented by a negative value (−).

In our example, the $1,000 initial transaction (PV), and the periodic $50 payments would both be negative values. The amount received at the end of the time span would be positive.

The sign convention allows you to solve financial problems with 4 *or* 5 variables. (For instance, we shall soon solve for FV, given values for n, i, PV, and PMT.*) In fact, you can easily solve for any of the financial values above as long as you specify the values of at least three other financial variables.

Remember:

n = number of compounding periods
i = interest rate per compounding period
PV = present value
PMT = periodic payment
FV = future value
BEGIN = payments made at the beginning of the period
END = payments made at the end of the period

Now let's do the problem represented by the cash flow diagram and calculate the FV. Before beginning the calculation, one additional piece of information is necessary; the interest rate paid each compounding period. For this example let the interest rate be .75% per period (or 9% nominal interest). Remember, all cash that is paid out has a negative value.

Since the $50 payments are made at the end of each period, set the payment mode to END.

Keystrokes	**Display**	
XEQ ALPHA SIZE ALPHA 010	***SIZE 010***	
XEQ ALPHA FINANCE ALPHA	***0.00***	
gold E	***0.00***	Clear previous financial values.
gold C	***BEGIN***	
gold C	***END***	Press until you get the output shown.
6 A	***N=6.00***	
.75 B	***I=0.75***	

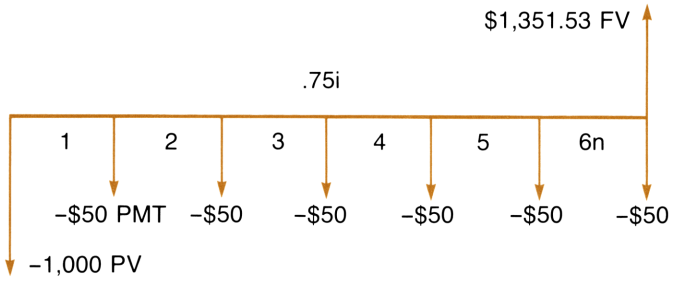
* Early financial calculators could handle only two of the three kinds of cashflows at a time. The sign did not need to be specified because the cash flows were necessarily of opposite sign (e.g. PV positive, PMT negative; or PV negative, FV positive). Since this program can handle three kinds of cash exchanges (PV, PMT, and FV) at a time, their direction is no longer obvious. Thus, the sign needs to be specified using the described sign convention.

Keystroke	Display	
1000 CHS C	***PV=-1,000.00***	Negative for cash paid out.
50 CHS D	***PMT=-50.00***	

The calculator now has all of the necessary information to solve for FV, which is the last key pressed.

Keystroke	Display	
E	***FV=1,351.53***	The calculated value is positive indicating we receive this amount.

As you can see, the functions on the top row keys and the signs of the values entered correspond precisely to the problem as represented by the cash flow diagram.



Suppose you wanted to increase your initial investment (PV) sufficiently to create an ending balance (FV) of $2,000 with the same interest rate, number of periods, and payments. What present value would be necessary?

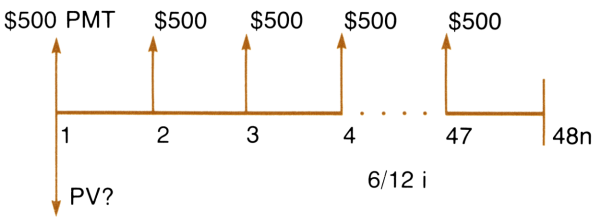
There is no need to start the entire problem over again. The n, i, and PMT are unchanged and therefore do not have to be reentered. The only value that needs to be entered is the new desired FV. Enter the FV and solve for PV.

Keystrokes	Display	
2000 E	***FV=2,000.00***	Desired cash receipt.
C	***PV=-1,620.04***	Necessary cash paid out.

Looking over our example we find that with only a few easy keystrokes we have solved problems that would have required a great deal of time had we attempted to answer them by evaluating the complex mathematical formulas involved. The program's power allows you to consider numerous investment alternatives while concerning yourself only with the underlying concepts and the practicality of the values used.

Let's try another problem. Suppose you are concerned about providing for your daughter's college education 14 years from today. You expect that the cost will be about $6,000 a year or about $500 a month. If you withdrew the monthly expenses for 4 years from a bank account paying 6% a year, compounded monthly, how much must you deposit in the bank at the start of the college years (PV) to make the monthly payments?

A cash flow diagram of the problem would look like the following:



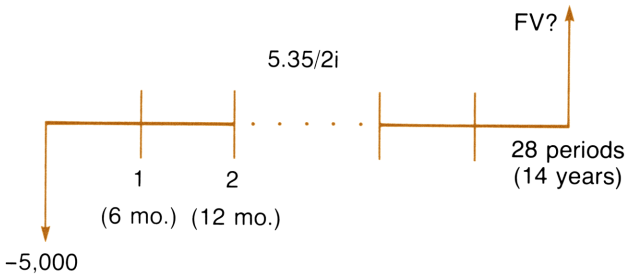
The periodic interest rate must correspond to the time span between payments (compounding periods), so you must divide the yearly rate (6%) by 12 in order to produce a monthly rate, i. As you can see from the diagram, the payments of $500 a month (PMT) start with the beginning of the time span; so you should set the payment to BEGIN. Since we are beginning a new problem, it is best to clear out any values remaining from the previous problem by pressing [f] [E].

Rather than multiplying 4 times 12 to get the proper number of compounding periods for n and dividing 6 by 12 for i, we can use a shortcut provided on the top row keys for making quick conversions from years and yearly rates to months and monthly rates.

Keystrokes	**Display**	
[f] [E]	***0.00***	Clears previous financial values.
[f] [C]	***BEGIN***	Press until you get the output shown.
6 [f] [B]	***I=0.50***	Calculate and enter interest rate per period.

Keystroke	Display	
4 [gold] [A]	***N=48.00***	Calculate and enter the number of compounding periods.
500 [D]	***PMT=500.00***	Amount received each period.
[C]	***PV=-21,396.61***	Total deposit required.

The next question we might ask is, "How do we accumulate such a sum by the time she enters college?" We have several possibilities. Your daughter has a $5,000 paid up insurance policy that pays 5.35% (nominal) a year compounded semiannually. How much would it be worth by the time she enters college?

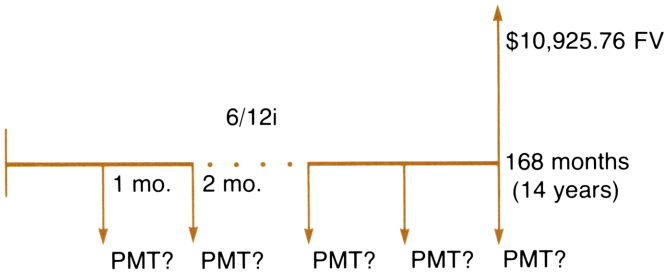


There are no payments so the BEGIN/END toggle has no effect. In this problem our compounding periods occur semiannually so the yearly rate must be divided in half to obtain i. The value of n is 14 years times 2 periods per year. This is another new problem, so be sure to clear previous financial entries.

Keystrokes	Display	
[gold] [E]	***0.00***	
14 [ENTER↑] 2 [×] [A]	***N=28.00***	Total number of periods.
5.35 [ENTER↑] 2 [÷] [B]	***I=2.68***	Periodic interest rate.
5000 [CHS] [C]	***PV=-5,000.00***	Deposited (a negative value).
[E]	***FV=10,470.85***	Value of policy.

The insurance policy will supply about half of the needed amount. An additional amount must be set aside to make up the $10,925.76 deficit (21,396.61

− 10,470.85). Beginning next month, if we made monthly payments into a special college account, how large would the payments have to be to accumulate the necessary future value of $10,926.76 in the 14 years remaining? Assume the account would pay 6% a year, compounded monthly.



Remember: n must always be the total number of compounding periods in the time span. i must always be the interest rate per compounding period.

