

HEWLETT-PACKARD

# HP-67/HP-97

Business Decisions Pac



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# 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	

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## 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

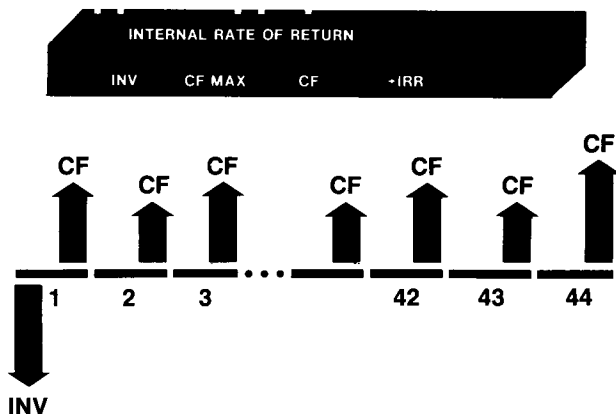


Figure 1

**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  $\pm .01\%$  (.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	<b>A</b>	INV
3	If there are > 22 cash flows, key in the largest cash flow.	CF MAX	<b>B</b>	CF MAX
4	Beginning with the first period, key in all cash flows in sequence, pressing <b>C</b> after each value.	CF	<b>C</b>	# of CFs
5	Calculate the periodic internal rate of return		<b>D</b>	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)

Keystrokes:

250000 **A** 46423 **C** 40710 **C**  
36638 **C** 34097 **C** 32485 **C**  
23199 **C** 21612 **C** 20037 **C**  
18460 **C** 311406 **C** **D** →

Outputs:

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:

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** →  
201 **C** 195 **C** 178 **C** 197 **C**  
210 **C** 220 **C** 206 **C** 194 **C**  
187 **C** 190 **C** 201 **C** 35000 **C** →  
**D** →  
12 **X** →

Outputs:

12.00 (12 cash flows input)  
  
24.00 (all cash flows input)  
1.15 (monthly IRR)  
13.79 (an annual IRR of 13.79%)

## INTERNAL RATE OF RETURN—GROUPS OF CASH FLOWS

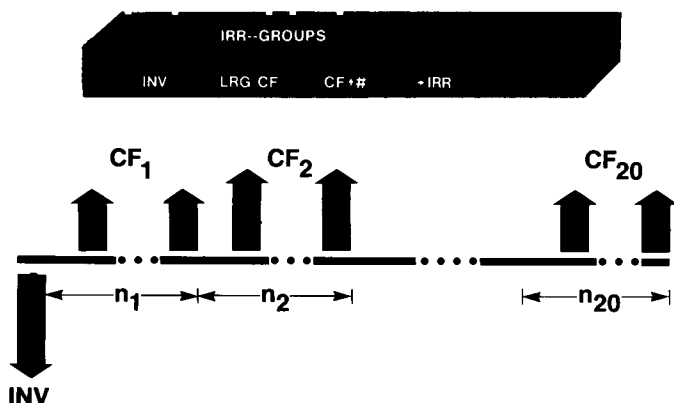


Figure 2

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	<b>A</b>	INV
3	If one cash flow has more than 8 digits, key it in.	LRG CF	<b>B</b>	LRG CF/10 <sup>k</sup> *
4	Beginning with the first period, key in each cash flow and the number of times it occurs, pressing <b>C</b> after each group.	CF #	<b>ENTER</b> <b>C</b>	 # of groups
5	Calculate the periodic internal rate of return.		<b>D</b>	IRR (%)
6	To recalculate the IRR, enter the number of groups.	# of groups	<b>f D</b>	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:**

50000 **A**  
 9000 **ENTER** **↓** 5 **C**  
 7500 **ENTER** **↓** 4 **C**  
 6000 **ENTER** **↓** 4 **C**  
 7500 **ENTER** **↓** 3 **C**  
 5000 **ENTER** **↓** 7 **C** →

**Outputs:**

**D** → 5.0000 (5 groups of cash flows entered)  
 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:**

620000000 **A** 100000000 **B** → 62000000.00

100000000 **ENTER** **↓** 10 **C**

5000000 **ENTER** **↓** 5 **C** **D** → 10.0649 (annual IRR of 10.0649%)

## 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.		<b>f E</b>	1.00 or 0.00
3	Key in			
	• Initial investment amount	INV	<b>A</b>	INV
	• Periodic interest (discount) rate	i (%)	<b>B</b>	i (%)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Key in the number of equal cash flows if greater than 1.	#	<b>C</b>	#
5	Key in cash flow amount(s) and calculate net present value.	CF	<b>D</b>	NPV
6	Optional: Display total number of cash flows entered so far.		<b>E</b>	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 10 <sup>th</sup> 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	<u>2,270</u>
Total Net Cash Cost	\$6,941

LEASE	
Year	Net Cash Cost
1	\$1,310
2	1,310
3	1,310
4	1,310
5	<u>1,310</u>
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**  $\longrightarrow$  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

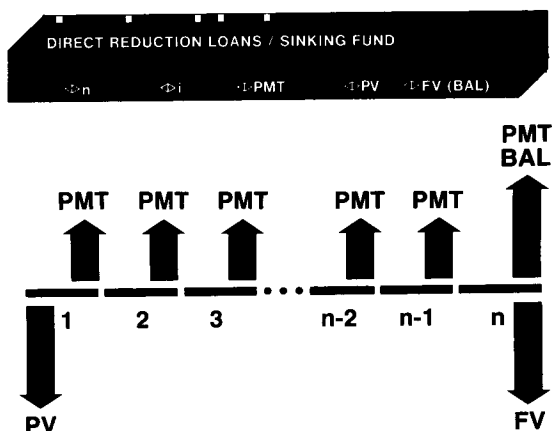


Figure 3

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  $n = 12 \times 30 = 360$ .)
- $i$  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)		<b>f</b> <b>A</b>	0.00
3	Input the known values:			
	• Number of periods	$n$	<b>A</b>	$n$
	• Periodic interest rate	$i$ (%)	<b>B</b>	$i$ (%)
	• Periodic payment	PMT	<b>C</b>	PMT
	• Present value	PV	<b>D</b>	PV
	• Future value, balloon			
	payment, or balance	FV(BAL)	<b>E</b>	FV(BAL)
4	Calculate the unknown value:			
	• Number of periods		<b>A</b>	$n$
	• Periodic interest rate		<b>B</b>	$i$ (%)
	• Periodic payment		<b>C</b>	PMT
	• Present value		<b>D</b>	PV
	• Future value, balloon			
	payment, or balance		<b>E</b>	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:**

f A 14 ENTER 12 ÷ B

60 A 250 C 10000 E

D →

14500 D B →

12 x →

**Outputs:**

15730.27 (maximum price to pay to yield 14%)

1.39 (monthly percent yield)

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:**

f A 10000 D

8 ENTER 12 ÷ B

6 ENTER 12 x A C → 175.33 (monthly payment)

Now determine the purchase price of the note.

13 ENTER 12 ÷ B

D → 8734.26 (purchase price)

**Outputs:****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 8% 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:**

First calculate the periodic payment amount.

f A 60000 D

30 ENTER 12 x 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 x → 8.97 (% APR)

**Outputs:**

**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  $5\frac{1}{2}\%$  account, compounded monthly, how long will it take from today to accumulate \$2500 for the trip?

**Keystrokes:**

f A 150 C

5.5 ENTER 12 ÷ B

2500 E A

**Outputs:**

16.10 (months)

**Example 7:**

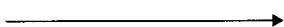
A corporation has determined that a certain piece of equipment costing \$50,000 will be required in 3 years. Assuming a fund paying 7% compounded quarterly is available, what quarterly payment amount must be placed in the fund in order to cover this cost if savings are to start at the end of this quarter?

