HEWLETT-PACKARD

HP-67/HP-97

Business Decisions Pac

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

HEWLETT hp PACKARD

WE NEED YOUR HELP

To provide better calculator support for people like you, we need your help. Your timely inputs will enable us to provide high quality software in the future and improve the existing application pacs for your calculator. Your early 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. Did you buy this pac and your calculator at the same time? ☐ Yes ☐ No

4. In deciding to buy this application pac, which three programs seemed most useful to you? Program numbers 1._____ 2._____ 3._____

5. Which three programs in this application pac seemed least useful to you? Program numbers 1._____ 2._____ 3._____

6. What program(s) would you add to this pac?

_____

_____

_____

7. In the list below, select up to three application areas for which you purchased this pac. Please indicate the order of importance by 1, 2, 3, (1 represents the most important area).

Engineering
- ___ 01 Chemical
- ___ 02 Civil/Structural
- ___ 03 Electrical/Electronic
- ___ 04 Industrial
- ___ 05 Mechanical
- ___ 06 Surveying
- ___ 10 Other (Specify) _____

Science
- ___ 31 Biology
- ___ 32 Chemistry
- ___ 33 Earth Sciences
- ___ 34 Mathematics
- ___ 35 Medical Sciences
- ___ 36 Physics
- ___ 37 Statistics
- ___ 39 Other (Specify) _____

Business
- ___ 51 Accounting
- ___ 52 Banking
- ___ 53 Insurance
- ___ 54 Investment Analysis
- ___ 55 Real Estate
- ___ 56 Securities
- ___ 57 Sales
- ___ 58 Marketing
- ___ 59 Other (Specify) _____

Other
- ___ 71 Architecture
- ___ 72 Aviation
- ___ 73 Computer Science
- ___ 74 Education
- ___ 75 Navigation
- ___ 79 Other (Specify) _____

Thank you for your time and cooperation.

Name _____ Date _____

Address _____

City _____ State _____

Zip _____ Phone _____

Please fold and staple for mailing.

Additional Comments:

FIRST CLASS
Permit No.
33
Corvallis,
Oregon

BUSINESS REPLY MAIL

No postage stamp is necessary if mailed in United States

Postage will be paid by:

Hewlett-Packard
1000 N.E. Circle Blvd.
Corvallis, OR 97330

ATTENTION: APPLICATIONS

Introduction

The 22 programs of the Business Decisions Pac have been selected from the areas of investment analysis, real estate, banking, leasing, securities, and statistics, areas which require rapid and accurate analysis of data. Programs for the most frequently occurring business decisions are included in the pac.

Each program in this pac is represented by one magnetic card. The manual provides a description of the program, a set of instructions for using the program, and one or more examples, each of which includes a list of the actual keystrokes required for its solution. Program listings for all of the programs in the pac appear at the back of this manual. Explanatory comments have been incorporated in the listings to facilitate your understanding of the actual working of each program. Thorough study of a commented listing can help you to expand your programming repertoire since interesting techniques can often be found in this way.

On the face of each magnetic card are various mnemonic symbols which provide shorthand instructions for the use of the program. You should first familiarize yourself with a program by running the examples in the manual. Thereafter, the mnemonics on the cards themselves should provide the necessary instructions, including what variables are to be input, which user-definable keys are to be pressed, and what values will be output. A full explanation of the mnemonic symbols for magnetic cards may be found in appendix A.

If you have already worked through a few programs in the Standard Pac, you will understand how to load a program and how to interpret the User Instructions form. If these procedures are not clear to you, take a few minutes to review the sections, Loading a Program and Format of User Instructions, in your Standard Pac.

We hope that the Business Decisions Pac will be of assistance in the solution of your problems. We would very much appreciate knowing your reactions to the programs in the 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 in the comments we receive from you that we learn how best to increase the usefulness of programs like these.

Applications Table	Real Estate	Banking	Leasing	Investments	Securities	Insurance	Forecasting & Planning	Consumer Finance	Industrial Production	Accounting
Internal Rate of Return	X		X	X					X	X
Internal Rate of Return-Groups	X		X	X					X	X
Discounted Cash Flow Analysis	X		X	X					X	X
Direct Reduction Loans/Sinking Fund	X	X		X		X		X		
Accumulated Interest/ Remaining Balance	X	X						X		
Wrap-Around Mortgage	X									
Constant Payment to Principal Loan	X	X								
Add-on Rate Loan/ Rule of 78's	X	X						X		
Savings Plan—Leases		X	X	X		X		X		
Advance Payments			X							
Savings-Compounding Different from Payments		X				X		X		
Simple Interest/ Interest Conversions	X	X						X		
Depreciation Schedules	X		X					X	X	X
Days Between Dates		X		X	X			X	X	
Bond Price & Yield				X	X			X		
Interest at Maturity/ Discounted Securities					X					
Linear Regression/ Exponential Curve Fit					X		X		X	
Multiple Linear Regression					X		X		X	
Break-Even Analysis							X		X	
Invoicing										X
Payroll										X
Inventory									X	

Table of Contents

Appendices

A WORD ABOUT PROGRAM USAGE

This application pac has been designed for both the HP-97 Programmable Printing Calculator and the HP-67 Programmable Pocket Calculator. The most significant difference between the HP-67 and the HP-97 calculators is the printing capability of the HP-97. The two calculators also differ in a few minor ways. The purpose of this section is to discuss the ways that the programs in this pac are affected by the differences in the two machines, and to suggest how you can make optimal use of your machine, be it an HP-67 or an HP-97.

Some of the computed results in this pac are output by PRINTx statements. On the HP-97, these results will be output on the printer. On the HP-67, each PRINT command will be interpreted as a PAUSE: the program will halt, display the result for about five seconds, then continue execution. The term "PRINT/PAUSE" is used to describe this output condition.

If you own an HP-67, you may want more time to copy down the number displayed by a PRINT/PAUSE. All you need to do is press down any key on the keyboard. If the command being executed is PRINTx (four rapid blinks of the decimal point), pressing down a key will cause the program to halt. Execution of the halted program may be re-initiated by pressing R/S.

A "display" subroutine has been incorporated into some of the programs in this pac. The function of this routine is to test flag 0 and display the result with a PRINT/PAUSE if the flag is set or by halting execution if the flag is not set. When this option is available, the user may set and clear flag 0 by pressing f E. Successive use of f E will alternately display 1.00 and 0.00, indicating that the print mode is on or off respectively.

The HP-97 users 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 their corresponding user-definable keys will be listed on the printer, thus providing a record of the entire operation of the program.

Another area that could reflect differences between the HP-67 and the HP-97 is in the keystroke solutions to example problems. It is sometimes necessary in these solutions to include operations that involve prefix keys, namely, f on the HP-97 and f, g, and h on the HP-67. For example, the operation % is a primary key on the HP-97, and is performed on the HP-67 as f %. In such cases, the keystroke solution omits the prefix key and indicates only the operation (as here, %). As you work through the example problems, take care to press the appropriate prefix keys (if any) for your calculator.

INTERNAL RATE OF RETURN

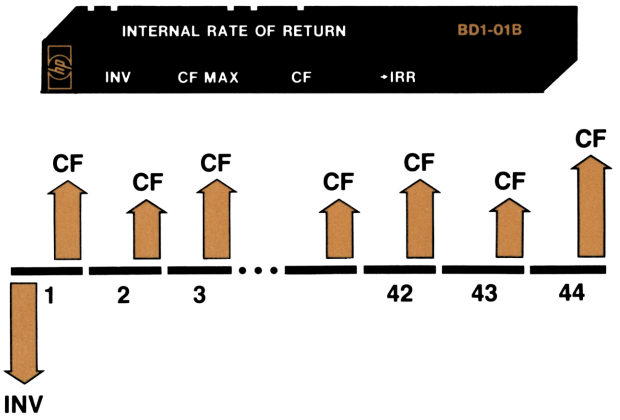


Figure 1

Note:

The above diagram is representative of diagrams which will be used in this pac. The horizontal line represents the time period(s) involved, while the arrows represent the cash flows.

The interest rate that equates the present value of all future cash flows with the original investment is known as the internal rate of return (IRR, also called discounted rate of return or yield). Given a non-zero initial investment and up to 44 **positive** cash flows, this program calculates the periodic IRR. If there are negative as well as positive cash flows, the program accepts up to 22 cash flows.

If more than 44 positive cash flows are entered, all cash flows over 44 will be ignored. There will be no indication, however, that more than 44 cash flows have been entered. Likewise, if more than 22 positive and negative cash flows are entered, erroneous results will occur.

Zero should be entered for periods with no cash flow.

When more than 22 cash flows are involved (all of which must be positive), the user is asked to enter the largest cash flow in step 3 because of the storage techniques being used. This value is then used to scale all other cash flows, and depending on these values, accuracy may be reduced. Consequently, the resulting periodic rate of return should be considered accurate to within ±.01% (.0001 decimal). This largest cash flow must be entered again in sequence in step 4. If a cash flow larger than the value entered for CF MAX is keyed in at step 4, erroneous results may occur.

The answer produced is the *periodic rate of return*. If the cash flow periods are

other than annual (monthly, quarterly) the answer should be multiplied by the number of periods per year to determine the annual internal rate of return.

In many instances another program may be more suitable for calculating IRR. If all cash flows are equal and equally spaced, or if all cash flows except the last are equal and equally spaced, DIRECT REDUCTION LOANS (BD-04) is a better choice. If the cash flows occur in groups of uneven amounts, IRR-GROUPS (BD-02) may be more suitable.

This program was designed for optimum operation when the interest rate being solved for is between 0 and 100%. The program will often solve for interest rates outside this range, but occasionally may halt prematurely with ERROR in the display. This is an error condition generated by an intermediate calculation, and indicates that the program cannot solve that particular problem.

The calculated answer may be verified by using DISCOUNTED CASH FLOW ANALYSIS—NET PRESENT VALUE (BD-03), to calculate the net present value. The NPV should be close to 0.

Note:

When the sign of the cash flows is reversed more than once, more than one interest rate is considered correct in the mathematical sense. While this program may find one of the answers, it has no way of finding or indicating other possibilities.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Input initial investment.	INV	A	INV
3	If there are > 22 cash flows, key			
	in the largest cash flow.	CF MAX	B	CF MAX
4	Beginning with the first period,			
	key in all cash flows in sequence,			
	pressing C after each value.	CF	C	# of CFs
5	Calculate the periodic internal			
	rate of return		D	IRR (%)

Example 1:

Income property requiring a $250,000 equity investment and to be sold in ten years is expected to generate the "after tax" cash flows shown below. What is the expected yield or IRR?

End of Year	Cash Flow	End of Year	Cash Flow
1	$46,423	6	$ 23,199
2	40,710	7	21,612
3	36,638	8	20,037
4	34,097	9	18,460
5	32,485	10	311,406 (property sold)

Keystokes: **Outputs:**

250000 [A] 46423 [C] 40710 [C]
36638 [C] 34097 [C] 32485 [C]
23199 [C] 21612 [C] 20037 [C]
18460 [C] 311406 [C] [D] ⟶ 13.98 (annual IRR is 13.98%)

Example 2:

Property requiring a $30,000 investment will be sold at the end of 2 years. If the investment results in the monthly net cash flows shown below, what is the IRR?

End of Month	Cash Flow	End of Month	Cash Flow
1	$ 16	13	$ 201
2	50	14	195
3	175	15	178
4	181	16	197
5	143	17	210
6	147	18	220
7	151	19	206
8	176	20	194
9	184	21	187
10	193	22	190
11	157	23	201
12	190	24	35,000 (property sold)

Keystrokes: **Outputs:**

30000 [A] 35000 [B]
16 [C] 50 [C] 175 [C] 181 [C]
143 [C] 147 [C] 151 [C] 176 [C]
184 [C] 193 [C] 157 [C] 190 [C] ⟶ 12.00 (12 cash flows input)
201 [C] 195 [C] 178 [C] 197 [C]
210 [C] 220 [C] 206 [C] 194 [C]
187 [C] 190 [C] 201 [C] 35000 [C] ⟶ 24.00 (all cash flows input)
[D] ⟶ 1.15 (monthly IRR)
12 [×] ⟶ 13.79 (an annual IRR of 13.79%)

NOTES

INTERNAL RATE OF RETURN—GROUPS OF CASH FLOWS

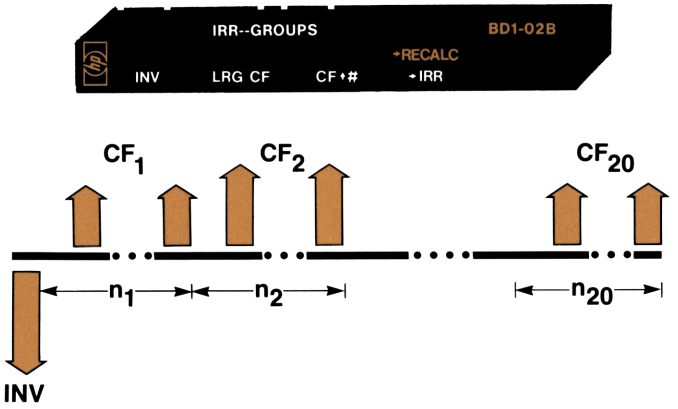


Figure 2

This program solves for the internal rate of return (IRR) when groups of uneven cash flows are involved. Given a non-zero initial investment (INV), the cash flows (CF) and the corresponding number of times each cash flow occurs (#), the periodic IRR is calculated.

Up to 20 groups of positive or negative cash flows, with each group containing a maximum of 99 cash flows, may be entered. If more than 20 groups are input, erroneous results will occur.

Zero should be entered for periods with no cash flow.

The program works with even dollar amounts. When dollars and cents are involved, the cents will be lost.

If a cash flow (other than the investment) exists with more than 8 digits (i.e., more than $99999999.00) the user is asked to enter this value in step 3 because of the storage techniques being used. The value is then used to scale all other cash flows, and depending on these values, accuracy may be reduced. This large cash flow must be entered again in sequence in step 4.

The answer produced is the *periodic rate of return*. If the cash flow periods are other than annual (monthly, quarterly) the answer should be multiplied by the number of periods per year to determine the annual internal rate of return.

The calculator must be in FIX mode, as the program is dependent upon the display setting. To obtain 4 decimals of accuracy, the program card was recorded in FIX 4 mode. More or less accuracy may be obtained by changing the display setting from DSP 4 to DSP 5, DSP 6, DSP 2, etc. However, time for solution increases as accuracy is improved.

If the user wishes to re-calculate the IRR without changing the data in any manner, simply input the number of groups and press f D. This feature is useful if the calculator is halted prematurely, as it is not necessary to re-enter all of the data.

This program was designed for optimum operation when the interest rate being solved for is between 0 and 100%. The program will often solve for interest rates outside this range, but occasionally may halt prematurely with ERROR in the display. This is an error condition generated by an intermediate calculation, and indicates that the program cannot solve that particular problem.

The calculated answer may be verified by using DISCOUNTED CASH FLOW ANALYSIS—NET PRESENT VALUE (BD-03), to calculate the net present value. The NPV should be close to 0.

Note:

When the sign of the cash flows is reversed more than once, more than one interest rate is considered correct in the mathematical sense. While this program may find one of the answers, it has no way of finding or indicating other possibilities.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Input initial investment.	INV	A	INV
3	If one cash flow has more than			
	8 digits, key it in.	LRG CF	B	LRG CF/10^{k*}
4	Beginning with the first period,			
	key in each cash flow and the			
	number of times it occurs,			
	pressing C after each group.	CF	ENTER↑	
		#	C	# of groups
5	Calculate the periodic internal			
	rate of return.		D	IRR (%)
6	To recalculate the IRR, enter			
	the number of groups.	# of groups	f D	IRR (%)
	* k = 1 (LRG CF has 9 digits)			
	k = 2 (LRG CF has 10 digits)			

Example 1:

An income property is available for $50,000. The annual income over a 23-year projection period (all payments received at the end of the year) may be grouped as follows:

Number of Years	Cash Flow ($)
First 5 Years	9,000
Next 4 Years	7,500
Next 4 Years	6,000
Next 3 Years	7,500
Last 7 Years	5,000

If the investor wishes a 15% return, does the property meet his objectives?

Keystrokes:	Outputs:	
50000 A		
9000 ENTER↑ 5 C		
7500 ENTER↑ 4 C		
6000 ENTER↑ 4 C		
7500 ENTER↑ 3 C		
5000 ENTER↑ 7 C →	5.0000	(5 groups of cash flows entered)
D →	15.2681	(annual IRR of 15.2681%)

Since the IRR is more than 15%, the property meets the investor's objectives.

Example 2:

An investment of $620,000,000 is expected to have the following annual income stream for the next 15 years.

Number of Years	Cash Flow ($)
First 10 Years	100,000,000
Next 5 Years	5,000,000

What is the expected rate of return?

Keystrokes:	Outputs:	
620000000 A 100000000 B →	62000000.00	
100000000 ENTER↑ 10 C		
5000000 ENTER↑ 5 C D →	10.0649	(annual IRR of 10.0649%)

NOTES

DISCOUNTED CASH FLOW ANALYSIS
NET PRESENT VALUE

Assuming a minimum desired yield (cost of capital, discount rate), this program finds the present value of the future cash flows generated by the investment and subtracts the initial investment from this amount. If the final net present value is a positive value, the investment exceeds the profit objectives assumed. If the final net present value is a negative value, then the investment is not profitable to the extent of the desired yield. If the net present value is zero, the investment meets the profit objectives.

The function associated with the C key (#) is designed to accommodate those situations where a series of the cash flows are equal. You enter the number of times these equal periodic cash flows occur with C, and then the amount only once with D. The program automatically assumes 1 for #. If the cash flow occurs only once, there is no need to enter anything for #.

Zero must be entered for all periods with no cash flow. When a cash flow other than the initial investment is an outlay (additional investment, loss, etc.) the value must be entered as a negative number with CHS.

Cash flows are assumed to occur at the end of cash flow periods.

This program can also be used to find the present value of a series of irregular cash flows that cannot be accommodated by the DIRECT REDUCTION LOANS program by simply entering zero as the initial investment.

An option is provided to print the initial investment and the NPV after each cash flow. Pressing f E sets and clears the print flag. Successive use of f E will alternately display 1.00 and 0.00, indicating that the print mode is on or off respectively.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1.			
2	Optional: Select			
	print/pause mode.		f E	1.00 or 0.00
3	Key in			
	• Initial investment amount	INV	A	INV
	• Periodic interest (discount) rate	i (%)	B	i (%)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Key in the number of equal			
	cash flows if greater than 1.	#	C	#
5	Key in cash flow amount(s) and			
	calculate net present value.	CF	D	NPV
6	Optional: Display total number			
	of cash flows entered so far.		E	n
7	For next cash flow(s) go to			
	step 4.			
8	For a new case go to step 2.			

Example 1:

An investor has an opportunity to purchase a piece of property for $70,000. If the going rate of return on this type of investment is 13.75%, and the after-tax cash flows are forecast as follows, should the investor purchase the property?

Year	Cash Flow ($)	
1	$14,000	
2	11,000	
3	10,000	
4	10,000	
5	10,000	
6	9,100	
7	9,000	
8	9,000	
9	4,500	
10	71,000	(property sold in 10th year)

Keystrokes: **Outputs:**

70000 A 13.75 B

14000 D → −57692.31 (NPV after 1 cash flow)

11000 D → −49190.92 (NPV after 2 cash flows)

3 C 10000 D → −31172.57 (NPV after 5 cash flows)

9100 D → −26971.76 (NPV after 6 cash flows)

2 C 9000 D → −20108.39 (NPV after 8 cash flows)

E →	8.00	(checking that we've entered 8 periods cash flows so far)
4500 D →	-18696.99	(NPV after 9 cash flows)
71000 D →	879.93	(NPV after 10 cash flows)

Since the final NPV is positive, the investment meets the profit objectives.

Example 2:

The Cooper Company needs a new photocopier and is considering leasing the equipment as an alternative to buying. The end-of-the-year net cash cost of each option is:

PURCHASE

Year	Net Cash Cost
1	$ 533
2	948
3	1,375
4	1,815
5	2,270
Total Net Cash Cost	$6,941

LEASE

Year	Net Cash Cost
1	$1,310
2	1,310
3	1,310
4	1,310
5	1,310
Total Net Cash Cost	$6,550

Looking at total cost, leasing appears to be less. But, purchasing costs less the first two years. Mr. Cooper knows that he can make a 15% return on every dollar he puts in the business; the sooner he can reinvest money, the sooner he earns 15%. Therefore, he decides to consider the **timing of the costs,** discounting the cash flows at 15% to find the present value of the alternatives. Which option should he choose?

Keystokes:	**Outputs:**
PURCHASE	
0 A 15 B 533 D 948 D	
1375 D 1815 D 2270 D →	4250.71

LEASE

0 A 5 C 1310 D ⟶ 4391.32

Leasing has a present value cost of $4391.32, while purchasing has a present value cost of $4250.71. Since these are both expense items, the lowest present value is the most desirable. So, in this case, purchase is the least costly alternative.

DIRECT REDUCTION LOANS
SINKING FUND

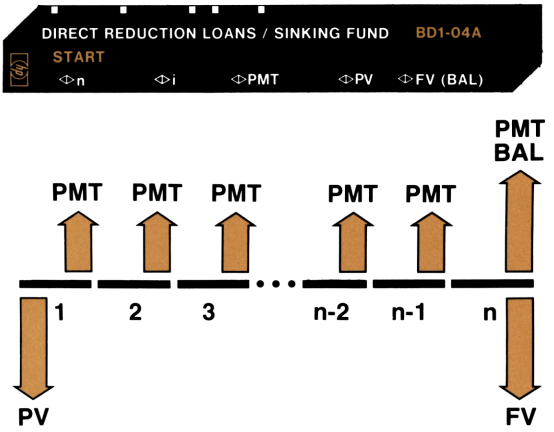


Figure 3

This program may be used to solve problems when payments are made at the end of the compounding periods (ordinary annuity). Direct reduction loans and mortgages are typical examples.

The following variables may be inputs or outputs:

- n is the number of compounding periods. (For a 30 year loan with monthly payments n = 12 × 30 = 360.)
- i is the periodic interest rate expressed as a percent. (For other than annual compounding, divide the annual percentage rate by the number of compounding periods in a year, i.e., 8% annual interest compounded monthly equals 8/12 or 0.667%.)
- PMT is the periodic payment amount.
- PV is the present value of the cash flows.
- FV is the future value of a series of cash flows.
- BAL is the balloon payment or remaining balance at the end of a series of payments.

In this program, **A** is used to input/calculate n, **B** to input/calculate i, **C** to input/calculate PMT, **D** to input/calculate PV, and **E** to input/calculate FV(BAL). After all inputs have been entered, it is possible to calculate the unknown value by pressing the appropriate user definable key.

When the START function (**f** **A**) is executed, it sets PMT, PV, and BAL to zero (n and i are not affected). START provides a safe, convenient, easy to remember method of preparing the calculator for a new problem. It is not

necessary to use START between problems containing the same combination of variables. For instance, any number of n, i, PMT, PV problems involving different numbers and/or different combinations of known values could be done in succession without using START. Only the values which change from problem to problem would have to be keyed in. To change the combination of variables without using START, simply input zero for any variable which is no longer applicable. To go from n, i, PMT, PV problems to n, i, PMT, FV problems a zero would be input (0 D) for PV.
START should always be used immediately after loading DIRECT REDUCTION LOANS/SINKING FUND.

Iterative interest solutions are accurate to the number of significant figures of the display setting. It is possible to obtain more significant figures by changing the display setting from DSP 2 to DSP 3, DSP 4, DSP 5, etc. before calculating. However, time for solution increases as accuracy is improved.

Problems with negative balloon payments may have more than one mathematically correct answer (or no answer at all). While this program may find one of the answers, it has no way of finding or indicating other possibilities.

The values for n, i, PMT, PV, and FV(BAL) are stored in registers A—E respectively. They may be displayed by recalling the appropriate register.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Initialize (START)		f A	0.00
3	Input the known values:			
	• Number of periods	n	A	n
	• Periodic interest rate	i (%)	B	i (%)
	• Periodic payment	PMT	C	PMT
	• Present value	PV	D	PV
	• Future value, balloon payment, or balance	FV(BAL)	E	FV(BAL)
4	Calculate the unknown value:			
	• Number of periods		A	n
	• Periodic interest rate		B	i (%)
	• Periodic payment		C	PMT
	• Present value		D	PV
	• Future value, balloon payment, or balance		E	FV(BAL)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
5	For a new case, go to step 3			
	and change appropriate values.			
6	For a new type of problem, go			
	to step 2.			

Example 1:

A borrower can afford a $368.21 monthly principal and interest payment on a 30 year, 9¼% mortgage. What is the largest such mortgage he can obtain?

Keystrokes:	**Outputs**	
f A		
368.21 C		
30 ENTER↑ 12 × A →	360.00	(total monthly periods in mortgage life)
9.25 ENTER↑ 12 ÷ B →	0.77	(monthly interest rate)
D →	44757.63	(mortgage amount)

Example 2:

A 30 year, $50,000 mortgage has monthly payments of $320, including principal and interest. What is the annual percentage rate?

Keystrokes:	**Outputs:**	
f A		
30 ENTER↑ 12 × A		
50000 D		
320 C B →	0.55	(monthly percentage rate)
12 × →	6.62	(annual percentage rate)

Example 3:

An investor wishes to purchase a mortgage with a balloon payment to yield him 14% per annum. What maximum price can he pay if there are 60 monthly payments of $250 and a $10,000 balloon at the end of year 5? If he purchases the mortgage for $14,500, what annual yield is he achieving?

Keystrokes:	Outputs:	
f A 14 ENTER↑ 12 ÷ B		
60 A 250 C 10000 E		
D →	15730.27	(maximum price to pay to yield 14%)
14500 D B →	1.39	(monthly percent yield)
12 × →	16.67	(annual % yield at $14,500 price)

Example 4:

You have an opportunity to purchase a $10,000, 8% note which has a term of 6 years (monthly payments). What should you pay for the note if you wish to achieve a 13% yield?

Keystrokes:	Outputs:	
f A 10000 D		
8 ENTER↑ 12 ÷ B		
6 ENTER↑ 12 × A C →	175.33	(monthly payment)

Now determine the purchase price of the note.

13 ENTER↑ 12 ÷ B		
D →	8734.26	(purchase price)

Example 5:

A borrower is charged 2 points for the issuance of his mortgage and note. If the mortgage amount is $60,000 for 30 years, and the interest rate is 8¾% per year, with monthly payments, what annual percentage rate (APR) is the borrower paying? (1 point is equal to 1% of the mortgage amount.)

Keystrokes:	Outputs:	
First calculate the periodic payment amount.		
f A 60000 D		
30 ENTER↑ 12 × A		
8.75 ENTER↑ 12 ÷ B C →	472.02	(monthly payment)

Now calculate the mortgage amount less fees.

RCL D 2 % − D →	58800.00	(effective amount borrowed)

To obtain the annual percentage rate, press:

B 12 × →	8.97	(% APR)

Example 6:

You are setting up a travel fund for a trip to Australia. If you start in a month, depositing $150 per month in a 5½% account, compounded monthly, how long will it take from today to accumulate $2500 for the trip?

Keystrokes:	**Outputs:**
f A 150 C	
5.5 ENTER↑ 12 ÷ B	
2500 E A ⟶	16.10 (months)

Example 7:

A corporation has determined that a certain piece of equipment costing $50,000 will be required in 3 years. Assuming a fund paying 7% compounded quarterly is available, what quarterly payment amount must be placed in the fund in order to cover this cost if savings are to start at the end of this quarter?

Keystrokes:	**Outputs:**
f A 50000 E 3 ENTER↑	
4 × A 7 ENTER↑	
4 ÷ B C ⟶	3780.69 (quarterly payment)

NOTES

ACCUMULATED INTEREST/REMAINING BALANCE

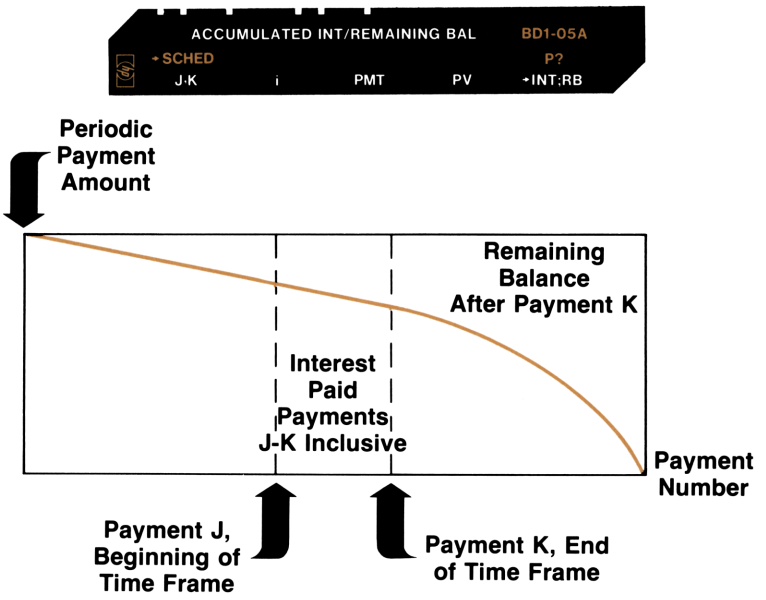


Figure 4

This program finds both the total interest paid over a specified number of payment periods and the remaining balance at the end of the last specified period, given the periodic interest rate, periodic payment amount, loan amount, and the beginning and ending payment numbers for the time span being considered. The payments associated with both the beginning (J) and the ending (K) payment period are included in the calculation.

The program can be used for loans with a balloon payment as well as loans arranged to be fully amortized provided two cautions are observed. First, the balloon payment of the loan must be at the same time as, and in addition to the last payment. Second, care should be taken not to enter a value for K that is after the last payment since the program has no way of knowing the term of the loan.

An option is available to output the amortization schedule between payments J and K (f A).

Pressing f E sets and clears the print flag. Successive use of f E will alternately display 1.00 and 0.00, indicating that the print/pause mode is on or off respectively.

The data generated is valid for loans that have a balloon payment, as well as those that are arranged to be fully amortized. For loans with a balloon payment, the remaining balance of the last payment period is the balloon payment due in addition to the last periodic payment.

For loans scheduled to be fully amortized, the remaining balance after the last payment period may be slightly more or less than zero. This is because the program assumes that **all** payments are equal to the value entered for PMT. In fact for most loans, the last payment is slightly more or less than the rest.

The calculator performs all internal calculations to ten digits. If the user wishes to round the schedule to dollars and cents, the following sequence may be used:

1. Press GTO .113
2. Switch to PRGM mode.
3. Press RND
4. Switch back to RUN mode.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Optional: Select print/pause			
	mode for amortization			
	schedule.		f E	1.00 or 0.00
3	Key in			
	• Starting period number	J	A	J
	• Ending period number	K	A	K
	• Periodic interest rate	i (%)	B	i (%)
	• Periodic payment amount	PMT	C	PMT
	• Initial loan amount	PV	D	PV
4	Compute the total interest paid			
	between periods J and K			
	inclusive, and the remaining			
	balance at the end of period K.		E	INT
			R/S	BAL
	OR			
5	Generate the amortization			
	schedule between payments J			
	and K inclusive. If the			
	print/pause mode is on (1.00),			
	the results are printed			
	automatically.		f A	J

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
6	Calculate amount paid to			
	interest for period J.		R/S	PMT to INT
7	Calculate amount paid to			
	principal for period J.		R/S	PMT to PRIN
8	Calculate remaining balance at			
	the end of period J.		R/S	BAL
9	Calculate total interest paid			
	between periods J thru K			
	inclusive.		R/S	TOT INT
10	Increment J for next period.		R/S	J + 1
	If J ≤ K, go to step 6 for next			
	period's values. Otherwise,			
	stop.			
11	For a new case, go to step 2 and			
	change appropriate input			
	values.			