Set the payment toggle to END.

Keystrokes	Display	
[gold] [E]	*0.00*	
[gold] [C]	*END*	Press until you get the output shown.
14 [gold] [A]	*N=168.00*	Automatically carries out the multiplication by 12 and stores the answer in n.
6 [gold] [B]	*I=0.50*	Divides by 12 and stores in i.
10925.76 [E]	*FV=10,925.76*	Future value desired.
[D]	*PMT=-41.65*	Necessary deposit each period (each month).

Note that we used [gold] [A] (12×) to automatically compute and store the value of n, and [gold] [B] (12÷) to automatically compute and store the value of i.

If we made the payment only $35 a month, how many months (n) would it be before we reached the desired amount?

Keystrokes	Display	
35 CHS D	*PMT=-35.00*	
A	*N=188.54*	Number of periods.

In order to find the number of years, divide by 12.

Keystrokes	Display	
12 ÷	*15.71*	Years.

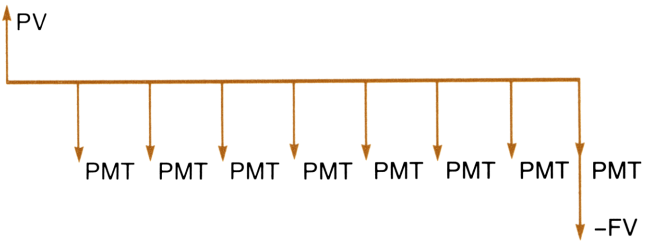
If, on the other hand, the monthly payment were increased to $45, with the 14-year term, the excess could be used as a contingency fund. For instance, with a $45 a month payment, what interest rate could the bank pay, while still enabling us to meet our goal?

Keystrokes	Display	
14 f A	*N=168.00*	Original term.
45 CHS D	*PMT=-45.00*	New monthly deposit.
B	*I=0.42*	Monthly interest rate.
12 ×	*5.01*	Nominal yearly interest rate.

Note that it was necessary to reenter the length of the original term. Our previous computation of n (188.54) was stored in the calculator and would have otherwise been used for the term of this calculation.

In the preceding sample problems, we have seen how cash flow diagrams can be useful in representing a wide range of compound interest problems, and how the diagrams can be translated directly into solutions using this program. The diagrams are helpful tools that describe complex business and financial problems in a manner suitable for calculation. In addition, the cash flow diagram can be applied in other ways to become a valuable aid.

As we are all too often aware, each segment of the business community has its own special vocabulary. When considering compound interest problems of the kind we have been discussing, there are often numerous terms used throughout the business world describing the same problem, but which are not familiar outside a particular area. For instance, this diagram:



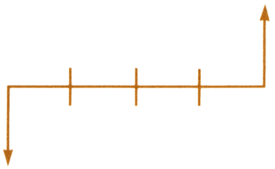
might represent a mortgage with a balloon payment in the terminology of the banking and real estate industries or a lease with a buy back (residual) in the leasing industry. There are probably many other terms in other industries as well as countries for describing this cash transaction. But regardless of the language, the essential problem is the same. By providing a means of describing business financial problems without using terminology specific to a particular segment, the cash flow diagram becomes, in a sense, a universal language.

The cash flow diagrams for four basic compound interest problems are presented in the following table along with some of the more common terminology.

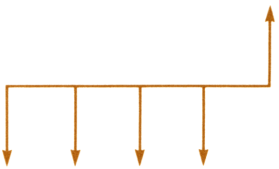
Some of the terms you see listed in the table may be familiar to you and some may not. There also may be diagrams represented that correspond to familiar transactions, but which do not bear familiar names. The important point to remember is that for financial calculations, it is the **magnitude** and **timing** of the cash exchanges represented by the cash flow diagram that are important, not the industry-dependent terminology.

Generalized Net Cash Flow Diagrams and Terminology

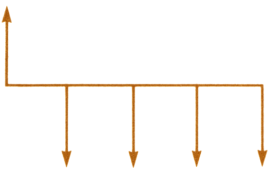
(Note that diagrams involving payments may be represented with payments at the beginning or end of the period.)



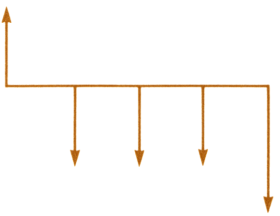
Compound Growth
Savings Account
Appreciation
Reversion Factor
Future Worth of One
Present Worth of One



Savings Plan
Sinking Fund
Pension Fund
Annuity (series of payments)



Mortgage
Lease
Direct Reduction (Installment) Loan
Amortization
Annuity



Mortgage w/Balloon (Residual)
Lease w/Buyback
Annuity

Summary

n	A	Number of periods.
i	B	Interest rate per period.
PV	C	Present value.
PMT	D	Payment.
FV	E	Future value.
12×	f A	Multiply by 12, store in n.
12÷	f B	Divide by 12, store in i.
LIST	f D	Displays the contents of the financial registers.
CL FIN	f E	Clears the financial registers.
BEG/END	f C	END for ordinary annuity or BEGIN for annuity due.

The Financial Registers

Registers 01 thru 05 are used to store n, i, PV, PMT and FV respectively. These are referred to in this program as the financial registers. To enter data into a financial register, simply key in the number and press the appropriate top row key. The financial keys either store or solve. If you key in a value, it will be stored, if you don't, the calculator will solve for that particular variable.

Displaying Financial Values

Any of the values associated with the financial registers can be recalled by pressing RCL followed by the appropriate key (e.g., RCL D will recall the PMT).

Clearing the Financial Registers

Each time you begin a new problem press f E (CL FIN) to erase previous financial values. When you press f E, the previous financial register values are replaced with zeros. If you want to change some, but not all, of the values in a financial problem, it is not necessary to press f E and reenter all of the values again. Simply key in the new data and press the appropriate financial keys to change particular financial values.

Reentering Values

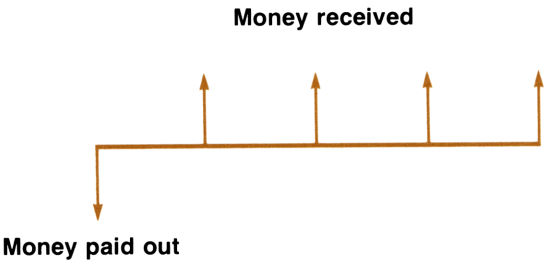
Once a value is stored in a particular register, it remains in the register for possible future use until it is either overwritten (replaced by another number) or the financial registers are cleared.

There are three ways to overwrite (and consequently change) values stored in the financial registers.

1. Pressing f E (CL FIN).
2. Keying in a different number and pressing the appropriate key. This stores the new value in the place of the original value.
3. Keying in a different number and pressing STO A ... STO E.

You can solve virtually any compound interest problem with your calculator by using a cash flow diagram. A cash flow diagram enables you to describe a compound interest problem in terms that the calculator can understand. Once you draw and label your diagram, you simply key in the known data and solve for an unknown value.

If the solution to your problem isn't evident at first, construct a cash flow diagram—a picture of money received and money paid out.



Once you've done this, label your diagram with all of the known data that pertains to the problem: interest rate, duration of the transaction, number of

compounding periods, payment amounts, amount of the loan or investment, etc. Instead of "What is the problem?" ask yourself, "What are the cash flows?"

Solving for any of the top row values (n, i, PV, PMT, or FV) is easy with your calculator. There are four simple rules to remember—rules that are the same for all compound interest calculations:

1. Given three or four of the financial values (n, i, PV, PMT, or FV), you can solve for the fourth and/or fifth values, as long as n and/or i are known. Both n and i are involved in all financial calculations. You can enter the values in any order.
2. Use the cash flow sign convention throughout all compound interest calculations: *Cash received (arrow pointing up) is represented by a positive value (+). Cash paid out (arrow pointing down) is represented by a negative value (−).*
3. Whenever payments (PMT) are involved, it is always necessary to specify whether the payments are made at the beginning of the payment period or whether the payments are made at the end of the payment period, by setting the payment toggle, [orange] [C], to the proper position BEGIN or END. (Remember, program is automatically in END after initialization.)
4. Remember that n and i must correspond to the same time frame. If n is months, then i must be the monthly interest rate; if n is the number of quarterly compounding periods, i must be the quarterly interest rate.