**Keystrokes:**

f A 50000 E 3 ENTER

4 X A 7 ENTER

4 ÷ B C

**Outputs:**

3780.69 (quarterly payment)

## ACCUMULATED INTEREST/REMAINING BALANCE

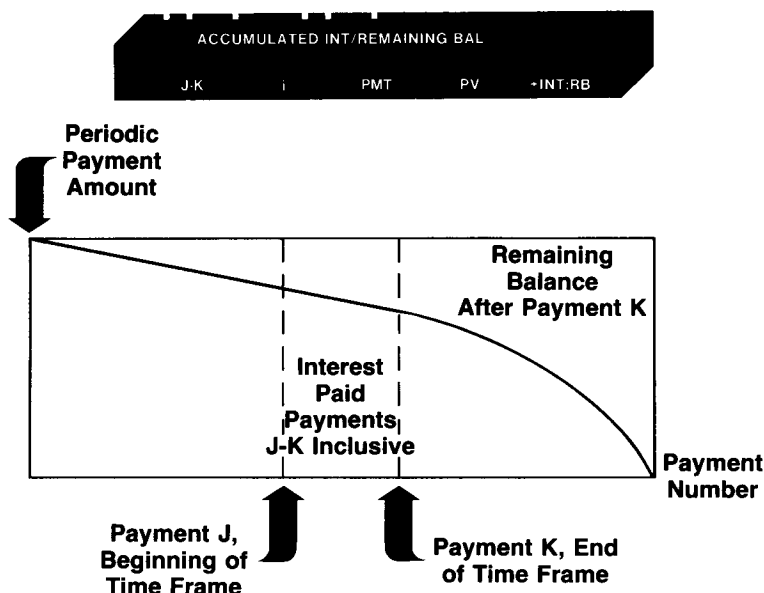


Figure 4

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.		<b>f E</b>	1.00 or 0.00
3	Key in			
	• Starting period number	J	<b>A</b>	J
	• Ending period number	K	<b>A</b>	K
	• Periodic interest rate	i (%)	<b>B</b>	i (%)
	• Periodic payment amount	PMT	<b>C</b>	PMT
	• Initial loan amount	PV	<b>D</b>	PV
4	Compute the total interest paid between periods J and K inclusive, and the remaining balance at the end of period K.		<b>E</b>	INT
			<b>R/S</b>	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.		<b>f A</b>	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 $J \leq K$ , 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 36<sup>th</sup> payment.

**Keystrokes:**

1 **A** 2 **A** 7 **ENTER** 12 **÷** **B**

200 **C** 30000 **D** **f** **A** →

**R/S** →

**R/S** →

**R/S** →

**R/S** →

**R/S** →

**R/S** →

**R/S** →

**R/S** →

**R/S** →

**Outputs:**

1.00 (starting 1<sup>st</sup> period)

175.00 (payment to interest)

25.00 (payment to principal)

29975.00 (remaining balance)

175.00 (total interest to date)

2.00 (starting 2<sup>nd</sup> period)

174.85 (payment to interest)

25.15 (payment to principal)

29949.85 (remaining balance)

349.85 (total interest to date)

**Keystrokes:**

Now let's skip ahead to the 36<sup>th</sup> payment period.

36 **A** **A** **f** **A** →

**R/S** →

**R/S** →

**R/S** →

**R/S** →

**Outputs:**

36.00 (starting 36<sup>th</sup> period)

169.36 (payment to interest)

30.64 (payment to principal)

29001.75 (remaining balance)

6201.75 (total interest to date)

WRAP-AROUND MORTGAGE

WRAP-AROUND MORTGAGE

PV<sub>1</sub>•PMT<sub>1</sub>•n<sub>1</sub>      PV<sub>2</sub>•PMT<sub>2</sub>•n<sub>2</sub>      BAL      ~Yield

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 mortgage (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 <sub>1</sub>	ENTER	PV <sub>1</sub>
	• Periodic payment	PMT <sub>1</sub>	ENTER	PMT <sub>1</sub>
	• Number of periods remaining	n <sub>1</sub>	A	n <sub>1</sub>
3	Key in the following information			
	from the wrap-around			
	mortgage:			
	• Total wrap-around amount	PV <sub>2</sub>	ENTER	PV <sub>2</sub>
	• Periodic payment on wrap-			
	around	PMT <sub>2</sub>	ENTER	PMT <sub>2</sub>
	• Number of periods in term of			
	wrap-around	n <sub>2</sub>	C	n <sub>2</sub>

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	<b>D</b>	BAL
5	Calculate the periodic yield of the wrap-around to the lender.		<b>E</b>	Yield (%)
6	Optional: If a payment amount is not known, it may be calculated by keying in:			
	• Total number of periods	n	<b>f A</b>	n
	• Periodic interest rate	i (%)	<b>f B</b>	i (%)
	• Loan amount	PV	<b>f D</b>	PV
7	Calculate periodic payment		<b>f C</b>	PMT
	The payment is stored in $R_C$ , and may be recalled at a later time.		<b>RCL C</b>	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:**

200000 **ENTER** 2030.21 **ENTER**

144 **A** →

**Outputs:**

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 preceding keystroke was **ENTER**, **CLX**, 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 240<sup>th</sup> month of \$129963.35. If you accept the proposal, what is your rate of return?

**Keystrokes:**

125000 **ENTER** 1051.61 **ENTER**

200 **A**

200000 **ENTER** 1681.71 **ENTER**

240 **C**

129963.35 **D** **E** 12 **X** —————→

**Outputs:**

11.84 (% rate of return)

## 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		<b>f E</b>	1.00 or 0.00
3	Key in:			
	• First period of the desired schedule (need not be 1)	K	<b>A</b>	K
	• Periodic interest rate	i (%)	<b>B</b>	i (%)
	• Constant payment to principal	CPMT	<b>C</b>	CPMT
	• Initial loan amount (present value)	PV	<b>D</b>	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 <b>R/S</b> .		<b>E</b>	PMT to INT
			<b>R/S</b>	TOT PMT
			<b>R/S</b>	BAL
			<b>R/S</b>	TOT INT
			<b>R/S</b>	K + 1
			etc.	
	OR			
5	To find the accumulated interest between any two points (J, K), key in:			
	• Periodic interest rate	i (%)	<b>B</b>	i (%)
	• Constant payment to principal	CPMT	<b>C</b>	CPMT
	• Initial loan amount (present value)	PV	<b>D</b>	PV
	• Starting period number	J	<b>ENTER</b>	J
	• Ending period number	K	<b>f A</b>	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:**

1 **A** 8 **B** 5000 **C** 100000 **D** **E** →

**R/S** →

**R/S** →

**Outputs:**

8000.00 (1<sup>st</sup> year's payment to interest)

13000.00 (total 1<sup>st</sup> payment)

95000.00 (remaining balance)

## 07-03

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

8 **B** 5000 **C** 100000 **D**

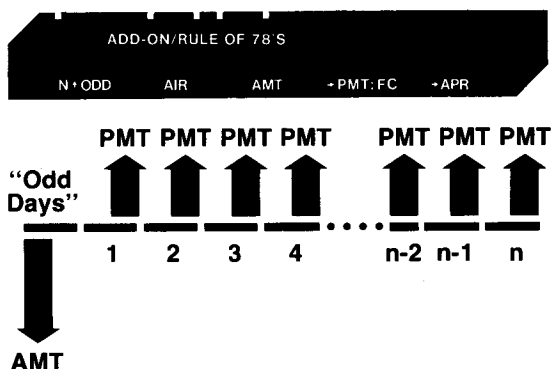
5 **ENTER** 10 **f** **A** →

#### Outputs:

32400.00



## 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	<b>ENTER</b>	N
	• “Odd-days” to beginning of			
	first month (0-30)	ODD	<b>A</b>	ODD
	• Add-on interest rate (annual			
	rate)	AIR (%)	<b>B</b>	AIR (%)
	• Loan amount	AMT	<b>C</b>	AMT
3	Calculate monthly payment.		<b>D</b>	PMT

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

36 **ENTER** 18 **A** 6 **B** 3500 **C** **D** →  
**R/S** →  
**E** →

**Outputs:**

115.01 (monthly payment)  
640.36 (total finance charge)  
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 25<sup>th</sup> regular payment?

**Keystrokes:**

30 **f A** 25 **f B**  
39.33 **f C**  
180 **f D** **f E** →

**Outputs:**

5.81 (unearned interest for payments 26 to 30)  
190.84 (remaining balance after payment 25)

**R/S** →

## SAVINGS PLAN—LEASES

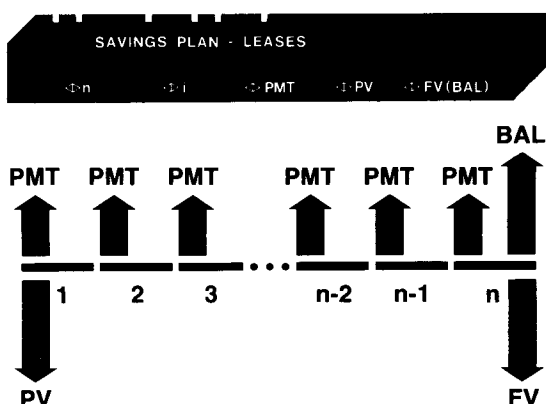


Figure 6

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  $n = 12 \times 30 = 360$ .)
- $i$  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.