Example 1:

A mortgage is arranged such that the first payment is made at the end of October, 1975 (i.e., October is payment period 1). It is a $20,000 loan at 9%, with monthly payments of $167.84. What is the accumulated interest for 1975 (periods 1-3) and 1976 (periods 4-15) and what would the remaining balance be at the end of each year?

Keystrokes:

1 A 3 A 9 ENTER↑ 12 ÷ B
167.84 C 20000 D E →

R/S →

4 A 15 A E →

R/S →

Outputs:

449.60 (interest paid in 1975)

19946.08 (remaining balance at the end of 1975)

1785.89 (interest paid in 1976)

19717.88 (remaining balance at the end of 1976)

Example 2:

Generate an amortization schedule for the first two payments of a $30,000, 7% mortgage having monthly payments of $200. Then jump ahead and generate the data for the 36th payment.

Keystrokes:	**Outputs:**	
1 A 2 A 7 ENTER↑ 12 ÷ B		
200 C 30000 D f A →	1.00	(starting 1st period)
R/S →	175.00	(payment to interest)
R/S →	25.00	(payment to principal)
R/S →	29975.00	(remaining balance)
R/S →	175.00	(total interest to date)
R/S →	2.00	(starting 2nd period)
R/S →	174.85	(payment to interest)
R/S →	25.15	(payment to principal)
R/S →	29949.85	(remaining balance)
R/S →	349.85	(total interest to date)

Keystrokes:	**Outputs:**	
Now let's skip ahead to the 36th payment period.		
36 A A f A →	36.00	(starting 36th period)
R/S →	169.36	(payment to interest)
R/S →	30.64	(payment to principal)
R/S →	29001.75	(remaining balance)
R/S →	6201.75	(total interest to date)

WRAP-AROUND MORTGAGE

A wrap-around mortgage is essentially the same as a refinancing mortgage, except that the new mortgage is a junior lien mortgage granted by a different lender, who assumes the payments on the existing mortgage, which remains in full force. The new (second) mortgage is thus "wrapped around" the existing mortgage. The "wrap-around" lender advances the net difference between the new (second) mortgage and the existing mortgage in cash to the borrower, and receives as net cash flow the difference between debt service on the new (second) mortgage and debt service on the existing mortgage.

This program calculates the periodic yield to the lender (E) of a wrap-around mortgage, with or without a balloon payment. A routine to solve for the periodic payment (f C) necessary to amortize a mortgage is also available.

The value of each mortgage, as well as the periodic payments, life of each mortgagé (number of periods remaining), and balloon payment on the wrap-around mortgage (if it exists) must be entered to calculate the yield.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Key in the following information			
	from the original mortgage:			
	• Remaining balance	PV_1	ENTER↑	PV_1
	• Periodic payment	PMT_1	ENTER↑	PMT_1
	• Number of periods remaining	n_1	A	n_1
3	Key in the following information			
	from the wrap-around			
	mortgage:			
	• Total wrap-around amount	PV_2	ENTER↑	PV_2
	• Periodic payment on wrap-			
	around	PMT_2	ENTER↑	PMT_2
	• Number of periods in term of			
	wrap-around	n_2	C	n_2

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Optional: If a balloon payment			
	exists on the wrap-around at			
	period n_2, key in the balloon			
	amount.	BAL	D	BAL
5	Calculate the periodic yield of			
	the wrap-around to the lender.		E	Yield (%)
6	Optional: If a payment amount			
	is not known, it may be calculat-			
	ed by keying in:			
	• Total number of periods	n	f A	n
	• Periodic interest rate	i (%)	f B	i (%)
	• Loan amount	PV	f D	PV
7	Calculate periodic payment		f C	PMT
	The payment is stored in R_C,			
	and may be recalled at a later			
	time.		RCL C	PMT

Example 1:

A mortgage loan on an income property has a balance of $200,000. The loan has a remaining life of 12 years, and a monthly payment of $2030.21 A lender has agreed to "wrap" a $300,000 second mortgage at 9.5%, with full amortization in level monthly payments over 12 years. What is the effective yield (IRR) to the lender on net cash advanced?

Keystrokes: **Outputs:**

200000 ENTER↑ 2030.21 ENTER↑
144 A → 144.00

Since the payment on the wrap-around is not given, it must be calculated, and is automatically stored in Register C.

144 f A 9.5 ENTER↑ 12 ÷ f B
300000 f D f C → 3499.12 (payment of second or wrapped mortgage)

Now calculate the yield.

300000 RCL C 144 C E 12 × → 14.50 (% effective yield)

Note:

Recalling a number causes the stack to lift unless the proceding keystroke was ENTER↑, CL x, or Σ+. See Appendix D in your Owner's Handbook.

Example 2:

A customer has an existing mortgage with a balance of $125,000, a remaining term of 200 months, and a $1051.61 monthly payment. He wishes to obtain a $200,000, 9½% wrap-around with 240 monthly payments of $1681.71 and a balloon payment at the end of the 240th month of $129963.35. If you accept the proposal, what is your rate of return?

Keystrokes:	**Outputs:**
125000 ENTER↑ 1051.61 ENTER↑	
200 A	
200000 ENTER↑ 1681.71 ENTER↑	
240 C	
129963.35 D E 12 × ⟶	11.84 (% rate of return)

NOTES

CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE

This type of loan is structured such that the principal is repaid in equal installments with the interest paid in addition. Therefore, each periodic payment is different; it has a constant amount applied to the principal and a decreasing amount to the interest.

The first part of the program displays the payment number and calculates the payment to interest, total payment, remaining balance, and total interest. The constant payment to principal required as input data (CPMT) can be found by simply dividing the loan amount by the total number of payment periods. The schedule may be started at any desired payment period; that is, the value entered for K need not be 1.

The second part of the program calculates the accumulated interest between any two payments J and K. The necessary inputs are the periodic interest rate, constant payment, initial loan amount, and the numbers of the starting and ending payments in the time frame.

A print option is available (f E) to automatically print the entire amortization schedule, or the accumulated interest. Successive use of f E will alternately display 1.00 and 0.00 indicating that the print mode is on or off respectively.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1.			
2	Optional: Select print/pause			
	mode		f E	1.00 or 0.00
3	Key in:			
	• First period of the desired			
	schedule (need not be 1)	K	A	K
	• Periodic interest rate	i (%)	B	i (%)
	• Constant payment to			
	principal	CPMT	C	CPMT
	• Initial loan amount (present			
	value)	PV	D	PV

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Generate the amortization			
	schedule for payments K			
	through term of loan. If the print			
	mode is on (1.00), the schedule			
	may be terminated prior to			
	completion by pressing R/S.		E	PMT to INT
			R/S	TOT PMT
			R/S	BAL
			R/S	TOT INT
			R/S	K + 1
			etc.	
	OR			
5	To find the accumulated interest			
	between any two points (J, K),			
	key in:			
	• Periodic interest rate	i (%)	B	i (%)
	• Constant payment to			
	principal	CPMT	C	CPMT
	• Initial loan amount (present			
	value)	PV	D	PV
	• Starting period number	J	ENTER↑	J
	• Ending period number	K	f A	ACC INT

Example 1:

A twenty year, 8% loan for $100,000 is being amortized by annual payments to principal of $5,000 plus interest on the remaining balance. Generate a 2-year amortization schedule for this loan.

Keystrokes: **Outputs:**

1 A 8 B 5000 C 100000 D E → 8000.00 (1st year's payment to interest)

R/S → 13000.00 (total 1st payment)

R/S → 95000.00 (remaining balance)

R/S →	8000.00	(total interest paid to date)
R/S →	2.00	(now starting 2nd period)
R/S →	7600.00	(2nd year's payment to interest)
R/S →	12600.00	(total 2nd payment)
R/S →	90000.00	(remaining balance)
R/S →	15600.00	(total interest paid to date)

Example 2:

In the previous example, how much interest is accumulated during years 5 to 10 (inclusive)?

Keystrokes:	**Outputs:**
8 B 5000 C 100000 D	
5 ENTER↑ 10 f A →	32400.00

NOTES

ADD-ON RATE INSTALLMENT LOAN/ INTEREST REBATE—RULE OF 78's

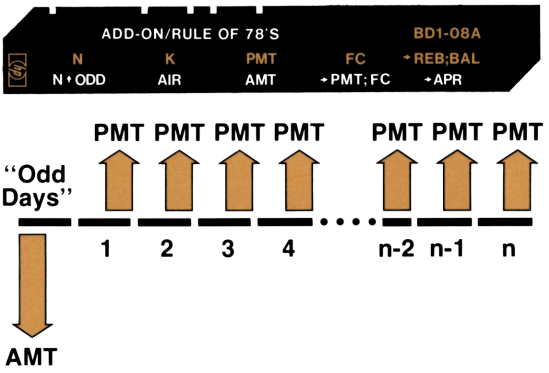


Figure 5

This program calculates the monthly payment amount, total finance charge, and the Annual Percentage Rate (APR) for an add-on rate loan.

When a loan is initiated in the middle of a month, the first payment is generally not required until the end of the first full month. The number of days from the beginning of the loan to the beginning of the first month (see above diagram) are called "odd days" and affect (decrease) the APR to be quoted with the loan. The calculation of the APR considers these odd days.

Note:

The payment amount (PMT) must be calculated in order to calculate the APR.

The second part of this program calculates the unearned interest (rebate) as well as the remaining principal due for a prepaid consumer loan using the rule of 78's.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Key in:			
	• Number of monthly pay-			
	ments in loan	N	ENTER↑	N
	• "Odd-days" to beginning of			
	first month (0-30)	ODD	A	ODD
	• Add-on interest rate (annual			
	rate)	AIR (%)	B	AIR (%)
	• Loan amount	AMT	C	AMT
3	Calculate monthly payment.		D	PMT

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Calculate total finance charge.		R/S	FC
5	Calculate the annual			
	percentage rate.		E	APR (%)
6	Key in all of the following:			
	• Total number of monthly			
	payments in loan	N	f A	N
	• Number of the last payment			
	made	K	f B	K
	• Monthly payment amount	PMT	f C	PMT
	• Total finance charge	FC	f D	FC
7	Calculate the unearned			
	interest (rebate).		f E	REB
8	Calculate the remaining			
	balance.		R/S	BAL

Example 1:

A 36 month car loan for $3,500 with a 6% add-on rate is initiated such that there are 18 ''odd days''. Calculate the monthly payment required to amortize this loan, the total finance charge, and the annual percentage rate.

Keystrokes: **Outputs:**

36 ENTER↑ 18 A 6 B 3500 C D → 115.01 (monthly payment)

R/S → 640.36 (total finance charge)

E → 10.89 (10.89% APR)

Example 2:

A $1000 loan, with a total finance charge of $180.00 is being paid at $39.33 per month for 30 months. What is the unearned interest (rebate) and remaining balance after the 25th regular payment?

Keystrokes: **Outputs:**

30 f A 25 f B

39.33 f C

180 f D f E → 5.81 (unearned interest for payments 26 to 30)

R/S → 190.84 (remaining balance after payment 25)

SAVINGS PLAN—LEASES

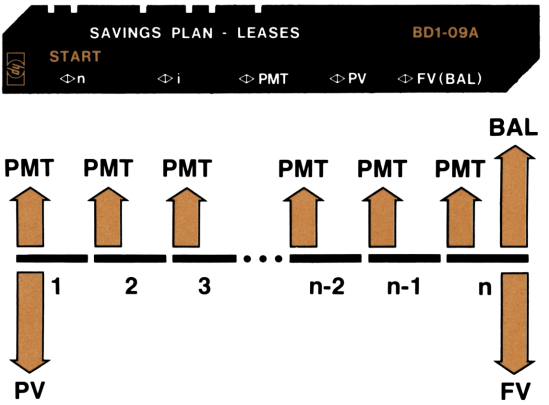


Figure 6

This program may be used to solve problems when payments are made at the beginning of the compounding periods (annuity due). The program also calculates all variables in compound interest situations. Savings plans and leasing problems are typical examples.

The following variables may be inputs or outputs:

- n is the number of compounding periods. (For a 30 year loan with monthly payments n = 12 × 30 = 360.)
- i is the periodic interest rate expressed as a percent. (For other than annual compounding, divide the annual percentage rate by the number of compounding periods in a year, i.e., 8% annual interest compounded monthly equals 8/12 or 0.667%.)
- PMT is the periodic payment amount.
- PV is the present value of the cash flows or compounded amount.
- FV is the future value of a compounded amount or a series of cash flows.
- BAL is the balloon payment or remaining balance at the end of a series of payments.

In this program, A is used to input/calculate n, B to input/calculate i, C to input/calculate PMT, D to input/calculate PV, and E to input/calculate FV or BAL. After all inputs have been entered, the unknown value may be calculated by pressing the appropriate user definable key.

When the START function (f A) is executed, it sets PMT, PV, and FV(BAL) to zero (n and i are not affected). START provides a safe, convenient, easy-to-remember method of preparing the calculator for a new problem. It is not necessary to use START between problems containing the same combination of variables. For instance, any number of n, i, PMT, FV problems

involving different numbers and/or different combinations of known values could be done in succession without using START. Only the values which change from problem to problem would have to be keyed in. To change the combination of variables without using START, simply input zero for any variable which is no longer applicable. To go from n, i, PMT, PV problems to n, i, PV, FV problems a zero would be stored (0 C) in place of PMT. START should always be used immediately after loading SAVINGS PLAN—LEASES.

Interative interest solutions are accurate to the number of significant figures of the display setting. It is possible to obtain more significant figures by changing the display setting from DSP 2 to DSP 3, DSP 4, DSP 5, etc. before calculating. However, time for solution increases as accuracy is improved.

Problems with negative balloon payments may have more than one mathematically correct answer (or no answer at all). While this program may find one of the answers, it has no way of finding or indicating other possibilities.

The values for n, i, PMT, PV, and FV(BAL) are stored in registers A—E respectively. They may be displayed by recalling the appropriate register.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
2	Initialize (START)		f A	0.00
3	Input the known values:			
	• Number of periods	n	A	n
	• Periodic interest rate	i (%)	B	i (%)
	• Periodic payment	PMT	C	PMT
	• Present value	PV	D	PV
	• Future value, balloon pay-			
	ment, or balance	FV(BAL)	E	FV(BAL)
4	Calculate the unknown value:			
	• Number of periods		A	n
	• Periodic interest rate		B	i (%)
	• Periodic payment		C	PMT
	• Present value		D	PV
	• Future value, balloon pay-			
	ment, or balance		E	FV(BAL)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
5	For a new case, go to step 3			
	and change appropriate values.			
6	For a new type of problem, go			
	to step 2.			

Example 1:

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

Keystrokes: **Outputs:**

f A
10000 E 8 ENTER↑ 4 × A → 32.00 (quarters)
6000 D B → 1.61 (% quarterly interest rate)
4 × → 6.44 (% annual interest rate)

Example 2:

The buyer of 3 acres of land can afford to pay $375.00 per month toward interest and principal. If the asking price is $35,000 and the seller wants 8% annual interest with payments in advance, how long will it take to pay off the mortgage?

Keystrokes: **Output:**

f A 375 C 35000 D
8 ENTER↑ 12 ÷ B A → 144.87 (number of months)
12 ÷ → 12.07 (years)

Example 3:

An annuity of $100 per month will begin in 2 years and continue for 3 years. What is its present value if the interest rate is 12%, compounded monthly?

Keystrokes: **Outputs:**

Calculate the present value of the annuity when it commences (2 years from now).

f A 100 C
3 ENTER↑ 12 × A
12 ENTER↑ 12 ÷ B D → 3040.86 (present value when annuity commences)

Now find the present value of the annuity today.

STO E 0 C 2 ENTER↑
12 × A D ⟶ 2394.88 (present value today)

Example 4:

Today you begin annual withdrawals of $2,500 from a $40,000 fund earning 6% annual interest. How long will it be before the fund is reduced to $25,000?

Keystrokes: **Outputs:**

f A 6 B 2500 C 40000 D

25000 E A ⟶ 26.19 (years to reach balance of $25,000)

Example 5:

The Cooper Company needs a photocopier, and the one that best suits its needs costs $10,000. If the copier is purchased, the company would need a 5-year loan, with monthly payments of $220.00. Mr. Cooper may also elect leasing as an alternative way of financing. The leased photocopier would have 36 monthly payments (in advance) of $250.00 with a 33% purchase option at the end of 36 months. Which alternative is the least costly?

Keystrokes: **Outputs:**

First find the annual interest rate of the lease option.

f A 36 A 250 C 10000 D
33 % E B 12 × ⟶ 11.47 (% annual interest rate)

Now insert DIRECT REDUCTION LOANS/SINKING FUND (BD-04) and find the annual interest rate of the loan.

f A 5 ENTER↑ 12 × A
220 C 10000 D B 12 × ⟶ 11.51 (% annual interest rate)

Since the lease option has a lower annual interest rate, it is the least costly alternative.

ADVANCE PAYMENTS

Payments on loans are typically made at the end of the period (in arrears). However, there are situations where payments are made in advance (leasing is a good example). Sometimes these agreements call for extra payments to be made when the transaction is closed, before the payments would normally be due. Or, the transaction has advance payments and a residual value at the end of the normal term.

This program solves for the periodic payment amount necessary to achieve a desired yield when a number of payments are made in advance. And, given the periodic payment, the program finds the yield. Either amount may be calculated when a residual value exists.

The necessary inputs are the total number of periods in the loan (n), the number of payments made in advance (A), the loan amount (PV), and either the periodic payment amount (PMT) or the periodic yield (i). The residual value at the end of the n^{th} period (RESID) is optional.

The value of A must be less than the value of n. If this condition is not met, the display flashes the illegal input. Pressing **R/S** halts the flashing, and the values of n and A must be re-entered.

When A = 0 or 1, BD-04 or BD-09 could be used. A = 0 implies an ordinary annuity calculation, while A = 1 means an annuity due calculation.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Key in the following:			
	• Number of periods in term			
	of loan	n	**ENTER↑**	n
	• Number of payments made			
	in advance	A	**A**	A
	• Loan amount	PV	**D**	PV
3	Optional: Key in residual value			
	at end of nth period.	RESID	**E**	RESID
4	Key in one of the following:			
	• Periodic payment	PMT		PMT
	• Periodic interest rate	i (%)		i (%)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
5	Calculate the remaining			
	variable.		f B	i (%)
			f C	PMT
6	For a new case, go to 2 and			
	change the appropriate values.			

Example 1:

A lease has been written to run for 60 months. The leased equipment has a value of $25,000 with a $600 monthly payment. The lessee has agreed to make 3 payments in advance at the time of closing. What is the annual yield? (There is no residual value at the end of 60 months.)

Keystrokes: **Outputs:**

60 ENTER↑ 3 A
25000 D 600 f B 12 × ⟶ 17.33 (% annual yield)

Example 2:

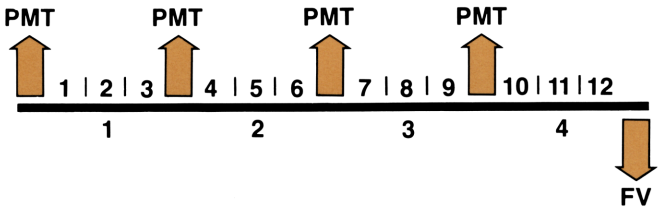
A copier worth $22,000 is to be leased for 48 months. The lessee has agreed to make 4 payments in advance, with a purchase option at the end of 48 months enabling him to buy the copier for 30% of the purchase price. What monthly payment is necessary to yield the lessor 12% annually?

Keystrokes: **Outputs:**

48 ENTER↑ 4 A
22000 D 30 % E
12 ENTER↑ 12 ÷ f C ⟶ 453.84 (monthly payment)

SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

Quarterly Payments/Monthly Compounding



Monthly Payments/Quarterly Compounding

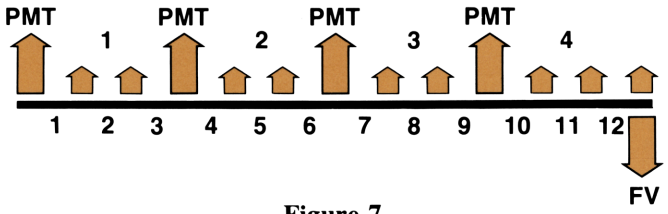


Figure 7

Payments into a savings plan may not occur with the same frequency as the compounding frequency offered. This program solves for the number of payments, the periodic payment amount, or future value.

The diagrams above depict two of the many combinations that may be encountered. Note that payments are assumed to occur at the beginning of the payment period (annuity due).

Another assumption of this program is that payments deposited for a partial compounding period will accrue simple interest for the remainder of the compounding period. Thus, a deposit at the beginning of the 2nd month of a quarter into a savings plan that compounds quarterly is assumed to accrue two months simple interest. This is often the case, but is not true for all institutions.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Key in the number of payment			
	periods per year.	P	ENTER↑	P
3	Key in the number of com-			
	pounding periods per year.	C	A	P/C

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Key in the periodic interest rate	i (%)	B	i (%)
	and two of the following:			
	• Total number of payments	n	f A	n
	• Periodic payment amount	PMT	f C	PMT
	• Final amount (future value)	FV	f E	FV
5	Calculate the remaining value			
	• Total number of payments		f A	n
	• Periodic payment amount		f C	PMT
	• Final amount (future value)		f E	FV
6	For a new case, go to step 2.			

Example 1:

Quarterly deposits of $95 are to be made into a savings account paying 5% compounded monthly. What amount will be in that account after 7 years (i.e., 28 total payments)?

Keystrokes: **Outputs:**

4 ENTER↑ 12 A → 0.33
5 ENTER↑ 12 ÷ B
7 ENTER↑ 4 × f A
95 f C f E → 3203.59 (amount after 7 years)

Example 2:

Assuming the previous calculation has just been performed as shown, determine the future value if the quarterly payment amount were $100 instead of $95.

Keystrokes: **Outputs:**

100 f C f E → 3372.20 (amount after 7 years)

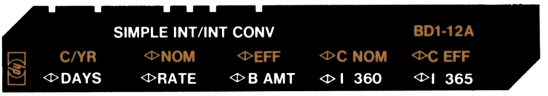
Example 3:

In 2 years, you will need $4000. If a savings account will pay 5¼% compounded quarterly, what amount must you deposit each month to accumulate the desired amount?

Keystrokes: **Outputs:**

12 ENTER↑ 4 A → 3.00
5.25 ENTER↑ 4 ÷ B
2 ENTER↑ 12 × f A
4000 f E f C → 157.78 (monthly deposit necessary)

SIMPLE INTEREST/INTEREST CONVERSIONS



This card actually contains three independent programs. The first part of the program (A—E keys) permits the user to solve for any variable of an accrued simple interest calculation. Given three of the four variables (number of days, annual interest rate, beginning amount, or accrued interest) the fourth is calculated. Accrued interest can be based on a 360 or 365 day year. In addition, the user may choose to add the calculated accrued interest to the initial principal to determine the final amount.

The shifted keys (f A — f E) deal with nominal to effective interest rate conversions, and vice-versa. By definition, an annual effective interest rate demonstrates the **effect** of compounding for a full year of compounding periods at a particular periodic interest rate. The periodic interest rate to be used is determined by dividing the number of compounding periods in a year into the stated annual nominal interest rate. The effect is such that if the nominal rate is held constant, as the number of compounding periods per year is increased, the annual effective interest rate will increase. The ultimate, or upper limit, in this process is to have an infinite number of compounding periods in a year, commonly called continuous compounding.

Three keys (f A , f B , f C) address finite compounding, that is, quarterly compounding, monthly compounding, etc. Given the number of compounding periods in a year, and one of the rates (nominal or effective), the other rate can be calculated. If for example, you require the periodic interest rate for a calculation, given the effective rate, use this program to determine the annual nominal rate first. Dividing the annual nominal rate by the number of compounding periods in a year will give the required periodic interest rate.

The remaining keys (f D , f E) are for continuous compounding. Given either rate, the other is calculated.

The most common and straightforward definition of effective interest rate has been implemented (see Appendix B). Occasionally other definitions will be used and the results will not compare exactly with those calculated by these programs. For example, since the maximum annual nominal rate that savings institutions can offer is regulated by law, they may modify the process (also regulated) so that the effective rate is even higher (e.g., for daily compounding, the periodic rate may be divided by 360 and then compounding accomplished for 365 periods). It is important then, when attempting to match results, to understand the process employed.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Initialize.		R/S	0.00
	Simple Interest			
3	Key in three of the following:			
	• Number of days	DAYS	A	DAYS
	• Annual interest rate	RATE (%)	B	RATE (%)
	• Beginning amount	B AMT	C	B AMT
	• Accrued interest (360 day			
	year)	I 360	D	I 360
	OR			
	• Accrued interest (365 day			
	year)	I 365	E	I 365
4	Calculate the remaining			
	variable			
	• Number of days		A	DAYS
	• Annual interest rate		B	RATE (%)
	• Beginning amount		C	B AMT
	• Accrued interest (360 day			
	year)		D	I 360
	• Final amount (optional)		+	FIN AMT
	• Accrued interest (365 day			
	year)		E	I 365
	• Final amount (optional)		+	FIN AMT
	Interest Conversions			
5	Go to either step 6 for finite			
	compounding or step 8 for			
	continuous compounding.			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
6	Key in:			
	• Number of compounding			
	periods/yr and one of the			
	following:	C/YR	f A	C/YR
	• Annual nominal rate	NOM (%)	f B	NOM (%)
	• Annual effective rate	EFF (%)	f C	EFF (%)
7	Calculate the remaining rate			
	• Annual nominal rate		f B	NOM (%)
	• Annual effective rate		f C	EFF (%)
	Go to step 6 for new data.			
8	Key in one of the following:			
	• Annual nominal rate	C NOM (%)	f D	C NOM
	• Annual effective rate (for			
	continuous compounding).	C EFF (%)	f E	C EFF
9	Calculate the remaining rate			
	• Annual nominal rate		f D	C NOM (%)
	• Annual effective rate (for			
	continuous compounding).		f E	C EFF (%)
10	For continuous compounding			
	on a 365/360 day basis key in:			
	• Annual nominal rate	C NOM (%)		
11	Calculate the continuous ef-			
	fective rate (365/360 basis).		GSB 8	C EFF (%)

Example 1:

Calculate the accrued interest and final amount (both 360 and 365 day basis) for a $30,000, 8%, 90 day interest at maturity note.

Keystrokes:	**Outputs:**	
R/S →	0.00	
30000 C 8 B 90 A D →	600.00	(interest, 360 day basis)
+ →	30600.00	(final amount, 360 day basis)

E → 591.78 (interest, 365 day basis)

+ → 30591.78 (final amount, 365 day basis)

Example 2:

What is the nominal rate if the effective annual rate is 13% compounded quarterly?

Keystrokes:	**Outputs:**
4 f A 13 f C f B →	12.41 (% nominal interest rate)

Example 3:

A bank offers a savings plan with a 5% annual nominal interest rate. What is the annual effective rate if compounding is continuous?

Keystrokes:	**Outputs:**
5 f D f E →	5.13 (an annual effective rate of 5.13%)

Example 4:

In the above example, what is the annual effective rate if compounding is continuous on a 365/360 basis?

Keystrokes:	**Outputs:**
5 GSB 8 →	5.20 (an annual effective rate of 5.20%)

DEPRECIATION SCHEDULES

Three methods of depreciation are commonly used: straight-line, sum-of-the-years'-digits, and declining balance. This program evaluates the depreciation schedules for these three methods, and calculates the crossover point between straight line and declining balance depreciation. For the schedules, the output is the annual depreciation amount (DEP), remaining depreciable amount (RDV), remaining book value (RBV), and the total depreciation to date (TOT DEP), as well as an increment for the next year's schedule.

An option is available to output the depreciation schedule beginning at a specified year. Pressing f E sets and clears the print flag. Successive use of f E will alternately display 1.00 and 0.00, indicating that the print mode is on or off respectively.

Values for the last year of an asset with fractional years life (i.e., the 21st year's values for an asset with 20.5 years life) are calculated correctly. However, all other values represent a full year's depreciation. For this reason only integer values (whole number, 1.0, 2.0, 17.0 etc.) may be entered for YR (the D key). The program makes no checks on this value and generates invalid results if other than whole numbers are entered.

Straight Line Depreciation

The annual depreciation allowance using this method is determined by dividing the cost or other basis of valuation (starting book value) less its estimated salvage value by its useful life expectancy. This program develops the starting book value (SBV), salvage value (SAL), life expectancy (LIFE), and first year of the schedule (YR). (The schedule may be started at any point in the useful life.)

Fractional years life must be entered as an integer plus a fraction. Thus a life of 12 years 3 months would be keyed in as 12.25 for LIFE.

Sum of the Years' Digits Depreciation

The sum-of-the-years' digits method is an accelerated form of depreciation, allowing more depreciation in the early years of an asset's life than allowed under the straight line method. This program generates the schedule output, given the starting book value (SBV), the salvage value (SAL), expected useful life in years (LIFE), and beginning year (YR) for the schedule. (The schedule may be started at any point in the useful life.)

Fractional years asset life must be entered as an integer plus a fraction. Thus a life of 12 years 3 months would be keyed in as 12.25 for LIFE.

Variable Rate Declining Balance Depreciation

The variable rate declining balance method is another form of accelerated depreciation; as such it provides for more depreciation in earlier years and decreasing depreciation in later years. The program generates the depreciation schedule given the starting book value (SBV), salvage value (SAL), useful life expectancy (LIFE), the declining rate factor (FACT), and the first year of the desired schedule (YR). The schedule may be started at any point in the useful life.

The ''variable rate'' is indicated as either a factor or percent with equal frequency in the business community. Thus, ''1.5 declining balance factor'' and ''150% declining balance'' have the same meaning. The number to be keyed in for FACT (E) in this program, should be in factor form, that is 1.25, 1.5, 2, and not 125, 150 or 200.

This method of depreciation is unique in that it may generate depreciation greater than the depreciable value for some assets, while it may not generate sufficient depreciation for others. The crossover calculation (f D) is provided to assist in determining the best time to switch to straight line depreciation (tax laws permitting) so that an asset may be fully depreciated.

Fractional years life must be entered as an integer and a decimal. Thus, a life of 12 years 3 months would be keyed in as 12.25.

Crossover Point

As indicated in the description above, the declining balance method of depreciation may not fully depreciate an asset in the asset's lifetime. In these circumstances there is an optimum point in the useful life where a switch from the declining balance method to the straight line method should be made. This is the ''crossover point'', the first year in which the depreciation by the straight line method is greater than if depreciation were continued using declining balance method. (In accordance with Internal Revenue Service Publication 534, the straight line depreciation is determined by dividing the remaining depreciable value by the remaining useful life.)

Given the starting book value (SBV), salvage value (SAL), useful life expectancy (LIFE), and declining balance factor (FACT), this routine calculates the last year that the declining balance method should be used, and the remaining life and remaining book value after this ''last year'' so that a switch to straight line depreciation can be made. As in the previous routine, the factor (FACT) should be entered in factor form (1.25, 1.5, 2.0), not as a percent (125, 150, 200).

The crossover routine (f D) may be used with the declining balance (f C) and straight line (f A) depreciation routines as follows:

1. Use f D to determine the ''crossover point'' and associated values.

2. Use f C to generate a declining balance depreciation schedule for the early years up to and including the year indicated as being the ''last year''. Since the same input values are used, only a value for YR (D) need be keyed in before pressing f C.
3. Now use f A to generate a straight line depreciation schedule for the remaining years. The remaining book value at the end of the last ''declining balance year'' is keyed in for starting book value (A), and the remaining life is keyed in for the asset's life (C). There is no need to enter the salvage value as it has been retained throughout this process.