Remember, the n value represents the total number of compounding or payment periods. The alternate function, [orange] [A] converts yearly periods to monthly periods (12x) then automatically stores that number as n. To enter 30 years, press 30 [A]. If you wish to input that in monthly periods, press 30 [orange] [A]. The calculator converts 30 (years) to 360 (months) and stores it automatically as n. There is no need to press [A] again.

The i value is the interest rate per period. If interest is expressed as an annual rate compounding monthly, pressing [orange] [B] calculates the interest rate per month and automatically stores it as i. To enter 9% annual interest press 9 [B] To input the monthly rate, press 9 [orange] [B]. There is no need to press [B] again; the monthly rate is automatically stored.

The [C] key stands for present value;* the amount of money at the start of a transaction or the discounted amount of a future cash flow.

The [D] key stands for periodic payment* or deposit amount. It assumes equal periodic payments and must correspond to the same time frame as n or i.

* Remember the cash flow sign convention!

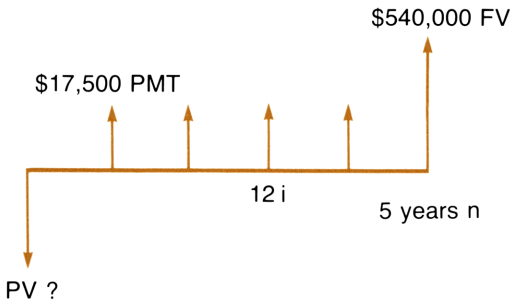
The [E] key represents the future value of money or the amount you will obtain/pay at the end of the term. Or you can use [E] to solve for a balloon payment at the end of a transaction.

				SIZE: 010
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module, place the overlay on the keyboard, execute Size and begin the program		[XEQ] SIZE 010 [XEQ] FINANCE	 0.00
2	Optional: Set payment mode for "Annuity Due" (BEGIN) or "Ordinary Annuity" (END). Repeat this step until you see the desired display. (Remember: Performing step 1 automatically sets END mode and clears the financial registers.) You may check flag annunciators to determine mode setting: flag 0 displayed (set) indicates BEGIN mode, no flag 0 display (cleared) indicates END mode.		[shift] [C]	BEGIN or END
3	Input the known values (any 3 or 4 values):			
	• Number of periods, n	n	[A]	N= (n)
	or n × 12	n	[shift] [A]	N= (n×12)
	• Interest rate (in %) per period, i	i	[B]	I= (i)
	or i ÷ 12	i	[shift] [B]	I= (i÷12)
	• Present value, PV*	PV	[C]	PV=
	• Payment, PMT*	PMT	[D]	PMT=
	• Future value, FV*	FV	[E]	FV=
4	Calculate the unknown value:			
	• Number of periods, n		[A]	N=
	• Interest rate per period, i		[B]	I=
	• Present value, PV*		[C]	PV=
	• Payment, PMT*		[D]	PMT=
	• Future value, FV*		[E]	FV=
	*Remember, the cash flow convention: Positive for money received, Negative for money paid out.			
5	Optional: List the contents of the financial registers.		[shift] [D] [R/S] * [R/S] * [R/S] *	BEGIN or END N= I= PV=
	*This [R/S] not necessary if calculator is used with a printer.		[R/S] * [R/S] *	PMT= FV=

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
6	For new values go to step 3 and input *only* the new values. Then proceed to step 4. OR			
7	For a new case: Clear the financial registers. Then go to step 2 or 3.		[■] [E]	0.00
8	To recall the contents of any of the financial registers:			
	• Recall number of payments, n		[RCL] [A]	n
	• Recall interest rate, i		[RCL] [B]	i
	• Recall present value, PV		[RCL] [C]	PV
	• Recall payment, PMT		[RCL] [D]	PMT
	• Recall future value, FV		[RCL] [E]	FV

Example 1:

A development company is purchasing a group of condominiums with an annual net cash flow of $17,500. The expected holding period is 5 years with an estimated selling price of $540,000 at that time. If the company wishes to realize a 12% yield, what is the maximum purchase price of the condominiums?

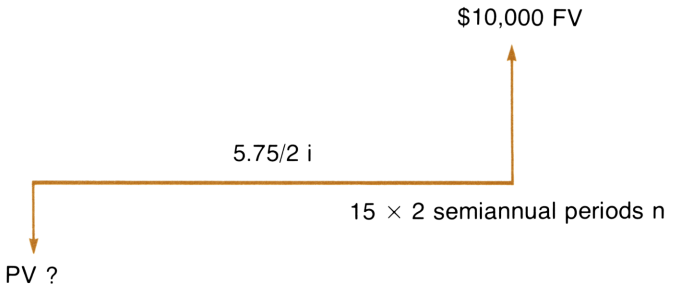


Keystrokes	Display	
[XEQ] [ALPHA] SIZE [ALPHA] 010	***SIZE 010***	
[XEQ] [ALPHA] FINANCE [ALPHA]	***0.00***	Payment mode is in END
5 [A]	***N=5.00***	
12 [B]	***I=12.00***	
17500 [D]	***PMT=17,500.00***	
540000 [E]	***FV=540,000.00***	
[C]	***PV=-369,494.09***	Amount that company can pay to realize a 12% yield.

In this case, PV represents the maximum price, $369,494.09 necessary to achieve the desired yield.

Example 2:

You look forward to retirement in 15 years and wish to deposit one lump sum which will grow to $10,000 at that time, earning 5¾% interest compounded semiannually. How much do you need to deposit today to reach that goal?



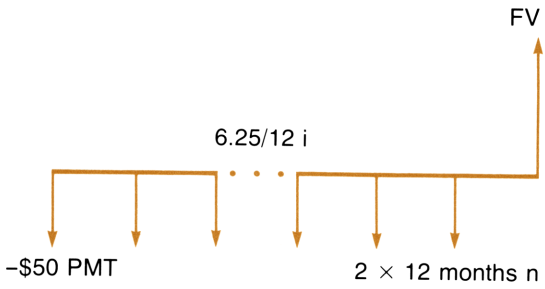
Keystrokes	Display	
[■] [E]	*0.00*	
15 [ENTER↑] 2 [×] [A]	*N=30.00*	Semiannual periods.
5.75 [ENTER↑] 2 [÷] [B]	*I=2.88*	% semiannual interest rate.
10000 [E]	*FV=10,000.00*	Amount needed.
[C]	*PV=-4,272.72*	Principal to be invested.

What if you also make semiannual deposits of $50?

50 [CHS] [D]	*PMT=-50.00*	Payment amount.
[C]	*PV=-3,276.67*	Principal to be invested.

Example 3:

If you can afford to deposit $50 per month (beginning today) in an account with 6¼% interest compounded monthly, how much will you have 2 years from now?



Set the payment toggle to BEGIN.

Keystrokes	Display	
[gold] [E] [gold] [C]	***0.00*** ***BEGIN***	Press until you get the output shown.
2 [gold] [A]	***N=24.00***	Months.
6.25 [gold] [B]	***I=0.52***	% monthly interest rate.
50 [CHS] [D]	***PMT=-50.00***	Monthly deposits.
[E]	***FV=1,281.34***	Savings.

If the interest rate remained the same, what monthly deposit amount would be necessary to have a savings of $1,500 in 2 years?