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)		<b>f</b> <b>A</b>	0.00
3	Input the known values:			
	• Number of periods	$n$	<b>A</b>	$n$
	• Periodic interest rate	$i$ (%)	<b>B</b>	$i$ (%)
	• Periodic payment	PMT	<b>C</b>	PMT
	• Present value	PV	<b>D</b>	PV
	• Future value, balloon payment, or balance	$FV(BAL)$	<b>E</b>	$FV(BAL)$
4	Calculate the unknown value:			
	• Number of periods		<b>A</b>	$n$
	• Periodic interest rate		<b>B</b>	$i$ (%)
	• Periodic payment		<b>C</b>	PMT
	• Present value		<b>D</b>	PV
	• Future value, balloon payment, or balance		<b>E</b>	$FV(BAL)$

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 x A → 32.00 (quarters)  
6000 D B → 1.61 (% quarterly interest rate)  
4 x → 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 x 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 x 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 x → 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 x A

220 C 10000 D B 12 x → 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  $n^{\text{th}}$  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	$n$	<b>ENTER</b>	$n$
	• Number of payments made			
	in advance	$A$	<b>A</b>	$A$
	• Loan amount	$PV$	<b>D</b>	$PV$
3	Optional: Key in residual value			
	at end of $n^{\text{th}}$ period.	$RESID$	<b>E</b>	$RESID$
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.		<b>f B</b>	i (%)
			<b>f C</b>	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 **x** → 17.33 (% annual yield)

**Example 2:**

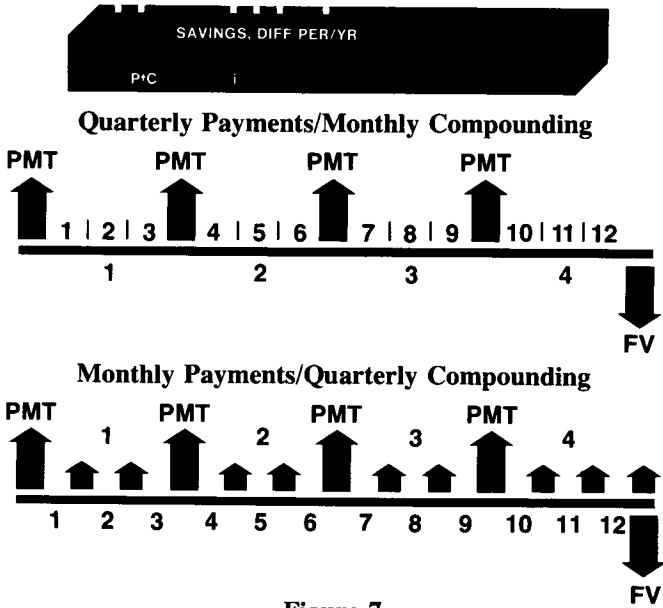
A copier worth \$22,000 is to be leased for 48 months. The lessee has agreed to make 4 payments in advance, with a purchase option at the end of 48 months enabling him to buy the copier for 30% of the purchase price. What monthly payment is necessary to yield the lessor 12% annually?

**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**



**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 2<sup>nd</sup> 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	<b>ENTER</b>	P
3	Key in the number of com- pounding periods per year.	C	<b>A</b>	P/C

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
4	Key in the periodic interest rate	i (%)	<b>B</b>	i (%)
	and two of the following:			
	• Total number of payments	n	<b>f A</b>	n
	• Periodic payment amount	PMT	<b>f C</b>	PMT
	• Final amount (future value)	FV	<b>f E</b>	FV
5	Calculate the remaining value			
	• Total number of payments		<b>f A</b>	n
	• Periodic payment amount		<b>f C</b>	PMT
	• Final amount (future value)		<b>f E</b>	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:**

4 **ENTER** 12 **A** →

5 **ENTER** 12 **÷** **B**

7 **ENTER** 4 **x** **f A**

95 **f C** **f E** →

**Outputs:**

0.33

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:**

100 **f C** **f E** →

**Outputs:**

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:**

12 **ENTER** 4 **A** →

5.25 **ENTER** 4 **÷** **B**

2 **ENTER** 12 **x** **f A**

4000 **f E** **f C** →

**Outputs:**

3.00

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
	<b>Simple Interest</b>			
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
	<b>Interest Conversions</b>			
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	<b>f</b> <b>A</b>	C/YR
	• Annual nominal rate	NOM (%)	<b>f</b> <b>B</b>	NOM (%)
	• Annual effective rate	EFF (%)	<b>f</b> <b>C</b>	EFF (%)
7	Calculate the remaining rate			
	• Annual nominal rate		<b>f</b> <b>B</b>	NOM (%)
	• Annual effective rate		<b>f</b> <b>C</b>	EFF (%)
	Go to step 6 for new data.			
8	Key in one of the following:			
	• Annual nominal rate	C NOM (%)	<b>f</b> <b>D</b>	C NOM
	• Annual effective rate (for			
	continuous compounding).	C EFF (%)	<b>f</b> <b>E</b>	C EFF
9	Calculate the remaining rate			
	• Annual nominal rate		<b>f</b> <b>D</b>	C NOM (%)
	• Annual effective rate (for			
	continuous compounding).		<b>f</b> <b>E</b>	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).		<b>GSB</b> <b>B</b>	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:**

**R/S** →

30000 **C** 8 **B** 90 **A** **D** →

**+** →

**Outputs:**

0.00

600.00 (interest, 360  
day basis)

30600.00 (final amount,  
360 day basis)

<b>E</b>	→	591.78 (interest, 365 day basis)
<b>+</b>	→	30591.78 (final amount, 365 day basis)

**Example 2:**

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

**Keystrokes:**

4 **f** **A** 13 **f** **C** **f** **B** →

**Outputs:**

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:**

5 **f** **D** **f** **E** →

**Outputs:**

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:**

5 **GSB** **B** →

**Outputs:**

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 **F1E** sets and clears the print flag. Successive use of **F1E** 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 21<sup>st</sup> 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 **F1D** 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 (**F**) 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		<b>f E</b>	1.00 or 0.00
3	Key in all of the following:			
	• Starting book value	SBV	<b>STO A</b>	SBV
	• Salvage value	SAL	<b>STO B</b>	SAL
	• Life of the asset	LIFE	<b>STO C</b>	LIFE
4	For depreciation schedules,			
	key in:			
	• Year for which depreciation			
	is to be calculated.	YR	<b>STO D</b>	YR
5	To calculate straight line			
	depreciation schedule		<b>f A</b>	YR
			<b>R/S</b>	DEP
			<b>R/S</b>	RDV
			<b>R/S</b>	RBV
			<b>R/S</b>	TOT DEP
			<b>R/S</b>	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		<b>f B</b>	YR
			<b>R/S</b>	DEP
			<b>R/S</b>	RDV
			<b>R/S</b>	RBV
			<b>R/S</b>	TOT DEP
			<b>R/S</b>	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	<b>STO E</b>	FACT
			<b>f C</b>	YR
			<b>R/S</b>	DEP
			<b>R/S</b>	RDV
			<b>R/S</b>	RBV
			<b>R/S</b>	TOT DEP
			<b>R/S</b>	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	<b>STO E</b>	FACT
9	Calculate last year to use de-			
	clining balance method.		<b>f D</b>	LAST YEAR
10	Calculate remaining life.		<b>R/S</b>	REM LIFE
11	Calculate remaining book			
	value.		<b>R/S</b>	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 1<sup>st</sup> year's depreciation schedule using each of the common methods. Assume a declining balance factor of 1.5. Then jump ahead to the 15<sup>th</sup> year and generate the data for that year.

**Keystrokes:**375000 **STO** **A** 30000 **STO** **B**40 **STO** **C** 1 **STO** **D****Straight Line**

<b>f</b> <b>A</b> →	1.00 (1 <sup>st</sup> year)
<b>R/S</b> →	8625.00 (1 <sup>st</sup> year's depreciation)
<b>R/S</b> →	336375.00 (remaining depreciable value)
<b>R/S</b> →	366375.00 (remaining book value)
<b>R/S</b> →	8625.00 (total depreciation to date)

Now jump ahead to the 15<sup>th</sup> year.