   For this portion of the depreciation schedule, the value for ''total depreciation to date'' will be in error by an amount equal to the amount depreciated during the declining balance calculations.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
2	Optional: Select print mode		f E	1.00 or 0.00
3	Key in all of the following:			
	• Starting book value	SBV	STO A	SBV
	• Salvage value	SAL	STO B	SAL
	• Life of the asset	LIFE	STO C	LIFE
4	For depreciation schedules,			
	key in:			
	• Year for which depreciation			
	is to be calculated.	YR	STO D	YR
5	To calculate straight line			
	depreciation schedule		f A	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and			
	4 and change appropriate			
	inputs.			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
6	Calculate the SOYD schedule		f B	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and			
	4 and change appropriate			
	inputs.			
7	Calculate the declining balance			
	schedule (the appropriate			
	factor must be entered).	FACT	STO E	FACT
			f C	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and			
	4 and change appropriate			
	inputs.			
8	To find crossover point the			
	declining balance factor must			
	be stored.	FACT	STO E	FACT
9	Calculate last year to use de-			
	clining balance method.		f D	LAST YEAR
10	Calculate remaining life.		R/S	REM LIFE
11	Calculate remaining book			
	value.		R/S	RBV

Example 1:

For a starting book value of \$375,000, a salvage value of \$30,000 and an expected life of 40 years, generate the 1st year's depreciation schedule using each of the common methods. Assume a declining balance factor of 1.5. Then jump ahead to the 15th year and generate the data for that year.

Keystrokes:	**Outputs:**	
375000 STO A 30000 STO B 40 STO C 1 STO D		
Straight Line		
f A →	1.00	(1st year)
R/S →	8625.00	(1st year's depreciation)
R/S →	336375.00	(remaining depreciable value)
R/S →	366375.00	(remaining book value)
R/S →	8625.00	(total depreciation to date)

Now jump ahead to the 15th year.

Keystrokes:	**Outputs:**	
15 STO D f A →	15.00	(15th year)
R/S →	8625.00	(15th year's depreciation)
R/S →	215625.00	(remaining depreciable value)
R/S →	245625.00	(remaining book value)
R/S →	129375.00	(total depreciation after 15 years)
SOYD		
1 STO D f B →	1.00	(1st year)
R/S →	16829.27	(1st year's depreciation)
R/S →	328170.73	(remaining depreciable value)
R/S →	358170.73	(remaining book value)

R/S →	16829.27	(total depreciation to date)

Jump ahead to the 15th year.

15 STO D f B →	15.00	(15th year)
R/S →	10939.02	(15th year's depreciation)
R/S →	136737.80	(remaining depreciable value)
R/S →	166737.80	(remaining book value)
R/S →	208262.20	(total depreciation 1st through 15th year)

Declining Balance

1 STO D 1.5 STO E f C →	1.00	(1st year)
R/S →	14062.50	(1st year's depreciation)
R/S →	330937.50	(remaining depreciable value)
R/S →	360937.50	(remaining book value)
R/S →	14062.50	(total depreciation to date)

Keystrokes:	**Outputs:**	

Now jump to the 15th year.

15 STO D f C →	15.00	(15th year)
R/S →	8235.18	(15th year's depreciation)
R/S →	181369.51	(remaining depreciable value)
R/S →	211369.51	(remaining book value)
R/S →	163630.49	(total depreciation 1st through 15th year)

Example 2:

Having just performed the previous calculation, determine the crossover point and the associated remaining life and remaining book value. Generate the depreciation data for the declining balance "last year," and then switch to the straight line method to generate the depreciation data for the year following the declining balance "last year."

Keystrokes:	**Outputs:**	
f D →	18.00	(last year to use declining balance)
R/S →	22.00	(asset's remaining life after 18 years)
R/S →	188471.01	(remaining book value after 18th year)
18 STO D f C →	18.00	(18th year)
R/S →	7343.03	(18th year's depreciation)
R/S →	158471.01	(remaining depreciable value)
R/S →	188471.01	(remaining book value)
R/S →	186528.99	(total depreciation 1st through 18th year)
188471.01 STO A 22 STO C		
1 STO D f A →	1.00	(1st year)
R/S →	7203.23	(19th year's depreciation)

Note:

Although 1 was keyed in for YR—the first year of straight line depreciation—this is the 19th year of the asset's life.

R/S →	151267.78	(remaining depreciable value)
R/S →	181267.78	(remaining book value)

etc.

NOTES

DAYS BETWEEN DATES

This program calculates the number of days between two dates on an actual or 30/360 basis (30 day month, 360 day year). When the actual number of days is desired, the two dates must occur between January 1, 1901 and December 31, 2099. There is no limitation for the 30/360 basis.

The earlier date is keyed in for DT 1 (A), the later date is keyed in for DT 2 (B). The calculation is performed by pressing C for the actual number of days or by pressing D for the number of days on a 30/360 basis. Both input dates are retained, so that only a changed date must be keyed in for a new calculation.

The date format for input is MM.DDYYYY (March 3, 1976 is keyed in as 3.031976). The program does not check input data. Thus, if an improper format or an invalid date (i.e., February 30) is keyed in, erroneous answers will result.

An important feature of this program is that it is designed to be used in conjunction with BOND PRICE AND YIELD (BD-15). When the settlement date is entered for DT 1 and the redemption date (maturity date, call date, etc.) is entered for DT 2, pressing C or D also causes the number of remaining semiannual coupon periods to be stored for use by the bond program. The number of semiannual coupon periods on an actual day basis is determined by subtracting the number of leap days (February 29 of a leap year) from the actual number of days (the displayed value) and dividing this by 182.5 (days per semiannual period). On a 30/360 basis the number of semiannual coupon periods is found by dividing the number of days (displayed value) by 180 days per semiannual period).

In addition, the settlement date is retained throughout the bond calculations. Therefore, on return to this program, it is only necessary to key in a new DT 1 if the settlement date is different.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Key in the following:			
	• Earliest date (DT 1)	MM.DDYYYY	A	DT 1
	• Latest date (DT 2)	MM.DDYYYY	B	DT 2
3	Calculate the number of days			
	between the two dates on an			
	"actual" day basis.		C	Actual Days

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Calculate the number of days			
	between the two dates on a			
	30/360 basis.		D	30/360 Days
5	For a new case, go to step 2			
	and change DT 1 and/or DT 2			
	as appropriate.			

Example 1:

Calculate the actual number of days between June 24, 1974 and December 5, 1985.

Keystrokes: **Outputs:**

6.241974 A 12.051985 B C → 4182.00 (actual)

Example 2:

Having just performed the above calculation, now calculate the actual number of days between June 24, 1974 and March 21, 1990.

Keystrokes: **Outputs:**

3.211990 B C → 5749.00 (actual)

Example 3:

Calculate the number of days, on both an actual and 30/360 basis, between May 1, 1975 and November 1, 1980.

Keystrokes: **Outputs:**

5.011975 A 11.011980 B C → 2011.00 (actual)

D → 1980.00 (30/360)

BOND PRICE AND YIELD

This program calculates the "flat" price (i.e., not including accrued interest) or annual yield of a semiannual coupon bond. Data required for input are the number of coupon periods (PER) between settlement date and redemption date (maturity date, call date, etc.), the annual coupon rate expressed as a percent (CR), the redemption value (RV) if other than 100, and either the annual yield expressed as a percent (YLD) or the bond price (PRICE).

All prices are expressed as a percent of the face value. (e.g., since most bonds have a face value of $1,000, a call price of 107 implies an actual redemption value of $1,070 if the bond is "called".)

The amount of the accrued interest for the expired portion of the current coupon period is available in register 8 and may be recalled (RCL 8).

Each time the coupon rate is entered by pressing B, the redemption value is automatically set to 100. This is the proper value for a price-to-maturity calculation, and no value must be keyed in for redemption value (RV). If however, the price-to-call is desired and the call price is other than 100, the call price has to be entered for RV *after* the coupon rate has been keyed in.

All input data are retained so that when alternative calculations are to be performed, only changed data must be keyed in. This permits, for instance, calculating the price for each of several different yields. In addition, the settlement date is retained throughout the bond calculations, and need not be reentered when returning to the calendar program for another bond calendar calculation.

The number of remaining coupon periods between settlement date and redemption date may be calculated and entered in two ways. If the calendar program is used to calculate the number of days between the settlement date and redemption date, the number of remaining semiannual coupon periods is automatically calculated and stored in register 0 for use by the bond program. In this case the instruction to enter the number of remaining coupon periods in step 3 below may be ignored. If however, the number of remaining coupon periods is already known, or the method used to calculate this value by the calendar program is deemed inappropriate, it may be entered in step 3. Choosing between an actual or 30/360 calendar calculation depends on trade custom for the particular security. Corporate bonds are traditionally traded on a 30/360 basis, while many government securities use an "actual" calendar.

This program may be used for after-tax as well as before-tax yield calculations. The procedure is to reduce the coupon and redemption values to their after-tax net values prior to entering them in the program. This can be important when

comparing a bond with taxable coupons to one whose coupons are tax-free. The program may also be used to calculate a yield when a bond is purchased, and then sold prior to redemption by the issuer. The procedure is simple to treat the exit date and price as the redemption date and reemption value respectively. The yield calculated is the precise yield if the exit date is also a coupon date, and is an approximate yield for other exit dates.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Optional: Use program BD-14			
	to calculate the number of re-			
	maining coupon periods.			
2	Load side 1 and side 2 of the			
	bond program.			
3	Key in:			
	• Number of remaining cou-			
	pon periods (may be omitted			
	if step 1 is performed)	PER	A	PER
	• Annual coupon rate	CR (%)	B	CR (%)
	• Redemption value if other			
	than 100.	RV	D	RV
4	To determine the yield, key in			
	the bond price.	PRICE	E	PRICE
5	Calculate the annual yield.		C	YLD (%)
6	To find the price, key in the			
	annual yield rate.	YLD (%)	C	YLD (%)
7	Calculate the "flat" price.		E	PRICE
8	Optional: Recall the accrued			
	interest		RCL 8	ACC INT
	AND			
	add it to the "flat" price to obtain			
	total bond value as of the			
	settlement date.		+	Bond Value

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
9	For a new case go to step 1 or 3			
	and change appropriate values.			
	NOTE: When CR is entered,			
	RV is automatically set to 100.			

Example 1:

What is the price of a semiannual 3% bond to yield 10% with settlement date of January 1, 1972? The bond matures March 6, 1978, and a 30/360 calendar is used.

Keystrokes: **Outputs:**

Enter program BD-14

1.011972 [A] 3.061978 [B] [D] ⟶ 2225.00 (days settlement to maturity, 30/360 basis)

Now enter program BD-15

3 [B] 10 [C] [E] ⟶ 68.29 (price-to-maturity)

Example 2:

Having performed the above calculation, determine the price of the same bond using the "actual" number of days. Remember, the settlement date has been retained and need not be reentered.

Keystrokes: **Outputs:**

Enter program BD-14

3.061978 [B] [C] ⟶ 2256.00 (actual days settlement to maturity)

Enter program BD-15

3 [B] 10 [C] [E] ⟶ 68.31 (price-to-maturity)

Example 3:

A U.S. Treasury Note with a 5.75% coupon and 88 days from settlement to maturity is purchased at 100 18/32. If there are assumed to be 183 days in a coupon period, what is the yield-to-maturity?

Keystrokes: **Outputs:**

5.75 [B] 88 [ENTER↑] 183 [÷] [A] ⟶ 0.48 (fraction of a coupon period remaining)

18 ENTER↑ 32 ÷ 100 + E C ⟶ 3.34 (% annual yield-to-maturity)

Example 4:

Assuming that the previous problem has just been performed as shown, calculate the yield if there are assumed to be 182 days in a coupon period instead of 183.

Keystrokes: **Outputs:**

88 ENTER↑ 182 ÷ A C ⟶ 3.35 (% annual yield-to-maturity)

Example 5:

An **annual** coupon bond with a 5% coupon is settled on March 1, 1974. If the yield is 5.5%, and the bond matures on February 1, 1984 what is the price-to-maturity on a 30/360 basis?

Keystrokes: **Outputs:**

Enter program BD-14

3.011974 A 2.011984 B D ⟶ 3570.00 (days settlement to maturity, 30/360 basis)

Determine the number of **annual coupon periods** remaining by dividing by the number of days in a coupon period.

360 ÷ ⟶ 9.92 (number of annual coupon periods)

Enter program BD-15

A ⟶ 9.92 (the correct value for PER is entered)

The coupon rate and yield rate must be multiplied by a factor prior to input. This factor is determined by dividing the number of coupon periods per year into 2. For annual coupon bonds the factor is therefore 2 (for quarterly coupons the factor is 0.5 etc.).

5 ENTER↑ 2 × B 5.5 ENTER↑
2 × C E ⟶ 96.24 (price-to-maturity)

Example 6:

A semiannual coupon bond with a 5% coupon rate maturing February 6, 1993 was purchased November 15, 1973 for a price of 99. The bond is callable on February 6, 1980 at a call price of 101. What is the yield-to-call and yield-to-maturity if the 30/360 calendar is used?

Keystrokes:	Outputs:	
Enter program BD-14		
11.151973 A 2.061980 B D →	2241.00	(days settlement to call)
Enter Program BD-15		
5 B 101 D 99 E C →	5.33	(% yield-to-call)
Enter program BD-14		
2.061993 B D →	6921.00	(days settlement to maturity)
Enter program BD-15		
5 B 99 E C →	5.08	(% yield-to-maturity)

Example 7:

Having just completed the before tax yield-to-maturity calculation in the previous example, the bond purchaser wishes to perform an after tax yield-to-maturity calculation. He is in a 40% income tax bracket and a 25% tax is to be applied to capital gains.

Keystrokes:	Outputs:	
First, calculate and enter the after tax value of the coupon.		
5 ENTER↑ ENTER↑ .4 × − B →	3.00	(net after tax coupon)

Now calculate and enter the net after tax proceeds when the bond is redeemed for 100 at maturity.

100 ENTER↑ ENTER↑ 99 − →	1.00	(capital gain)
.25 × →	0.25	(capital gains tax)
− D →	99.75	(net proceeds from bond redemption)

(The price and remaining coupon periods have been retained from the previous calculation.)

C →	3.06	(% after tax yield)

NOTES

INTEREST AT MATURITY/DISCOUNTED SECURITIES

The first part of this program calculates the price or yield of interest at maturity securities. The necessary inputs are the days from issue to maturity (DIM), the days from settlement to maturity (DSM), the calendar basis (360 or 365), the coupon rate (CR), and either the price (to calculate yield) or the yield (to calculate price).

The second part of the program calculates the price or yield of discounted securities such as U.S. Treasury Bills. The required inputs are the number of days from settlement to maturity and one of the following: discount rate (to calculate price and/or yield), yield (to calculate price) or price (to calculate yield).

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
	Interest at Maturity			
2	Enter the following:			
	• Days issue to maturity	DIM	ENTER↑	DIM
	• Days settlement to maturity	DSM	A	DSM
	• Basis (360 or 365)	BASIS	B	BASIS
	• Coupon rate (as a percent)	CR (%)	C	CR (%)
3	Enter one of the following:			
	• Yield (%)	YLD (%)	D	YLD (%)
	• Price	PRICE	E	PRICE
4	Calculate remaining variable		D	YLD (%)
			E	PRICE
	Discounted Securities			
5	Key in days settlement to			
	maturity	DSM	f A	DSM
6	Input one of the following:			
	• Discount rate	DR	f B	DR
	• Yield (as a %)	YLD (%)	f D	YLD (%)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	• Price	PRICE	E	PRICE
7	Calculate either or both		D	YLD (%)
			E	PRICE

Example 1:

Find the yield of the following interest at maturity security:

DIM = 220
DSM = 117
Basis = 360
CR = 5%
Price = 99.531250

Keystrokes: **Outputs:**

220 ENTER↑ 117 A
360 B 5 C
99.531250 E D ⟶ 6.38 (% yield)

Example 2:

Having just performed the above calculation, what is the price of this interest at maturity security to give a yield of 7%?

Keystrokes: **Output:**

7 D E ⟶ 99.33 (price)

Example 3:

Given the number of days from settlement to maturity and the discount rate of the following security, find the price and yield.

DSM = 81
DR = 5.60

Keystrokes: **Outputs:**

81 f A 5.6 f B
f E ⟶ 98.74 (price)
f D ⟶ 5.67 (% yield)

Example 4:

Find the yield of the following discounted security:

DSM = 307
Price = 96.27

Keystrokes:	**Outputs:**
307 f A 96.27 f E f D →	4.54 (% yield)

NOTES

LINEAR REGRESSION—EXPONENTIAL CURVE FIT

This program performs a least squares regression to determine both a linear and exponential fit for the given set of data pairs (x, y).

Linear regression is a statistical method for finding a straight line that best fits a set of data points. Forecasting and market projections are business applications where linear regression could be used to fit a set of data.

The equation of this straight line expresses the linear relationship between an independent (x) and dependent (y) variable and is of the form:

$$y = a + bx$$

where:

y = dependent variable
a = the value of y when x = 0, called the ''y-intercept''
b = the slope of the straight line
x = independent variable

In addition to calculating values for the slope and y-intercept, this program also calculates the coefficient of determination r^2. This is an indication of the ''goodness of fit'' for the calculated straight line, and is a number between 0 and 1. Values closer to 1 indicate ''better'' fits than values closer to 0.

If the coefficient of determination is lower than expected, perhaps the data points could be better represented as a curve, rather than a straight line.

The program also determines the best exponential curve fit of the form:

$$y = ae^{bx} \quad (a > 0 \text{ and } y > 0)$$

where:

y = dependent variable
a = the value of y when x = 0, called the ''y-intercept''
e = a constant (2.718281828)
b = the slope or rate of growth of the curve
x = independent variable

The coefficient of determination is also calculated for the exponential curve.

The exponential curve fitting technique is often used to determine the growth rate of a variable such as a stock's value over time, when it is suspected that the performance is non-linear. The value for b is the decimal value of the *continuous* growth rate. For instance, assume after keying in several end-of-month price quotes for a particular stock, it is determined that the value for b is 0.10. This means that over the measured period the stock has experienced a 10%

continuous growth rate. (An option is available to convert this decimal continuous growth rate to an effective rate in percent. See program BD-12 for a description of continuous and effective interest rates.)

When evaluating the exponential curve, only positive y-values may be input. If a value of y is entered as a negative number, the linear regression slope, intercept, and goodness of fit will be calculated, and then the display will show ERROR. This means that at least one y-value is less than or equal to zero, and the exponential curve may not be evaluated.

When the user has data where the x-values are evenly spaced (i.e., the difference between any two successive x-values is always the same), the trend line key (C) may be used. In this case, it is necessary to key in only the y-values; the x-values are automatically incremented by 1. This feature may be used for inputting data for lines or exponential curves. Remember that if any y-values are input which are less than or equal to zero, the exponential curve fit cannot be calculated.

If any (x, y) data pair was input incorrectly it may be deleted by re-entering the incorrect pair and pressing f B. Likewise, if the last trend value was input incorrectly, key in the incorrect value and press f C.

After determining whether the linear or exponential fit is better, the user may then key in x-values and generate projected y-values ($\hat{y}$), by pressing D for the line, or by pressing E for the curve.

A print/pause option is available (f E). Successive use of f E will display 1.00 or 0.00 indicating that the print/pause mode is on or off respectively. When the print, pause mode is on (1.00) the results are automatically printed/displayed.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
2	Optional: Set print/pause mode		f E	1.00 or 0.00
3	Initialize (START)		A	0.00
4	If data is unevenly spaced, key			
	in x and y-values, until each pair			
	has been entered.	x	ENTER↑	
		y	B	# entries
5	To delete an incorrect data pair			
	(x_k, y_k)	x_k	ENTER↑	
		y_k	f B	# entries − 1
6	If data is evenly spaced, key in			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	successive y-values until all			
	have been entered.	y	C	# entries
7	To delete the *last* y-value	y	f C	# entries −1
8	Calculate. If the print/pause flag			
	is on (1.00), these values are			
	automatically printed.		f A	a
			R/S	b } linear
			R/S	r^2
			R/S	a
			R/S	b } exp.
			R/S	r^2
	Optional: Calculate			
	growth rate		R/S	% growth rate
9	Optional: Key in an x-value and			
	calculate a corresponding			
	y-value on the line. This may be			
	repeated as often as desired.	x	D	$\hat{y}$ (lin.)
10	Optional: Key in an x-value and			
	calculate a corresponding			
	y-value on the curve. This may			
	be repeated as often as desired.	x	E	$\hat{y}$ (exp.)
11	Return to step 2 for a new set of			
	data.			

Example 1:

You bought a house three years ago for $47,500. The first year it appreciated $5,000. The second year its value rose to $60,000. Today you figure the market price to be $64,000 if you were to sell. What will your house be worth next year?

Keystrokes: **Outputs:**

Since the data is evenly spaced, the trend line function could be used.

A → 0.00

47500 C → 1.00

52500 C →	2.00
60000 C →	3.00
64000 C →	4.00

Now calculate the equation of the line (or curve if that gives a better fit).

f A →	41750.00 (linear a)
R/S →	5700.00 (linear b)
R/S →	0.99 (linear r^2)
R/S →	43021.27 (exponential a)
R/S →	0.10 (exponential b)
R/S →	0.98 (exponential r^2)

Since linear regression gives a better fit, use D to project new values.

5 D →	70250.00 (projected value at 5th year)

Example 2:

A stock's price history is listed below. What effective growth rate does this represent? If the stock continues this growth rate, what is the price projected to be at the end of 1976 (year 5)?

End of Year	Price
1972 (1)	52½
1973 (2)	55¼
1974 (3)	(missing data)
1975 (4)	75
1976 (5)	?

Keystrokes:	Outputs:
A →	0.00
1 ENTER↑ 52.5 B →	1.00
2 ENTER↑ 55.25 B →	2.00
4 ENTER↑ 75 B →	3.00 (total number of entries)
f A →	42.63 (linear a)
R/S →	7.84 (linear b)
R/S →	0.95 (linear r^2)
R/S →	45.06 (exponential a)
R/S →	0.12 (exponential b)
R/S →	0.96 (exponential r^2)
R/S →	13.17 (percent annual growth rate)

The exponential curve gives a better fit.

5 E →	83.65 (projected price at the end of 1976)

MULTIPLE LINEAR REGRESSION

This program performs a least squares multiple linear regression for a series of data points x, y, z. Linear regression is a statistical method for finding a straight line that best fits a set of data points. The equation of this straight line expresses the linear relationship between independent (x and y) and dependent (z) variables and is of the from:

$$z = a + bx + cy$$

Independent variables are input by pressing **B**. If one or more of the data points was entered incorrectly, simply re-enter the incorrect value(s) and press **f** **A**. Then continue as before. The three coefficients (a, b, c) are calculated by pressing **C**.

In addition, the program also calculates the coefficient of determination r^2 (**D**). This is an indication of the "goodness of fit" for the calculated straight line, and is a number between 0 and 1. Values closer to 1 indicate "better" fits than values closer to 0.

Having determined the equation (the **C** key), the user can then project estimates of z for given x, y values (**E**). The sums (Σx_i; Σy_i; Σz_i), the sums of squares (Σx_i^2; Σy_i^2; Σz_i^2), and the sums of cross products ($\Sigma x_i y_i$; $\Sigma x_i z_i$; $\Sigma y_i z_i$) are stored in registers 7–9, 4–6, and 1–3 respectively.

An option is available (**f** **E**) to automatically print/pause the calculated values. Pressing **f** **E** sets and clears the print option. Successive use of **f** **E** will alternately display 1.00 and 0.00, indicating that the print/pause mode is on or off respectively.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
2	Optional: Select print/pause			
	mode		**f** **E**	1.00 or 0.00
3	Initialize (START)		**A**	0.00
4	Key in x and y, and correspond-			
	ing z value	x	ENTER↑	
		y	ENTER↑	
		z	**B**	# entries
5	Repeat step 4 for all x, y, z data			
	pairs.			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
6	If a data pair was input incor-			
	rectly, re-enter incorrect x, y, z			
	values	x	ENTER↑	
		y	ENTER↑	
		z	f A	# entries − 1
7	Calculate coefficients:		C	a
			R/S	b
			R/S	c
	If the print/pause mode is on			
	(1.00), b and c are auto-			
	matically calculated.			
8	Optional: Calculate the coeffi-			
	cient of determination: r^2		D	r^2
9	Optional: Key in x and y values			
	and calculate the estimated			
	z value. (This may be repeated			
	as often as desired.)	x	ENTER↑	
		y	E	$\hat{z}$
10	For a new case, go to step 2.			

Example 1:

A commercial land appraiser has examined 5 vacant lots in the downtown section of a local community, all of which have different depths, frontages, and values as shown below. Based on this data, what is the relationship between depth, frontage, and lot value? What is the coefficient of determination? What predicted value would a lot have with a 50 foot depth and 70 foot frontage? With a 75 foot depth and 80 foot frontage?

Lot Depth (feet)	Lot Frontage (feet)	Lot Value
70	70.8	$101,000
90	60.0	82,190
85	90.0	170,000
40	70.0	100,000
100	60.0	90,000

Keystrokes:	Outputs:	
A 70 ENTER↑ 70.8 ENTER↑ 101000 B		
90 ENTER↑ 60 ENTER↑ 82190 B		
85 ENTER↑ 90 ENTER↑ 170000 B		
40 ENTER↑ 70 ENTER↑ 100000 B		
100 ENTER↑ 60 ENTER↑ 90000 B →	5.00	(number of entries)
C →	-118499.03	(a)
R/S →	314.71	(b)
R/S →	2892.02	(c)

Hence, $z = -118499.03 + 314.71x + 2892.02y$

D →	0.98	(r^2)
50 ENTER↑ 70 E →	99678.08	(value of 50 × 70 foot lot)
75 ENTER↑ 80 E →	136466.08	(value of 75 × 80 foot lot)

Notice that if your lot has a depth of 50 feet and a frontage of 10 feet a negative $ value results (-73843.26). You may have difficulty selling this property!

NOTES

BREAK-EVEN ANALYSIS

Break-even analysis is basically a technique for analyzing the relationships among fixed costs, variable costs, and income. Until the break-even point is reached, at the intersection of the total income and total cost lines, the producer operates at a loss. After the break-even point, each unit produced and sold makes a profit. Break-even analysis may be represented as follows:

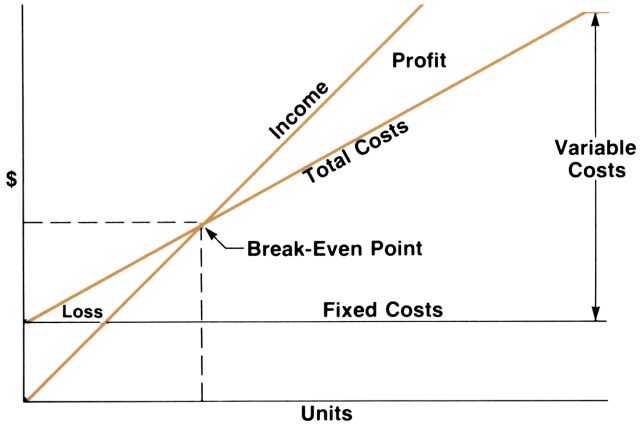


Figure 8

Given four of the following variables: fixed costs (F), sales price per unit (P), variable costs per unit (V), number of units sold (U), and gross profit (GP), this program evaluates the remaining variable. To calculate the break-even values, simply let the gross profit equal zero.

The degree of operating leverage (OL) at a point is defined as the ratio of the percentage change in net operating income to the percentage change in units sold. The greatest degree of operating leverage is found near the break-even point, where a small change in sales may produce a very large increase in profits. This happens because the profits are close to zero near the break-even point. Likewise, firms with a small degree of operating leverage are operating farther from the break-even point, and they are relatively insensitive to changes in sales volume.

The necessary inputs to calculate the degree of operating leverage are fixed costs (F), sales price per unit (P), variable costs per unit (V), and number of units (U).

For subsequent calculations, it is necessary only to input *new* data.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1			
2	Key in four of the following in			
	any order:			
	• Fixed costs	F	A	F
	• Sales price per unit	P	B	P
	• Variable costs per unit	V	C	V
	• Number of units	U	D	U
	• Gross profit	GP	E	GP
3	Calculate the remaining			
	variable.		A	F
			B	P
			C	V
			D	U
			E	GP
4	To calculate the degree of			
	operating leverage		f A	OL

Example 1:

The Cooper Company sells finance textbooks at $13 apiece. Given costs and revenues below, how many textbooks must be sold to break even?

Fixed Costs	
Typesetting	$ 4,000
Graphics production	5,000
Printing and binding	3,000
Total fixed costs	$12,000
Variable costs per copy	
Distribution	$1.00
Commissions	3.75
Royalties	2.00
Total variable costs per copy	$6.75
Sales price per copy	$13.00

Keystrokes:	Outputs:	
12000 A 13 B 6.75 C		
0 E D →	1920.00	(number of units)

Example 2:

Having just completed the above problem, what is the Copper Company's degree of operating leverage at 2000 units? At 5000 units?

Keystrokes:	Outputs:	
2000 D f A →	25.00	(this is close to the break-even point)
5000 D f A →	1.62	(the company is farther from the break-even point and less sensitive to changes in sales volume)

NOTES

INVOICING

Given a discount rate (DISC), number of units (UNITS), and price per unit (PRICE) for each line item, this program calculates the net line total (NLT), maintains a running subtotal (ST) and grand total (GT), and determines each line total's percent of the grand total (%T). A maximum of 20 line items may be input. If more than 20 are input, ERROR is displayed.

The net line total is the number of units multiplied by the unit price, less the discount amount. Each time it is calculated (E), the value is added to both the running subtotal and the grand total. Pressing f A displays the running subtotal and clears the subtotal accumulation (grand total is not affected). Pressing f B displays the grand total (without clearing it). The grand total is not cleared (set to zero) until you START (A) a new problem.

Each line total's percent of the grand total is determined by pressing f C. If the print/pause flag is on, the percentages are output automatically. Otherwise R/S must be used. The last output is 100.00, indicating that all percentages have been calculated.

If after calculating a net line total (E) it is discovered that one of the last input values was keyed incorrectly, press f D to delete the last line total. The previous subtotal is displayed. If a prior line total was incorrect, it is necessary to input the appropriate discount, number of units, and price before f D is pressed to delete the corresponding line total.

The discount rate, number of units and unit price are retained and must only be keyed in when they change.

Pressing f E sets and clears the print/pause option. Successive use of f E will alternately display 1.00 and 0.00, indicating that the print/pause mode is on or off respectively.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1			
2	Optional: Select print/pause			
	mode.		f E	1.00 or 0.00
3	Initialize (START)		A	0.00
4	Key in:			
	• Discount rate	DISC (%)	B	DISC (%)
	• Number of units	UNITS	C	UNITS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	• Price per unit	PRICE	D	PRICE
5	Calculate net line total		E	NLT
6	Optional: Display running			
	subtotal		f A	ST
7	Optional: Display running			
	grand total		f B	GT
8	Display each line total's percent			
	of the grand total		f C	% T_1
	Use R/S if print/pause mode is			
	off (0.00).		R/S	% T_2
			R/S	% T_3
			etc.	
9	If last net line total was incorrect		f D	ST
10	For additional items, same			
	grand total, go to step 4 and			
	change appropriate inputs. For			
	a new case (clear everything)			
	go to step 3.			

Example 1:

The controller of a small company can take advantage of several discounts if he pays the three bills shown below. What amount should be remitted for each bill, what is the grand total to be paid, and what percentage of the grand total is each payment?