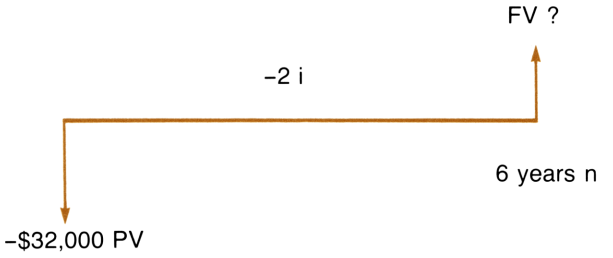
Keystrokes	Display	
1500 [E]	***FV=1,500.00***	
[D]	***PMT=-58.53***	Monthly deposit.

If you want to leave the deposit amount at $50 per month, how long would it take to accumulate $1,500?

Keystrokes	Display	
50 [CHS] [D]	***PMT=-50.00***	
[A]	***N=27.81***	Months.
12 [÷]	***2.32***	Years.

Example 4:

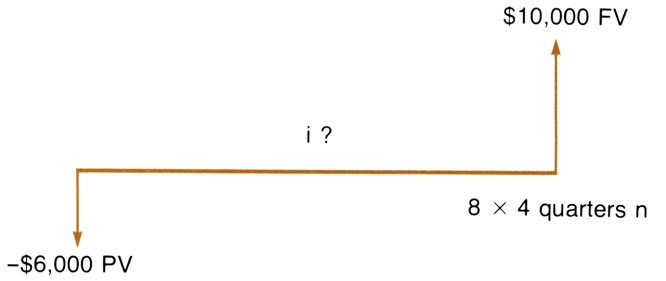
Property values in an unattractive area are declining at the rate of 2% per year. What will property presently valued at $32,000 be worth in 6 years if this trend continues?



Keystrokes	Display	
[f] [E]	*0.00*	
6 [A]	*N=6.00*	
2 [CHS] [B]	*I=-2.00*	% interest rate.
32000 [CHS] [C]	*PV=-32,000.00*	
[E]	*FV=28,346.96*	Property value.

Example 5:

What annual interest rate must be obtained to accumulate $10,000 in 8 years on an investment of $6,000, with quarterly compounding?



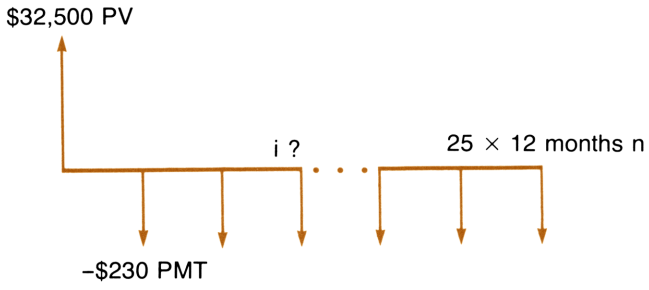
Keystrokes	Display	
[f] [E]	*0.00*	
8 [ENTER↑] 4 [×] [A]	*N=32.00*	Quarters.
6000 [CHS] [C]	*PV=-6,000.00*	Investment.
10000 [E]	*FV=10,000.00*	Total returned.
[B]	*I=1.61*	% quarterly interest rate.
4 [×]	*6.44*	% annual interest rate.

What if the compounding were monthly?

Keystrokes	Display	
8 [f] [A]	*N=96.00*	Months.
[B]	*I=0.53*	% monthly interest rate.
12 [×]	*6.40*	% annual interest rate.

Example 6:

What is the annual interest rate on a 25-year, $32,500 mortgage with $230 monthly payments?



Set the payment toggle to END.

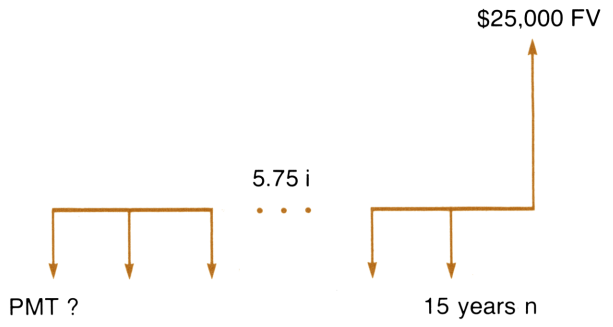
[gold] [E]	*0.00*	
[gold] [C]	*END*	Press until you get the output shown.
25 [gold] [A]	*N=300.00*	Months.
230 [CHS] [D]	*PMT=-230.00*	Remember the sign convention.
32500 [C]	*PV=32,500.00*	Mortgage amount
[B]	*I=0.58*	% monthly interest rate.
12 [×]	*7.01*	% annual interest rate.

What is the annual interest if there is a balloon payment of $14,000 at the end of the 20th year?

Keystrokes	**Display**	
14000 [CHS] [E]	*FV=-14,000.00*	Put balloon payment in FV.
20 [gold] [A]	*N=240.00*	Change the value in n.
[B]	*I=0.60*	% monthly interest rate.
12 [×]	*7.21*	% annual interest rate.

Example 7:

Calculate the annual payment amount necessary to accumulate $25,000 in 15 years at 5¾% annual interest.



Set the payment toggle to BEGIN.

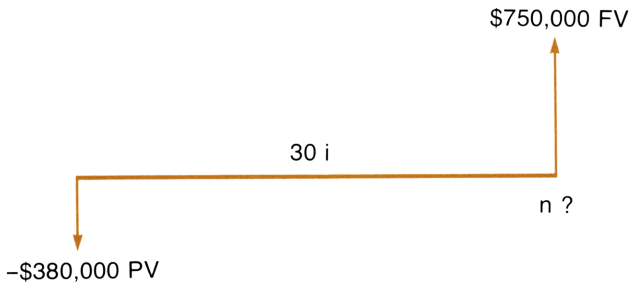
Keystrokes	Display	
[f] [E]	*0.00*	
[f] [C]	*BEGIN*	Press until you get the output shown.
15 [A]	*N=15.00*	
5.75 [B]	*I=5.75*	
25000 [E]	*FV=25,000.00*	
[D]	*PMT=-1,035.17*	

If your deposits are limited to $1,000 per year, how much will have accumulated over the same time period?

Keystrokes	Display
1000 [CHS] [D]	*PMT=-1,000.00*
[E]	*FV=24,150.72*

Example 8:

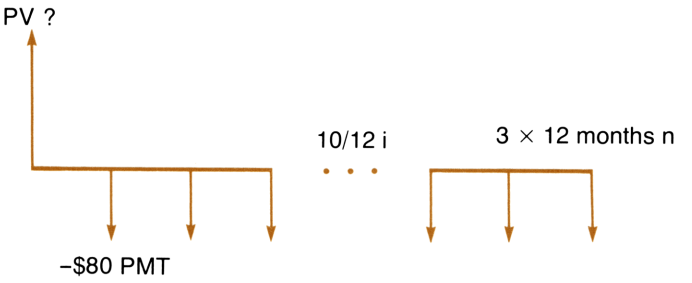
A potential oil field site currently appraised at $380,000 appreciates at 30% per year. If this rate continues, how many years will it be before this land is worth $750,000?



Keystrokes	Display	
[f] [E]	*0.00*	Clear financial registers.
30 [B]	*I=30.00*	
380000 [CHS] [C]	*PV=-380,000.00*	Remember the sign convention.
750000 [E]	*FV=750,000.00*	
[A]	*N=2.59*	Years.

Example 9:

You decide to purchase a snowmobile. If you plan to pay $80 per month for 3 years, and if you are willing to pay 10% annual interest, how much can you afford to pay for the snowmobile?



Set the payment toggle to END.

Keystrokes	Display	
[gold] [E]	*0.00*	
[gold] [C]	*END*	
3 [gold] [A]	*N=36.00*	Press until you get the output shown. Months.
10 [gold] [B]	*I=0.83*	% monthly interest rate.
80 [CHS] [D]	*PMT=-80.00*	Monthly payment
[C]	*PV=2,479.30*	Price you can afford for snowmobile.

Example 10:

Leaving the data from our last example in the calculator, what would your monthly payments be if you find a snowmobile for $2,150 and if the interest rate and duration of the transaction remain the same? Simply change the value in PV.