**Keystrokes:**15 **STO** **D** **f** **A** →

<b>R/S</b> →	8625.00 (15 <sup>th</sup> year's depreciation)
<b>R/S</b> →	215625.00 (remaining depreciable value)
<b>R/S</b> →	245625.00 (remaining book value)
<b>R/S</b> →	129375.00 (total depreciation after 15 years)

**SOYD**1 **STO** **D** **f** **B** →

<b>R/S</b> →	16829.27 (1 <sup>st</sup> year's depreciation)
<b>R/S</b> →	328170.73 (remaining depreciable value)
<b>R/S</b> →	358170.73 (remaining book value)

**Outputs:****Outputs:**

R/S → 16829.27 (total depreciation to date)

Jump ahead to the 15<sup>th</sup> year.

15 STO D f B → 15.00 (15<sup>th</sup> year)

R/S → 10939.02 (15<sup>th</sup> year's depreciation)

R/S → 136737.80 (remaining depreciable value)

R/S → 166737.80 (remaining book value)

R/S → 208262.20 (total depreciation 1<sup>st</sup> through 15<sup>th</sup> year)

Declining Balance

1 STO D 1.5 STO E f C → 1.00 (1<sup>st</sup> year)

R/S → 14062.50 (1<sup>st</sup> 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 15<sup>th</sup> year.

15 STO D f C → 15.00 (15<sup>th</sup> year)

R/S → 8235.18 (15<sup>th</sup> year's depreciation)

R/S → 181369.51 (remaining depreciable value)

R/S → 211369.51 (remaining book value)

R/S → 163630.49 (total depreciation 1<sup>st</sup> through 15<sup>th</sup> 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:**

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

**Note:**

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

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

etc.

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.		<b>D</b>	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:**

6.241974 **A** 12.051985 **B C** →

**Outputs:**

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:**

3.211990 **B C** →

**Outputs:**

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:**

5.011975 **A** 11.011980 **B C** →

**Outputs:**

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 redemption 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 remaining coupon periods.			
2	Load side 1 and side 2 of the bond program.			
3	Key in:			
	• Number of remaining coupon periods (may be omitted if step 1 is performed)	PER	<b>A</b>	PER
	• Annual coupon rate	CR (%)	<b>B</b>	CR (%)
	• Redemption value if other than 100.	RV	<b>D</b>	RV
4	To determine the yield, key in the bond price.	PRICE	<b>E</b>	PRICE
5	Calculate the annual yield.		<b>C</b>	YLD (%)
6	To find the price, key in the annual yield rate.	YLD (%)	<b>C</b>	YLD (%)
7	Calculate the "flat" price.		<b>E</b>	PRICE
8	Optional: Recall the accrued interest		<b>RCL B</b>	ACC INT
	AND			
	add it to the "flat" price to obtain			
	total bond value as of the			
	settlement date.		<b>+</b>	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:

88 **ENTER** 182 **÷** **A** **C** →

#### Outputs:

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:

Enter program BD-14

3.011974 **A** 2.011984 **B** **D** →

#### Outputs:

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:**

Enter program BD-14

11.151973 **A** 2.061980 **B D** →

Enter Program BD-15

5 **B** 101 **D** 99 **E C** →

Enter program BD-14

2.061993 **B D** →

Enter program BD-15

5 **B** 99 **E C** →**Outputs:**2241.00 (days settlement  
to call)

5.33 (% yield-to-call)

6921.00 (days settlement  
to maturity)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:**

First, calculate and enter the after tax value of the coupon.

5 **ENTER** **ENTER** .4 **x** **=** **B** →**Outputs:**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 **=** →.25 **x** →**=** **D** →

1.00 (capital gain)

0.25 (capital gains tax)

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)

# 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			
	<b>Interest at Maturity</b>			
2	Enter the following:			
	• Days issue to maturity	DIM	<b>ENTER</b>	DIM
	• Days settlement to maturity	DSM	<b>A</b>	DSM
	• Basis (360 or 365)	BASIS	<b>B</b>	BASIS
	• Coupon rate (as a percent)	CR (%)	<b>C</b>	CR (%)
3	Enter one of the following:			
	• Yield (%)	YLD (%)	<b>D</b>	YLD (%)
	• Price	PRICE	<b>E</b>	PRICE
4	Calculate remaining variable		<b>D</b>	YLD (%)
			<b>E</b>	PRICE
	<b>Discounted Securities</b>			
5	Key in days settlement to maturity	DSM	<b>f A</b>	DSM
6	Input one of the following:			
	• Discount rate	DR	<b>f B</b>	DR
	• Yield (as a %)	YLD (%)	<b>f D</b>	YLD (%)

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	• Price	PRICE	<b>F</b>	PRICE
7	Calculate either or both		<b>D</b>	YLD (%)
			<b>F</b>	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:**220 **ENTER** 117 **A**360 **B** 5 **C**99.531250 **E** **D** →**Outputs:**

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:**7 **D** **E** →**Output:**

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:**81 **f** **A** 5.6 **f** **B****f** **E** →**f** **D** →**Outputs:**

98.74 (price)

5.67 (% yield)


Example 4:

Find the yield of the following discounted security:

$$\begin{aligned} \text{DSM} &= 307 \\ \text{Price} &= 96.27 \end{aligned}$$

Keystrokes:

Outputs:

307 **f** **A** 96.27 **f** **E**  
**f** **D** 

4.54 (% yield)

## 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	<b>C</b>	# entries
7	To delete the <i>last</i> y-value	y	<b>f C</b>	# entries -1
8	Calculate. If the print/pause flag			
	is on (1.00), these values are			
	automatically printed.		<b>f A</b>	a
			<b>R/S</b>	b
			<b>R/S</b>	r <sup>2</sup>
			<b>R/S</b>	a
			<b>R/S</b>	b
			<b>R/S</b>	r <sup>2</sup>
	Optional: Calculate			
	growth rate		<b>R/S</b>	% 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	<b>D</b>	$\hat{y}$ (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	<b>E</b>	$\hat{y}$ (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 5<sup>th</sup> 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:

**A** →  
 1 **ENTER** 52.5 **B** →  
 2 **ENTER** 55.25 **B** →  
 4 **ENTER** 75 **B** →

### Outputs:

0.00  
 1.00  
 2.00  
 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 form:

$$z = a + bx + cy$$

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 ( $\Sigma x_i$ ;  $\Sigma y_i$ ;  $\Sigma z_i$ ), the sums of squares ( $\Sigma x_i^2$ ;  $\Sigma y_i^2$ ;  $\Sigma z_i^2$ ), 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		<b>f E</b>	1.00 or 0.00
3	Initialize (START)		<b>A</b>	0.00
4	Key in $x$ and $y$ , and corresponding $z$ value	$x$	<b>ENTER</b>	
		$y$	<b>ENTER</b>	
		$z$	<b>B</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 incorrectly, re-enter incorrect x, y, z values	x	ENTER	
		y	ENTER	
		z	F1 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 automatically calculated.			
8	Optional: Calculate the coefficient 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:**

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 →

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  $50 \times 70$   
foot lot)75 ENTER 80 E → 136466.08 (value of  $75 \times 80$   
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!

**Outputs:**

## 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:

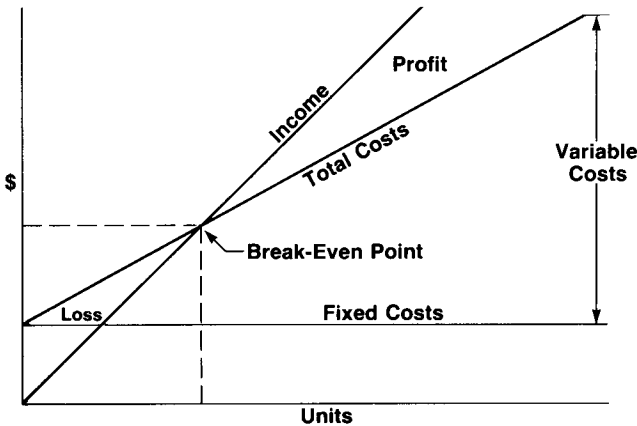


Figure 8

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	<b>A</b>	F
	• Sales price per unit	P	<b>B</b>	P
	• Variable costs per unit	V	<b>C</b>	V
	• Number of units	U	<b>D</b>	U
	• Gross profit	GP	<b>E</b>	GP
3	Calculate the remaining variable.			
			<b>A</b>	F
			<b>B</b>	P
			<b>C</b>	V
			<b>D</b>	U
			<b>E</b>	GP
4	To calculate the degree of operating leverage		<b>f A</b>	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	<u>\$12,000</u>

**Variable costs per copy**

Distribution	\$1.00
Commissions	3.75
Royalties	2.00
Total variable costs per copy	<u>\$6.75</u>