Bill 1 (2% discount if paid today)

Line Item	# of Units	Unit Price
1	25	$ 2.75
2	60	1.50
3	71	1.50

Bill 2 (2% discount if paid today)

Line Item	# of Units	Unit Price
1	12	$10.50
2	17	37.20

Bill 3 (3% discount if paid today)

Line Item	# of Units	Unit Price
1	155	$ .28
2	38	.92
3	217	.56

Keystrokes:	Outputs:	
A 2 B 25 C 2.75 D E →	67.38	
60 C 1.50 D E →	88.20	
71 C E →	104.37	
f A →	259.95	(Subtotal—Bill 1)
12 C 10.50 D E →	123.48	
17 C 37.20 D E →	619.75	
f A →	743.23	(Subtotal—Bill 2)
3 B 155 C .28 D E →	42.10	
38 C .92 D E →	33.91	
217 C .56 D E →	117.87	
f A →	193.88	(Subtotal—Bill 3)
f B →	1197.06	(Grand total)
f C →	5.63	Each net line total's percent of the grand total.
R/S →	7.37	
R/S →	8.72	
R/S →	10.32	
R/S →	51.77	
R/S →	3.52	
R/S →	2.83	
R/S →	9.85	
R/S →	100.00	

NOTES

PAYROLL

This section gives an illustration of a payroll program for a small business, which may be modified to suit the employer's particular needs. Since each individual business will have its own needs, requiring modification of this program, we have included a *blank* magnetic card with an unclipped corner. To run the example, the user must record the program included in the Program Listings section. For *example* purposes we have chosen a small business operating in the state of California.

The basic concept around which the program is built is that there is one main program, with a separate data card for each employee. After the net pay for each individual is calculated (based on the data card information), the data card is re-entered to record the new data onto the card.

The data card may contain information on the employee's Social Security number, the number of exemptions, marital status, hourly wage, overtime wage, gross pay to date, Federal, State, Federal Insurance Contributions Act (FICA) and California State Disability Insurance (SDI) withholdings to date, and deductions such as savings deposits, contributions, health insurance, life insurance, stock plans, etc.

The program reflects the 1976 Federal Tax Laws. During 1976, the Social Security (FICA) tax base was increased to $15,300, with the rate remaining at 5.85%. The California State Disability Insurance (SDI) taxable wage base is $9000, with a rate of 1%.

The number of regular hours worked (#hrs), and the number of hours of overtime (#hrs OT), are input by pressing B and C respectively. Federal (FEDL) and state (STATE) taxes are input by pressing D and E. The net pay key (f A) calculates the weekly FICA and SDI, deducts three constants, asks for a data card to record new data, and displays the net pay. All results are rounded to two decimal places.

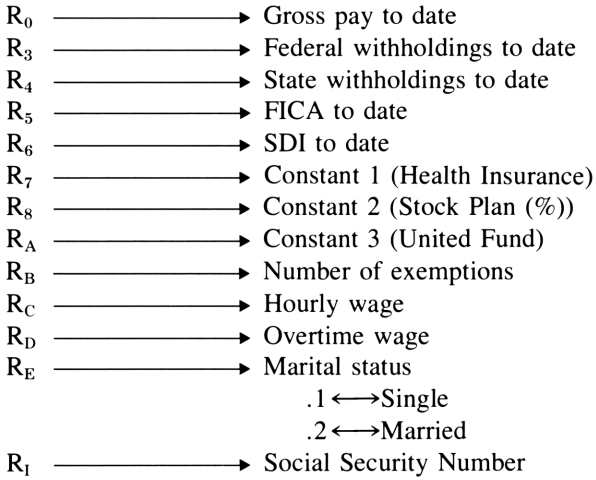
An option is available (f B) to display the gross pay and the Federal, State, FICA, and SDI deductions to date.

A print/pause option is also available (f E). Successive use of f E will alternately display 1.00 and 0.00, indicating that the print/pause mode is on or off respectively. When the print/pause mode is off (0.00), multiple results must be output with R/S. If the print/pause mode is on (1.00) multiple results are automatically printed or displayed.

Note:

The user must provide the applicable Federal and State tax tables.

To use this program, the following registers need to be recorded on a data card:



To record data onto a data card, the following procedure may be used:

1. Set the PRGM-RUN switch to RUN.

2. Key the data into the appropriate storage registers.

3. Press [W/DATA] on the HP-67, or press [WRITE DATA] on the HP-97. The display will show [Crd].

4. Insert an unclipped blank card. If the secondary storage registers contain non-zero data, insert the second side of the card. The data in the storage registers is now recorded on the data card.

5. To change data already on an unclipped card, enter the card, key in the appropriate new data, repeat step 3, and re-enter the data card. The card now contains the revised data.

The following example illustrates the use of this program.

Example 1:

Having just purchased an HP-97 (or HP-67), Mr. Cooper is anxious to set up a payroll system for his hourly employees. The Cooper Company is located in Cupertino, California. A typical employee summary is:

	Gross	Total Federal Tax	Total State Tax	Total FICA	Total SDI	Health Insurance	Stock Plan(%)	United Fund
Joyce Waters SS No: 553-86-7778 Marital Status: Single Exemptions: 1 Hourly Wage: $4.00 Overtime Wage: $6.00	$2064.00	$335.64	$44.20	$120.74	$20.64	$2.50	5%	$1.00

Table 1

Mr. Cooper checks Ms. Waters' time card and finds that she worked 37½ hours this week. What is her take-home pay, gross pay, and Federal, State, FICA and SDI deductions to date?

To make a data card for Ms. Waters:

Keystrokes: **Outputs:**

553867778 STO I
.1 STO E
1 STO B
4 STO C
6 STO D

2064 STO 0
335.64 STO 3
44.20 STO 4
120.74 STO 5
20.64 STO 6
2.50 STO 7
5 STO 8
1 STO A
W/DATA ——————→ Crd

Insert an unclipped blank magnetic card.

To determine net pay, record the Payroll program on the printed card and initialize.

Keystrokes:		Outputs:	
A	→	0.00	(blinking)
Insert data card	→	553867778.0	(Ms. Waters' Social Security Number)
R/S	→	0.10	(Ms. Waters is single)
R/S	→	1.00	(one exemption)
37.5 B	→	150.00	(weekly wage)

From a federal tax table for single persons paid weekly, the withholding for a wage of $150.00 and one exemption is $20.50. The corresponding amount of California State Tax to be withheld is $2.90.

Keystrokes:		Outputs:	
20.50 D	→	20.50	(Federal tax)
2.90 E	→	2.90	(California tax)

To find the net pay:

f A	→	8.78	(FICA)
R/S	→	1.50	(SDI)
R/S	→	2.50	(Health insurance)
R/S	→	7.50	(Stock fund)
R/S	→	1.00	(United Fund)
R/S	→	Crd	

Insert data card to record new data. Program will then continue and display the net pay.

	→	105.32	(Net pay)

Keystrokes:		Outputs:	
f B	→	2214.00	(Gross pay to date)
R/S	→	356.14	(Federal withholdings to date)
R/S	→	47.10	(State withholdings to date)
R/S	→	129.52	(FICA to date)
R/S	→	22.14	(SDI to date)

For subsequent weeks, it will not be necessary to make a new data card for Ms. Waters. Simply input the Payroll program, initialize (A), input her data card, execute the program, and re-record on the same data card. Using this procedure, the payroll information is constantly updated.

Suppose that in 1977 the FICA is increased to 6.15% of the base pay, with a taxable wage base of $16,000. To change the program to meet new requirements, the following procedure should be followed:

1. Press GTO .051
2. Switch to PRGM mode ⟶ 051 03
3. Delete the last two steps
   DEL DEL ⟶ 049 01
4. Insert the two digits of the wage base which were changed
   60 ⟶ 051 00
5. Press GTO .062 ⟶ 062 05
6. Delete the last four steps
   DEL DEL DEL DEL ⟶ 058 _ _ 03 (this code will vary between the HP-67 and HP-97)
7. Insert the new percentage
   6.15 ⟶ 062 05
8. Switch to RUN mode.

A similar procedure may be used to change or delete the SDI subroutine (LBL 2). Simply press GTO 2, switch to PRGM mode, and make the appropriate changes.

The user may also wish to expand or decrease the number of deductions to be taken. Eleven additional registers are available for constant storage (S0–S9, I). Subroutine 5 (LBL 5) may be accessed by pressing GTO 5 (in RUN mode) and then switching to PRGM mode. Changes in the routine may then be made. Be sure to delete inappropriate routines already recorded.

Remember that if the secondary storage registers are used (S0–S9), both sides of the data card will need to be recorded.

We recommend that the user does not clip the corner of the magnetic card provided. If you wish a permanent program card, you should use another blank card to record the program.

NOTES

INVENTORY

This section gives an illustration of how an inventory program might be written. Every business will probably have a different inventory method, so we have included a *blank* magnetic card with an unclipped corner. To run the example, the user must record the program included in the Program Listings section.

The first step in developing any program is to define what will be calculated, and which labels will be used to do the calculations. The card art shown above, could be programmed to do the following:

START — initializes the program by asking for a data card; then displays a part number (10 digit maximum)

PRICE — stores price of parts received

RECD — subtracts the number of units received from amount ordered; adds the number of units received to total on hand; calculates new unit price by weighted average method; calculates slack (quantity on hand plus quantity on order less quantity required)

ISSUED — subtracts number of units issued from those on hand; calculates slack

ORDER — adds number of units ordered to those already on order; calculates slack

MIN — stores minimum quantity

LT→SLK— when the lead time (in days) is input, the slack is calculated

LIST — recalls and displays inventory information

UPDATE — asks for data card to record new inventory information

P? — sets and unsets the print/pause flag; successive use of f E displays 1.00 and 0.00 indicating that the print/pause mode is on or off respectively

The main program contains the instructions to perform the above calculcations. A separate data card holds the current inventory information for each part number. The data card may be updated after the transactions have been completed.

To use this program, the following registers should be recorded on a data card:

R_0 ⟶ Part number (10 digit maximum)

R_1 ⟶ Unit price

R_2 → Quantity on hand
R_3 → Quantity on order
R_4 → Minimum quantity
R_5 → Lead time (days)
R_6 → Slack (Optional—as it may be calculated)

The program uses three additional registers for calculations, so 16 registers are still available.

The following report illustrates how this program might be used.

Inventory Report
February 15, 1976

Part #	Unit Price	Quantity on Hand	Quantity on Order	Minimum Quantity	Lead Time
2417126	9.91	275	319	370	56
3668871	4.96	250	100	225	46
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

Data cards for each part number could be made in this manner:

1. In RUN mode, store data in the appropriate registers.

   [CL REG]
   2417126 [STO] 0
   9.91 [STO] 1
   275 [STO] 2
   319 [STO] 3
   370 [STO] 4
   56 [STO] 5

2. Press [W/DATA] and insert a blank, unclipped card.
3. Repeat the procedure for each part number.

Suppose that in the next week, the following part was received:

Part #	Unit Price	Amount Received
2417126	10.25	150

To update the data card to reflect this transaction, use the following procedure:

1. Record the inventory program.
2. Press [A]. The display will blink zeros until a data card is input. When the data card is entered, the display will show the part number
   → 2417126.00

3. Key in the price of each unit received and press B.
   10.25 B
4. Key in the number of units received and press C.
   150 C → 425.00

   The number displayed is the quantity on hand.
5. To review the status of the part number, press:

f C →	10.03	(New unit price)
R/S →	425.00	(Amount on hand)
R/S →	169.00	(Amount on order)
R/S →	370.00	(Minimum quantity)
R/S →	56.00	(Lead time)
R/S →	224.00	(Slack
R/S →	2417126.00	(Part number)

If the print/pause flag was on (1.00), these values would have been displayed automatically.

6. To record the new data press f D and insert the data card. The new data is recorded, and the display shows 0.00.

Likewise, if parts had been sold or ordered, the appropriate amounts would be keyed in, the user would press D or E respectively, and then update the data card.

If the minimum quantity requirements change, key in the new minimum and press f A. And if the user wishes to calculate the slack, key in the lead time and press f B.

We recommend that the use does not clip the corner of the magnetic card provided. If you wish a permanent program card, you should use another blank card to record the program.

PROGRAM LISTINGS

The following listings are included for your reference. A table of keycodes and keystrokes corresponding to the symbols used in the listings can be found in Appendix E of your Owners Handbook.

INTERNAL RATE OF RETURN

001	*LBLA	21 11	Clear registers
002	CLRG	16-53	
003	P≠S	16-51	
004	CLRG	16-53	INV→R_E
005	STOE	35 15	
006	CF0	16 22 00	Clear flags
007	CF1	16 22 01	
008	RTN	24	
009	*LBLB	21 12	
010	2	02	Input largest cash flow if #CFs > 22.
011	x	-35	
012	STO6	35 06	
013	RCLE	36 15	
014	X≠Y	-41	
015	÷	-24	INV/2 CMAX→R_E
016	STOE	35 15	
017	LSTX	16-63	
018	SF0	16 21 00	Flag 0 indicates > 22 cash
019	2	02	flows.
020	÷	-24	
021	RTN	24	
022	*LBLC	21 13	
023	ISZI	16 26 46	If F0, pack data in registers.
024	F0?	16 23 00	
025	GSBc	23 16 13	
026	ST+i	35-55 45	
027	X≠Y	-41	
028	RCLI	36 46	Display # of cash flows (add
029	F1?	16 23 01	if > 22 CF).
030	+	-55	
031	RTN	24	
032	*LBLc	21 16 13	
033	2	02	
034	3	03	
035	RCLI	36 46	
036	X≠Y?	16-32	23rd cash flow?
037	GTO0	22 00	
038	1	01	Reset I
039	STOI	35 46	
040	+	-55	Drop stack and clear x.
041	CLX	-51	
042	EEX	-23	
043	5	05	2 CMAX/10^5→R_0
044	ST÷0	35-24 00	
045	SF1	16 21 01	
046	*LBL0	21 00	
047	R↓	-31	
048	1	01	
049	-	-45	
050	X≠Y	-41	
051	RCL0	36 00	Scale cash flow
052	÷	-24	
053	F1?	16 23 01	If CF_j, j > 22, drop frac-
054	INT	16 34	tional part of CF_j.
055	RTN	24	
056	*LBLa	21 16 11	

057	RCLI	36 46	LBL fa sets up I for count down *and* keeps track of original # of cash flows by storing N.N.
058	1	01	
059	0	00	
060	1	01	
061	x	-35	
062	STOI	35 46	
063	RTN	24	
064	*LBLe	21 16 15	
065	F0?	16 23 00	
066	GTO0	22 00	Unpacks double-stored
067	INT	16 34	cash flows.
068	EEX	-23	
069	5	05	
070	÷	-24	
071	RTN	24	
072	*LBL0	21 00	
073	FRC	16 44	
074	RTN	24	
075	*LBLD	21 14	
076	GSBa	23 16 11	Set-up I
077	RCLI	36 46	NN
078	EEX	-23	
079	2	02	
080	÷	-24	
081	STOI	35 46	N.N→I
082	1	01	
083	.	-62	
084	0	00	
085	1	01	$1 + i_0$→R_D
086	STOD	35 14	
087	*LBL4	21 04	
088	CF0	16 22 00	
089	0	00	
090	STO0	35 00	
091	*LBL5	21 05	
092	RCLI	36 46	
093	INT	16 34	
094	F1?	16 23 01	Get j
095	GSBd	23 16 14	
096	RCLi	36 45	
097	F1?	16 23 01	
098	GSBe	23 16 15	Unpack CF_j
099	ST+0	35-55 00	
100	x	-35	
101	+	-55	f(i) in R_0
102	RCLD	36 14	
103	ST÷0	35-24 00	
104	÷	-24	
105	DSZI	16 25 46	
106	GTO5	22 05	
107	F1?	16 23 01	
108	GTO0	22 00	
109	*LBL6	21 06	
110	RCL0	36 00	
111	RCLE	36 15	
112	-	-45	

REGISTERS

0 Used	1 Used	2 Used	3 Used	4 Used	5 Used	6 Used	7 Used	8 Used	9 Used
S0 Used	S1 Used	S2 Used	S3 Used	S4 Used	S5 Used	S6 Used	S7 Used	S8 Used	S9 Used
A Used	B Used	C Used	D $1 + i_0$	E Used	I Used				

113	X≠Y	-41			
114	÷	-24	$\frac{f}{f'}$ (1 + i)		
115	RCLD	36 14			
116	×	-35			
117	RCLD	36 14			
118	X≠Y	-41			
119	+	-55	(1 + i) next		
120	STOD	35 14			
121	LSTX	16-63			
122	ABS	16 31			
123	EEX	-23	f(i)/f'(i)		
124	CHS	-22			
125	5	05			
126	X>Y?	16-34			
127	GTO7	22 07	←DONE!		
128	GSBa	23 16 11			
129	GTO4	22 04			
130	*LBL0	21 00			
131	F0?	16 23 00			
132	GTO6	22 06			
133	SF0	16 21 00			
134	GSBb	23 16 12			
135	GTO5	22 05			
136	*LBLb	21 16 12	Loop back for		
137	2	02	lower 22 CFs		
138	2	02			
139	RCLI	36 46			
140	+	-55	Reset I to lower 22 CFs.		
141	STOI	35 46			
142	CLX	-51			
143	+	-55			
144	RTN	24			
145	*LBLd	21 16 14	Add 22 if flag 0 clear.		
146	2	02			
147	2	02			
148	F0?	16 23 00			
149	CLX	-51			
150	+	-55			
151	RTN	24			
152	*LBL7	21 07	Reset R_I for another		
153	RCLD	36 14	pressing of [D]		
154	1	01			
155	-	-45			
156	STOD	35 14	R_I must contain integer		
157	EEX	-23	here.		
158	2	02			
159	×	-35			
160	RCLI	36 46			
161	LSTX	16-63			
162	×	-35			
163	STOI	35 46			
164	X≠Y	-41			
165	RTN	24			
166	R/S	51			

LABELS					FLAGS	SET STATUS		
A INV	B CF MAX	C CF	D →IRR	E	0 > 22 CFs	FLAGS	TRIG	DISP
a Used	b Used	c Used	d Used	e Used	1 Used	ON OFF 0 ☐ ☒ 1 ☐ ☒	DEG ☒	FIX ☒
0 Used	1	2	3	4 Used	2	2 ☐ ☒	GRAD ☐	SCI ☐
5 Used	6 Used	7 Used	8	9	3	3 ☐ ☒	RAD ☐	ENG ☐
								n 2

INTERNAL RATE OF RETURN—GROUPS OF CASH FLOWS

001	*LBLA	21 11		057	STOI	35 45	$CF_j \cdot n_j \rightarrow R(i)$
002	CLRG	16-53		058	RCLI	36 46	
003	STOE	35 15	INV→R_E	059	CF0	16 22 00	
004	1	01		060	RTN	24	
005	STOD	35 14		061	*LBLd	21 16 14	Routine to sum cash flows and recall number of groups before going to iteration routine.
006	X≠Y	-41		062	GSB3	23 03	
007	RTN	24		063	0	00	
008	*LBLB	21 12	If LRG CF exists	064	STOC	35 13	
009	ABS	16 31		065	GTO7	22 07	
010	EEX	-23		066	*LBLD	21 14	
011	7	07		067	RCLI	36 46	
012	÷	-24		068	GSB3	23 03	
013	LOG	16 32		069	*LBL7	21 07	
014	INT	16 34	INT $\left[\log \frac{\text{LRG CF}}{10^7}\right]$	070	1	01	
015	X<0?	16-45		071	.	-62	1 + Initial guess
016	CLX	-51		072	0	00	
017	10ˣ	16 33		073	1	01	
018	STOD	35 14		074	GSBe	23 16 13	
019	RCLE	36 15		075	GTO8	22 00	
020	X≠Y	-41	$INV/10^k \rightarrow R_E$	076	*LBL1	21 01	
021	÷	-24		077	RCL0	36 00	
022	STOE	35 15	k = 1 or 2	078	GSBe	23 16 15	
023	RTN	24		079	STOC	35 13	
024	*LBLC	21 13		080	*LBL0	21 00	The secant method is used to evaluate f(i).
025	ISZI	16 26 46	Scaling routine	081	RCLB	36 12	
026	RCLC	36 13		082	RCL0	36 00	
027	X≠Y	-41		083	STOB	35 12	
028	+	-55		084	-	-45	
029	STOC	35 13		085	RCLD	36 14	
030	CLX	-51		086	RCLC	36 13	
031	LSTX	16-63		087	STOD	35 14	
032	X	-35		088	-	-45	
033	ST+0	35-55 00	$\Sigma n_j \, CF_j$	089	÷	-24	
034	LSTX	16-63		090	X	-35	
035	÷	-24		091	ST-0	35-45 00	
036	LSTX	16-63		092	RCL0	36 00	
037	EEX	-23		093	÷	-24	
038	2	02		094	RND	16 24	
039	÷	-24		095	X≠0?	16-42	
040	X≠Y	-41		096	GTO1	22 01	
041	RCLD	36 14		097	RCL0	36 00	
042	÷	-24		098	1	01	
043	INT	16 34		099	-	-45	
044	X<0?	16-45		100	EEX	-23	
045	SF0	16 21 00		101	2	02	
046	ABS	16 31		102	X	-35	
047	+	-55		103	RTN	24	
048	F0?	16 23 00		104	*LBL3	21 03	
049	CHS	-22		105	1	01	1.01 (# groups)
050	LSTX	16-63		106	.	-62	
051	X=0?	16-43		107	0	00	
052	GSB5	23 05		108	1	01	
053	ENT↑	-21		109	X	-35	→R_I
054	ABS	16 31		110	STOI	35 46	
055	÷	-24		111	RTN	24	
056	X	-35		112	*LBLc	21 16 13	

REGISTERS

0 1 + i	1 $CF_1 \cdot n_1$	2 $CF_2 \cdot n_2$	3 $CF_3 \cdot n_3$	4 $CF_4 \cdot n_4$	5 $CF_5 \cdot n_5$	6 $CF_6 \cdot n_6$	7 $CF_7 \cdot n_7$	8 $CF_8 \cdot n_8$	9 $CF_9 \cdot n_9$
S0 $CF_{10} \cdot n_{10}$	S1 $CF_{11} \cdot n_{11}$	S2 $CF_{12} \cdot n_{12}$	S3 $CF_{13} \cdot n_{13}$	S4 $CF_{14} \cdot n_{14}$	S5 $CF_{15} \cdot n_{15}$	S6 $CF_{16} \cdot n_{16}$	S7 $CF_{17} \cdot n_{17}$	S8 $CF_{18} \cdot n_{18}$	S9 $CF_{19} \cdot n_{19}$
A $CF_{20} \cdot n_{20}$	B Used	C $f(i_k)$	D $f(i_{k-1})$	E Investment	I Used				

113	EEX	-23	
114	CHS	-22	
115	2	02	
116	%	55	.01
117	STOC	35 13	
118	+	-55	
119	STO0	35 00	
120	STOB	35 12	
121	GSBe	23 16 15	
122	STOD	35 14	
123	RCL0	36 00	
124	RCLC	36 13	
125	-	-45	
126	STO0	35 00	
127	GSBe	23 16 15	
128	STOC	35 13	
129	RTN	24	
130	*LBLE	21 15	
131	EEX	-23	
132	2	02	
133	÷	-24	
134	1	01	
135	+	-55	$1 + i \rightarrow R_0$
136	STO0	35 00	
137	*LBLe	21 16 15	
138	0	00	
139	*LBL4	21 04	
140	RCL0	36 00	Continued fractions are
141	RCLi	36 45	used to find the PV of
142	FRC	16 44	the cash flows.
143	ABS	16 31	
144	EEX	-23	
145	2	02	
146	x	-35	
147	CHS	-22	
148	Y^x	31	
149	x	-35	
150	1	01	
151	LSTX	16-63	
152	-	-45	
153	RCLi	36 45	
154	INT	16 34	
155	x	-35	
156	+	-55	
157	DSZI	16 25 46	
158	GTO4	22 04	
159	RCLI	36 46	
160	1	01	
161	0	00	
162	1	01	
163	x	-35	
164	STOI	35 46	
165	X≷Y	-41	$\frac{DCF}{i}$ −INV = NPV
166	RCL0	36 00	
167	1	01	
168	-	-45	
169	÷	-24	
170	RCLE	36 15	
171	-	-45	
172	RTN	24	
173	*LBL5	21 05	
174	+	-55	
175	ENT↑	-21	
176	RTN	24	
177	R/S	51	

LABELS

A INV	B Large CF	C CF ↑ #	D IRR	E Used
a	b	c Used	d IRR	e Used
0 Used	1 Used	2	3 Used	4 Used
5 Used	6	7 Used	8	9

FLAGS

0
1
2
3

SET STATUS

FLAGS		TRIG	DISP
	ON OFF		
0	☐ ☒	DEG ☒	FIX ☒
1	☐ ☒	GRAD ☐	SCI ☐
2	☐ ☒	RAD ☐	ENG ☐
3	☐ ☒		n 4

DISCOUNTED CASH FLOW ANALYSIS
NET PRESENT VALUE

```
001  *LBLA    21 11
002    CHS      -22
003   STOA    35 11
004      0       00
005   STO9    35 09
006      1       01
007   STOC    35 13
008   RCLA    36 11
009    CHS      -22
010   GSB9    23 09
011    RTN       24
012  *LBLB    21 12
013    EEX      -23
014      2       02
015      ÷      -24
016   STOB    35 12
017   LSTX    16-63
018      ×      -35
019    RTN       24
020  *LBLC    21 13
021   STOC    35 13
022    RTN       24
023  *LBLD    21 14
024   STOD    35 14
025      1       01
026   RCLB    36 12
027      +      -55
028   RCLC    36 13
029   ST+9  35-55 09
030     Y^       31
031   STOE    35 15
032   RCLA    36 11
033      ×      -35
034   RCLE    36 15
035      1       01
036      -      -45
037   RCLB    36 12
038      ÷      -24
039   RCLD    36 14
040      ×      -35
041      +      -55
042   STOA    35 11
043      1       01
044   RCLB    36 12
045      +      -55
046   RCL9    36 09
047      Y^       31
048      ÷      -24
049      1       01
050   STOC    35 13
051     R↓      -31
052   GSB9    23 09
053    RTN       24
054  *LBLE    21 15
055   RCL9    36 09
056    RTN       24
```

-NPV→R_A
0→R_9
1→R_C

---

i/100→R_B

#→R_C

Calculate present value of series.

Reset n to 1.

Recall Σn

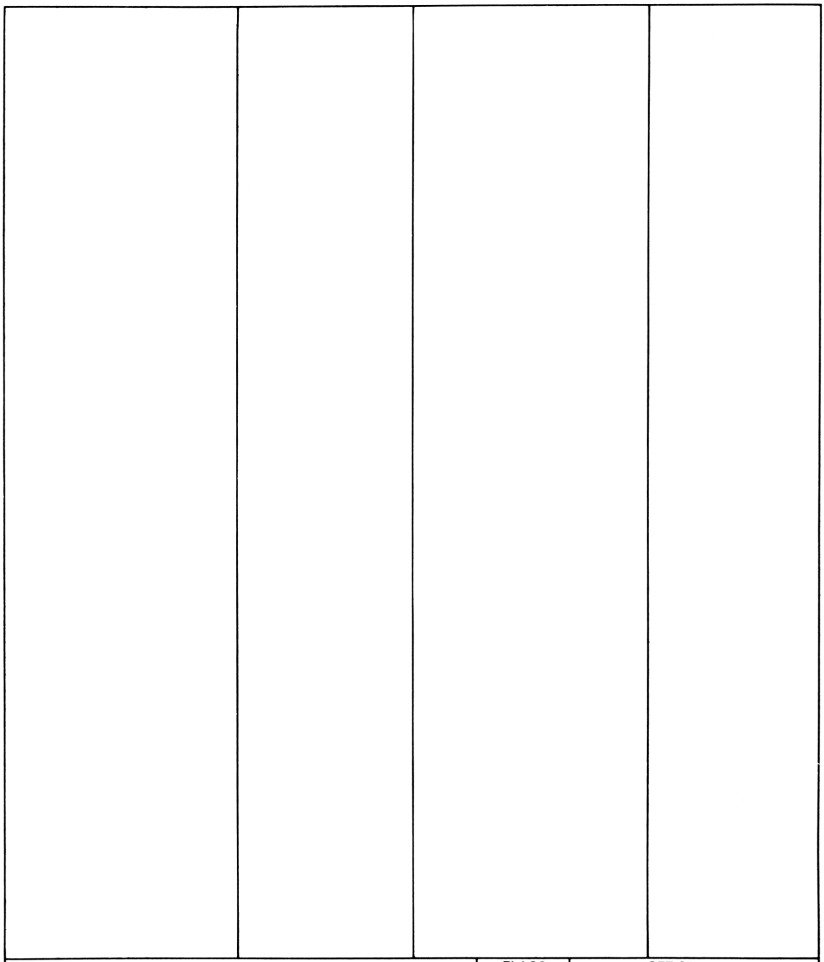
```
057  *LBLe    21 16 15
058    F0?    16 23 00
059    GTO1       22 01
060    SF0    16 21 00
061      1       01
062    RTN       24
063  *LBL1    21 01
064      0       00
065    CF0    16 22 00
066    RTN       24
067  *LBL9    21 09
068    F0?    16 23 00
069    GTO2       22 02
070    R/S       51
071    RTN       24
072  *LBL2    21 02
073    PRTX      -14
074    R/S       51
```

Print option

REGISTERS

0	1	2	3	4	5	6	7	8	9 Σn
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
NPV	i/100	#	CF	$(1+i)^n$	



LABELS					FLAGS	SET STATUS		
A INV	B i(%)	C #	D NPV	E Σn	0 Print?	FLAGS	TRIG	DISP
a	b	c	d	e Print?	1	ON OFF 0 ☐ ☒ 1 ☐ ☒	DEG ☒	FIX ☒
0	1 Used	2 Used	3	4	2	GRAD ☐ RAD ☐		SCI ☐ ENG ☐
5	6	7	8	9 Used	3	2 ☐ ☒ 3 ☐ ☒		n 2