Keystrokes	Display	
2150 [C]	*PV=2,150.00*	
[D]	*PMT=-69.37*	Monthly payments.

Example 11:

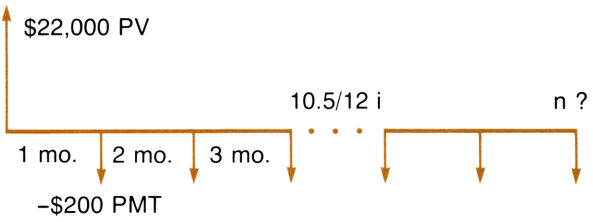
Find the monthly payment amount on a 20-year, $27,000 mortgage with an 8.5% annual interest rate.

The payment toggle is at END.

[f] [E]	*0.00*	
20 [f] [A]	*N=240.00*	Months.
8.5 [f] [B]	*I=0.71*	% monthly interest rate.
27000 [C]	*PV=27,000.00*	Loan amount.
[D]	*PMT=-234.31*	Monthly payment

Example 12:

You plan to invest in a $22,000 log cabin as a summer home. A local merchant has offered to loan the $22,000 at 10.5% interest. Making $200 monthly payments, how long will it take you to repay your mortgage?



The payment toggle is at END.

[f] [E]	*0.00*	
10.5 [f] [B]	*I=0.88*	% monthly interest rate.
200 [CHS] [D]	*PMT=-200.00*	Negative for money paid out.
22000 [C]	*PV=22,000.00*	Loan amount (received).
[A]	*N=376.89*	Months.
12 [÷]	*31.41*	Years.

We calculated 376.89 payment periods, but chances are, you wouldn't make the last payment separately on a fraction of a month. Let's calculate the fractional payment amount and add it to the regular payment to calculate, in essence, the balloon payment made in the 376^{th} month.

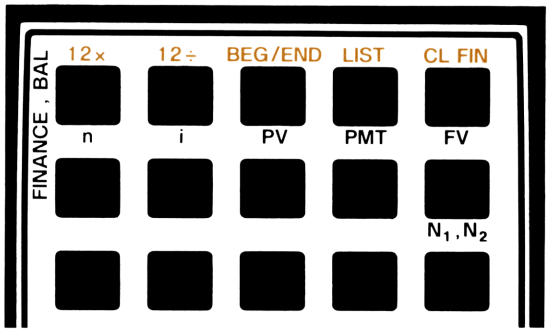
Keystrokes	Display	
376 [A]	*N=376.00*	Integer portion of number of periods
[E]	*FV=-175.88*	Remaining balance after 376 payments.
[RCL] [D]	*-200.00*	Regular payment amount.
[+]	*-375.88*	Balloon payment.

What if, instead of a balloon payment, you wanted to make a final short payment? Round the calculated n to the next larger integer, then press [E] (FV) to find the amount you should subtract from the payment amount.

(FV shows the amount that you would have overpaid, had you paid the full payment amount.)

Keystrokes	Display	
377 [A]	*N=377.00*	n rounded up to whole number.
[E]	*FV=22.58*	Amount to be subtracted from payment.
[RCL] [D]	*-200.00*	Payment amount.
[+]	*-177.42*	Final short payment.

ACCUMULATED INTEREST AND REMAINING BALANCE



One is often interested in obtaining the remaining balance to be paid on a loan at some particular time. Other values of interest are the accumulated principal and the accumulated interest as well as the incremental interest, i.e., the amount of interest paid between two payment periods.

This program provides convenient calculation of these values. It uses routines in the Finance program to calculate the periodic payment or other unknown loan variables. After this data has been calculated the user inputs the number of the first payment period and the number of the last payment period in the time frame of interest and obtains, in sequence: the remaining balance of the loan, the total principal paid toward the loan and the total interest paid on the loan.

In addition the interest paid between any two periods may be calculated. This is particularly valuable, for instance, for income tax deductions of the interest paid on mortgages.

The program calculates results using a periodic payment rounded to the nearest cent. This usually corresponds to the manner in which actual payments are made. However, if you compare your answers with statements of savings and loan institutions you may find differences of a few cents, due to different rounding techniques.

Note:

- Use this program only for calculations using the "END" payment mode.
- Displayed values of remaining balance, principal and interest are positive, (without regard to the sign convention).

SIZE:011

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Insert the application module, place the overlay on the keyboard; execute Size and begin the program.		XEQ SIZE 011 XEQ BAL	REM BAL
2†	Clear the financial registers and set the payment mode for ordinary annuity (END). (Repeat until you get "END"). NOTE: Do not use with "BEGIN" payment mode.		f E f C	0.00 END
3†	Input any 3 or 4 of the following values:			
	• Number of periods, n	n	A	N= (n)
	or n × 12	n	f A	N= (n ×12)
	• Interest rate (in %) per period,i	i	B	I= (i)
	or i ÷ 12	i	f B	I= (i÷12)
	• Present Value, PV	PV	C	PV=
	• Payment, PMT	PMT	D	PMT=
	• Future Value or balance, FV	FV	E	FV=
4†	Calculate the unknown value:			
	• Number of periods, n		A	N=
	• Interest rate (in %) per period, I		B	I=
	• Present Value, PV		C	PV=
	• Payment, PMT		D	PMT=
	• Future Value or balance, FV		E	FV=
5	Initialize the Remaining Balance routine by keying in the number of the first payment period in the time frame of interest. (Input 0 if the first period of interest begins on the date of the loan).	n_1	J	N= (n_1)
6	Input the number of the last payment period in the time frame of interest and obtain the remaining balance of the loan, the total accumulated principal and total accumulated interest paid on the loan. The incremental interest between the two periods will also be displayed if n_1 was other than zero.	n_2	R/S * R/S R/S * R/S * R/S * R/S *	N= ? N= (n_2) REM BAL= ΣPRIN= ΣINT= INCREM INT=

†See the program "Your Financial Calculator" for complete details concerning steps 2, 3 and 4. These steps need not be repeated if they have just been performed for the problem in question.

*This R/S not needed if calculator is used with a printer.

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
7	For the next period of interest, input payment period and repeat.	n_3	R/S	N=(n_3)
7a	To start again at the beginning of the loan go to step 5 and input 0.			(go to step 8)
7b	To start again at some other period go to step 5 and input the number of the first payment period of interest for n.	n_1	R/S * R/S	N=? N=(n_1)
8	For a new loan or other financial calculations go to step 2.			
	*This R/S not needed if calculator is used with a printer.			

Example:

Suppose you decide to sell your house after owning it for 4 years, 7 months. If you have a 9¼%, $35,000 mortgage and you've made monthly payments of $287.94, what is the remaining balance of your mortgage? How much have you paid toward the principal? How much total interest have you paid?

Keystrokes	Display	
XEQ ALPHA SIZE ALPHA 011	*SIZE 011*	
XEQ ALPHA BAL ALPHA	*REM BAL*	
f E	*0.00*	
f C	*BEGIN*	Repeat this step
f C	*END*	until you get END.
9.25 f B	*I=0.77*	
35000 C	*PV=35,000*	
287.94 CHS D	*PMT=-287.94*	Observe sign convention.
A	*N=359.98*	Original length of loan 360 periods (or 30 years).
0 J	*N=0.00*	
R/S	*N=?*	
4 ENTER↑ 12 × 7 + R/S	*N=55.00*	Sold at end of 55 periods.
R/S	*REM BAL=33,762.74*	
R/S	*ΣPRIN=1,237.26*	
R/S	*ΣINT=14,599.44*	

Review the remaining balance, accumulated principal and accumulated interest for each 6 month period from the 36^{th} through the 48^{th} payments.