Sales price per copy	<u>\$13.00</u>
----------------------	----------------



**Keystrokes:**

12000 **A** 13 **B** 6.75 **C**

0 **E** **D** →

**Outputs:**

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:**

2000 **D** **f** **A** →

**Outputs:**

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)

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.		<b>f E</b>	1.00 or 0.00
3	Initialize (START)		<b>A</b>	0.00
4	Key in:			
	• Discount rate	DISC (%)	<b>B</b>	DISC (%)
	• Number of units	UNITS	<b>C</b>	UNITS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	• Price per unit	PRICE	<b>D</b>	PRICE
5	Calculate net line total		<b>E</b>	NLT
6	Optional: Display running subtotal		<b>f A</b>	ST
7	Optional: Display running grand total		<b>f B</b>	GT
8	Display each line total's percent of the grand total		<b>f C</b>	% T <sub>1</sub>
	Use <b>R/S</b> if print/pause mode is off (0.00).		<b>R/S</b>	% T <sub>2</sub>
			<b>R/S</b>	% T <sub>3</sub>
			etc.	
9	If last net line total was incorrect		<b>f D</b>	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:

A 2 B 25 C 2.75 D E →  
60 C 1.50 D E →  
71 C E →  
f A →  
12 C 10.50 D E →  
17 C 37.20 D E →  
f A →  
3 B 155 C .28 D E →  
38 C .92 D E →  
217 C .56 D E →  
f A →  
f B →  
f C →  
R/S →  
R/S →  
R/S →  
R/S →  
R/S →  
R/S →  
R/S →  
R/S →

Outputs:

67.38  
88.20  
104.37  
259.95 (Subtotal—Bill 1)  
123.48  
619.75  
743.23 (Subtotal—Bill 2)  
42.10  
33.91  
117.87  
193.88 (Subtotal—Bill 3)  
1197.06 (Grand total)  
5.63  
7.37  
8.72  
10.32  
51.77  
3.52  
2.83  
9.85  
100.00

Each net line  
total's percent  
of the grand  
total.

## PAYROLL

PAYROLL				
START	#hrs	#hrs OT	FEDL	STATE

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:

R <sub>0</sub>	—————→	Gross pay to date
R <sub>3</sub>	—————→	Federal withholdings to date
R <sub>4</sub>	—————→	State withholdings to date
R <sub>5</sub>	—————→	FICA to date
R <sub>6</sub>	—————→	SDI to date
R <sub>7</sub>	—————→	Constant 1 (Health Insurance)
R <sub>8</sub>	—————→	Constant 2 (Stock Plan (%))
R <sub>A</sub>	—————→	Constant 3 (United Fund)
R <sub>B</sub>	—————→	Number of exemptions
R <sub>C</sub>	—————→	Hourly wage
R <sub>D</sub>	—————→	Overtime wage
R <sub>E</sub>	—————→	Marital status
		.1 ↔ Single
		.2 ↔ Married
R <sub>I</sub>	—————→	Social Security Number

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:**

<b>A</b> _____	0.00 (blinking)
Insert data card _____	553867778.0 (Ms. Waters' Social Security Number)
<b>R/S</b> _____	0.10 (Ms. Waters is single)
<b>R/S</b> _____	1.00 (one exemption)
37.5 <b>B</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 <b>D</b> _____	20.50 (Federal tax)
2.90 <b>E</b> _____	2.90 (California tax)

To find the net pay:

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

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

_____	105.32 (Net pay)
-------	------------------

**Keystrokes:****Outputs:**

<b>f B</b> _____	2214.00 (Gross pay to date)
<b>R/S</b> _____	356.14 (Federal withholdings to date)
<b>R/S</b> _____	47.10 (State withholdings to date)
<b>R/S</b> _____	129.52 (FICA to date)
<b>R/S</b> _____	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.

## INVENTORY

START	PRICE	RECD	ISSUED	ORDER
-------	-------	------	--------	-------

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 calculations. 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<sub>0</sub> —————→ Part number (10 digit maximum)
- R<sub>1</sub> —————→ Unit price

R <sub>2</sub>	→	Quantity on hand
R <sub>3</sub>	→	Quantity on order
R <sub>4</sub>	→	Minimum quantity
R <sub>5</sub>	→	Lead time (days)
R <sub>6</sub>	→	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:

<b>f</b> <b>C</b>	→	10.03 (New unit price)
<b>R/S</b>	→	425.00 (Amount on hand)
<b>R/S</b>	→	169.00 (Amount on order)
<b>R/S</b>	→	370.00 (Minimum quantity)
<b>R/S</b>	→	56.00 (Lead time)
<b>R/S</b>	→	224.00 (Slack)
<b>R/S</b>	→	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.

<b>Program</b>	<b>Page</b>
1. Internal Rate of Return .....	<b>L01-01</b>
2. Internal Rate of Return—Groups of Cash Flows .....	<b>L02-01</b>
3. Discounted Cash Flow Analysis—Net Present Value .....	<b>L03-01</b>
4. Direct Reduction Loans—Sinking Fund .....	<b>L04-01</b>
5. Accumulated Interest/Remaining Balance .....	<b>L05-01</b>
6. Wrap-Around Mortgage .....	<b>L06-01</b>
7. Constant Payment to Principal Loan .....	<b>L07-01</b>
8. Add-On Rate Installment Loan/Rule of 78's .....	<b>L08-01</b>
9. Savings Plan—Leases .....	<b>L09-01</b>
10. Advance Payments .....	<b>L10-01</b>
11. Savings—Compounding Periods Different from Payment Periods	<b>L11-01</b>
12. Simple Interest/Interest Conversions .....	<b>L12-01</b>
13. Depreciation Schedules .....	<b>L13-01</b>
14. Days Between Dates .....	<b>L14-01</b>
15. Bond Price and Yield .....	<b>L15-01</b>
16. Interest at Maturity/Discounted Securities .....	<b>L16-01</b>
17. Linear Regression—Exponential Curve Fit .....	<b>L17-01</b>
18. Multiple Linear Regression .....	<b>L18-01</b>
19. Break-Even Analysis .....	<b>L19-01</b>
20. Invoicing .....	<b>L20-01</b>
21. Payroll .....	<b>L21-01</b>
22. Inventory .....	<b>L22-01</b>

## INTERNAL RATE OF RETURN

001 *LBLA 21 11	Clear registers	057 RCLI 36 46	LBL fa sets up I for count
002 CLRG 16-53		058 1 01	down and keeps track of
003 PCS 16-51		059 0 00	original # of cash flows by
004 CLRG 16-53	INV $\rightarrow R_E$	060 1 01	storing N.N.
005 STOE 35 15		061 x -35	
006 CF0 16 22 00	Clear flags	062 STOI 35 46	
007 CF1 16 22 01		063 RTN 24	
008 RTN 24		064 *LBL e 21 16 15	
009 *LBLB 21 12		065 F0? 16 23 00	
010 2 02	Input largest cash flow if	066 GT00 22 00	Unpacks double-stored
011 x -35	#CFs > 22.	067 INT 16 34	cash flows.
012 ST00 35 00		068 EEX -23	
013 RCLE 36 15		069 5 05	
014 XZY -41		070 ÷ -24	
015 ÷ -24	INV/2 CMAX $\rightarrow R_E$	071 RTN 24	
016 STOE 35 15		072 *LBL0 21 00	
017 LSTX 16-63		073 FRC 16 44	
018 SF0 16 21 00	Flag 0 indicates > 22 cash	074 RTN 24	
019 2 02	flows.	075 *LBLD 21 14	
020 ÷ -24		076 GSB a 23 16 11	Set-up I
021 RTN 24		077 RCLI 36 46	NN
022 *LBLC 21 13		078 EEX -23	
023 ISZ1 16 25 46	If F0, pack data in registers.	079 2 02	
024 F0? 16 23 00		080 ÷ -24	
025 GSB c 23 16 13		081 STOI 35 46	N.N $\rightarrow$ I
026 ST+1 35-55 45		082 1 01	
027 XZY -41		083 . -62	
028 RCLI 36 46	Display # of cash flows (add	084 0 00	
029 FI? 16 23 01	if > 22 CF).	085 1 01	
030 + -55		086 STOD 35 14	1 + $i_0 \rightarrow R_D$
031 RTN 24		087 *LBL4 21 04	
032 *LBL c 21 16 13		088 CF0 16 22 00	
033 2 02		089 0 00	
034 3 03		090 ST00 35 00	
035 RCLI 36 46		091 *LBL5 21 05	
036 XZY? 16-32	23 <sup>rd</sup> cash flow?	092 RCLI 36 46	
037 GT00 22 00		093 INT 16 34	
038 1 01	Reset I	094 FI? 16 23 01	Get j
039 STOI 35 46		095 GSB d 23 16 14	
040 + -55	Drop stack and clear x.	096 RCL i 36 45	
041 CLX -51		097 FI? 16 23 01	
042 EEX -23		098 GSB e 23 16 15	Unpack CF <sub>j</sub>
043 5 05	2 CMAX/ $10^5 \rightarrow R_0$	099 ST+0 35-55 00	
044 ST+0 35-24 00		100 x -35	
045 SF1 16 21 01		101 + -55	
046 *LBL0 21 00		102 RCLD 36 14	f(i) in $R_0$
047 R+ -31		103 ST=0 35-24 00	
048 1 01		104 ÷ -24	
049 - -45		105 DSZ1 16 25 46	
050 XZY -41		106 GTOS 22 05	
051 RCL0 36 00	Scale cash flow	107 FI? 16 23 01	
052 ÷ -24		108 GT00 22 00	
053 FI? 16 23 01	If CF <sub>j</sub> , j > 22, drop frac-	109 *LBL6 21 06	
054 INT 16 34	tional part of CF <sub>j</sub> .	110 RCL0 36 00	
055 RTN 24		111 RCLE 36 15	
056 *LBL a 21 16 11		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	F Used	G Used	H Used	I Used	J Used