DIRECT REDUCTION LOANS
SINKING FUND

001	*LBLA	21 11	
002	STOA	35 11	n→R_A
003	F3?	16 23 03	Digit entered?
004	RTN	24	
005	GSB0	23 00	
006	RCLE	36 15	Solve for n and store in R_A.
007	LSTX	16-63	
008	-	-45	
009	RCLD	36 14	
010	LSTX	16-63	
011	-	-45	
012	÷	-24	
013	LN	32	
014	RCL7	36 07	
015	LN	32	
016	÷	-24	
017	STOA	35 11	
018	RTN	24	
019	*LBLC	21 13	PMT→R_C
020	STOC	35 13	Digit entered?
021	F3?	16 23 03	
022	RTN	24	
023	1	01	Store dummy 1 for PMT.
024	STOC	35 13	
025	GSB0	23 00	
026	1/X	52	Solve for PMT and store in R_C.
027	RCLD	36 14	
028	R↑	16-31	
029	-	-45	
030	x	-35	
031	STOC	35 13	
032	RTN	24	
033	*LBLD	21 14	PV→R_D
034	STOD	35 14	Digit entered?
035	F3?	16 23 03	
036	RTN	24	
037	GSB0	23 00	Solve for PV and store in
038	+	-55	R_D.
039	STOD	35 14	
040	RTN	24	
041	*LBLE	21 15	FV(BAL)→R_E
042	STOE	35 15	Digit entered?
043	F3?	16 23 03	
044	RTN	24	
045	GSB0	23 00	
046	RCLD	36 14	Solve for FV(BAL) and
047	X≠Y	-41	store in R_E.
048	-	-45	
049	RCL8	36 08	
050	÷	-24	
051	STOE	35 15	
052	RTN	24	
053	*LBL0	21 00	Clear FV(BAL) flag.
054	CF1	16 22 01	If PV = 0 set FV(BAL)
055	RCLD	36 14	flag.
056	X=0?	16-43	
057	SF1	16 21 01	
058	1	01	
059	RCLB	36 12	i/100→R_9
060	%	55	
061	STO9	35 09	
062	+	-55	$(1+i)\rightarrow R_7$
063	STO7	35 07	
064	RCLA	36 11	
065	CHS	-22	$(1+i)^{-n}\rightarrow R_8$
066	Y^x	31	
067	STO8	35 08	
068	RCLE	36 15	
069	x	-35	$1-(1+i)^{-n}\rightarrow R_4$
070	1	01	
071	RCL8	36 08	
072	-	-45	Calculate
073	STO4	35 04	±(PMT/i)
074	RCLC	36 13	and store in
075	RCL9	36 09	R_3
076	÷	-24	
077	F1?	16 23 01	
078	CHS	-22	$\pm\frac{PMT}{i}\left[1-(1+i)^{-n}\right]$
079	STO3	35 03	
080	x	-35	
081	RTN	24	
082	*LBLa	21 16 11	Start by clearing PMT,
083	CLX	-51	PV, FV(BAL) registers.
084	STOC	35 13	
085	STOD	35 14	
086	STOE	35 15	
087	RTN	24	
088	*LBLB	21 12	i→R_B
089	STOB	35 12	Digit entered?
090	F3?	16 23 03	
091	RTN	24	
092	0	00	Clear R_B for sum of i
093	STOB	35 12	terms.
094	2	02	Store address of R_B in
095	1	01	R_I for indirect access.
096	STOI	35 46	
097	RCLE	36 15	
098	RCLA	36 11	
099	RCLC	36 13	Start guess of i:
100	x	-35	n PMT + FV(BAL)
101	+	-55	
102	RCLD	36 14	If PV = 0 GTO FV(BAL)
103	X=0?	16-43	guess
104	GTO3	22 03	PV guess for i:
105	-	-45	$\frac{n\,PMT+FV(BAL)-PV}{n}$
106	RCLA	36 11	
107	÷	-24	and recall PV.
108	RCLD	36 14	
109	GTO4	22 04	
110	*LBL3	21 03	FV(BAL) guess for i
111	RCLE	36 15	numerator:
112	LSTX	16-63	

REGISTERS

0	1	2	3 ±(PMT/i)	4 $[1-(1+i)^{-n}]$	5	6 $n(1+i)^{-n-1}$	7 $(1+i)$	8 $(1+i)^{-n}$	9 i/100
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
n	i	PMT	PV	FV(BAL)	21

113	-	-45	2(FV(BAL) – n PMT)	169	÷	-24	
114	ENT↑	-21		170	RND	16 24	If value ≠ 0, loop again.
115	+	-55		171	X≠0?	16-42	
116	RCLA	36 11	and denominator	172	GTO6	22 06	
117	1	01	$(n-1)^2$ PMT + FV(BAL)	173	RCLB	36 12	Stop and display
118	-	-45		174	RTN	24	
119	X²	53		175	*LBL5	21 05	
120	RCLC	36 13		176	EEX	-23	Convert i to % and add to content of R_B.
121	x	-35		177	2	02	
122	RCLE	36 15		178	x	-35	
123	+	-55		179	ST+i	35-55 45	
124	*LBL4	21 04	Guess for i	180	RTN	24	
125	÷	-24	IF guess < –0.9, use –0.9	181	R/S	51	
126	.	-62	for guess				
127	9	09					
128	CHS	-22					
129	X≤Y?	16-35					
130	X≷Y	-41					
131	GSB5	23 05					
132	X=0?	16-43	If guess = 0 stop				
133	RTN	24					
134	*LBL6	21 06					
135	GSB0	23 00					
136	+	-55	Calculate f(i)				
137	F1?	16 23 01					
138	CHS	-22					
139	RCLD	36 14					
140	-	-45					
141	RCL8	36 08					
142	RCLA	36 11					
143	RCL7	36 07	Calculate f'(i)				
144	÷	-24					
145	x	-35					
146	F1?	16 23 01					
147	CLX	-51					
148	STO6	35 06					
149	F1?	16 23 01					
150	R↓	-31					
151	F1?	16 23 01					
152	LSTX	16-63					
153	RCL4	36 04					
154	RCL9	36 09					
155	÷	-24					
156	-	-45					
157	RCLC	36 13					
158	x	-35					
159	RCL9	36 09					
160	÷	-24					
161	RCL6	36 06					
162	RCLE	36 15					
163	x	-35					
164	-	-45					
165	÷	-24	f(i)/f'(i)				
166	CHS	-22					
167	GSB5	23 05					
168	RCLB	36 12					

LABELS

A n	B i	C PMT	D PV	E FV(BAL)
a START	b	c	d	e
0 Calc.	1	2	3 FV guess	4 guess
5 i→%	6 loop	7	8	9

FLAGS

0
1 PV = 0
2
3 Digit?

SET STATUS

FLAGS			TRIG		DISP	
	ON	OFF				
0	☐	☒	DEG	☒	FIX	☒
1	☐	☒	GRAD	☐	SCI	☐
2	☐	☒	RAD	☐	ENG	☐
3	☐	☒			n 2	

ACCUMULATED INTEREST/REMAINING BALANCE

001	*LBL A	21 11	
002	RCL 0	36 00	
003	STO 7	35 07	J→R_7
004	X≷Y	-41	K→R_0
005	STO 0	35 00	
006	RTN	24	
007	*LBL B	21 12	- - - - - - - - - - - -
008	EEX	-23	
009	2	02	i/100→R_1
010	÷	-24	
011	STO 1	35 01	
012	LSTX	16-63	
013	x	-35	
014	RTN	24	
015	*LBL C	21 13	- - - - - - - - - - - -
016	STO 2	35 02	PMT→R_2
017	RTN	24	- - - - - - - - - - - -
018	*LBL D	21 14	
019	STO 3	35 03	
020	RTN	24	PV→R_3
021	*LBL E	21 15	- - - - - - - - - - - -
022	RCL 0	36 00	
023	RCL 7	36 07	
024	X≤Y?	16-35	
025	GTO 0	22 00	
026	STO 0	35 00	
027	R↓	-31	
028	STO 7	35 07	
029	*LBL 0	21 00	
030	1	01	
031	RCL 1	36 01	
032	+	-55	(1 + i/100)→R_8
033	STO 8	35 08	
034	RCL 0	36 00	
035	GSB 1	23 01	BAL_K→R_4
036	STO 4	35 04	
037	RCL 8	36 08	
038	RCL 7	36 07	
039	1	01	
040	-	-45	
041	GSB 1	23 01	-BAL_{J-1}
042	CHS	-22	
043	RCL 4	36 04	
044	+	-55	$BAL_K - BAL_{J-1}$→R_6
045	STO 6	35 06	
046	RCL 0	36 00	
047	RCL 7	36 07	
048	-	-45	
049	1	01	
050	+	-55	
051	RCL 2	36 02	
052	x	-35	
053	+	-55	
054	RTN	24	INT_{J-K}
055	RCL 4	36 04	BAL_K
056	R/S	51	

057	*LBL a	21 16 11	
058	RCL 7	36 07	
059	F0?	16 23 00	
060	SPC	16-11	
061	GSB 9	23 09	J
062	1	01	
063	RCL 1	36 01	
064	+	-55	
065	STO 8	35 08	
066	RCL 7	36 07	
067	GSB 1	23 01	
068	STO 4	35 04	
069	RCL 8	36 08	
070	RCL 7	36 07	
071	1	01	
072	-	-45	
073	GSB 1	23 01	
074	RCL 4	36 04	
075	-	-45	
076	STO 6	35 06	
077	RCL 2	36 02	
078	X≷Y	-41	
079	-	-45	INT_J
080	GSB 9	23 09	
081	RCL 6	36 06	
082	GSB 9	23 09	$PRINC_J$
083	RCL 4	36 04	
084	GSB 9	23 09	$RBAL_J$
085	RCL 7	36 07	
086	RCL 2	36 02	
087	x	-35	
088	RCL 3	36 03	
089	RCL 4	36 04	
090	-	-45	
091	-	-45	
092	GSB 9	23 09	TOT INT
093	1	01	
094	ST+ 7	35-55 07	
095	RCL 0	36 00	
096	RCL 7	36 07	
097	X≤Y?	16-35	J≤K?
098	GTO a	22 16 11	
099	RTN	24	- - - - - - - - - - - -
100	*LBL 1	21 01	
101	CHS	-22	
102	Y^x	31	
103	STO 5	35 05	
104	1	01	
105	-	-45	
106	RCL 1	36 01	
107	÷	-24	
108	RCL 2	36 02	
109	x	-35	
110	RCL 3	36 03	
111	+	-55	
112	RCL 5	36 05	

REGISTERS

0	1	2	3	4	5	6	7	8	9
K	i/100	PMT	PV	Used	Used	Used	J	1+i/100	
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I

```
113      ÷          -24
114     RTN          24
115  *LBLe  21 16 15
116     F0?  16 23 00
117    GTO2     22 02
118     SF0  16 21 00
119       1        01
120     RTN          24
121  *LBL2     21 02
122       0        00
123     CF0  16 22 00
124     RTN          24
125  *LBL9     21 09
126     F0?  16 23 00
127    GTO3     22 03
128     R/S          51
129     RTN          24
130  *LBL3     21 03
131    PRTX         -14
132     RTN          24
133     R/S          51
```

RND may be inserted here.

Print mode option.

LABELS					FLAGS
A J, K	B i	C PMT	D PV	E INT; RB	0 Print?
a SKD	b	c	d	e Print?	1
0 Used	1 Used	2 Used	3 Used	4	2
5	6	7	8	9 Used	3

SET STATUS

FLAGS		TRIG	DISP
	ON OFF		
0	☐ ☒	DEG ☒	FIX ☒
1	☐ ☒	GRAD ☐	SCI ☐
2	☐ ☒	RAD ☐	ENG ☐
3	☐ ☒		n 2

WRAP-AROUND MORTGAGE

001	*LBLA	21 11	$-n_1 \rightarrow R_1$	057	×	-35			
002	CLRG	16-53	$PMT_1 \rightarrow R_3$	058	+	-55			
003	CHS	-22	$-PV_1 \rightarrow R_5$	059	RCL5	36 05			
004	STO1	35 01		060	RCL6	36 06			
005	R↓	-31		061	×	-35			
006	STO3	35 03		062	-	-45	f(x)		
007	R↓	-31		063	STO1	35 46	----------		
008	CHS	-22		064	RCL8	36 08			
009	STO5	35 05		065	RCL1	36 01			
010	RCL1	36 01		066	×	-35			
011	CHS	-22		067	RCL3	36 03			
012	RTN	24	----------	068	×	-35			
013	*LBLC	21 13		069	RCL9	36 09			
014	CHS	-22	$-n_2 \rightarrow R_2$	070	RCL2	36 02			
015	STO2	35 02	$PMT_2 \rightarrow R_4$	071	×	-35			
016	R↓	-31	$PV_2 - PV_1 \rightarrow R_5$	072	RCL4	36 04			
017	STO4	35 04		073	×	-35			
018	R↓	-31		074	-	-45			
019	ST+5	35-55 05		075	RCL7	36 07			
020	RCL2	36 02		076	÷	-24			
021	CHS	-22		077	RCLE	36 15			
022	RTN	24	----------	078	RCL6	36 06			
023	*LBLD	21 14	$BAL \rightarrow R_0$	079	÷	-24			
024	STO0	35 00		080	-	-45			
025	RTN	24	----------	081	RCL0	36 00			
026	*LBLE	21 15		082	RCL2	36 02			
027	EEX	-23	Initial guess	083	×	-35			
028	CHS	-22	$i \rightarrow R_6$	084	RCL6	36 06			
029	3	03		085	×	-35			
030	STO6	35 06	----------	086	RCL9	36 09			
031	*LBL0	21 00		087	×	-35			
032	1	01	Newton's method is used to	088	RCL7	36 07			
033	RCL6	36 06	find i.	089	÷	-24			
034	1	01		090	+	-55	$f(x)/f'(x)$		
035	+	-55		091	÷	-24	----------		
036	STO7	35 07		092	ST-6	35-45 06			
037	RCL2	36 02		093	ABS	16 31			
038	Y^x	31		094	EEX	-23	Is this within desired		
039	STO9	35 09		095	CHS	-22	range? If not, go to 0.		
040	-	-45		096	6	06	Otherwise multiply by		
041	RCL4	36 04		097	X≠Y?	16-35	100 and display periodic		
042	×	-35		098	GTO0	22 00	yield.		
043	1	01		099	RCL6	36 06			
044	RCL7	36 07		100	EEX	-23			
045	RCL1	36 01		101	2	02			
046	Y^x	31		102	×	-35			
047	STO8	35 08		103	RTN	24			
048	-	-45		104	*LBLa	21 16 11	----------		
049	RCL3	36 03		105	STOA	35 11	$n \rightarrow R_A$		
050	×	-35		106	RTN	24			
051	-	-45		107	*LBLb	21 16 12			
052	STOE	35 15		108	EEX	-23	$i/100 \rightarrow R_B$		
053	RCL9	36 09		109	2	02			
054	RCL0	36 00		110	÷	-24			
055	×	-35		111	STOB	35 12			
056	RCL6	36 06		112	LSTX	16-63			

REGISTERS

0	1	2	3	4	5	6	7	8	9
BAL	$-n_1$	$-n_2$	PMT_1	PMT_2	$PV_2 - PV_1$	i	1 + i	$(1 + i)^{-n1}$	$(1 + i)^{-n2}$
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
n	i	PMT	PV	Used	Used

```
113    x          -35
114    RTN         24
115    *LBL d  21 16 14
116    STOD       35 14
117    RTN         24
118    *LBL c  21 16 13
119    RCLB       36 12
120    1           01
121    +          -55
122    RCLA       36 11
123    CHS        -22
124    Y^x         31
125    1           01
126    X≷Y        -41
127    -          -45
128    RCLB       36 12
129    ÷          -24
130    1/X         52
131    RCLD       36 14
132    x          -35
133    STOC       35 13
134    RTN         24
135    R/S         51
```

PV→R_D

Calculate PMT and store in R_C.

LABELS					FLAGS
A n_1,PMT$_1$,PV$_1$	B	C n_2,PMT$_2$,PV$_2$	D BAL	E →i	0
a n	b i	c →PMT	d PV	e	1
0	1	2	3	4	2
5	6	7	8	9	3

SET STATUS

FLAGS		TRIG	DISP
	ON OFF		
0	☐ ☒	DEG ☒	FIX ☒
1	☐ ☒	GRAD ☐	SCI ☐
2	☐ ☒	RAD ☐	ENG ☐
3	☐ ☒		n 2

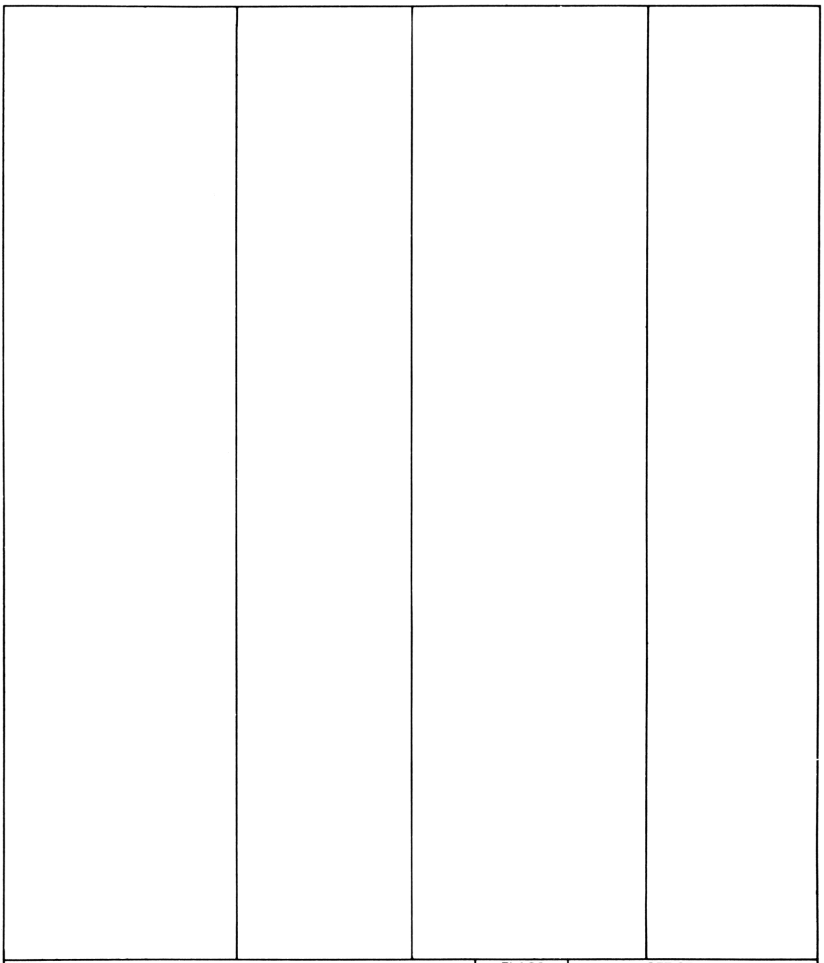
CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE

001	*LBLA	21 11		057	RCLB	36 12	
002	CF1	16 22 01		058	×	-35	
003	STO0	35 00	$K \rightarrow R_0$	059	RCLD	36 14	
004	GSB9	23 09		060	×	-35	
005	RTN	24		061	F1?	16 23 01	
006	*LBLB	21 12		062	RTN	24	
007	EEX	-23	$i/100 \rightarrow R_B$	063	GSB9	23 09	TOT INT
008	2	02		064	RCLD	36 14	
009	÷	-24		065	RCLC	36 13	
010	STOB	35 12		066	÷	-24	Is loan paid off?
011	LSTX	16-63		067	RCL0	36 00	
012	×	-35		068	X>Y?	16-34	
013	RTN	24		069	RTN	24	
014	*LBLC	21 13		070	SPC	16-11	
015	STOC	35 13	$CPMT \rightarrow R_C$	071	GSB9	23 09	
016	RTN	24		072	GTOE	22 15	
017	*LBLD	21 14		073	*LBLa	21 16 11	
018	STOD	35 14	$PV \rightarrow R_D$	074	SF1	16 21 01	$K \rightarrow R_0$
019	RTN	24		075	STO0	35 00	$J \rightarrow R_8$
020	*LBLE	21 15		076	X≠Y	-41	
021	RCLD	36 14		077	STO8	35 08	
022	RCLC	36 13		078	1	01	
023	RCL0	36 00		079	ST+0	35-55 00	
024	×	-35		080	GSB8	23 00	$TOT\ INT_{K+1}$
025	-	-45		081	STOI	35 46	
026	STOE	35 15	$RBAL \rightarrow R_E$	082	RCL8	36 08	
027	RCLC	36 13		083	STO0	35 00	
028	+	-55		084	GSB0	23 00	$TOT\ INT_J$
029	RCLB	36 12		085	RCLI	36 46	
030	×	-35		086	X≠Y	-41	
031	STO9	35 09	$PMT_i \rightarrow R_9$	087	-	-45	
032	1	01	Increment for next period.	088	GSB9	23 09	$TOT\ INT_{K+1} - TOT\ INT_J$
033	ST+0	35-55 00		089	RTN	24	
034	RCL9	36 09		090	*LBLe	21 16 15	
035	GSB9	23 09	INT	091	F0?	16 23 00	Print/pause flag
036	RCLC	36 13		092	GTO1	22 01	
037	+	-55		093	SF0	16 21 00	
038	GSB9	23 09	TOT PMT	094	1	01	
039	RCLE	36 15		095	RTN	24	
040	GSB9	23 09	RBAL	096	*LBL1	21 01	
041	*LBL0	21 00		097	0	00	
042	2	02		098	CF0	16 22 00	
043	RCL0	36 00		099	RTN	24	
044	-	-45	$\left[\frac{(2-K)\ CPMT}{PV} + 2\right]$	100	*LBL9	21 09	
045	RCLC	36 13		101	F0?	16 23 00	Print/pause routine.
046	×	-35		102	GTO2	22 02	
047	RCLD	36 14		103	R/S	51	
048	÷	-24		104	RTN	24	
049	2	02		105	*LBL2	21 02	
050	+	-55		106	PRTX	-14	
051	2	02		107	RTN	24	
052	÷	-24		108	R/S	51	
053	RCL0	36 00					
054	1	01					
055	-	-45					
056	×	-35					

REGISTERS

0 K	1	2	3	4	5	6	7	8 J	9 PMT_i
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B i/100	C CPMT	D PV	E RBAL	I Used		



LABELS					FLAGS	SET STATUS		
A K	B i	C CPMT	D PV	E SKED	0 Print?	FLAGS	TRIG	DISP
a J↑K	b I	c	d	e Print?	1	ON OFF 0 ☐ ☒	DEG ☒	FIX ☒
0 Used	1 Used	2 Used	3	4	2	1 ☐ ☒ 2 ☐ ☒	GRAD ☐ RAD ☐	SCI ☐ ENG ☐
5	6	7	8	9 Used	3	3 ☐ ☒		n 2

ADD-ON RATE INSTALLMENT LOAN/ INTEREST REBATE—RULE OF 78's

001	*LBLA	21 11	$\frac{\text{ODD} \times 12}{365} = h$		057	1	01				
002	STO0	35 00			058	+	-55				
003	1	01			059	STO6	35 06	Calculate f(i)			
004	2	02			060	RCL2	36 02				
005	×	-35			061	CHS	-22				
006	3	03			062	Y^x	31				
007	6	06			063	STO7	35 07				
008	5	05			064	-	-45				
009	÷	-24			065	RCL0	36 00				
010	STO1	35 01			066	÷	-24				
011	X≷Y	-41			067	RCL5	36 05				
012	STO2	35 02			068	×	-35				
013	RCL0	36 00			069	RCL6	36 06				
014	RTN	24			070	RCL1	36 01				
015	*LBLB	21 12			071	Y^x	31				
016	STO3	35 03	$AIR \rightarrow R_3$		072	RCL4	36 04				
017	RTN	24			073	×	-35				
018	*LBLC	21 13			074	-	-45				
019	STO4	35 04	$AMT \rightarrow R_4$		075	RCL7	36 07				
020	RTN	24			076	RCL6	36 06	Calculate f'(i)			
021	*LBLD	21 14			077	÷	-24				
022	RCL2	36 02			078	RCL2	36 02				
023	RCL1	36 01			079	1	01				
024	+	-55			080	+	-55				
025	1	01			081	×	-35				
026	2	02			082	RCL0	36 00				
027	÷	-24	$\left[\left(\frac{N+h}{12}\right)AIR\right] AMT$		083	×	-35				
028	RCL3	36 03			084	1	01				
029	×	-35			085	RCL7	36 07				
030	EEX	-23			086	-	-45				
031	2	02			087	RCL0	36 00				
032	÷	-24			088	+	-55				
033	RCL4	36 04	$FC \rightarrow R_0$		089	-	-45				
034	×	-35			090	RCL0	36 00				
035	STO0	35 00			091	X²	53				
036	RCL4	36 04			092	÷	-24				
037	+	-55			093	RCL5	36 05				
038	RCL2	36 02	$\frac{FC + AMT}{N} \rightarrow R_5$		094	×	-35				
039	÷	-24			095	RCL6	36 06				
040	STO5	35 05			096	RCL1	36 01				
041	RTN	24			097	Y^x	31				
042	RCL0	36 00			098	RCL6	36 06				
043	R/S	51			099	÷	-24				
044	*LBLE	21 15			100	RCL1	36 01				
045	RCL3	36 03	Calculate APR		101	X≷Y	-41				
046	1	01			102	×	-35				
047	2	02			103	LSTX	16-63				
048	EEX	-23	Guess = AIR/1200		104	-	-45				
049	2	02			105	RCL4	36 04				
050	÷	-24			106	×	-35				
051	X=0?	16-43	If AIR = 0 then APR = 0		107	-	-45				
052	RTN	24			108	÷	-24				
053	STO0	35 00			109	RCL0	36 00				
054	*LBL1	21 01			110	X≷Y	-41	$i_k = i_{k-1} - \frac{f(i)}{f'(i)}$			
055	1	01			111	-	-45				
056	RCL0	36 00			112	STO0	35 00				

REGISTERS

0 Used	1 Used	2 Used	3 Used	4 AMT	5 PMT	6 1+i/100	7 $(1+i/100)^{-n}$	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I

113	LSTX	16-63	Is answer close enough?		
114	ABS	16 31			
115	EEX	-23			
116	6	06			
117	CHS	-22			
118	X≤Y?	16-35	No→go to LBL 1		
119	GTO1	22 01			
120	RCL0	36 00			
121	1	01			
122	2	02	Display answer		
123	0	00			
124	0	00			
125	x	-35			
126	RTN	24			
127	*LBLa	21 16 11			
128	STO0	35 00	$N \rightarrow R_0$		
129	RTN	24			
130	*LBLb	21 16 12			
131	STO1	35 01	$K \rightarrow R_1$		
132	RTN	24			
133	*LBLc	21 16 13			
134	STO2	35 02	$PMT \rightarrow R_2$		
135	RTN	24			
136	*LBLd	21 16 14			
137	STO3	35 03	$FC \rightarrow R_3$		
138	RTN	24			
139	*LBLe	21 16 15			
140	RCL0	36 00			
141	RCL1	36 01			
142	-	-45			
143	1	01			
144	+	-55			
145	RCL3	36 03	$\frac{FC(N-K+1)}{N(N+1)}$		
146	x	-35			
147	RCL0	36 00			
148	X^2	53			
149	LSTX	16-63			
150	+	-55			
151	÷	-24			
152	RCL0	36 00			
153	RCL1	36 01	$(N-K)\left[\frac{FC(N-K+1)}{N(N+1)}\right]$		
154	-	-45			
155	x	-35			
156	STO4	35 04	(Rebate)		
157	RTN	24			
158	RCL2	36 02			
159	RCL0	36 00	PMT(N - K) - Rebate		
160	RCL1	36 01			
161	-	-45			
162	x	-35			
163	RCL4	36 04			
164	-	-45			
165	R/S	51			

LABELS					FLAGS
A N↑ODD	B AIR	C AMT	D PMT, FC	E APR	0
a N	b K	c PMT	d FC	e REB, BAL	1
0	1 Used	2	3	4	2
5	6	7	8	9	3

SET STATUS				
FLAGS		TRIG	DISP	
	ON OFF			
0	☐ ☒	DEG ☒	FIX ☒	
1	☐ ☒	GRAD ☐	SCI ☐	
2	☐ ☒	RAD ☐	ENG ☐	
3	☐ ☒		n 2	

SAVINGS PLAN—LEASES

001	*LBL A	21 11		
002	STO A	35 11	$n \rightarrow R_A$	
003	F3?	16 23 03	Digit entered?	
004	RTN	24		
005	GSB 0	23 00		
006	RCL E	36 15		
007	LSTX	16-63	Solve for n and store in R_A.	
008	-	-45		
009	RCL D	36 14		
010	LSTX	16-63		
011	-	-45		
012	÷	-24		
013	LN	32		
014	RCL 7	36 07		
015	LN	32		
016	÷	-24		
017	STO A	35 11		
018	RTN	24		
019	*LBL C	21 13		
020	STO C	35 13	$PMT \rightarrow R_C$	
021	F3?	16 23 03	Digit entered?	
022	RTN	24		
023	1	01	Store dummy 1 for PMT.	
024	STO C	35 13		
025	GSB 0	23 00		
026	1/X	52		
027	RCL D	36 14	Solve for PMT and store in R_C.	
028	R↑	16-31		
029	-	-45		
030	x	-35		
031	STO C	35 13		
032	RTN	24		
033	*LBL D	21 14	$PV \rightarrow R_D$	
034	STO D	35 14		
035	F3?	16 23 03	Digit entered?	
036	RTN	24		
037	GSB 0	23 00	Solve for PV and store in R_D.	
038	+	-55		
039	STO D	35 14		
040	RTN	24		
041	*LBL E	21 15		
042	STO E	35 15	$FV(BAL) \rightarrow R_E$	
043	F3?	16 23 03	Digit entered?	
044	RTN	24		
045	GSB 0	23 00		
046	RCL D	36 14	Solve for FV(BAL) and store in R_E.	
047	X≠Y	-41		
048	-	-45		
049	RCL 8	36 08		
050	÷	-24		
051	STO E	35 15		
052	RTN	24		
053	*LBL 0	21 00	Clear FV(BAL) flag.	
054	CF1	16 22 01	If PV = 0, set FV(BAL) flag.	
055	RCL D	36 14		
056	X=0?	16-43		
057	SF1	16 21 01		
058	1	01		
059	RCL B	36 12	$i/100 \rightarrow R_9$	
060	%	55		
061	STO 9	35 09		
062	+	-55	$(1 + i) \rightarrow R_7$	
063	STO 7	35 07		
064	RCL A	36 11		
065	CHS	-22	$(1 + i)^{-n} \rightarrow R_8$	
066	Y^x	31		
067	STO 8	35 08		
068	RCL E	36 15		
069	x	-35		
070	1	01		
071	RCL 8	36 08	$1 - (1 + i)^{-n} \rightarrow R_4$	
072	-	-45		
073	STO 4	35 04	Calculate ± (PMT/i)	
074	RCL C	36 13	and store in R_3.	
075	RCL 9	36 09		
076	÷	-24		
077	F1?	16 23 01		
078	CHS	-22		
079	STO 3	35 03		
080	RCL 7	36 07	$\pm \frac{PMT}{i} [1-(1+i)^{-n}] R_7$	
081	x	-35		
082	x	-35		
083	RTN	24		
084	*LBL a	21 16 11		
085	CLX	-51		
086	STO C	35 13	Start by clearing PMT,	
087	STO D	35 14	PV, FV(BAL) registers.	
088	STO E	35 15		
089	RTN	24		
090	*LBL B	21 12		
091	STO B	35 12	$i \rightarrow R_B$	
092	F3?	16 23 03	Digit entered?	
093	RTN	24		
094	0	00	Clear R_B for sum of i	
095	STO B	35 12	terms.	
096	2	02		
097	1	01	Store address of R_B in	
098	STO I	35 46	R_I for indirect access.	
099	RCL E	36 15		
100	RCL A	36 11	Recall FV(BAL), n, PMT	
101	RCL C	36 13		
102	X=0?	16-43	If PMT = 0 GTO n, i, PV,	
103	GTO 8	22 08	FV solution.	
104	x	-35		
105	+	-55	Start guess of i: n PMT	
106	RCL D	36 14	+ FV(BAL)	
107	X=0?	16-43	If PV = 0 GTO FV guess	
108	GTO 3	22 03	PV guess for i:	
109	-	-45		
110	RCL A	36 11	$\frac{n\ PMT + BAL - PV}{n}$	
111	÷	-24		
112	RCL D	36 14	and recall PV	

REGISTERS

0	1	2	3 ±(PMT/i)	4 Used	5	6 Used	7 (1 + i)	8 $(1 + i)^{-n}$	9 i/100
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
n	i	PMT	PV	FV(BAL)	21

113	GTO4	22 04	
114	*LBL3	21 03	FV(BAL) guess for i numerator:
115	RCLE	36 15	
116	LSTX	16-63	
117	-	-45	
118	ENT↑	-21	2(BAL − n PMT) and denominator $(n-1)^2$ PMT + BAL
119	+	-55	
120	RCLA	36 11	
121	1	01	
122	-	-45	
123	X²	53	
124	RCLC	36 13	
125	x	-35	
126	RCLE	36 15	
127	+	-55	
128	*LBL4	21 04	Guess for i
129	÷	-24	If guess < −0.9, use −0.9 for guess
130	.	-62	
131	9	09	
132	CHS	-22	
133	X≤Y?	16-35	
134	X≷Y	-41	
135	GSB5	23 05	
136	X=0?	16-43	If guess = 0 stop.
137	RTN	24	
138	*LBL6	21 06	
139	GSB0	23 00	
140	+	-55	Calculate f(i)
141	F1?	16 23 01	
142	CHS	-22	
143	RCLD	36 14	
144	-	-45	
145	RCL8	36 08	
146	RCLA	36 11	
147	RCL7	36 07	Calculate f'(i)
148	÷	-24	
149	x	-35	
150	F1?	16 23 01	
151	CLX	-51	
152	STO6	35 06	
153	F1?	16 23 01	
154	R↓	-31	
155	F1?	16 23 01	
156	LSTX	16-63	
157	RCL4	36 04	
158	RCL9	36 09	
159	÷	-24	
160	-	-45	
161	RCL7	36 07	
162	x	-35	
163	RCL4	36 04	
164	+	-55	
165	RCLC	36 13	
166	x	-35	
167	RCL9	36 09	
168	÷	-24	
169	RCL6	36 06	
170	RCLE	36 15	f(i)/f'(i)
171	x	-35	
172	-	-45	
173	÷	-24	
174	CHS	-22	
175	GSB5	23 05	
176	RCLB	36 12	
177	÷	-24	
178	RND	16 24	If value ≠ 0, loop again.
179	X≠0?	16-42	
180	GTO6	22 06	
181	RCLE	36 12	Stop and display.
182	RTN	24	
183	*LBL8	21 08	Compute i for n, i, PV, FV problem.
184	RCLE	36 15	
185	RCLD	36 14	
186	÷	-24	
187	RCLA	36 11	
188	1/X	52	
189	Y^X	31	
190	1	01	
191	-	-45	
192	*LBL5	21 05	
193	EEX	-23	Convert i to % and add to content of R_B.
194	2	02	
195	x	-35	
196	ST+I	35-55 45	
197	RTN	24	
198	R/S	51	

LABELS

A n	B i	C PMT	D PV	E FV(BAL)
a START	b	c	d	e
0 Calc.	1	2	3 FV guess	4 guess
5 →%	6 loop	7	8 n,PV,FV→i	9

FLAGS

0	
1	PV = 0
2	
3	Digit?