36 J	*N=36.00*
R/S	*N=?*
42 R/S	*N=42.00*
R/S	*REM BAL=34,103.95*
R/S	*ΣPRIN=896.05*
R/S	*ΣINT=11,197.43*
R/S	*INCREM INT=1,581.28*
R/S	*N=?*
48 R/S	*N=48.00*
R/S	*REM BAL=33,950.70*
R/S	*ΣPRIN=1,049.30*
R/S	*ΣINT=12,771.82*
R/S	*INCREM INT=1,574.38*

HOME OWNER'S EQUITY ANALYSIS

This program is designed to provide the home owner or purchaser of real estate with useful information on future monthly payments, accumulated equity and tax deductions. The user inputs the purchase price and down payment along with the interest rate and length (term) of the mortgage. The program calculates and displays the basic monthly payment.

Further inputs include the expected percent appreciation or depreciation in value per year and the number of months remaining in the tax year. The total dollar amount of property taxes and the anticipated yearly percent increase in taxes are then input.

The program provides, for each year of ownership, the estimated monthly payment (covering mortgage payments and taxes), the total accumulated equity in the property and the tax deduction due to interest and property taxes for the year.

				SIZE: 019
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module, execute Size and begin the program.		XEQ SIZE 019 XEQ HOME	 PRICE=?
2	Input the price of the home, and the down payment.	Price Down Payment	R/S R/S	DOWN=? % INT=?
3	Input the mortgage interest rate (in percent per year) and the term of the mortgage in years. The monthly payment to amortize the mortgage is displayed.	INT (%) Term (yrs)	R/S R/S	TERM=? MORT PMT=
4	Input the anticipated yearly appreciation in value of the house (as a /), and the number of months remaining in the tax year at the time of purchase.	 Apprec (%) Mon. rem.	R/S * R/S R/S	%APPR=? MONTHS=? TAXES=?
5	Input the annual taxes on the property at the time of purchase and the expected percent increase or decrease in taxes each year.	Taxes ($) Exp Inc (%)	R/S	% INC=?
6	Calculate and display the following information for the year of purchase (first year): Monthly payment Total equity Total tax deductions Appreciated value of the property		R/S R/S * R/S * R/S * R/S *	YEAR 1 MON PMT= TOT EQUITY= TOT DED= VALUE=

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
7	For succeeding years press R/S and go to step 6. Repeat as desired.		R/S	YEAR 2
8	For a new case, go to step 1. *This R/S not necessary if calculator is used with a printer.			

Example:

A family is contemplating purchase of a new home priced at $62,500. They will be able to pay $9,500 as a down payment and can obtain a 30 year mortgage loan for the balance at 9.75% interest. Property values in the area have been appreciating at about 8% per year. Property taxes for the current year are $1050 and have been increasing at the rate of about 4% per year. The buyer will take possession of the house with 10 months remaining in the tax year. What is the basic mortgage payment? Calculate the expected total monthly payments, total equity in the property and income tax deductibles for years 1 through 3 of the mortgage.

Keystrokes	Display	
XEQ ALPHA SIZE ALPHA 019	*SIZE 019*	
XEQ ALPHA HOME ALPHA	*PRICE=?*	
62500 R/S	*DOWN=?*	
9500 R/S	*% INT=?*	
9.75 R/S	*TERM=?*	
30 R/S	*MORT PMT=455.35*	
R/S	*% APPR=?*	
8 R/S	*MONTHS=?*	
10 R/S	*TAXES=?*	
1050 R/S	*% INC=?*	
4 R/S	*YEAR 1*	
R/S	*MON PMT=542.85*	(Remaining 10 months)
R/S	*TOT EQUITY= 13,923.16*	
R/S	*TOT DED=5,172.01*	
R/S	*VALUE=66,666.67*	

Keystroke	Display
R/S	*YEAR 2*
R/S	*MON PMT=546.35*
R/S	*TOT EQUITY= 19,592.97*
R/S	*TOT DED=6,219.72*
R/S	*VALUE=72,000.00*
R/S	*YEAR 3*
R/S	*MON PMT=549.99*
R/S	*TOT EQUITY= 25,723.76*
R/S	*TOT DED=6,229.09*
R/S	*VALUE=77,760.00*

THE RENT OR BUY DECISION

The question of whether to rent or purchase a residence is not always easy to answer, especially when the time period over which you would own or rent the house is short. This program is designed to help in reaching a decision by performing one type of financial analysis which could be helpful. In essence, it calculates a yield or rate of return on the hypothetical investment assuming an estimated resale value, and compares this yield with that which could be obtained by renting a residence and investing the down payment and monthly payment difference in a savings account or some other investment opportunity.

The program takes into account the tax shelter advantages obtained by a home owner on property taxes and mortgage interest.

The user inputs the price of the house, down payment and other mortgage data. The program calculates the monthly mortgage payment. The time period involved and the expected rate of appreciation of the house are input and an anticipated market value is calculated. After input of the real estate commission paid upon selling the house, the program displays the Net Cash Proceeds upon Resale, (NCPR).†

The closing costs are input and the user is then prompted for the percent income tax rate. The user should input the total marginal income tax rate —federal plus state—to obtain calculations that reflect the effect of the tax shelter on property taxes and mortgage interest.*

Further inputs call for monthly property taxes, estimated monthly maintenance expenses and the rent which would have to be paid for a satisfactory alternative residence.

The program then calculates the annual percent yield on the investment in the house. Inputting the % interest one could obtain on an alternate investment yields the actual cash gain or loss on the investment in the house.

In addition, one may calculate the actual market value and annual percent appreciation which would be necessary to equal the proceeds of the alternate investment.

† The Net Cash Proceeds on Resale (NCPR = sales price − commission − mortgage balance), is pre-tax proceeds. The program assumes that the buyer reinvests in like property and is then not subject to capital gains tax.

* Because of the complexities of tax laws and the differing financial and tax considerations for each individual, this program serves only as an approximate, rough guide in considering an investment of this type. One should consult a tax accountant or qualified tax advisor for more specific, detailed information.

SIZE: 018

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Insert the application module, execute Size and begin the program.		XEQ SIZE 018 XEQ BUY?	PRICE=?
2	Input the price of the house, the down payment, the percent interest (yearly) on the mortgage, and the term of the mortgage (in years). The monthly mortgage payment is calculated and displayed.	PRICE DOWN PMT % INT TERM	R/S R/S R/S R/S	DOWN=? % INT=? TERM=? MORT PMT=
3	Input the number of years you intend to occupy the house and the expected appreciation in value of the house (% annually). The anticipated resale value at the end of occupancy is displayed.	 YEARS % APPR	R/S * R/S R/S	YRS=? % APPR=? MKT VAL=
4	Input the percent commission (zero if no commission) charged by the real estate agency to sell the house. The Net Cash Proceeds on Resale (NCPR) of the house are displayed.	 % COMM	R/S * R/S	%COMM=? NCPR=
5	Input the closing costs paid on purchase of the house.	 CLOSING COST	R/S * R/S	CLOSE=? TAX RATE=?
6	Input your marginal income tax rate (federal + state), in percent.	% TAX	R/S	TAXES=?
7	Input the anticipated monthly property taxes on the house and the anticipated monthly cost of maintenance.	TAXES MAINT	R/S R/S	MAINT=? RENT=?
8	Input the monthly rent for an acceptable alternative residence. The annual rate of return on your investment in the house is calculated and displayed.	RENT	R/S	% ANN YLD=
9	Input the rate of interest (annual %) available to you if you were to invest the money in some form of savings. The display will show the total dollar gain (if positive) or loss (if negative) from buying a house as compared to renting. *This R/S not necessary if calculator is used with a printer.	 % INT	R/S * R/S	BANK % INT=? $GAIN=

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	Comparison (optional):			
10	Calculate the market value of the house at which you would obtain the same annual return as on the investment at step 9.		R/S R/S *	MKT VAL=
11	Calculate the yearly % appreciation at which you would obtain this value.		R/S *	% APPR=

Example:

You are being transferred for 4 years to a distant city and are faced with the decision of whether to rent or buy a house. A quick survey of the housing market indicates that you can purchase an acceptable house for $65,000 with an $8,000 down payment on a 30 year mortgage at 10.5% interest. The closing costs would be about $800 and a real estate agency would charge 6% commission on resale. Houses in the area are appreciating at 10% per year. Property taxes would be about $110 per month and you estimate that maintenance would cost an additional $70 per month.