INTERNAL RATE OF RETURN—GROUPS  
OF CASH FLOWS

001 #LBLA 21 11		057 STOI 35 45	
002 CLRG 16-53	INV→R <sub>E</sub>	058 RCLI 36 46	CF <sub>j</sub> · n <sub>j</sub> →R(i)
003 STOE 35 15		059 CF8 16 22 00	
004 1 01		060 RTN 24	
005 STOD 35 14		061 #LBLd 21 16 14	-----
006 XZY -41		062 GSB3 23 03	Routine to sum cash
007 RTN 24		063 0 00	flows and recall number
008 #LBLB 21 12	If LRG CF exists	064 STOC 35 13	of groups before going
009 ABS 16 31		065 GTOT 22 07	to iteration routine.
010 EEK -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 CLK -51		072 0 00	
017 10* 16 33		073 1 01	
018 STOD 35 14		074 GSBc 23 16 13	
019 RCLE 36 15		075 GTOT 22 00	
020 XZY -41	INV/10 <sup>k</sup> →R <sub>E</sub>	076 #LBL1 21 01	
021 ÷ -24	k = 1 or 2	077 RCLD 36 00	
022 STOE 35 15		078 GSBc 23 16 15	
023 RTN 24		079 STOC 35 13	
024 #LBLC 21 13		080 #LBL0 21 00	
025 ISZI 16 26 46	Scaling routine	081 RCLB 36 12	The secant method is used
026 RCLC 36 13		082 RCLD 36 00	to evaluate f(i).
027 XZY -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	Σn <sub>j</sub> CF <sub>j</sub>	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 EEK -23		093 ÷ -24	
038 2 02		094 RND 16 24	
039 ÷ -24		095 X=0? 16-42	
040 XZY -41		096 GTOI 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 EEK -23	
045 SF0 16 21 00		101 2 02	
046 ABS 16 31		102 X -35	
047 + -55		103 RTN 24	
048 FOP 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 <sub>i</sub>
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 <sub>1</sub> · n <sub>1</sub>	2 CF <sub>2</sub> · n <sub>2</sub>	3 CF <sub>3</sub> · n <sub>3</sub>	4 CF <sub>4</sub> · n <sub>4</sub>	5 CF <sub>5</sub> · n <sub>5</sub>	6 CF <sub>6</sub> · n <sub>6</sub>	7 CF <sub>7</sub> · n <sub>7</sub>	8 CF <sub>8</sub> · n <sub>8</sub>	9 CF <sub>9</sub> · n <sub>9</sub>
S0 CF <sub>10</sub> · n <sub>10</sub>	S1 CF <sub>11</sub> · n <sub>11</sub>	S2 CF <sub>12</sub> · n <sub>12</sub>	S3 CF <sub>13</sub> · n <sub>13</sub>	S4 CF <sub>14</sub> · n <sub>14</sub>	S5 CF <sub>15</sub> · n <sub>15</sub>	S6 CF <sub>16</sub> · n <sub>16</sub>	S7 CF <sub>17</sub> · n <sub>17</sub>	S8 CF <sub>18</sub> · n <sub>18</sub>	S9 CF <sub>19</sub> · n <sub>19</sub>
A CF <sub>20</sub> · n <sub>20</sub>	B Used	C f(i <sub>k</sub> )	D f(i <sub>k-1</sub> )	E Investment	I Used				



113	EEX	-23		169	÷	-24	
114	CHS	-22		170	RCL	36 15	
115	2	02		171	-	-45	
116	x	55	.01	172	RTN	24	
117	STOC	35 13		173	*LBL5	21 05	
118	+	-55		174	+	-55	
119	STO0	35 00		175	ENT↑	-21	
120	STOB	35 12		176	RTN	24	
121	GSBe	23 16 15		177	R/S	51	
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	*LBL5	21 15					
131	EEX	-23					
132	2	02					
133	÷	-24					
134	1	01					
135	+	-55	1 + i → R <sub>0</sub>				
136	STO0	35 00					
137	*LBL5	21 16 15					
138	0	00					
139	*LBL4	21 04					
140	RCL0	36 00					
141	RCL1	36 45	Continued fractions are used to find the PV of the cash flows.				
142	FRC	16 44					
143	ABS	16 31					
144	EEX	-23					
145	2	02					
146	x	-35					
147	CHS	-22					
148	Y <sup>x</sup>	31					
149	x	-35					
150	1	01					
151	LSTX	16-63					
152	-	-45					
153	RCL1	36 45					
154	INT	16 34					
155	x	-35					
156	+	-55					
157	DSZ1	16 25 46					
158	GTO4	22 04					
159	RCL1	36 46					
160	1	01					
161	0	00					
162	1	01					
163	x	-35					
164	STOI	35 46					
165	X <sup>Y</sup>	-41	DCF - INV = NPV				
166	RCL0	36 00					
167	1	01					
168	-	-45					

LABELS					FLAGS	SET STATUS			
A INV	B Large CF	C CF ↑ #	D IRR	E Used	0	FLAGS		TRIG	DISP
a	b	c Used	d IRR	e Used	1	ON OFF			
0 Used	1 Used	2	3 Used	4 Used	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>	
5 Used	6	7 Used	8	9	3	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>	
						2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>	n 4
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>			

# DISCOUNTED CASH FLOW ANALYSIS NET PRESENT VALUE

001 #LBLA 21 11	-NPV → R <sub>A</sub> 0 → R <sub>0</sub> 1 → R <sub>C</sub>	057 #LBL <sub>e</sub> 21 16 15	Print option
002 CHS -22		058 F0? 16 23 00	
003 ST0A 35 11		059 GT01 22 01	
004 0 00		060 SF0 16 21 00	
005 ST09 35 09		061 1 01	
006 1 01		062 RTN 24	
007 ST0C 35 13		063 #LBL1 21 01	
008 RCL A 36 11		064 0 00	
009 CHS -22		065 CF0 16 22 00	
010 GSB9 23 09		066 RTN 24	
011 RTN 24	067 #LBL9 21 09		
012 #LBL <sub>e</sub> 21 12	068 F0? 16 23 00		
013 EEX -23	069 GT02 22 02		
014 2 02	070 R/S 51		
015 ÷ -24	071 RTN 24		
016 ST0B 35 12	072 #LBL2 21 02		
017 LSTX 16-63	073 PRTX -14		
018 X -35	074 R/S 51		
019 RTN 24	----- # → R <sub>C</sub>	----- Calculate present value of series.	
020 #LBLC 21 13			
021 ST0C 35 13			
022 RTN 24			
023 #LBLD 21 14			
024 ST0D 35 14			
025 1 01			
026 RCLB 36 12			
027 + -55			
028 RCLC 36 13			----- Reset n to 1.
029 ST+9 35-55 09			
030 YX 31			
031 ST0E 35 15			
032 RCL A 36 11			
033 X -35			
034 RCL E 36 15			
035 1 01			
036 - -45			
037 RCLB 36 12	----- Recall Σ <sub>n</sub>		
038 ÷ -24			
039 RCLD 36 14			
040 X -35			
041 + -55			
042 ST0A 35 11			
043 1 01			
044 RCLB 36 12			
045 + -55			
046 RCL9 36 09			
047 YX 31	----- Recall Σ <sub>n</sub>		
048 ÷ -24			
049 1 01			
050 ST0C 35 13			
051 R1 -31			
052 GSB9 23 09			
053 RTN 24			
054 #LBL <sub>e</sub> 21 15			
055 RCL9 36 09			
056 RTN 24			