SET STATUS

FLAGS	ON	OFF
0	☐	☒
1	☐	☒
2	☐	☒
3	☐	☒

TRIG		DISP	
DEG	☒	FIX	☒
GRAD	☐	SCI	☐
RAD	☐	ENG	☐
		n	2

ADVANCE PAYMENTS

001	*LBLA	21 11	A→R1
002	STO1	35 01	
003	X≷Y	-41	-n→R0
004	CHS	-22	
005	STO0	35 00	
006	CHS	-22	
007	X≷Y	-41	
008	X>Y?	16-34	A > n?
009	GTO2	22 02	
010	RTN	24	
011	*LBLD	21 14	
012	STO4	35 04	PV→R4
013	RTN	24	
014	*LBLE	21 15	
015	STO5	35 05	RESID→R5
016	RTN	24	
017	*LBLc	21 16 13	
018	EEX	-23	i/100→R2
019	2	02	
020	÷	-24	
021	STO2	35 02	
022	1	01	
023	+	-55	(1 + i/100)→R7
024	STO7	35 07	
025	RCL0	36 00	
026	Y^x	31	
027	RCL5	36 05	
028	x	-35	
029	RCL4	36 04	Calculate PMT
030	X≷Y	-41	
031	-	-45	
032	RCL7	36 07	
033	RCL0	36 00	
034	RCL1	36 01	
035	+	-55	
036	Y^x	31	
037	1	01	
038	X≷Y	-41	
039	-	-45	
040	RCL2	36 02	
041	÷	-24	
042	RCL1	36 01	
043	+	-55	
044	÷	-24	
045	RTN	24	
046	*LBLb	21 16 12	
047	STO3	35 03	PMT→R3
048	EEX	-23	
049	CHS	-22	
050	3	03	
051	STO2	35 02	
052	*LBL0	21 00	
053	1	01	Calculate f(i)
054	RCL2	36 02	
055	+	-55	
056	STO7	35 07	

057	RCL0	36 00	
058	RCL1	36 01	
059	+	-55	
060	Y^x	31	
061	1	01	
062	X≷Y	-41	
063	-	-45	
064	RCL2	36 02	
065	÷	-24	
066	RCL1	36 01	
067	+	-55	
068	RCL3	36 03	
069	x	-35	
070	RCL7	36 07	
071	RCL0	36 00	
072	Y^x	31	
073	RCL5	36 05	
074	x	-35	
075	+	-55	
076	RCL4	36 04	
077	-	-45	
078	STO6	35 06	
079	RCL7	36 07	Calculate f'(i)
080	RCL0	36 00	
081	RCL1	36 01	
082	+	-55	
083	1	01	
084	-	-45	
085	Y^x	31	
086	RCL0	36 00	
087	CHS	-22	
088	RCL1	36 01	
089	-	-45	
090	x	-35	
091	RCL2	36 02	
092	x	-35	
093	RCL7	36 07	
094	RCL0	36 00	
095	RCL1	36 01	
096	+	-55	
097	Y^x	31	
098	1	01	
099	X≷Y	-41	
100	-	-45	
101	-	-45	
102	RCL2	36 02	
103	X^2	53	
104	÷	-24	
105	RCL3	36 03	
106	x	-35	
107	RCL7	36 07	
108	RCL0	36 00	
109	1	01	
110	-	-45	
111	Y^x	31	
112	RCL5	36 05	

REGISTERS

0 −n	1 A	2 i/100	3 PMT	4 PV	5 RESID	6 f(i)	7 i+i/100	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

113	x	-35			
114	RCL0	36 00			
115	x	-35			
116	+	-55			
117	RCL6	36 06	f(i)/f'(i)		
118	X≠Y	-41			
119	÷	-24			
120	ST-2	35-45 02			
121	ABS	16 31			
122	EEX	-23	Is this within desired		
123	CHS	-22	accuracy?		
124	6	06			
125	X≤Y?	16-35			
126	GTO6	22 00			
127	RCL2	36 02			
128	EEX	-23			
129	2	02			
130	x	-35	Display i		
131	RTN	24	----------		
132	*LBL2	21 02	If A > n, flash A on display.		
133	PSE	16 51			
134	GTO2	22 02			
135	R/S	51			

LABELS					FLAGS
A n, A	B	C	D PV	E RESID	0
a	b →i	c →PMT	d	e	1
0 Used	1	2 Used	3	4	2
5	6	7	8	9	3

SET STATUS

FLAGS			TRIG	DISP	
	ON	OFF			
0	☐	☒	DEG ☒	FIX ☒	
1	☐	☒	GRAD ☐	SCI ☐	
2	☐	☒	RAD ☐	ENG ☐	
3	☐	☒		n 2	

SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

001	*LBL A	21 11	If P/C > 1, set flag 0.
002	÷	-24	
003	STO D	35 14	
004	1	01	
005	X≷Y	-41	
006	X>Y?	16-34	
007	F0?	16 23 00	
008	RTN	24	
009	*LBL B	21 12	
010	EEX	-23	
011	2	02	i/100→R_B
012	÷	-24	
013	STO B	35 12	
014	LSTX	16-63	
015	×	-35	
016	RCL B	36 12	
017	1	01	
018	+	-55	
019	RCL D	36 14	
020	1/X	52	
021	Y^x	31	$(1+i)^{C/P}\rightarrow R_9$
022	STO 9	35 09	
023	X≷Y	-41	
024	RTN	24	
025	*LBL a	21 16 11	If digit entered, store in R_A.
026	STO A	35 11	
027	F3?	16 23 03	
028	RTN	24	
029	F0?	16 23 00	
030	GTO 0	22 00	
031	RCL 9	36 09	P/C ≤ 1, solve for number of payments.
032	1	01	
033	-	-45	
034	RCL E	36 15	
035	×	-35	
036	RCL 9	36 09	
037	RCL C	36 13	
038	×	-35	
039	÷	-24	
040	1	01	
041	+	-55	
042	LN	32	
043	RCL 9	36 09	
044	LN	32	
045	÷	-24	
046	RTN	24	
047	*LBL 0	21 00	P/C > 1, solve for number of payments.
048	RCL E	36 15	
049	RCL B	36 12	
050	×	-35	
051	RCL D	36 14	
052	1	01	
053	+	-55	
054	RCL B	36 12	
055	2	02	
056	÷	-24	
057	×	-35	
058	RCL D	36 14	
059	+	-55	
060	RCL C	36 13	
061	×	-35	
062	÷	-24	
063	1	01	
064	+	-55	
065	LN	32	
066	RCL B	36 12	
067	1	01	
068	+	-55	
069	LN	32	
070	÷	-24	
071	RCL D	36 14	
072	×	-35	
073	RTN	24	
074	*LBL c	21 16 13	If digit entered, store in R_C.
075	STO C	35 13	
076	F3?	16 23 03	
077	RTN	24	
078	F0?	16 23 00	
079	GTO 1	22 01	
080	RCL 9	36 09	
081	1	01	
082	-	-45	If P/C ≤ 1, solve for payment amount.
083	RCL 9	36 09	
084	RCL A	36 11	
085	Y^x	31	
086	1	01	
087	-	-45	
088	÷	-24	
089	RCL E	36 15	
090	×	-35	
091	RCL 9	36 09	
092	÷	-24	
093	RTN	24	
094	*LBL 1	21 01	If P/C > 1, solve for payment amount.
095	RCL D	36 14	
096	1/X	52	
097	RCL A	36 11	
098	×	-35	
099	RCL B	36 12	
100	1	01	
101	+	-55	
102	X≷Y	-41	
103	Y^x	31	
104	1	01	
105	-	-45	
106	RCL B	36 12	
107	X≷Y	-41	
108	÷	-24	
109	RCL D	36 14	
110	1	01	
111	+	-55	
112	RCL B	36 12	

REGISTERS

0	1	2	3	4	5	6	7	8	9 $(1+1)^{C/P}$
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
# PAY	i/100	PMT	P/C	FV	

113	2	02			
114	÷	-24			
115	×	-35			
116	RCLD	36 14			
117	+	-55			
118	÷	-24			
119	RCLE	36 15			
120	×	-35			
121	RTN	24			
122	*LBLe	21 16 15	If digit entered, store in R_E.		
123	STOE	35 15			
124	F3?	16 23 03			
125	RTN	24			
126	F0?	16 23 00			
127	GTO2	22 02			
128	RCL9	36 09	If P/C≤1, solve for future value.		
129	RCLA	36 11			
130	Y^x	31			
131	1	01			
132	-	-45			
133	RCL9	36 09			
134	×	-35			
135	RCLC	36 13			
136	×	-35			
137	RCL9	36 09			
138	1	01			
139	-	-45			
140	÷	-24			
141	RTN	24			
142	*LBL2	21 02			
143	RCLD	36 14	If P/C > 1, solve for future value.		
144	1	01			
145	+	-55			
146	RCLB	36 12			
147	2	02			
148	÷	-24			
149	×	-35			
150	RCLD	36 14			
151	+	-55			
152	RCLB	36 12			
153	1	01			
154	+	-55			
155	RCLA	36 11			
156	RCLD	36 14			
157	1/X	52			
158	×	-35			
159	Y^x	31			
160	1	01			
161	-	-45			
162	×	-35			
163	RCLC	36 13			
164	×	-35			
165	RCLB	36 12			
166	+	-24			
167	RTN	24			
168	R/S	51			

LABELS

A P/C	B i/100	C	D	E
a #PAY	b	c PMT	d	e FV
0 Used	1 Used	2 Used	3	4
5	6	7	8	9

FLAGS

0 P/C > 1
1
2
3 Digit?

SET STATUS

FLAGS	ON	OFF
0	☐	☒
1	☐	☒
2	☐	☒
3	☐	☒

TRIG	
DEG	☒
GRAD	☐
RAD	☐

DISP	
FIX	☒
SCI	☐
ENG	☐
n	2

SIMPLE INTEREST/INTEREST CONVERSIONS

001	3	03		057	GTO3	22 03	
002	6	06	Initialize	058	*LBLC	21 13	BEG AMT→R_C
003	0	00	360→R_8	059	STOC	35 13	Digit entered?
004	STO8	35 08	365→R_9	060	F3?	16 23 03	
005	5	05		061	RTN	24	
006	+	-55		062	F2?	16 23 02	360 or 365?
007	STO9	35 09		063	GTO4	22 04	
008	0	00		064	RCL0	36 14	
009	R/S	51	_____	065	RCL8	36 08	
010	*LBLA	21 11	Days→R_A	066	*LBL5	21 05	
011	STOA	35 11	Digit entered?	067	x	-35	Calculate BEG AMT and
012	F3?	16 23 03		068	RCLA	36 11	store in R_C.
013	RTN	24		069	÷	-24	
014	F2?	16 23 02	Test for 360 or 365 day	070	RCLB	36 12	
015	GTO0	22 00	basis	071	÷	-24	
016	RCL0	36 14		072	STOC	35 13	
017	RCL8	36 08		073	RTN	24	
018	*LBL1	21 01		074	*LBL4	21 04	_____
019	x	-35	Calculate days and store in	075	RCLE	36 15	365 day basis
020	RCLC	36 13	R_A.	076	RCL9	36 09	
021	÷	-24		077	GTO5	22 05	_____
022	RCLB	36 12		078	*LBL0	21 14	INT_{360}→R_D
023	÷	-24		079	STO0	35 14	
024	STOA	35 11		080	F3?	16 23 03	
025	RTN	24		081	RTN	24	Digit entered?
026	*LBL0	21 00	_____	082	RCLC	36 13	
027	RCLE	36 15	365 day basis	083	RCLA	36 11	Calculate INT_{360} and
028	RCL9	36 09		084	RCL8	36 08	store in R_D.
029	GTO1	22 01	_____	085	GSB6	23 06	
030	*LBLB	21 12	RATE/100→R_B	086	STO0	35 14	
031	EEX	-23		087	RTN	24	_____
032	2	02		088	*LBLE	21 15	Set flag 2 for 365 day
033	÷	-24		089	STOE	35 15	basis.
034	STOB	35 12		090	SF2	16 21 02	
035	LSTX	16-63		091	F3?	16 23 03	Digit entered?
036	x	-35		092	RTN	24	
037	F3?	16 23 03	Digit entered?	093	RCLC	36 13	
038	RTN	24		094	RCLA	36 11	
039	F2?	16 23 02	Test for 360 or 365 day	095	RCL9	36 09	Calculate INT_{365} and
040	GTO2	22 02	basis.	096	GSB6	23 06	store in R_E.
041	RCL8	36 08		097	STOE	35 15	
042	RCL0	36 14		098	RTN	24	
043	*LBL3	21 03		099	*LBL6	21 06	
044	x	-35		100	÷	-24	
045	RCLA	36 11	Calculate RATE and store	101	RCLC	36 13	
046	÷	-24	in R_B	102	x	-35	
047	RCLC	36 13		103	RCLB	36 12	
048	÷	-24		104	x	-35	
049	EEX	-23		105	RTN	24	_____
050	2	02		106	*LBLa	21 16 11	C/YR→R_A
051	x	-35		107	STOA	35 11	
052	STOB	35 12		108	RTN	24	
053	RTN	24	_____	109	*LBLb	21 16 12	NOM→R_B
054	*LBL2	21 02	365 day basis	110	STOB	35 12	Digit entered?
055	RCL9	36 09		111	F3?	16 23 03	
056	RCLE	36 15		112	RTN	24	

REGISTERS

0	1	2	3	4	5	6	7	8 360	9 365
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
Used	Used	Used	Used	Used	

```
113  RCLC     36 13
114  EEX         -23
115  2           02
116  ÷          -24
117  1           01
118  +          -55
119  RCLA     36 11
120  1/X         52
121  Y^x         31
122  1           01
123  -          -45
124  RCLA     36 11
125  x          -35
126  EEX        -23
127  2           02
128  x          -35
129  STOB     35 12
130  RTN         24
131  *LBLc 21 16 13
132  STOC     35 13
133  F3?   16 23 03
134  RTN         24
135  RCLB     36 12
136  RCLA     36 11
137  EEX        -23
138  2           02
139  x          -35
140  ÷          -24
141  1           01
142  +          -55
143  RCLA     36 11
144  Y^x         31
145  1           01
146  -          -45
147  EEX        -23
148  2           02
149  x          -35
150  STOC     35 13
151  RTN         24
152  *LBLd 21 16 14
153  STOD     35 14
154  F3?   16 23 03
155  RTN         24
156  RCLE     36 15
157  EEX        -23
158  2           02
159  ÷          -24
160  1           01
161  +          -55
162  LN          32
163  EEX        -23
164  2           02
165  x          -35
166  STOD     35 14
167  RTN         24
168  *LBLe 21 16 15
```

Calculate NOM and store in R_B.

EFF→R_C
Digit entered?

Calculate EFF and store in R_C.

Continuous

Calculate NOM and store in R_D.

```
169  STOE     35 15
170  F3?   16 23 03
171  RTN         24
172  RCLD     36 14
173  *LBL7 21 16 07
174  EEX        -23
175  2           02
176  ÷          -24
177  e^x         33
178  1           01
179  -          -45
180  EEX        -23
181  2           02
182  x          -35
183  STOE     35 15
184  RTN         24
185  *LBL8 21 16 08
186  RCL9     36 09
187  x          -35
188  RCL8     36 08
189  ÷          -24
190  GTO7  22 07
191  R/S         51
```

Calculate EFF and store in R_E.

For continuous 365/360 day basis.

LABELS					FLAGS	SET STATUS		
A DAYS	B RATE	C BEG AMT	D INT 360	E INT 365	0	FLAGS	TRIG	DISP
a C/YR	b NOM	c EFF	d NOM(cont)	e EFF(cont)	1	ON OFF 0 ☐ X 1 ☐ X 2 ☐ X 3 ☐ X	DEG X GRAD ☐ RAD ☐	FIX X SCI ☐ ENG ☐ n 2
0 Used	1 Used	2 Used	3 Used	4 Used	2 365 basis			
5 Used	6 Used	7 Used	8 Used	9	3 Digit?			

DEPRECIATION SCHEDULES

001	*LBLa	21 16 11		057	-	-45	
002	F0?	16 23 00	Straight line	058	X<0?	16-45	
003	SPC	16-11		059	GTO3	22 03	
004	RCLD	36 14	K	060	GSB2	23 02	
005	GSB9	23 09		061	RCL7	36 07	
006	RCLA	36 11	$\frac{SBV - SAL}{LIFE} \rightarrow R_I$	062	÷	-24	
007	RCLB	36 12		063	STO4	35 04	
008	-	-45		064	RCL8	36 08	
009	RCLC	36 13		065	x	-35	
010	÷	-24		066	*LBL3	21 03	
011	STO1	35 46	DEP	067	STO6	35 06	
012	GSB9	23 09		068	GSB9	23 09	RDV_K
013	RCLC	36 13		069	RCLB	36 12	
014	RCLD	36 14		070	+	-55	
015	-	-45	(LIFE – YR) DEP = RDV_K	071	GSB9	23 09	$RBV_K = RDV_K + SAL$
016	RCL1	36 46		072	1	01	
017	x	-35		073	RCL4	36 04	
018	GSB9	23 09		074	-	-45	
019	RCLB	36 12		075	RCL8	36 08	
020	+	-55		076	x	-35	
021	GSB9	23 09	RBV_k	077	GSB9	23 09	
022	RCL1	36 46		078	1	01	TOT DEP_K
023	RCLD	36 14	$\left(\frac{SBV - SAL}{LIFE}\right)YR$ = TOT DEP	079	GSBD	23 14	
024	x	-35		080	RCLC	36 13	
025	GSB9	23 09		081	RCLD	36 14	K ≤ LIFE?
026	1	01		082	X≤Y?	16-35	
027	GSBD	23 14		083	GTOb	22 16 12	
028	RCLC	36 13		084	RTN	24	
029	RCLD	36 14		085	*LBL2	21 02	- - - - - - - - - - -
030	X≤Y?	16-35	K ≤ LIFE?	086	ENT↑	-21	
031	GTOa	22 16 11		087	FRC	16 44	
032	RTN	24	- - - - - - - - - - - -	088	ENT↑	-21	$\frac{(1 + W)(2F + W)}{2}$
033	*LBLb	21 16 12	SOYD	089	+	-55	
034	F0?	16 23 00		090	X≷Y	-41	
035	SPC	16-11		091	INT	16 34	= SOYD
036	RCLD	36 14		092	+	-55	
037	GSB9	23 09	K	093	LSTX	16-63	
038	RCLA	36 11		094	1	01	
039	RCLB	36 12		095	+	-55	
040	-	-45		096	x	-35	
041	STO8	35 08		097	2	02	
042	RCLC	36 13		098	÷	-24	
043	GSB2	23 02		099	RTN	24	
044	STO7	35 07	$\left(\frac{LIFE+1-K}{SOYD}\right)(SBV-SAL)$	100	*LBLc	21 16 13	- - - - - - - - - - -
045	RCLC	36 13		101	F0?	16 23 00	Declining Balance
046	1	01		102	SPC	16-11	
047	+	-55		103	RCLD	36 14	
048	RCLD	36 14		104	GSB9	23 09	K
049	-	-45		105	GSB4	23 04	
050	RCL7	36 07		106	RCLD	36 14	
051	÷	-24		107	1	01	
052	RCL8	36 08		108	-	-45	
053	x	-35		109	Y^x	31	
054	GSB9	23 09	DEP_K	110	RCLA	36 11	
055	RCLC	36 13		111	x	-35	
056	RCLD	36 14		112	RCL8	36 08	

REGISTERS

0	1	2	3	4 Used	5 Used	6 RDV_k	7 Used	8 Used	9 TOT DEP
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
SBV	SAL	LIFE	YR	FACTOR	SBV-SAL/LIFE

113	x	-35		169	R/S	51	
114	STO1	35 46	DEP_K	170	RTN	24	
115	GSB9	23 09		171	*LBL1	21 01	
116	1	01		172	PRTX	-14	
117	RCL7	36 07		173	RTN	24	
118	RCLD	36 14		174	*LBLd	21 16 14	Crossover point
119	Y^x	31		175	0	00	
120	-	-45		176	STOD	35 14	
121	RCLA	36 11	(SBV-SAL)-TOT DEP_K	177	GSB4	23 04	
122	x	-35		178	*LBL8	21 08	
123	STO9	35 09		179	RCL7	36 07	
124	RCLA	36 11		180	1	01	
125	RCLB	36 12		181	GSBD	23 14	
126	-	-45		182	1	01	
127	RCL9	36 09		183	-	-45	
128	-	-45		184	Y^x	31	
129	GSB9	23 09	RDV_K	185	RCLA	36 11	
130	RCLB	36 12		186	x	-35	
131	+	-55		187	RCL8	36 08	
132	GSB9	23 09	RBV_K	188	x	-35	
133	RCL9	36 09		189	RCL7	36 07	
134	GSB9	23 09	TOT DEP_K	190	RCLD	36 14	
135	1	01		191	1	01	
136	GSBD	23 14		192	-	-45	
137	RCLC	36 13		193	Y^x	31	
138	RCLD	36 14	$K \leqslant$ LIFE?	194	RCLA	36 11	
139	X≤Y?	16-35		195	x	-35	
140	GTOc	22 16 13		196	RCLB	36 12	
141	RTN	24		197	-	-45	
142	*LBLD	21 14	To add to register D.	198	STO9	35 09	
143	RCLD	36 14		199	RCLC	36 13	
144	+	-55		200	1	01	
145	STOD	35 14		201	+	-55	
146	RTN	24		202	RCLD	36 14	
147	*LBL4	21 04		203	-	-45	
148	1	01	FACT/LIFE→R_8	204	÷	-24	
149	RCLE	36 15		205	X≷Y	-41	
150	RCLC	36 13		206	X>Y?	16-34	
151	÷	-24		207	GTO8	22 08	
152	STO8	35 08	1 - FACT/LIFE→R_7	208	RCLD	36 14	
153	-	-45		209	1	01	
154	STO7	35 07		210	-	-45	
155	RTN	24		211	GSB9	23 09	Last year
156	*LBLe	21 16 15	Print/pause	212	RCLC	36 13	
157	F0?	16 23 00		213	X≷Y	-41	
158	GTO8	22 08		214	-	-45	
159	SF0	16 21 00		215	GSB9	23 09	
160	1	01		216	RCL9	36 09	Remaining life
161	RTN	24		217	RCLB	36 12	
162	*LBL8	21 00		218	+	-55	
163	0	00		219	GTO9	22 09	
164	CF0	16 22 00		220	R/S	51	RBV
165	RTN	24					
166	*LBL9	21 09					
167	F0?	16 23 00					
168	GTO1	22 01					

LABELS

A	B	C	D	E
			Used	
[a] St. line	[b] SOYD	[c] DEC BAL	[d] CROSS	[e] SCHED?
[0] Used	[1] Used	[2] SOYD	[3] Used	[4] Used
[5]	[6]	[7]	[8] Used	[9] Used

FLAGS

[0] Print?	
[1]	
[2]	
[3]	

SET STATUS

FLAGS		TRIG		DISP	
	ON OFF				
0	☐ ☒	DEG	☒	FIX	☒
1	☐ ☒	GRAD	☐	SCI	☐
2	☐ ☒	RAD	☐	ENG	☐
3	☐ ☒			n	2

DAYS BETWEEN DATES

001	*LBLA	21 11		057	CLX	-51	
002	STO7	35 07	$DT_1 \rightarrow R_7$	058	RCL5	36 05	Compute days since 0 AD
003	RTN	24		059	+	-55	neglecting 400s and 100s.
004	*LBLB	21 12		060	RCL3	36 03	
005	STO1	35 01	$DT_2 \rightarrow R_1$	061	1	01	
006	RTN	24		062	-	-45	
007	*LBLC	21 13		063	3	03	
008	RCL7	36 07		064	1	01	
009	GSBE	23 15		065	x	-35	
010	STO2	35 02		066	+	-55	
011	LSTX	16-63	Control and storage	067	RCL6	36 06	
012	STO0	35 00		068	4	04	
013	RCL1	36 01		069	÷	-24	
014	GSBE	23 15		070	INT	16 34	
015	LSTX	16-63		071	X≠Y	-41	
016	ST-0	35-45 00		072	+	-55	
017	CLX	-51		073	RTN	24	
018	RCL2	36 02		074	*LBLD	21 14	
019	-	-45		075	3	03	
020	RCL4	36 04		076	0	00	
021	2	02		077	STO2	35 02	Control and storage
022	÷	-24		078	RCL7	36 07	
023	ST÷0	35-24 00		079	GSBe	23 16 15	
024	X≠Y	-41		080	STO0	35 00	
025	RTN	24		081	RCL1	36 01	
026	*LBLE	21 15		082	GSBe	23 16 15	
027	GSB4	23 04		083	RCL0	36 00	
028	STO6	35 06		084	-	-45	
029	3	03		085	STO0	35 00	
030	6	06		086	RCL4	36 04	
031	5	05		087	CHS	-22	
032	STO4	35 04		088	2	02	
033	x	-35		089	÷	-24	
034	2	02	z = y - 1	090	ST÷0	35-24 00	
035	RCL3	36 03		091	R↓	-31	
036	X>Y?	16-34		092	RTN	24	
037	GTO0	22 00		093	*LBLe	21 16 15	
038	x	-35		094	GSB4	23 04	Sum years and months.
039	CLX	-51		095	3	03	
040	RCL6	36 06		096	6	06	
041	1	01		097	0	00	
042	-	-45		098	STO4	35 04	
043	STO6	35 06		099	x	-35	
044	GTO1	22 01		100	RCL3	36 03	
045	*LBL0	21 00		101	3	03	
046	.	-62		102	0	00	
047	4	04		103	x	-35	
048	x	-35		104	+	-55	
049	.	-62	x = INT (.4M + 2.3)	105	RCL5	36 05	
050	3	03		106	3	03	Are days equal to 31?
051	+	-55		107	1	01	
052	+	-55		108	X=Y?	16-33	
053	INT	16 34		109	GTO2	22 02	
054	-	-45		110	R↓	-31	No, add and return.
055	RCL6	36 06		111	STO2	35 02	
056	*LBL1	21 01		112	+	-55	

REGISTERS

0	1	2	3	4	5	6	7	8	9
-PER	DT_2	Used	M	365/360	D	y, z	DT_1		
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I

113	RTN	24			
114	*LBL2	21 02	Is register 2 equal to 30?		
115	R↓	-31			
116	R↓	-31			
117	RCL2	36 02			
118	3	03			
119	0	00			
120	X=Y?	16-33			
121	GTO3	22 03	No, add and return.		
122	R↓	-31			
123	CLX	-51			
124	RCL5	36 05			
125	STO2	35 02			
126	+	-55			
127	RTN	24			
128	*LBL3	21 03			
129	R↓	-31	31→30 add and return		
130	STO2	35 02			
131	+	-55			
132	RTN	24			
133	*LBL4	21 04			
134	ENT↑	-21			
135	INT	16 34	Break up year.		
136	STO3	35 03			
137	-	-45			
138	EEX	-23			
139	2	02			
140	x	-35			
141	ENT↑	-21			
142	INT	16 34			
143	STO5	35 05			
144	-	-45			
145	EEX	-23			
146	4	04			
147	x	-35			
148	RTN	24			
149	R/S	51			

LABELS					FLAGS
A DT_1	B DT_2	C Days Actual	D Days 360	E Used	0
a	b	c	d	e Used	1
0 Used	1 Used	2 Used	3 Used	4 Used	2
5	6	7	8	9	3

SET STATUS		
FLAGS	TRIG	DISP
ON OFF 0 ☐ X 1 ☐ X 2 ☐ X 3 ☐ X	DEG X GRAD ☐ RAD ☐	FIX X SCI ☐ ENG ☐ n 2

BOND PRICE AND YIELD

001	*LBLA	21 11		
002	CF3	16 22 03		
003	CHS	-22		
004	STO0	35 00	-PER→R_0	
005	CHS	-22		
006	RTN	24		
007	*LBLB	21 12		
008	EEX	-23		
009	2	02		
010	STO3	35 03	100→R_3	
011	R↓	-31		
012	STO1	35 01	CR→R_1	
013	RTN	24		
014	*LBLD	21 14		
015	CF3	16 22 03	RV→R_3	
016	STO3	35 03		
017	RTN	24		
018	*LBLC	21 13		
019	F3?	16 23 03	YLD→R_2	
020	GTO5	22 05		
021	RCL0	36 00		
022	ABS	16 31		
023	1	01		
024	X>Y?	16-34	1 > PER?	
025	GTO0	22 00		
026	SF2	16 21 02		
027	RCL1	36 01	Calculate initial guess	
028	2	02		
029	÷	-24		
030	RCL4	36 04		
031	STO5	35 05		
032	÷	-24		
033	STO6	35 06		
034	*LBL1	21 01		
035	1	01	Calculate f(y)	
036	RCL3	36 03		
037	RCL5	36 05		
038	÷	-24		
039	1	01		
040	RCL6	36 06		
041	+	-55		
042	RCL0	36 00		
043	Y^x	31		
044	STO8	35 08		
045	x	-35		
046	-	-45		
047	RCL6	36 06		
048	x	-35		
049	1	01		
050	RCL8	36 08		
051	-	-45		
052	÷	-24		
053	RCL1	36 01		
054	2	02		
055	÷	-24		
056	RCL5	36 05		
057	÷	-24		
058	-	-45		
059	ST-6	35-45 06		
060	ABS	16 31	Has limit been reached?	
061	EEX	-23		
062	CHS	-22		
063	6	06		
064	X≤Y?	16-35		
065	GTO1	22 01		
066	F2?	16 23 02		
067	GTO2	22 02		
068	RCL6	36 06		
069	GTO3	22 03		
070	*LBL2	21 02		
071	RCL5	36 05		
072	1	01	Modify price for next	
073	RCL0	36 00	set of iterations.	
074	FRC	16 44		
075	+	-55		
076	LSTX	16-63		
077	x	-35		
078	4	04		
079	÷	-24		
080	RCL1	36 01		
081	x	-35		
082	RCL6	36 06		
083	x	-35		
084	-	-45		
085	STO5	35 05		
086	GTO1	22 01		
087	*LBL0	21 00		
088	RCL3	36 03	Calculate yield if less than	
089	RCL1	36 01	1 coupon period remaining.	
090	2	02		
091	÷	-24		
092	+	-55		
093	LSTX	16-63		
094	RCL0	36 00		
095	1	01		
096	+	-55		
097	x	-35		
098	RCL4	36 04		
099	+	-55		
100	÷	-24		
101	1	01		
102	-	-45		
103	RCL0	36 00		
104	CHS	-22		
105	÷	-24		
106	*LBL3	21 03	Display answer if second	
107	2	02	time through.	
108	0	00		
109	0	00		
110	x	-35		
111	STO2	35 02		
112	RTN	24		

REGISTERS

0 -PER	1 CR	2 YLD	3 RV	4 PRICE	5 Used	6 Used	7 DT_1	8 Acc. Int.	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I

113	*LBL5	21 05	
114	STO2	35 02	
115	RTN	24	
116	*LBLE	21 15	
117	F3?	16 23 03	Price→R_4, R_5
118	GTO6	22 06	
119	RCL2	36 02	
120	2	02	
121	0	00	Calculate J
122	0	00	
123	÷	-24	
124	1	01	
125	+	-55	
126	STO5	35 05	
127	1	01	
128	RCL0	36 00	
129	FRC	16 44	
130	+	-55	
131	STO6	35 06	
132	RCL0	36 00	
133	CHS	-22	
134	1	01	Is PER < 1?
135	X>Y?	16-34	
136	GTO4	22 04	
137	RCL5	36 05	
138	RCL6	36 06	
139	Y^x	31	
140	RCL5	36 05	Calculate price for long
141	RCL0	36 00	term bonds.
142	Y^x	31	
143	STO5	35 05	
144	-	-45	
145	RCL1	36 01	
146	x	-35	
147	RCL2	36 02	
148	÷	-24	
149	EEX	-23	
150	2	02	
151	x	-35	
152	RCL6	36 06	
153	2	02	
154	÷	-24	
155	RCL1	36 01	
156	x	-35	
157	STO8	35 08	
158	-	-45	
159	RCL5	36 05	
160	RCL3	36 03	
161	x	-35	
162	+	-55	
163	RTN	24	
164	*LBL4	21 04	
165	RCL1	36 01	Calculate price for short
166	2	02	term bonds.
167	÷	-24	
168	RCL3	36 03	
169	+	-55	
170	RCL5	36 05	
171	1	01	
172	-	-45	
173	RCL0	36 00	
174	x	-35	
175	CHS	-22	
176	1	01	
177	+	-55	
178	÷	-24	
179	RCL1	36 01	
180	2	02	
181	÷	-24	
182	RCL6	36 06	
183	x	-35	
184	STO8	35 08	
185	-	-45	
186	RTN	24	
187	*LBL6	21 06	
188	STO4	35 04	
189	STO5	35 05	
190	RTN	24	
191	R/S	51	

LABELS

A PER	B CR	C YLD	D RV	E PRICE
a	b	c	d	e
0 Used	1 Used	2 Used	3 Used	4 Used
5 Used	6 Used	7	8	9

FLAGS

0
1
2 Used
3 Digit?