An alternative would be to rent a similar dwelling at $400 per month and invest the difference between purchase costs and rent at 8.25% interest.

Your personal income tax rate (marginal) is 25% federal and 5% state. Which alternative is more financially attractive?

Keystrokes	Display
XEQ ALPHA SIZE ALPHA 018	*SIZE 018*
XEQ ALPHA BUY? ALPHA	*PRICE=?*
65000 R/S	*DOWN=?*
8000 R/S	*% INT=?*
10.5 R/S	*TERM=?*
30 R/S	*MORT PMT=521.40*
R/S	*YRS=?*
4 R/S	*% APPR=?*
10 R/S	*MKT VAL=95,166.50*
R/S	*% COMM=?*

Keystroke	Display
6 R/S	*NCPR=33,800.45*
R/S	*CLOSE=?*
800 R/S	*TAX RATE=?*
30 R/S	*TAXES=?*
110 R/S	*MAINT=?*
70 R/S	*RENT=?*
400 R/S	*% ANN YLD=25.31*
R/S	*BANK % INT=?*
8.25 R/S	*$ GAIN=14,755.47*

(By purchasing the house you will have gained $14,755.47 over an alternate investment at 8.25% interest.)

R/S R/S	*MKT VAL=79,469.19*
R/S	*% APPR=5.15*

(To obtain the same return as the alternate investment the house would have had to appreciate only 5.15% or obtain a market value of $79,469.19.)

TAX FREE INDIVIDUAL RETIREMENT ACCOUNT (IRA) OR KEOGH PLANNING

The advent of tax free retirement accounts (IRA or Keogh plan) has resulted in major benefits for many persons who are not able to participate in group profit sharing or retirement plans. The savings due to the tax free status are considerable. However, comparing the expected future value of an account with alternative plans or with a taxable account, and forecasting diminished dollar value due to inflation is often complex and difficult. This program provides the HP-41C owner a convenient tool for comparison and investigation of alternatives.

The data required by the program are: 1) the number of years to retirement, 2) the amount of the annual investment, 3) the compound annual interest rate of the investment, 4) an assumed tax rate (maximum tax bracket) that would be paid on a similar taxable investment, and 5) an assumed annual rate of inflation.

The program provides you with:

1. The total amount you will have paid into the account at retirement.
2. The total future value (before taxes) of the investment at your retirement.
3. The total amount of the dividends earned by your investment.
4. The total after-tax future value of your investment fund at retirement, assuming a given tax rate upon withdrawal.
5. The future purchasing power, at retirement, due to inflation-diminished value of the funds.

In addition the program provides, for comparison:

6. The future value of a comparable taxable investment (taxable at your designated tax rate), and
7. The diminished purchasing power of this investment due to inflation.

Notes:

- The calculations are made on the basis of equal payments made at the beginning of each year with the investment available at the end of the final year.
- For maximum accuracy, input the interest (annual yield) to as many decimal places as possible.
- The total after-tax future value at retirement (4, above) is the value, after taxes, of the fund at retirement, assuming that it is taxable at a chosen, input tax rate. It does not take into account additional dividends earned after retirement on the remaining balance.

				SIZE:013
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module, execute Size and begin the IRA/ Keogh program.		XEQ SIZE 013 XEQ IRA	ANN PMT=?
2	Input the annual investment or payment.	PMT	R/S	YRS TO RET=?
3	Input the number of years till retirement.	YRS	R/S	% INT=?
4	Input the percent annual interest (or yield) on your investment and calculate the total amount you paid in, followed by the future value of the tax free (IRA or Keogh) investment at the time of your retirement, followed by the total dividends earned by your investment.	INT (%)	R/S R/S * R/S *	TOT PAID IN= TAX FREE INV FV= TOT DIV=
5	Input your current income tax rate (maximum surcharge rate) and the tax rate at which you expect withdrawals to be taxed after retirement and calculate the future value of your investment when taxed at your retirement tax rate.	 %TAX(NOW) %TAX(RET.)	R/S * R/S R/S	% TAX NOW=? RETIRED=? FV aRET TAX=
6	Input the expected annual rate of inflation over the investment period and calculate the diminished purchasing power of your investment.	 %INFLAT	R/S * R/S	% INFLAT=? DIM FV=
7	Calculate the future value of a comparable investment, taxable at the designated rate, and the diminished purchasing power (due to inflation) of this investment.		R/S *	DIM FV=
8	For a new case go to step 1. *This R/S not necessary if calculator used with printer.			

Example:

Assume that you plan to retire in 35 years. You would like to invest $1500 each year in a tax-free IRA account on which you can receive a dividend rate of 8.175%. Your maximum tax rate is 40%. What will be the fund's value at retirement? How much will you have paid in and how much will be dividends? If at retirement, the money is taxable at ½ the present rate, what is the after tax amount? Assuming a 7% annual rate of inflation what will be the actual purchasing power of the after tax amount? Find the comparable values for an ordinary taxable investment.

Keystrokes	Display
XEQ ALPHA SIZE ALPHA 013	*SIZE 013*
XEQ ALPHA IRA ALPHA	*ANN PMT=?*
1500 R/S	*YRS TO RET=?*
35 R/S	*% INT=?*
8.175 R/S	*TOT PAID IN=*
	52,500.00
R/S	*TAX FREE INV*
	FV=290,730.34
R/S	*TOT DIV=238,230.34*
R/S	*% TAX*
	NOW=?
40 R/S	*RETIRED=?*
20 R/S	*FV aRET TAX=*
	232,584.27
R/S	*% INFLAT=?*
7 R/S	*DIM FV=21,784.53*
R/S	*TAXABLE INV*
	FV=83,616.05
R/S	*DIM FV=7,831.73*

THE TRUE COST OF AN INSURANCE POLICY

The true cost of an insurance policy other than term life insurance is rarely immediately apparent. The cost should include not only the premium payments but also the extra interest which could have been earned on the cash value or "savings portion" of the policy.

This program calculates the true cost per $1000 of life insurance protection for comparison with term life insurance and also calculates the true percent interest paid by the insurance on the "cash value", or savings portion, of the policy.

Even complex policies such as minimum deposit plans can be analyzed in this manner using policy surrender values for cash values, and the actual (after tax) amounts for payments (premiums) and dividends.

Required data are:

1. The face amount (total death benefit) of the policy.
2. The annual premium for the policy year.
3. The dividend (if any) for the year.
4. The cash values (if any) at the beginning and at the end of the year.
5. An interest rate available to you on money in some alternate form of investment; savings account, one-year savings certificate, etc.
6. The cost per $1000 for alternative term (or other low cost) insurance, i.e., term policy of one year renewable type, etc.

Reference:

Belth, J.M., *Life Insurance–a Consumers Handbook,* Indiana University Press, 1973, p. 234.

				SIZE: 008
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	Insert the application module, execute Size and begin the "Insurance" program		XEQ SIZE 008 XEQ INS	AMT=?
2	Input the face amount of the policy.	AMT	R/S	DIV=?
3	Input the dividend to be received at the end of the current policy year.	DIV	R/S	PREM=?
4	Input the annual premium paid at the beginning of the policy year.	PREM	R/S	CASH VAL BEG=?

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
5	Input the cash value at the beginning of the year and the cash value at the end of the year.	C.V. BEG C.V. END	R/S R/S	CASH VAL END=? % INT=?
6	To calculate the true cost per $1000 of the insurance, input the interest rate that could be earned on the cash value.	%INT	R/S	TRUE COST=$ /THOU
7	To calculate the rate of interest being paid on the savings element of the policy, input the cost per $1000 of a term policy.	COST/THOU	R/S * R/S	TERM COST/THOU=? % INT=
8	For a new case go to step 1.			
	*This R/S not necessary if calculator is used with printer.			