REGISTERS									
0	1	2	3	4	5	6	7	8	9 Σ <sub>n</sub>
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A NPV	B i/100	C #	D CF	E (1 + i) <sup>n</sup>	I				

[illegible]

## DIRECT REDUCTION LOANS SINKING FUND

001	#LBLA	21	11	n→R <sub>A</sub>	057	SF1	16	21	01	
002	STOA	35	11	Digit entered?	058	1			01	i/100→R <sub>0</sub>
003	F3?	16	23		059	RCLB	36	12		
004	RTN		24		060	Z			55	
005	GSBB	23	00	Solve for n and store in R <sub>A</sub> .	061	STO9	35	09		(1+i)→R <sub>7</sub>
006	RCLC	36	15		062	+			-55	
007	LSTX	16	-63		063	STO7	35	07		(1+i) <sup>-n</sup> →R <sub>8</sub>
008	-	-45			064	RCLA	36	11		
009	RCLD	36	14		065	CHS		-22		
010	LSTX	16	-63		066	Y*		31		
011	-	-45			067	STO8	35	08		
012	÷	-24			068	RCLC	36	15		1-(1+i) <sup>-n</sup> →R <sub>4</sub>
013	LN		32		069	x		-35		
014	RCL7	36	07		070	1		01		
015	LN		32		071	RCL8	36	08		Calculate
016	÷	-24			072	-		-45		±(PMT/i)
017	STOA	35	11		073	STO4	35	04		and store in
018	RTN		24		074	RCLC	36	13		R <sub>3</sub>
019	#LBLC	21	13	PMT→R <sub>C</sub>	075	RCL9	36	09		
020	STOC	35	13	Digit entered?	076	÷		-24		
021	F3?	16	23		077	F1?	16	23	01	
022	RTN		24	Store dummy 1 for PMT.	078	CHS		-22		
023	1		01		079	STO3	35	03		
024	STOC	35	13		080	x		-35		± PMT / i [1 - (1 + i) <sup>-n</sup> ]
025	GSBB	23	00	Solve for PMT and store in	081	RTN		24		
026	1/X		52	R <sub>C</sub> .	082	#LBLA	21	16	11	Start by clearing PMT,
027	RCLD	36	14		083	CLX		-51		PV, FV(BAL) registers.
028	R†	16	-31		084	STOC	35	13		
029	-	-45			085	STOD	35	14		
030	x		-35		086	STOE	35	15		
031	STOC	35	13		087	RTN		24		
032	RTN		24		088	#LBLB	21	12		i→R <sub>8</sub>
033	#LBLD	21	14	PV→R <sub>D</sub>	089	STOB	35	12		Digit entered?
034	STOD	35	14	Digit entered?	090	F3?	16	23	03	
035	F3?	16	23		091	RTN		24		
036	RTN		24		092	0		00		Clear R <sub>8</sub> for sum of i
037	GSBB	23	00	Solve for PV and store in	093	STOB	35	12		terms.
038	+		-55	R <sub>D</sub> .	094	2		02		Store address of R <sub>8</sub> in
039	STOD	35	14		095	1		01		R <sub>1</sub> for indirect access.
040	RTN		24		096	STOI	35	46		
041	#LBLB	21	15	FV(BAL)→R <sub>E</sub>	097	RCLC	36	15		
042	STOE	35	15	Digit entered?	098	RCLA	36	11		Start guess of i:
043	F3?	16	23		099	RCLC	36	13		n PMT + FV(BAL)
044	RTN		24		100	x		-35		
045	GSBB	23	00		101	+		-55		If PV = 0 GTO FV(BAL)
046	RCLD	36	14	Solve for FV(BAL) and	102	RCLD	36	14		guess
047	X*Y		-41	store in R <sub>E</sub> .	103	X=0?		16	-43	PV guess for i:
048	-	-45			104	GT03		22	07	n PMT + FV(BAL) - PV
049	RCLB	36	08		105	-		-45		n
050	÷	-24			106	RCLA	36	11		and recall PV.
051	STOE	35	15		107	÷		-24		
052	RTN		24		108	RCLD	36	14		
053	#LBL0	21	00	Clear FV(BAL) flag.	109	GT04	22	04		FV(BAL) guess for i
054	CF1	16	22	If PV = 0 set FV(BAL)	110	#LBL3	21	03		numerator:
055	RCLD	36	14	flag.	111	RCLC	36	15		
056	X=0?	16	-43		112	LSTX	16	-63		

REGISTERS									
0	1	2	3	4	5	6	7	8	9
			±(PMT/i)	1-(1+i) <sup>-n</sup>		n(1+i) <sup>-n-1</sup>	(1+i)	(1+i) <sup>-n</sup>	i/100
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	n	B	i	C	PMT	D	PV	E	FV(BAL)
								I	21

113	-	-45	2(FV(BAL) - n PMT)	169	÷	-24	If value ≠ 0, loop again.
114	ENT↑	-21	and denominator (n - 1) <sup>2</sup> PMT + FV(BAL)	170	RND	16 24	
115	+	-55		171	X≠0?	16-42	
116	RCLA	36 11	Guess for i IF guess < -0.9; use -0.9 for guess	172	GT06	22 06	Stop and display
117	1	01		173	RCLB	36 12	
118	-	-45		174	RTN	24	
119	X²	53	If guess = 0 stop	175	*LBL5	21 05	Convert i to % and add to content of Rg.
120	RCLC	36 13		176	EEX	-23	
121	x	-35		177	2	02	
122	RCL E	36 15	Calculate f(i)	178	x	-35	
123	+	-55		179	ST+;	35-55 45	
124	*LBL4	21 04		180	RTN	24	
125	÷	-24	Calculate f'(i)	181	R/S	51	
126	.	-62					
127	9	09					
128	CHS	-22	Calculate f''(i)				
129	X≠Y?	16-35					
130	X≠Y	-41					
131	GSB5	23 05	f(i)/f'(i)				
132	x=0?	16-43					
133	RTN	24					
134	*LBL6	21 06					
135	GSB0	23 00					
136	+	-55					
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					
144	÷	-24					
145	x	-35					
146	F1?	16 23 01					
147	CLX	-51					
148	STD6	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	RCL E	36 15					
163	x	-35					
164	-	-45					
165	÷	-24					
166	CHS	-22					
167	GSB5	23 05					
168	RCLB	36 12					

LABELS				FLAGS		SET STATUS			
A	n	B	i	C	PMT	D	PV	E	FV(BAL)
0	START	1		2		3	FV guess	4	guess
5	i→%	6	loop	7		8		9	Digit?

1	PV = 0	ON OFF			
0	<input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>		
1	<input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>		
2	<input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>		
3	<input type="checkbox"/> <input checked="" type="checkbox"/>		n	2	