SET STATUS

FLAGS		TRIG	DISP
	ON OFF		
0	☐ ☒	DEG ☒	FIX ☒
1	☐ ☒	GRAD ☐	SCI ☐
2	☐ ☒	RAD ☐	ENG ☐
3	☐ ☒		n 2

INTEREST AT MATURITY/DISCOUNTED SECURITIES

001	*LBLA	21 11	
002	STOA	35 11	DSM→R_A
003	X≷Y	-41	DIM→R_9
004	STO9	35 09	
005	X≷Y	-41	
006	RTN	24	
007	*LBLB	21 12	Basis→R_B
008	STOB	35 12	
009	EEX	-23	100→R_8
010	2	02	
011	STO8	35 08	
012	X≷Y	-41	
013	RTN	24	
014	*LBLC	21 13	CR→R_C
015	STOC	35 13	
016	RTN	24	
017	*LBLD	21 14	YLD→R_D
018	STOD	35 14	
019	F3?	16 23 03	
020	RTN	24	
021	RCL9	36 09	Calc. Yield
022	RCLB	36 12	
023	÷	-24	
024	RCLC	36 13	
025	x	-35	
026	RCL8	36 08	
027	+	-55	
028	RCL9	36 09	
029	RCLA	36 11	
030	-	-45	
031	RCLB	36 12	
032	÷	-24	
033	RCLC	36 13	
034	x	-35	
035	RCLE	36 15	
036	+	-55	
037	÷	-24	
038	1	01	
039	-	-45	
040	RCLB	36 12	
041	x	-35	
042	RCLA	36 11	
043	÷	-24	
044	RCL8	36 08	
045	x	-35	Store yield in R_D.
046	STOD	35 14	
047	RTN	24	
048	*LBLE	21 15	
049	STOE	35 15	Price→R_E
050	F3?	16 23 03	
051	RTN	24	
052	RCL9	36 09	
053	RCLB	36 12	Calc. price
054	÷	-24	
055	RCLC	36 13	
056	x	-35	
057	RCL8	36 08	
058	÷	-24	
059	1	01	
060	+	-55	
061	RCLA	36 11	
062	RCLB	36 12	
063	÷	-24	
064	RCLD	36 14	
065	x	-35	
066	RCL8	36 08	
067	÷	-24	
068	1	01	
069	+	-55	
070	÷	-24	
071	RCL9	36 09	
072	RCLA	36 11	
073	-	-45	
074	RCLB	36 12	
075	÷	-24	
076	RCLC	36 13	
077	x	-35	
078	RCL8	36 08	
079	÷	-24	
080	-	-45	
081	EEX	-23	
082	2	02	Store price in R_E.
083	x	-35	
084	STOE	35 15	
085	RTN	24	
086	*LBLa	21 16 11	DSM→R_A
087	STOA	35 11	
088	CF1	16 22 01	
089	RTN	24	
090	*LBLb	21 16 12	
091	SF1	16 21 01	
092	STOI	35 46	Calc. price given DR
093	RCLA	36 11	
094	x	-35	
095	3	03	
096	6	06	
097	0	00	
098	÷	-24	
099	EEX	-23	
100	2	02	
101	X≷Y	-41	
102	-	-45	
103	STO7	35 07	
104	GSBc	23 16 13	
105	RCLI	36 46	
106	RTN	24	
107	*LBLc	21 16 13	Calc. yield given price
108	EEX	-23	
109	2	02	
110	X≷Y	-41	
111	-	-45	
112	LSTX	16-63	

REGISTERS

0	1	2	3	4	5	6	7 Used	8 100	9 DIM
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A DSM	B 360/365	C CR(%)	D YLD	E PRICE	I DISC RATE

```
113    ÷          -24
114    RCLA    36 11
115    ÷          -24
116     3          03
117     .          -62
118     6          06
119    EEX         -23
120     4          04
121     x          -35
122    STOD    35 14
123    RTN        24
124   *LBLd  21 16 14
125    F1?  16 23 01
126    GTO2    22 02
127    STOD    35 14
128    F3?  16 23 03
129    RTN        24
130    RCLE    36 15
131    GSBc  23 16 13
132    RTN        24
133   *LBLe  21 16 15
134    STOE    35 15
135    F1?  16 23 01
136    GTO1    22 01
137    F3?  16 23 03
138    RTN        24
139     1          01
140    RCLD    36 14
141    EEX         -23
142     2          02
143     ÷          -24
144    RCLA    36 11
145     x          -35
146     3          03
147     6          06
148     0          00
149     ÷          -24
150     +          -55
151    EEX         -23
152     2          02
153    X≠Y         -41
154     ÷          -24
155    STOE    35 15
156    RTN        24
157   *LBL1  21 01
158    RCL7    36 07
159    STOE    35 15
160    RTN        24
161   *LBL2  21 02
162    RCLD    36 14
163    RTN        24
164    R/S        51
```

Calc. price given yield

LABELS					FLAGS	SET STATUS		
A DIM/DSM	B Basis	C CR	D YLD	E PRICE	0	FLAGS	TRIG	DISP
a DSM	b DR	c Used	d YLD	e PRICE	1 DR	ON OFF 0 ☐ ☒ 1 ☐ ☒ 2 ☐ ☒ 3 ☐ ☒	DEG ☒ GRAD ☐ RAD ☐	FIX ☒ SCI ☐ ENG ☐ n 2
0	1	2	3	4	2			
5	6	7	8	9	3 Digit?			

LINEAR REGRESSION—EXPONENTIAL CURVE FIT

001	*LBL A	21 11	
002	CF1	16 22 01	Clears flag 1 and storage registers.
003	CLRG	16-53	
004	P≠S	16-51	
005	CLRG	16-53	
006	CLX	-51	
007	RTN	24	
008	*LBL B	21 12	$y \rightarrow R_8$
009	STO 8	35 08	
010	X≠Y	-41	
011	STO 9	35 09	$x \rightarrow R_9$
012	X≠Y	-41	
013	X>0?	16-44	$y > 0$?
014	GTO 0	22 00	
015	SF1	16 21 01	If no, set flag 1.
016	*LBL 4	21 04	
017	RCL 8	36 08	Performs summations
018	RCL 9	36 09	
019	Σ+	56	
020	RTN	24	
021	*LBL 0	21 00	
022	LN	32	
023	ST+ 0	35-55 00	$\Sigma \ln y \rightarrow R_0$
024	X²	53	
025	ST+ 1	35-55 01	$\Sigma (\ln y)^2 \rightarrow R_1$
026	RCL 8	36 08	
027	LN	32	
028	RCL 9	36 09	
029	×	-35	
030	ST+ 2	35-55 02	$\Sigma x \ln y \rightarrow R_2$
031	GTO 4	22 04	
032	*LBL a	21 16 11	
033	P≠S	16-51	
034	RCL 8	36 08	Calculate b (linear)
035	RCL 4	36 04	
036	RCL 6	36 06	
037	X	-35	
038	RCL 9	36 09	
039	÷	-24	
040	-	-45	
041	RCL 5	36 05	
042	RCL 4	36 04	
043	X²	53	
044	RCL 9	36 09	
045	÷	-24	
046	-	-45	
047	÷	-24	
048	STO B	35 12	$b \rightarrow R_B$
049	RCL 4	36 04	
050	×	-35	
051	CHS	-22	Calculate a (linear)
052	RCL 6	36 06	
053	+	-55	
054	RCL 9	36 09	
055	÷	-24	
056	STO A	35 11	$a \rightarrow R_A$
057	R↓	-31	
058	RCL B	36 12	Calculate linear r^2
059	×	-35	
060	RCL 7	36 07	
061	RCL 6	36 06	
062	X²	53	
063	RCL 9	36 09	
064	÷	-24	
065	-	-45	
066	÷	-24	
067	STO E	35 15	$r^2 \rightarrow R_E$
068	RCL A	36 11	
069	GSB 9	23 09	Display a (lin.)
070	RCL B	36 12	
071	GSB 9	23 09	Display b (lin.)
072	RCL E	36 15	Display r^2 (lin.)
073	P≠S	16-51	
074	GSB 9	23 09	
075	F1?	16 23 01	If any $y \leq 0$, display ERROR.
076	GTO 8	22 08	
077	RCL 2	36 02	
078	RCL 0	36 00	Calculate b (exponential)
079	P≠S	16-51	
080	RCL 4	36 04	
081	×	-35	
082	RCL 9	36 09	
083	÷	-24	
084	-	-45	
085	RCL 5	36 05	
086	RCL 4	36 04	
087	X²	53	
088	RCL 9	36 09	
089	÷	-24	
090	-	-45	
091	÷	-24	
092	STO C	35 13	$b \rightarrow R_C$
093	RCL 4	36 04	
094	×	-35	Calculate a (exponential)
095	CHS	-22	
096	P≠S	16-51	
097	RCL 0	36 00	
098	+	-55	
099	P≠S	16-51	
100	RCL 9	36 09	
101	÷	-24	
102	e^x	33	
103	STO D	35 14	$a \rightarrow R_D$
104	R↓	-31	
105	RCL C	36 13	Calculate exponential r^2
106	×	-35	
107	P≠S	16-51	
108	RCL 1	36 01	
109	RCL 0	36 00	
110	X²	53	
111	P≠S	16-51	
112	RCL 9	36 09	

REGISTERS

0 $\Sigma \ln y$	1 $\Sigma (\ln y)^2$	2 $\Sigma x \ln y$	3	4	5	6	7	8 y	9 x
S0	S1	S2	S3	S4 Σx_i	S5 Σx_i^2	S6 Σy_i	S7 Σy_i^2	S8 $\Sigma x_i y_i$	S9 n

A a (Linear)	B b (Linear)	C b(Exponential)	D a(Exponential)	E Used	I Used

```
113    ÷          -24
114    -          -45
115    ÷          -24
116    STOE    35 15
117    F0?  16 23 00
118    SPC        16-11
119    RCLD       36 14
120    GSB9       23 09
121    RCLC       36 13
122    GSB9       23 09
123    RCLE       36 15
124    P≠S        16-51
125    GSB9       23 09
126    RCLC       36 13
127    e^x           33
128    1             01
129    -          -45
130    EEX        -23
131    2             02
132    X          -35
133    GSB9       23 09
134    F0?  16 23 00
135    SPC        16-11
136    RTN           24
137    *LBLC      21 13
138    ISZI 16 26 46
139    RCLI       36 46
140    STO9       35 09
141    X≠Y        -41
142    STO8       35 08
143    X>0?       16-44
144    GTO8       22 00
145    SF1  16 21 01
146    GTO4       22 04
147    *LBLD      21 14
148    RCLB       36 12
149    X          -35
150    RCLA       36 11
151    +          -55
152    GTO9       22 09
153    *LBLE      21 15
154    RCLC       36 13
155    X          -35
156    e^x           33
157    RCLD       36 14
158    X          -35
159    GTO9       22 09
160    *LBL6   21 16 12
161    STO8       35 00
162    X≠Y        -41
163    STO9       35 09
164    X≠Y        -41
165    X>0?       16-44
166    GTO1       22 01
167    SF1  16 21 01
168    *LBL5      21 05
```

Display a (exp.)

Display b (exp.)

Display r^2 (exp.)

Continuous effective rate as a %.

Performs summations for trend line.

$\hat{y} = a + bx$

$\hat{y} = ae^{bx}$

For deleting incorrect inputs.

```
169    RCL8       36 08
170    RCL9       36 09
171    Σ-         16 56
172    RTN           24
173    *LBL1      21 01
174    LN            32
175    ST-0    35-45 00
176    X²            53
177    ST-1    35-45 01
178    RCL0       36 00
179    LN            32
180    RCL9       36 09
181    X          -35
182    ST-2    35-45 02
183    GTO5       22 05
184    *LBLc   21 16 13
185    DSZI 16 25 46
186    RCL9       36 09
187    X≠Y        -41
188    GTO1       22 01
189    *LBLe   21 16 15
190    F0?  16 23 00
191    GTO2       22 02
192    SF0  16 21 00
193    1             01
194    RTN           24
195    *LBL2      21 02
196    0             00
197    CF0  16 22 00
198    RTN           24
199    *LBL9      21 09
200    F0?  16 23 00
201    GTO3       22 03
202    R/S           51
203    RTN           24
204    *LBL3      21 03
205    PRTX       -14
206    RTN           24
207    R/S           51
```

Delete last trend value.

Print/pause flag.

Print command.

LABELS					FLAGS	SET STATUS		
[A] START	[B] Data Input	[C] Trend Line	[D] Lin y	[E] Exp y	[0] Print?	FLAGS	TRIG	DISP
[a] a; b; r^2	[b] Del. Data	[c] Del. T.L.	[d]	[e] Print?	[1] y ⩾ 0	ON OFF 0 ☐ ☒ 1 ☐ ☒ 2 ☐ ☒ 3 ☐ ☒	DEG ☒ GRAD ☐ RAD ☐	FIX ☒ SCI ☐ ENG ☐ n 2
[0] Used	[1] Used	[2] Used	[3] Used	[4] Used	[2]			
[5] Used	[6]	[7]	[8]	[9]	[3]			

MULTIPLE LINEAR REGRESSION

001	*LBLA	21 11	
002	CLRG	16-53	Initialize
003	CF1	16 22 01	
004	0	00	
005	RTN	24	
006	*LBLB	21 12	
007	STOC	35 13	
008	R↓	-31	
009	STOB	35 12	Input x_i, y_i, z_i
010	R↓	-31	
011	STOA	35 11	
012	F0?	16 23 00	
013	GSB8	23 08	
014	7	07	
015	STOI	35 46	Compute Σx_i, Σy_i, Σz_i
016	R↓	-31	Σx_i^2, Σy_i^2, Σz_i^2
017	GSB1	23 01	$\Sigma x_i y_i$, $\Sigma y_i z_i$, $\Sigma z_i x_i$
018	8	08	
019	STOI	35 46	
020	RCLB	36 12	
021	F0?	16 23 00	
022	GSB6	23 06	
023	GSB1	23 01	
024	9	09	
025	STOI	35 46	
026	RCLC	36 13	
027	F0?	16 23 00	
028	GSB6	23 06	
029	GSB1	23 01	
030	RCLA	36 11	
031	RCLB	36 12	
032	x	-35	
033	GSB2	23 02	
034	ST+1	35-55 01	
035	RCLA	36 11	
036	RCLC	36 13	
037	x	-35	
038	GSB2	23 02	
039	ST+2	35-55 02	
040	RCLB	36 12	
041	RCLC	36 13	
042	x	-35	
043	GSB2	23 02	
044	ST+3	35-55 03	
045	1	01	
046	GSB2	23 02	
047	ST+0	35-55 00	
048	RCL0	36 00	
049	F0?	16 23 00	
050	GSB6	23 06	
051	RTN	24	
052	*LBL1	21 01	Subroutine for Σx_i, ...
053	GSB2	23 02	Σx_i^2, ...
054	ST+i	35-55 45	
055	RCLI	36 46	
056	3	03	
057	-	-45	
058	STOI	35 46	
059	R↓	-31	
060	X²	53	
061	GSB2	23 02	
062	ST+i	35-55 45	
063	RTN	24	
064	*LBLC	21 13	
065	RCL0	36 00	
066	RCL4	36 04	Calculate a, b, c
067	x	-35	
068	RCL7	36 07	
069	X²	53	
070	-	-45	
071	STOD	35 14	
072	RCL0	36 00	
073	RCL3	36 03	
074	x	-35	
075	RCL8	36 08	
076	RCL9	36 09	
077	x	-35	
078	-	-45	
079	x	-35	
080	STOC	35 13	
081	RCL0	36 00	
082	RCL1	36 01	
083	x	-35	
084	RCL7	36 07	
085	RCL8	36 08	
086	x	-35	
087	-	-45	
088	STOA	35 11	
089	RCL0	36 00	
090	RCL2	36 02	
091	x	-35	
092	RCL7	36 07	
093	RCL9	36 09	
094	x	-35	
095	-	-45	
096	STOB	35 12	
097	x	-35	
098	RCLC	36 13	
099	X↕Y	-41	
100	-	-45	
101	RCLD	36 14	
102	RCL0	36 00	
103	RCL5	36 05	
104	x	-35	
105	RCL8	36 08	
106	X²	53	
107	-	-45	
108	x	-35	
109	RCLA	36 11	
110	X²	53	
111	-	-45	
112	=	-24	

REGISTERS

0 n	1 $\Sigma x_i y_i$	2 $\Sigma x_i z_i$	3 $\Sigma y_i z_i$	4 Σx_i^2	5 Σy_i^2	6 Σz_i^2	7 Σx_i	8 Σy_i	9 Σz_i
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A Used	B Used	C Used	D Used	E Used	I Used

```
113  STOC     35 13
114  RCLB     36 12
115  RCLA     36 11
116  RCLC     36 13
117    ×        -35
118    -        -45
119  RCLD     36 14
120    ÷        -24
121  STOB     35 12
122  RCL9     36 09
123  RCLC     36 13
124  RCL8     36 08
125    ×        -35
126    -        -45
127  RCLB     36 12
128  RCL7     36 07
129    ×        -35
130    -        -45
131  RCL0     36 00
132    ÷        -24
133  STOA     35 11
134  GSB7     23 07
135  RCLB     36 12
136  GSB9     23 09
137  RCLC     36 13
138  GTO9     22 09
139  *LBLD    21 14
140  RCLA     36 11
141  RCL9     36 09
142    x        -35
143  RCLB     36 12
144  RCL2     36 02
145    x        -35
146    +        -55
147  RCLC     36 13
148  RCL3     36 03
149    x        -35
150    +        -55
151  RCL5     36 09
152    √x       53
153  RCL0     36 00
154    ÷        -24
155    -        -45
156  RCLE     36 0E
157  RCL9     36 09
158    √x       53
159  RCL0     36 00
160    ÷        -24
161    -        -45
162    ÷        -24
163  GTO7     22 07
164  *LBLE    21 15
165    X≠Y      -41
166    F0?   16 23 00
167  GSB8     23 08
168    X≠Y      -41
```

a

b

c

Calculate r^2

Calculate $\hat{z}$ for given x, y.

```
169    F0?   16 23 00
170  GSB6     23 06
171  RCLC     36 13
172    x        -35
173    X≠Y      -41
174  RCLB     36 12
175    x        -35
176    +        -55
177  RCLA     36 11
178    +        -55
179  GTO9     22 09
180  *LBLa    21 16 11
181    SF1   16 21 01
182  GSBB     23 12
183    CF1   16 22 01
184    RTN      24
185  *LBLe    21 16 15
186    F0?   16 23 00
187  GTO5     22 05
188    SF0   16 21 00
189    1        01
190    RTN      24
191  *LBL5    21 05
192    0        00
193    CF0   16 22 00
194    RTN      24
195  *LBL7    21 07
196    F0?   16 23 00
197    SPC      16-11
198  *LBL9    21 09
199    F0?   16 23 00
200    GTO6     22 06
201    R/S      51
202    RTN      24
203  *LBL6    21 06
204    PRTX     -14
205    RTN      24
206  *LBL2    21 02
207    F1?   16 23 01
208    CHS      -22
209    RTN      24
210  *LBL8    21 08
211    SPC      16-11
212    GTO9     22 09
213    R/S      51
```

Correction of input values.

Print instructions

Change sign for correction.

LABELS					FLAGS	SET STATUS		
A START	B Σ+	C a; b; c	D r^2	E z	0 Print	FLAGS	TRIG	DISP
a Σ−	b	c	d	e Print?	1 Correction	ON OFF 0 ☐ ☒ 1 ☐ ☒ 2 ☐ ☒ 3 ☐ ☒	DEG ☒ GRAD ☐ RAD ☐	FIX ☒ SCI ☐ ENG ☐ n 2
0	1 Used	2 Used	3	4	2			
5 Used	6 Used	7 Used	8 Used	9 Used	3			

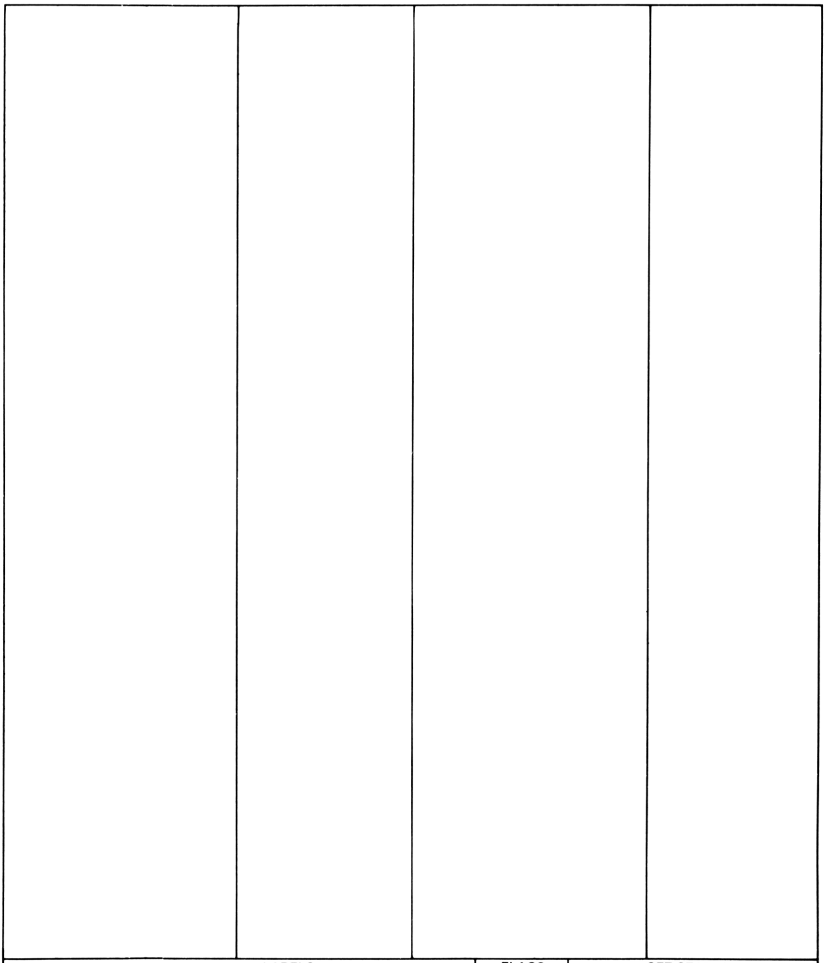
BREAK-EVEN ANALYSIS

001	*LBLA	21 11	
002	STOA	35 11	F→R_A
003	F3?	16 23 03	Digit entered?
004	RTN	24	
005	RCLB	36 12	
006	RCLC	36 13	
007	-	-45	Calculate F and store in R_A.
008	RCLD	36 14	
009	x	-35	
010	RCLE	36 15	
011	-	-45	
012	STOA	35 11	
013	RTN	24	
014	*LBLB	21 12	
015	STOB	35 12	P→R_B
016	F3?	16 23 03	Digit entered?
017	RTN	24	
018	RCLA	36 11	
019	RCLE	36 15	
020	+	-55	Calculate P and store in R_B.
021	RCLD	36 14	
022	÷	-24	
023	RCLC	36 13	
024	+	-55	
025	STOB	35 12	
026	RTN	24	
027	*LBLC	21 13	
028	STOC	35 13	V→R_C
029	F3?	16 23 03	Digit entered?
030	RTN	24	
031	RCLB	36 12	
032	RCLA	36 11	Calculate V and store in R_C.
033	RCLE	36 15	
034	+	-55	
035	RCLD	36 14	
036	÷	-24	
037	-	-45	
038	STOC	35 13	
039	RTN	24	
040	*LBLD	21 14	
041	STOD	35 14	U→R_D
042	F3?	16 23 03	Digit entered?
043	RTN	24	
044	RCLA	36 11	
045	RCLE	36 15	Calculate U and store in R_D.
046	+	-55	
047	RCLB	36 12	
048	RCLC	36 13	
049	-	-45	
050	÷	-24	
051	STOD	35 14	
052	RTN	24	
053	*LBLE	21 15	GP→R_E
054	STOE	35 15	
055	F3?	16 23 03	Digit entered?
056	RTN	24	
057	RCLB	36 12	
058	RCLC	36 13	Calculate GP and store in R_E.
059	-	-45	
060	RCLD	36 14	
061	x	-35	
062	RCLA	36 11	
063	-	-45	
064	STOE	35 15	
065	RTN	24	
066	*LBL$_a$	21 16 11	
067	RCLB	36 12	
068	RCLC	36 13	Calculate OL
069	-	-45	
070	RCLD	36 14	
071	x	-35	
072	STOI	35 46	
073	RCLI	36 46	
074	RCLA	36 11	
075	-	-45	
076	÷	-24	
077	RTN	24	
078	R/S	51	

REGISTERS

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	F	B	P	C	V	D	U	E	GP	I	P(U - V)



LABELS					FLAGS
A F	B P	C V	D U	E GP	0
a	b	c	d	e	1
0	1	2	3	4	2
5	6	7	8	9	3 Digit?

SET STATUS		
FLAGS	TRIG	DISP
ON OFF 0 ☐ ☒ 1 ☐ ☒ 2 ☐ ☒ 3 ☐ ☒	DEG ☒ GRAD ☐ RAD ☐	FIX ☒ SCI ☐ ENG ☐ n 2

INVOICING

```
001  *LBLA      21 11
002   CLRG      16-53
003   P≠S       16-51
004   CLRG      16-53
005     2         02
006   STOI      35 46
007     0         00
008   RTN         24
009  *LBLB      21 12
010   STOE      35 15
011   RTN         24
012  *LBLC      21 13
013   STOD      35 14
014   RTN         24
015  *LBLD      21 14
016   STOC      35 13
017   RTN         24
018  *LBLE      21 15
019   GSB5      23 05
020   STOi      35 45
021   ST+0   35-55 00
022   ST+1   35-55 01
023   ISZI   16 26 46
024     2         02
025     2         02
026   RCLI      36 46
027   X>Y?    16-34
028   GTO9      22 09
029     R↓       -31
030     R↓       -31
031   RTN         24
032  *LBL5      21 05
033   RCLC      36 13
034   ENT↑      -21
035   ENT↑      -21
036   RCLE      36 15
037    EEX      -23
038     2         02
039     ÷        -24
040     x        -35
041     -        -45
042   RCLD      36 14
043     ×        -35
044   RTN         24
045  *LBLa      21 16 11
046   RCL0      36 00
047   ENT↑      -21
048    CLX      -51
049   STO0      35 00
050    X≠Y      -41
051   GSB2      23 02
052   RTN         24
053  *LBLb      21 16 12
054   RCL1      36 01
055   GSB2      23 02
056   RTN         24
```

Clear registers and initialize R_I

DISC→R_E

UNITS→R_D

PRICE→R_C

Net line total→R_i

Check to see if number of inputs is ≤ 22. If not, show ERROR.

Net line total calculated.

Display subtotal and clear register.

Recall Grand Total

```
057  *LBLc      21 16 13
058     2         02
059   STOI      35 46
060  *LBL1      21 01
061   RCLi      36 45
062   X=0?    16-43
063   GTO4      22 04
064   RCL1      36 01
065     ÷        -24
066    EEX      -23
067     2         02
068     ×        -35
069   GSB2      23 02
070   ISZI   16 26 46
071     2         02
072     1         01
073   RCL1      36 46
074   X≤Y?    16-35
075   GTO1      22 01
076  *LBL4      21 04
077     1         01
078     0         00
079     0         00
080   GSB2      23 02
081   RTN         24
082  *LBL2      21 02
083   F0?   16 23 00
084   GTO3      22 03
085    R/S        51
086   RTN         24
087  *LBL3      21 03
088   PRTX       -14
089   RTN         24
090  *LBLe      21 16 15
091   F0?   16 23 00
092   GTO0      22 00
093   SF0   16 21 00
094     1         01
095   RTN         24
096  *LBL0      21 00
097   CF0   16 22 00
098     0         00
099   RTN         24
100  *LBLd      21 16 14
101   DSZI   16 25 46
102     0         00
103   STOi      35 45
104   GSB5      23 05
105   ST-0   35-45 00
106   ST-1   35-45 01
107   RCL0      36 00
108    R/S        51
```

Recall and display line total as % of Grand Total.