Example:

You have a $50,000 face amount cash value policy. The premium of $1,010 is due at the beginning of the year, and a dividend of $165 is received at the end of the policy year. A cash value of $3,302 at the beginning of the year grows to $4,104.

Assuming that you can receive 6% interest on a savings account and that insurance protection is available in the form of term insurance at $3.00 per $1,000 of protection, what is the true cost per $1,000 of your policy and what is the rate of return on the savings portion of the policy?

Keystrokes	Display
XEQ ALPHA SIZE ALPHA 008	*SIZE 008*
XEQ ALPHA INS ALPHA	*AMT=?*
50000 R/S	*DIV=?*
165 R/S	*PREM=?*
1010 R/S	*CASH VAL BEG=?*
3302 R/S	*CASH VAL END=?*
4104 R/S	*% INT=?*
6 R/S	*TRUE COST=$6.57*
	/THOU
R/S	*TERM*
	COST/THOU=?
3 R/S	*% INT=2.20*

Appendix A

PROGRAM DATA

Program	# Regs. to Copy	Data Registers	Flags	Display Format
Home Budgeting	95	00-62	00-02,21,22,27,28,29	FIX 2
Travel Expense Record	68	00-62	00-01,12,21,22,27,28,29	FIX 2
Stock Portfolio Evaluation	99	00-62	01,12,21,23,27,28,29	FIX 2
Checking Account Reconciliation	35	00-06	21,22,27,28,29	FIX 2
Your Financial Calculator	88	00-09	00,21,22,27,28,29	FIX 2
Accumulated Interest and Remaining Balance	88	00-10	00,02,21,22,27,28,29	FIX 2
Home Owner's Equity Analysis	41	00-18	00,03,05,21,27,28,29	FIX 2
The Rent or Buy Decision	38	00-17	05,21,27,28,29	FIX 2
Tax Free Individual Retirement Account (IRA) or Keogh Planning	36	00-14	00,02,21,27,28,29	FIX 2
True Cost of an Insurance Policy	25	00-07	21,27,28,29	FIX 2
Store and Reload	17	00-125	21,25	N.A.
Utilities (※,※0,CL)	11	00-62	00-04,21,27,28,29	FIX 2

Appendix B

STORAGE OF DATA

The Home Budget, Travel Expense Record and Stock Portfolio Evaluation programs record a large amount of data which should be preserved for maximum usefulness. Execution of other programs will destroy this data, therefore for maximum utility it should be stored elsewhere.

Two methods of data storage are provided:

1. Permanent storage on magnetic data cards, or

2. Temporary internal storage on an additional memory module in the calculator.

Data Card Storage:

The Model 82104A Card Reader allows convenient permanent storage of data on magnetic cards. The data may be stored or reloaded in a few seconds using User Instructions in the text of each program. This is the preferred method of storage for permanent storage without restrictions on the use of the calculator.

Temporary Internal Storage:

During use of the programs data is stored in registers 00 through 62. Execution of other programs which use any of these data storage registers will destroy the data. The "STORE" routine transfers all the data stored in registers 00 through 62 to registers 63 through 125 on an additional HP 82105A memory module. After execution of "STORE" any of the programs in the Home Management module as well as many other programs may be used at will, and the data can later be recalled intact. Note however:

1. Sufficient additional memory registers must be present in the HP-41C to allow execution of SIZE: 126. (At least one additional memory module is required.)

2. No program containing a clear register (CLRG) command may be used, nor may any program using registers above 62 (SIZE: 064 or higher).

3. The user must maintain data register allocation at SIZE: 126 or higher at all times while the data is being stored.

The data can be reloaded intact into registers 00-62 by executing "RELOAD."

				SIZE: 126
STEP	**INSTRUCTIONS**	**INPUT**	**FUNCTION**	**DISPLAY**
1	**To Store Data:** Allocate 126 memory registers to data storage.		XEQ SIZE 126	SIZE 126
2	Begin storage routine.		XEQ STORE	
3	If size has not been properly allocated, program prompts.			SIZE>=126
3a	User must allocate proper size (see step 1).		XEQ SIZE 126 R/S	SIZE 126
4	When data is stored display shows:			STORED
	To Reload Data:			
5	Execute the reloading routine.		XEQ RELOAD	RELOADED

Appendix C

FORMULAS

Your Financial Calculator

$$-PV = \frac{PMT}{i} A\left[1 - (1 + i)^{-n}\right] + (BAL \text{ or } FV)(1 + i)^{-n}$$

where $A = \begin{cases} 1 & \text{ordinary annuity} \\ (1 + i) & \text{annuity due} \end{cases}$

n = number of periods

i = periodic interest rate

PV = present value

PMT = periodic payment

FV = future value

BAL = balance

Accumulated Interest and Remaining Balance

$$BAL_k = \frac{1}{(1 + i)^{-k}}\left[PMT \frac{(1 + i)^{-k} - 1}{i} + PV\right]$$

$$Int_{j-k} = BAL_k - BAL_{j-1} + (k - J + 1) \cdot PMT$$

$$\Sigma PRIN = \sum_{j=kl}^{k2} PRIN_j$$

where:

k^{th} payment to principal = $BAL_{k-1} - BAL_k$

k^{th} payment to interest = $PMT - (BAL_{k-1} - BAL_k)$

Total payment to interest = $(k) \times (PMT) - (PV - VAL_k)$

ΣPRIN = accumulated principal from k1 to k2 inclusive

Home Owner's Equity Analysis

MON PMT = MORT PMT + Taxes/month

Tot. Equity = Down PMT + Accum. Principal + Appreciation

Tot. Deductible = Interest + Taxes (per year)

where:

MON PMT = monthly payment
MORT PMT = mortgage payment

The Rent or Buy Decision

$$\text{MKT VAL}_n = \frac{\text{MKL VAL}_0}{(1 + i)^{-n}}$$

where:

MKT VAL_n = market value at year n

n = number of years

i = % appreciation per year

$\text{NCPR} = \text{MKT VAL}_n - \text{BAL}_n - \text{COMM}$

where:

NCPR = Net Cash Proceeds on Resale

BAL_n = remaining mortgage balance at resale

COMM = real estate commission paid upon resale

% ANN YLD = Annual Interest Rate

where the annual interest rate is obtained by solving the financial (annuity and compound amounts) equation for i using:

n = number of years house is owned

PV = down payment + closing costs upon purchase

PMT = MORT PMT + TAXES + MAINT − RENT
− (% TAX) (Mort. Int./mon + Taxes)

FV = NCPR

Annual Interest Rate = 12xi

% TAX = total marginal tax rate expressed as a decimal percent.

Tax Free Individual Retirement Account or Keogh Planning

For ordinary taxable investment:

$$\text{FV} = \frac{-\text{PMT}\left[1 + i(1 - \%\text{TAX})\right]}{i}\left[\left[1 + i(1 - \%\,\text{TAX})\right]^n - 1\right]$$

For tax free investment:

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

Note:

sign convention, payments are negative (cash out)
future value is positive (cash received)

Paid-in cash = $-n(PMT)$

Total dividends = FV − Paid-in cash

After Tax FV at retirement = FV(1 − % Tax)

where % Tax is decimal tax rate after retirement

$$\text{Diminished FV due to inflation} = \frac{\text{After Tax FV}}{(1 + \%\ \text{inf})^n}$$

True Cost of an Insurance Policy

$$YPT_t = \frac{(P_t + V_t - 1)(1+i) - V_t - D_t}{(F_t - V_t)(.001)}$$

$$i = \frac{V_t + D_t + (YPT_t)(F_t - V_t)(.001)}{P_t + V_t - 1} - 1$$

where:

YPT_t = price per $1,000 of protection in policy year t

P_t = annual premium for policy year t

V_t = cash value for policy year t

D_t = dividend for policy year t

F_t = face amount for policy year t

i = rate of return on savings element, expressed as a decimal (after-tax)

(note that in using the program, i is expressed in percent)

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