Check to recall only those registers containing line totals.

Last output is 100 – you are done!

Test print/pause flag.

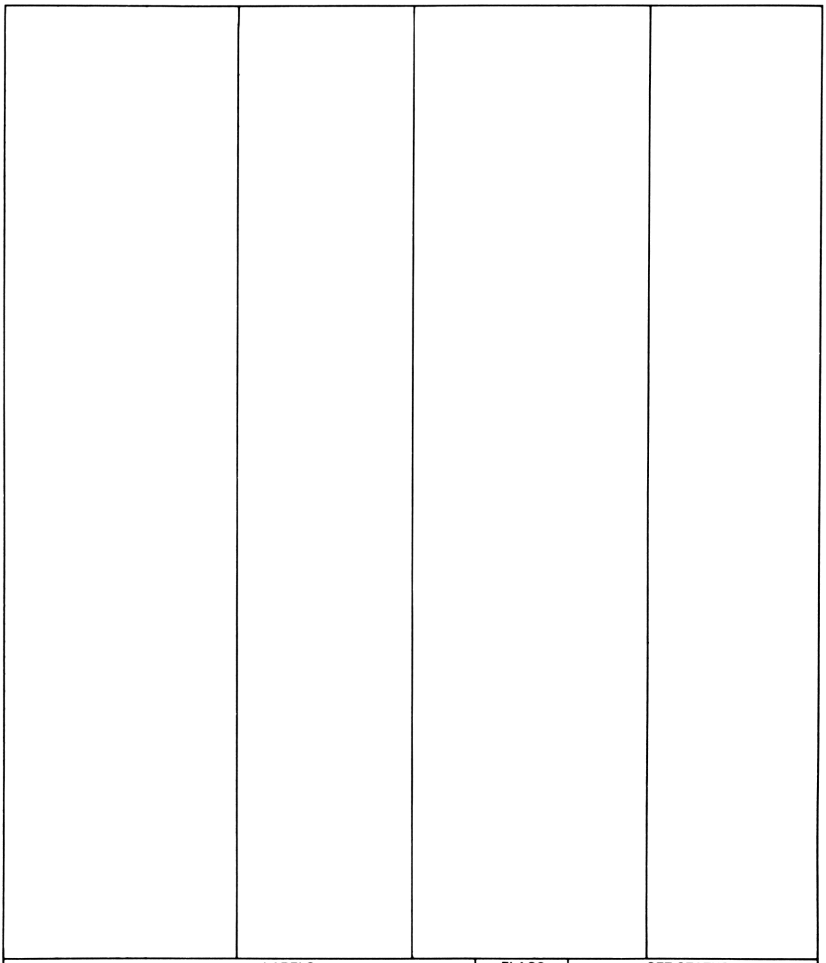
Print/pause

Print/pause flag set and unset.

Routine to delete incorrect line totals.

REGISTERS

0 Subtotal	1 Grand Total	2 Used	3 Used	4 Used	5 Used	6 Used	7 Used	8 Used	9 Used
S0 Used	S1 Used	S2 Used	S3 Used	S4 Used	S5 Used	S6 Used	S7 Used	S8 Used	S9 Used
A Used	B Used	C Price	D Units	E Disc.	I Control				



LABELS					FLAGS
A START	B Disc.	C Units	D Price	E Net Line Tot.	0 Print?
a Subtotal	b Grand Total	c % Total	d DEL	e Print?	1
0 Used	1 Used	2 Used	3 Used	4 Used	2
5 Used	6	7	8	9	3

SET STATUS

FLAGS		TRIG	DISP
	ON OFF		
0	☐ ☒	DEG ☒	FIX ☒
1	☐ ☒	GRAD ☐	SCI ☐
2	☐ ☒	RAD ☐	ENG ☐
3	☐ ☒		n 2

PAYROLL

001	*LBLA	21 11	Read data card. If data card read, go to c. Otherwise repeat sequence.	057	RCL1	36 01	(Wage) 5.85%
002	0	00		058	*LBL3	21 03	
003	PSE	16 51		059	5	05	
004	F3?	16 23 03		060	.	-62	
005	GTOc	22 16 13		061	8	08	
006	GTOA	22 11		062	5	05	
007	*LBLc	21 16 13	Display SS No.	063	%	55	
008	RCL1	36 46		064	RND	16 24	
009	GSB9	23 09	Display marital status.	065	ST+5	35-55 05	Σ FICA
010	RCLE	36 15		066	ST-9	35-45 09	Net pay-FICA
011	GSB9	23 09		067	GSB9	23 09	
012	RCLB	36 12	Display number of exemptions.	068	*LBL2	21 02	California SDI tax base
013	GSB9	23 09		069	9	09	
014	RTN	24		070	EEX	-23	
015	*LBLB	21 12		071	3	03	
016	RCLC	36 13	#hrs x hrly wage	072	RCL0	36 00	
017	x	-35		073	X>Y?	16-34	Gross > 9000?
018	RND	16 24		074	GTO6	22 06	
019	STO1	35 01		075	RCL1	36 01	
020	STO9	35 09		076	*LBL4	21 04	(Wage) 1%
021	ST+0	35-55 00		077	1	01	
022	GSB9	23 09		078	%	55	
023	RTN	24		079	RND	16 24	
024	*LBLC	21 13	#hrs x OT wage	080	ST+6	35-55 06	Σ SDI
025	RCLD	36 14		081	ST-9	35-45 09	
026	x	-35		082	GSB9	23 09	Net pay-SDI
027	RND	16 24		083	*LBL5	21 05	
028	ST+0	35-55 00		084	RCL7	36 07	Net pay-Const. 1
029	ST+1	35-55 01		085	ST-9	35-45 09	
030	ST+9	35-55 09		086	GSB9	23 09	
031	RCL9	36 09		087	RCL1	36 01	Net Pay-Wage x Const. 2
032	GSB9	23 09		088	RCL8	36 08	
033	RTN	24		089	%	55	
034	*LBLD	21 14	Fed'l. tax	090	RND	16 24	
035	STO2	35 02	Tot. Fed'l. tax	091	ST-9	35-45 09	
036	ST+3	35-55 03	Net pay-Fed'l. tax	092	GSB9	23 09	Net pay-Const. 3
037	ST-9	35-45 09		093	RCLA	36 11	
038	RCL2	36 02	Display Fed'l. tax	094	ST-9	35-45 09	
039	GSB9	23 09		095	GSB9	23 09	Net pay
040	RTN	24		096	RCL9	36 09	Write new data
041	*LBLE	21 15		097	NDTA	16-61	
042	STO2	35 02	State tax	098	CF3	16 22 03	
043	ST+4	35-55 04	Tot. State tax	099	GSB9	23 09	
044	ST-9	35-45 09	Net pay-State tax	100	RTN	24	DONE!
045	RCL2	36 02		101	*LBL6	21 00	
046	GSB9	23 09	Display State tax	102	X<>Y	-41	Gross-15300
047	RTN	24		103	-	-45	
048	*LBLa	21 16 11		104	RCL1	36 01	Wage > Gross-15300?
049	1	01	FICA tax base	105	X>Y?	16-34	
050	5	05		106	GTO1	22 01	No more FICA to withhold; continue.
051	3	03		107	0	00	
052	0	00		108	GSB9	23 09	
053	0	00		109	GTO2	22 02	
054	RCL0	36 00	Gross > 15300?	110	*LBL1	21 01	Amount to apply to FICA tax is wage-(Gross-15300)
055	X>Y?	16-34		111	X<>Y	-41	
056	GTO0	22 0.		112	-	-45	

REGISTERS

0 Gross	1 Wage	2 Fed'l/State	3 Total Fed'l	4 Total State	5 Σ FICA	6 Σ SDI	7 Const. 1	8 Const.2(%)	9 Net Pay
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A Const. 3	B #Exemptions	C Hrly Wage	D OT Wage	E Used	I SS Number

113 GTO 3	22 03		
114 *LBL 6	21 06		
115 X≷Y	-41	Gross − 9000	
116 -	-45		
117 RCL 1	36 01	Wage > Gross − 9000?	
118 X>Y?	16-34		
119 GTO 7	22 07	No more SDI to withhold; continue.	
120 0	00		
121 GSB 9	23 09		
122 GTO 5	22 05	- - - - - - - - - - - -	
123 *LBL 7	21 07	Amount to apply to SDI tax is Wage − (Gross − 9000)	
124 X≷Y	-41		
125 -	-45		
126 GTO 4	22 04		
127 *LBL e	21 16 15	- - - - - - - - - - - -	
128 F0?	16 23 00	Set and unset print/pause flag.	
129 GTO 1	22 01		
130 SF 0	16 21 00		
131 1	01		
132 RTN	24		
133 *LBL 1	21 01	- - - - - - - - - - - -	
134 CF 0	16 22 00		
135 0	00	Print command	
136 RTN	24		
137 *LBL 9	21 09		
138 F0?	16 23 00		
139 GTO 8	22 08		
140 R/S	51		
141 RTN	24		
142 *LBL 8	21 08		
143 PRTX	-14		
144 RTN	24		
145 *LBL b	21 16 12	- - - - - - - - - - - -	
146 RCL 0	36 00	Gross	
147 GSB 9	23 09		
148 RCL 3	36 03	Total Fed'l.	
149 GSB 9	23 09		
150 RCL 4	36 04	Total State	
151 GSB 9	23 09		
152 RCL 5	36 05	Total FICA	
153 GSB 9	23 09		
154 RCL 6	36 06	Total SDI	
155 GSB 9	23 09		
156 RTN	24		
157 R/S	51		

LABELS

A START	B #hrs	C #hrs OT	D Fed'l tax	E State tax	0 Print?
a Net Pay	b Totals	c Used	d	e Print?	1
0 Used	1 Used	2 Used	3 Used	4 Used	2
5 Used	6 Used	7 Used	8 Used	9 Used	3 Data?

FLAGS

SET STATUS

FLAGS		TRIG	DISP
ON OFF			
0 ☐ ☒		DEG ☒	FIX ☒
1 ☐ ☒		GRAD ☐	SCI ☐
2 ☐ ☒		RAD ☐	ENG ☐
3 ☐ ☒			n 2

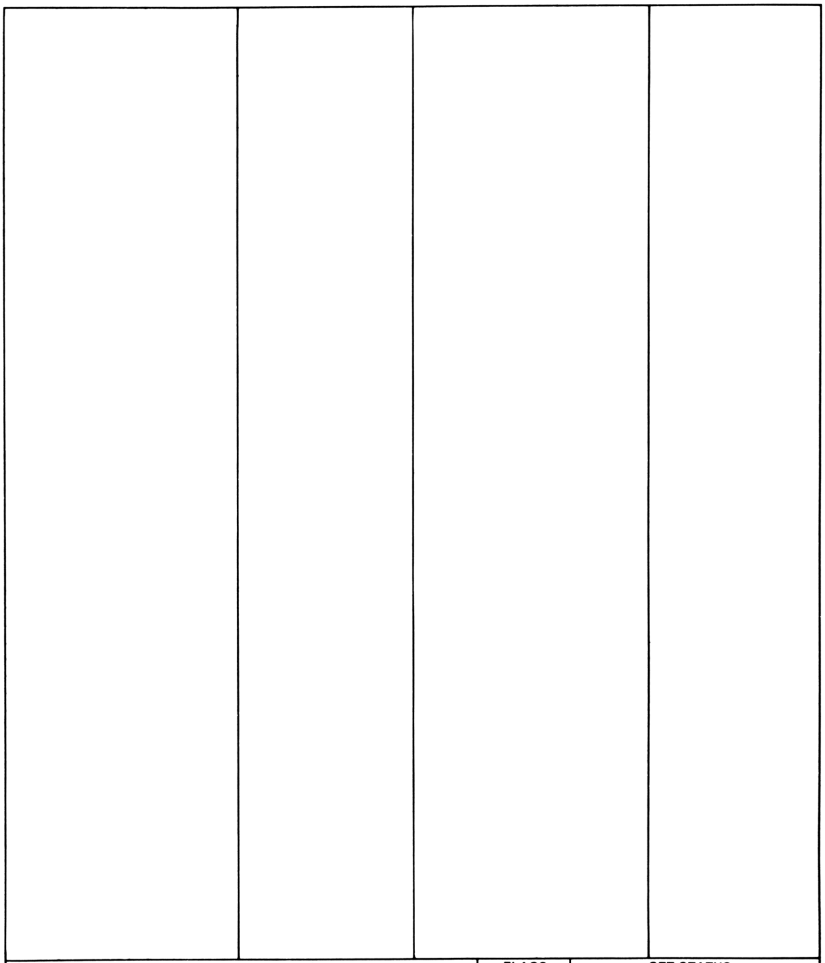
INVENTORY

001	*LBLA	21 11		057	RTN	24	
002	0	00	Read data card.	058	*LBLc	21 16 13	Initialize
003	PSE	16 51	If data card read, go to 1.	059	1	01	
004	F3?	16 23 03	Otherwise repeat sequence.	060	STOI	35 46	
005	GTO1	22 01		061	*LBL2	21 02	
006	GTOA	22 11		062	RCLi	36 45	
007	*LBL1	21 01		063	GSB9	23 09	Recall and display
008	CF3	16 22 03		064	ISZI	16 26 46	inventory information.
009	RCL0	36 00		065	RCLI	36 46	
010	GSB9	23 09		066	7	07	
011	RTN	24	- - - - - - - - - - - -	067	X>Y?	16-34	
012	*LBLB	21 12	Store new price.	068	GTO2	22 02	
013	STOE	35 15		069	RCL0	36 00	
014	RTN	24		070	GSB9	23 09	
015	*LBLC	21 13	- - - - - - - - - - - -	071	F0?	16 23 00	
016	STOD	35 14	Store amount rec'd.	072	SPC	16-11	
017	RCL1	36 01	- - - - - - - - - - - -	073	RTN	24	- - - - - - - - - - - -
018	RCL2	36 02		074	*LBLd	21 16 14	Asks for data card.
019	×	-35	Unit price by weighted	075	WDTA	16-61	
020	RCLE	36 15	average method.	076	CF3	16 22 03	
021	RCLD	36 14		077	CLX	-51	
022	×	-35		078	RTN	24	- - - - - - - - - - - -
023	+	-55		079	*LBLe	21 16 15	
024	RCL2	36 02		080	F0?	16 23 00	
025	RCLD	36 14		081	GTO0	22 00	Print/pause flag
026	+	-55		082	SF0	16 21 00	
027	÷	-24		083	1	01	
028	STO1	35 01	- - - - - - - - - - - -	084	RTN	24	
029	RCLD	36 14	Adjusts on hand and on	085	*LBL0	21 00	
030	ST+2	35-55 02	order quantities by amount	086	CF0	16 22 00	
031	ST-3	35-45 03	received.	087	0	00	
032	GSB3	23 03	Calc. slack.	088	RTN	24	
033	RCL2	36 02		089	*LBL9	21 09	Print command
034	RTN	24	- - - - - - - - - - - -	090	F0?	16 23 00	
035	*LBLD	21 14	Subtract # issued from	091	GTO8	22 08	
036	ST-2	35-45 02	those on hand.	092	R/S	51	
037	GSB3	23 03	Calc. slack.	093	RTN	24	
038	RCL2	36 02		094	*LBL8	21 08	
039	RTN	24		095	PRTX	-14	
040	*LBLE	21 15	- - - - - - - - - - - -	096	RTN	24	
041	ST+3	35-55 03	Add # ordered to those on	097	R/S	51	- - - - - - - - - - - -
042	GSB3	23 03	order.				
043	RCL3	36 03	Calc. slack.				
044	RTN	24	- - - - - - - - - - - -				
045	*LBLa	21 16 11					
046	STO4	35 04	Store minimum quantity.				
047	RTN	24	- - - - - - - - - - - -				
048	*LBLb	21 16 12					
049	STO5	35 05	Store lead time.				
050	*LBL3	21 03					
051	RCL2	36 02	Routine to calculate slack.				
052	RCL3	36 03					
053	+	-55					
054	RCL4	36 04					
055	-	-45					
056	STO6	35 06					

REGISTERS

0 Part #	1 Unit price	2 On hand	3 On Order	4 Min. Quant.	5 Lead Time	6 Slack	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D Amount Rec'd.	E New price	I Used



LABELS					FLAGS
A START	B Price	C Received	D Issued	E Ordered	0 Print?
a Min. Quant.	b LT→SLK	c List	d Update	e Print?	1
0 Used	1 Used	2 Used	3 Used	4	2
5	6	7	8 Used	9 Used	3 Data?

SET STATUS		
FLAGS	TRIG	DISP
ON OFF 0 ☐ ☒ 1 ☐ ☒ 2 ☐ ☒ 3 ☐ ☒	DEG ☒ GRAD ☐ RAD ☐	FIX ☒ SCI ☐ ENG ☐ n 2

Appendix A

MAGNETIC CARD SYMBOLS AND CONVENTIONS

SYMBOL OR CONVENTION	INDICATED MEANING
White mnemonic: x [A]	White mnemonics are associated with the user definable key they are above when the card is inserted in the calculator's window slot. In this case the value of x could be input by keying it in and pressing [A].
Gold mnemonic: y x [f] [E]	Gold mnemonics are similar to white mnemonics except that the gold [f] key must be pressed before the user definable key. In this case y could be input by pressing [f] [E].
x↑y [A]	↑ is the symbol for [ENTER↑]. In this case [ENTER↑] is used to separate the input variables x and y. To input both x and y you would key in x, press [ENTER↑], key in y and press [A].
[X] [A]	The box around the variable x indicates input by pressing [STO] [A].
(x) [A]	Parentheses indicate an option. In this case, x is not a required input but could be input in special cases.
→x [A]	→ is the symbol for calculate. This indicates that you may calculate x by pressing key [A].
→x, y, z [A]	This indicates that x, y, and z are calculated by pressing [A] once. The values would be printed in x, y, z order.
→x; y; z [A]	The semi-colons indicate that after x has been calculated using [A], y and z may be calculated by pressing [R/S].
→"x," y [A]	The quote marks indicate that the x value will be "paused" or held in the display for one second. The pause will be followed by the display of y.
◁▷ x [A]	The two-way arrow ◁▷ indicates that x may be either output or input when the associated user definable key is pressed. If numeric keys have been pressed between user-definable keys, x is stored. If numeric keys have not been pressed, the program will calculate x.

SYMBOL OR CONVENTION	INDICATED MEANING
P? A	The question mark indicates that this is a mode setting, while the mnemonic indicates the type of mode being set. In this case a print mode is controlled. Mode settings typically have a 1.00 or 0.00 indicator displayed after they are executed. If 1.00 is displayed, the mode is on. If 0.00 is displayed, it is off.
START A	The word START is an example of a command. The start function should be performed to begin or start a program. It is included when initialization is necessary.
DEL A	This special command indicates that the last value or set of values input may be deleted by pressing A.

Appendix B
PRINCIPAL EQUATIONS

Unless otherwise stated, all interest rates (i, APR, IRR, NOM, EFF, CR, YLD, etc.) are expressed in decimal form in the equations which follow. Only symbols not defined in the program descriptions are defined here.

Program Number

1. Internal Rate of Return

   Solve for IRR in:

$$INV = \sum_{j=1}^{n} \frac{CF_j}{(1 + IRR)^j}$$

   where:

   n = number of cash flows
   CF_j = j^{th} cash flow

2. Internal Rate of Return—Groups

$$INV = \sum_{j=1}^{k} CF_j \left[\frac{1 - (1 + i)^{-n_j}}{i} \right] \left[(1 + i)^{-\sum_{\ell<j} n_\ell} \right]$$

$$n_0 = 0$$

   where:

   CF_j = j^{th} cash flow
   n = number of cash flows

3. Discounted Cash Flow Analysis—Net Present Value

$$NPV_k = -INV + \sum_{k=1}^{n} \frac{CF_k}{(1 + i)^k}$$

where:

n = number of cash flows
CF_k = k^{th} cash flow
NPV_k = net present value after k^{th} cash flow

4. Direct Reduction Loans—Sinking Fund

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

5. Accumulated Interest/Remaining Balance

$$BAL_K = \frac{1}{(1 + i)^{-K}}\left[PMT\,\frac{(1 + i)^{-K} - 1}{i} + PV\right]$$

$$Int_{J-K} = BAL_K - BAL_{J-1} + (K - J + 1) \cdot PMT$$

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 = $(K) \times (PMT) - (PV - BAL_K)$

6. Wrap-Around Mortgage

$$PV_2 - PV_1 = \frac{PMT_2\left[1-(1+i)^{-n_2}\right]}{i} - \frac{PMT_1\left[1-(1+i)^{-n_1}\right]}{i} + BAL(1+i)^{-n_2}$$

7. Constant Payment to Principal Loan Amortization Schedule

where:

$BAL_K = PV - (K \times CPMT)$
K^{th} payment to interest = $(i)\,(BAL_{K-1}) = (PMT_i)_K$
K^{th} total payment = $CPMT + (PMT_i)_K$
Total interest to payment K =

$$\left[\frac{\frac{(2 - K)\,CPMT}{PV} + 2}{2}\right]\left[(K - 1)\,(i/100)\,(PV)\right]$$

8. Add-on Rate Installment Loan/Interest Rebate—Rule of 78's

$$FC = AMT \cdot \left(\frac{N + h}{12}\right) \cdot AIR$$

$$PMT = \frac{AMT + FC}{N} = AMT\,(1+i)^{h}\left[\frac{i}{1 - (1 + i)^{-N}}\right]$$

$$APR = 12i$$

where:

$$h = ODD \cdot 12/365$$

$$REB_K = (N - K) \cdot \left[\frac{FC\,(N - K + 1)}{N \times (N + 1)}\right]$$

$$BAL_K = (N - K) \cdot PMT - REBATE_K$$

9. Savings Plan—Leases

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

10. Advance Payments

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

11. Savings—Compounding Periods Different from Payment Periods

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

when $P/C \leq 1$

$$Q = (1 + i)^{C/P} - 1$$

$$Z = (1 + Q)$$

$$n = \#PAY$$

when P/C > 1

$$Q = i$$

$$n = (\#PAY) \times (C/P)$$

$$Z = (P/C + 1) \times \left(\frac{Q}{2}\right) + (P/C)$$

12. Simple Interest/Interest Conversions

$$INT\ 360 = \frac{DAYS}{360} \cdot BEG\ AMT \cdot RATE$$

$$INT\ 365 = \frac{DAYS}{365} \cdot BEG\ AMT \cdot RATE$$

finite compounding

$$EFF = \left(1 + \frac{NOM}{C}\right)^{C} - 1$$

continuous compounding

$$EFF = (e^{NOM} - 1)$$

13. Depreciation Schedules

where:

K = value for YR
$TOTDEP_K$ = total depreciation for years 1 through K.
W = integer portion of LIFE
F = decimal portion of LIFE
(i.e., for a LIFE of 12.25 years W = 12 and F = .25)

Straight Line Schedule

$$DEP_K = \frac{SBV - SAL}{LIFE}$$

$$DEP_K\ (\text{last year}) = \left(\frac{SBV - SAL}{LIFE}\right) \cdot F$$

$$TOTDEP_K = (K) \cdot \left(\frac{SBV - SAL}{LIFE}\right)$$

$$RDV_K = (LIFE - K) \cdot \left(\frac{SBV - SAL}{LIFE}\right)$$

$$RBV_K = RDV_K + SAL$$

Sum-of-the-Years'-Digits Schedule

$$SOYD = \frac{(W + 1)(W + 2F)}{2}$$

$$DEP_K = \left(\frac{LIFE + 1 - K}{SOYD}\right) \cdot (SBV - SAL)$$

$$TOTDEP_K = \left[1 - \frac{(W - K + 1) \times (W - K + 2F)}{2 \times (SOYD)}\right] \cdot (SBV - SAL)$$

$$RDV_K = \left[\frac{(W - K + 1) \times (W - K + 2F)}{2 \times (SOYD)}\right] \cdot (SBV - SAL)$$

$$RBV_K = RDV_K + SAL$$

Variable Rate Declining Balance Schedule

$$DEP_K = SBV \cdot \left(1 - \frac{FACT}{LIFE}\right)^{K-1} \cdot \left(\frac{FACT}{LIFE}\right)$$

$$TOTDEP_K = SBV \cdot \left[1 - \left(1 - \frac{FACT}{LIFE}\right)^{K}\right]$$

$$RDV_K = (SBV - SAL) - TOTDEP_K$$

$$RBV_K = RDV_K + SAL$$

Crossover Point—Declining Balance to Straight Line

$$SBV\left(1-\frac{FACT}{LIFE}\right)^{K-1}\cdot\left(\frac{FACT}{LIFE}\right)>\frac{(SBV-SAL)-TOT\,DEP_{K-1}}{L+1-K}$$

where $TOTDEP_{K-1}$ is determined as shown above.

The largest integer value for K which maintains the above relationship is the "last year" to use the Declining Balance depreciation method.

14. Days Between Dates

Actual

$$DAYS = f(DT2) - f(DT1)$$

where

$$f(DT) = 365\,(yyyy) + 31\,(mm - 1) + dd + Int\,(z/4) - x$$

and

for $mm \leq 2$

$$x = 0$$
$$z = (yyyy) - 1$$

for $mm > 2$

$$x = Int\,(.4\,mm + 2.3)$$
$$z = (yyyy)$$
$$Int = \text{Integer portion}$$

30/360 Basis

$$DAYS = f(DT2) - f(DT1)$$
$$f(DT) = 360\,(yyyy) + 30\,mm + z$$

for f(DT1)

if $dd_1 = 31$ then $z = 30$
if $dd_1 \neq 31$ then $z = dd_1$

for f (DT2)

if $dd_2 = 31$ and $dd_1 = 30$ or 31 then $z = 30$
if $dd_2 = 31$ and $dd_1 < 30$ then $z = dd_2$
if $dd_2 < 31$ then $z = dd_2$

15. Bond Price and Yield

for PER > 1

$$\text{PRICE} = \text{RV}\left(1 + \frac{\text{YLD}}{2}\right)^{-\text{PER}} + 100\,\frac{\text{CR}}{\text{YLD}}\left[\left(1 + \frac{\text{YLD}}{2}\right)^{\text{J}} - \left(1 + \frac{\text{YLD}}{2}\right)^{-\text{PER}}\right] - 100\left(\frac{\text{CR}}{2}\right)\text{J}$$

where

J = 1 − FRAC (PER)

FRAC (PER) = fractional portion of the number of remaining coupon periods

i.e., if PER = 12.6, FRAC (PER) = .6, and J = 1 − .6 = .4

for PER < 1

$$\text{PRICE} = \frac{\text{RV} + \frac{\text{CR}}{2}}{1 + \frac{\text{YLD}}{2} \cdot \text{PER}} - \left(\frac{\text{CR}}{2}\right)\text{J}$$

16. Interest at Maturity/Discounted Securities

Price (given yield) =

$$\frac{\left(\frac{\text{DIM}}{\text{B}} \times \frac{\text{CR}}{100} + 1\right)}{\left(\frac{\text{DSM}}{\text{B}} \times \frac{\text{YLD}}{100} + 1\right)} - \left(\frac{\text{DIM} - \text{DSM}}{\text{B}} \times \frac{\text{CR}}{100}\right)$$

Yield (given price) =

$$\left[\frac{\left(\frac{\text{DIM}}{\text{B}} \times \text{CR} + 100\right)}{\frac{\text{DIM} - \text{DSM}}{\text{B}} \times \text{CR} + \text{PRICE}} - 1\right]\left(\frac{\text{B}}{\text{DSM}}\right)(100)$$

$$\text{Price (given yield)} = \frac{100}{1 + \frac{\text{YLD}}{100} \times \frac{\text{DSM}}{360}}$$

$$\text{YLD (given price)} = \left(\frac{100 - \text{PRICE}}{\text{PRICE}} \times \frac{360}{\text{DSM}} \right) \times 100$$

$$\text{Price (given discount rate)} = 100 - \left(\frac{\text{DR} \times \text{DSM}}{360} \right)$$

17. Linear Regression

for

$$y = a + bx$$

$$b = \frac{\Sigma x_i y_i - \frac{\Sigma x_i \, \Sigma y_i}{n}}{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}}$$

$$a = \bar{y} - b\bar{x}$$

where:

$$\bar{x} = \frac{\Sigma x_i}{n} \qquad \bar{y} = \frac{\Sigma y_i}{n}$$

$$r^2 = \frac{\left[\Sigma x_i y_i - \frac{\Sigma x_i \, \Sigma y_i}{n} \right]^2}{\left[\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n} \right] \left[\Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n} \right]}$$

n = number of data pairs

Exponential Curve Fit

$$y = ae^{bx} \qquad (a > 0)$$

$$b = \frac{\Sigma x_i \ln y_i - \frac{1}{n}(\Sigma x_i)(\Sigma \ln y_i)}{\Sigma x_i^2 - \frac{1}{n}(\Sigma x_i)^2}$$

$$a = \exp\left[\frac{\Sigma \ln y_i}{n} - b\frac{\Sigma x_i}{n}\right]$$

$$r^2 = \frac{\left[\Sigma x_i \ln y_i - \frac{1}{n}\Sigma x_i \Sigma \ln y_i\right]^2}{\left[\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}\right]\left[\Sigma(\ln y_i)^2 - \frac{(\Sigma \ln y_i)^2}{n}\right]}$$

n = number of data pairs

Annual growth rate = $(e^b - 1)\ 100$

18. Multiple Linear Regression

$$z = a + bx + cy$$

$$\Sigma z_i = an + b\Sigma x_i + c\Sigma y_i \qquad i = 1, 2, \ldots, n$$

$$\Sigma x_i z_i = a\Sigma x_i + b\Sigma x_i^2 + c\Sigma x_i y_i$$

$$\Sigma y_i z_i = a\Sigma y_i + b\Sigma x_i y_i + c\Sigma y_i^2$$

$$c = \frac{A - B}{\left[n\Sigma x_i^2 - (\Sigma x_i)^2\right]\left[n\Sigma y_i^2 - (\Sigma y_i)^2\right] - \left[n\Sigma x_i y_i - (\Sigma x_i)(\Sigma y_i)\right]^2}$$

where:

$$A = \left[n\Sigma x_i^2 - (\Sigma x_i)^2\right]\left[n\Sigma y_i z_i - (\Sigma y_i)(\Sigma z_i)\right]$$

$$B = \left[n\Sigma x_i y_i - (\Sigma x_i)(\Sigma y_i)\right]\left[n\Sigma x_i z_i - (\Sigma x_i)(\Sigma z_i)\right]$$

$$b = \frac{\left[n\Sigma x_i z_i - (\Sigma x_i)(\Sigma z_i)\right] - c\left[n\Sigma x_i y_i - (\Sigma x_i)(\Sigma y_i)\right]}{n\Sigma x_i^2 - (\Sigma x_i)^2}$$

$$a = \frac{1}{n}(\Sigma z_i - c\,\Sigma y_i - b\,\Sigma x_i)$$

$$R^2 = \frac{a\,\Sigma z_i + b\,\Sigma x_i z_i + c\,\Sigma y_i z_i - \frac{1}{n}(\Sigma z_i)^2}{(\Sigma z_i^2) - \frac{(\Sigma z_i)^2}{n}}$$

19. Break Even Analysis

$$GP = U(P - V) - F$$

$$OL = \frac{U(P - V)}{U(P - V) - F}$$

20. Invoicing

$$\text{Net line total} = \left(\text{Price} - \text{Price} \times \frac{\text{DISC}}{100}\right) \cdot (\#)$$

NOTES

1000 N.E. Circle Blvd., Corvallis, OR 97330

Rev. 6/77 00097-90084

A B ● D E