# ACCUMULATED INTEREST/REMAINING BALANCE

001	*LBLA	21 11		057	*LBLA	21 16 11	
002	RCL0	36 00		058	RCL7	36 07	
003	ST07	35 07	J→R <sub>7</sub>	059	FB?	16 23 00	
004	XZ?Y	-41	K→R <sub>0</sub>	060	SPC	16-11	
005	ST00	35 00		061	GSB9	23 09	J
006	RTN	24		062	1	01	
007	*LBLB	21 12		063	RCL1	36 01	
008	EEX	-23		064	+	-55	
009	2	02	i/100→R <sub>1</sub>	065	ST00	35 00	
010	÷	-24		066	RCL7	36 07	
011	ST01	35 01		067	GSB1	23 01	
012	LSTX	16-63		068	ST04	35 04	
013	x	-35		069	RCL0	36 00	
014	RTN	24		070	RCL7	36 07	
015	*LBLC	21 13		071	1	01	
016	ST02	35 02	PMT→R <sub>2</sub>	072	-	-45	
017	RTN	24		073	GSB1	23 01	
018	*LBLD	21 14		074	RCL4	36 04	
019	ST03	35 03		075	-	-45	
020	RTN	24	PV→R <sub>3</sub>	076	ST06	35 06	
021	*LBLE	21 15		077	RCL2	36 02	
022	RCL0	36 00		078	XZ?Y	-41	
023	RCL7	36 07		079	-	-45	INT <sub>J</sub>
024	XZ?Y?	16-35		080	GSB9	23 09	
025	ST00	22 00		081	RCL6	36 06	
026	ST00	35 00		082	GSB9	23 09	PRINC <sub>J</sub>
027	R4	-31		083	RCL4	36 04	
028	ST07	35 07		084	GSB9	23 09	RBAL <sub>J</sub>
029	*LBL0	21 00		085	RCL7	36 07	
030	1	01		086	RCL2	36 02	
031	RCL1	36 01		087	x	-35	
032	+	-55	(1 + i/100)→R <sub>8</sub>	088	RCL3	36 03	
033	ST08	35 08		089	RCL4	36 04	
034	RCL0	36 00		090	-	-45	
035	GSB1	23 01	BAL <sub>K</sub> →R <sub>4</sub>	091	-	-45	
036	ST04	35 04		092	GSB9	23 09	TOT INT
037	RCL8	36 08		093	1	01	
038	RCL7	36 07		094	ST+7	35-55 07	
039	1	01		095	RCL0	36 00	
040	-	-45		096	RCL7	36 07	
041	GSB1	23 01		097	XZ?Y?	16-35	J < K?
042	CHS	-22	-BAL <sub>J-1</sub>	098	ST0A	22 16 11	
043	RCL4	36 04		099	RTN	24	
044	+	-55	BAL <sub>K</sub> - BAL <sub>J-1</sub> →R <sub>6</sub>	100	*LBL1	21 01	
045	ST06	35 06		101	CHS	-22	
046	RCL0	36 00		102	Y*	31	
047	RCL7	36 07		103	ST05	35 05	
048	-	-45		104	1	01	
049	1	01		105	-	-45	
050	+	-55		106	RCL1	36 01	
051	RCL2	36 02		107	÷	-24	
052	x	-35		108	RCL2	36 02	
053	+	-55		109	x	-35	
054	RTN	24	INT <sub>J-K</sub>	110	RCL3	36 03	
055	RCL4	36 04	BAL <sub>K</sub>	111	+	-55	
056	R/S	51		112	RCL5	36 05	

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

113	÷	-24	RND may be inserted here.			
114	RTN	24	-----			
115	*LBL e	21 16 15				
116	F0?	16 23 00				
117	GT02	22 02	Print mode option.			
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	GT03	22 03				
128	R/S	51				
129	RTN	24				
130	*LBL3	21 03				
131	PRTX	-14				
132	RTN	24				
133	R/S	51				

LABELS					FLAGS	SET STATUS			
A J, K	B i	C PMT	D PV	E INT; RB	0 Print?	FLAGS		TRIG	DISP
a SKD	b	c	d	e Print?	1	ON	OFF		
0 Used	1 Used	2 Used	3 Used	4	2	0 <input type="checkbox"/>	0 <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
5	6	7	8	9 Used	3	1 <input type="checkbox"/>	1 <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/>	2 <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/>	3 <input checked="" type="checkbox"/>		n <u>2</u>

# WRAP-AROUND MORTGAGE

001	#LBLA	21 11	-n <sub>1</sub> → R <sub>1</sub>	057	x	-35	
002	CLRC	16-53	PMT <sub>1</sub> → R <sub>3</sub>	058	+	-55	
003	CHS	-22	-PV <sub>1</sub> → R <sub>5</sub>	059	RCL5	36 05	
004	STO1	35 01		060	RCL6	36 06	
005	R4	-31		061	x	-35	
006	STO3	35 03		062	-	-45	f(x)
007	R4	-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	x	-35	
011	CHS	-22		067	RCL3	36 03	
012	RTN	24		068	x	-35	
013	#LBLC	21 13		069	RCL9	36 09	
014	CHS	-22	-n <sub>2</sub> → R <sub>2</sub>	070	RCL2	36 02	
015	STO2	35 02	PMT <sub>2</sub> → R <sub>4</sub>	071	x	-35	
016	R4	-31	PV <sub>2</sub> - PV <sub>1</sub> → R <sub>5</sub>	072	RCL4	36 04	
017	STO4	35 04		073	x	-35	
018	R4	-31		074	-	-45	
019	ST+5	35-55 05		075	RCL7	36 07	
020	RCL2	36 02		076	÷	-24	
021	CHS	-22		077	RCL6	36 15	
022	RTN	24		078	RCL6	36 06	
023	#LBLD	21 14	BAL → R <sub>0</sub>	079	÷	-24	
024	STO0	35 00		080	-	-45	
025	RTN	24		081	RCL8	36 08	
026	#LBL E	21 15		082	RCL2	36 02	
027	EEX	-23	Initial guess	083	x	-35	
028	CHS	-22	i → R <sub>0</sub>	084	RCL6	36 06	
029	3	03		085	x	-35	
030	STO6	35 06		086	RCL9	36 09	
031	#LBL0	21 00		087	x	-35	
032	1	01	Newton's method is used to find i.	088	RCL7	36 07	
033	RCL6	36 06		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*	31		094	EEX	-23	
039	STO9	35 09		095	CHS	-22	
040	-	-45		096	6	06	
041	RCL4	36 04		097	X<Y?	16-35	
042	x	-35		098	GT00	22 00	
043	1	01		099	RCL6	36 06	
044	RCL7	36 07		100	EEX	-23	
045	RCL1	36 01		101	2	02	
046	Y*	31		102	x	-35	
047	STO8	35 08		103	RTN	24	
048	-	-45		104	#LBLA	21 16 11	
049	RCL3	36 03		105	STO0	35 11	
050	x	-35		106	RTN	24	
051	-	-45		107	#LBLB	21 16 12	
052	STO E	35 15		108	EEX	-23	
053	RCL9	36 09		109	2	02	
054	RCL8	36 08		110	÷	-24	
055	x	-35		111	STO8	35 12	
056	RCL6	36 06		112	LSTX	16-63	

REGISTERS									
0 BAL	1 -n <sub>1</sub>	2 -n <sub>2</sub>	3 PMT <sub>1</sub>	4 PMT <sub>2</sub>	5 PV <sub>2</sub> - PV <sub>1</sub>	6 i	7 1 + i	8 (1 + i) <sup>-n1</sup>	9 (1 + i) <sup>-n2</sup>
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A n	B i	C PMT	D PV	E Used	F	G	H	I	J Used

Is this within desired range? If not, go to 0. Otherwise multiply by 100 and display periodic yield.

n → R<sub>A</sub>

i/100 → R<sub>B</sub>



113	x	-35					
114	RTN	24					
115	*LBLd	21 16 14	PV→R <sub>D</sub>				
116	STOD	35 14					
117	RTN	24					
118	*LBLc	21 16 13					
119	RCLB	36 12	Calculate PMT and store in R <sub>C</sub>				
120	I	01					
121	+	-55					
122	RCLA	36 11					
123	CHS	-22					
124	Y*	31					
125	I	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					

LABELS					FLAGS	SET STATUS			
A n <sub>1</sub> ,PMT <sub>1</sub> ,PV <sub>1</sub>	B	C n <sub>2</sub> ,PMT <sub>2</sub> ,PV <sub>2</sub>	D BAL	E →i	0	FLAGS		TRIG	DISP
a n	b i	c→PMT	d PV	e	1	0	ON <input type="checkbox"/> OFF <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
g	1	2	3	4	2	1	<input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2	<input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
b		7	8	9	3	3	<input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

# CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE

001 *LBLA 21 11		057 RCLB 36 12	
002 CF1 16 22 01		058 x -35	
003 ST00 35 00	K→R <sub>0</sub>	059 RCLD 36 14	
004 GSB9 23 09		060 x -35	
005 RTN 24	-----	061 F1? 16 23 01	
006 *LBLB 21 12		062 RTN 24	TOT INT
007 EEX -23	i/100→R <sub>B</sub>	063 GSB9 23 09	
008 2 02		064 RCLD 36 14	
009 ÷ -24		065 RCLC 36 13	Is loan paid off?
010 ST0B 35 12		066 ÷ -24	
011 LSTX 16-63		067 RCL0 36 00	
012 x -35		068 X)Y? 16-34	
013 RTN 24	-----	069 RTN 24	
014 *LBLC 21 13		070 SPC 16-11	
015 ST0C 35 13	CPMT→R <sub>C</sub>	071 GSB9 23 09	
016 RTN 24	-----	072 GT0E 22 15	
017 *LBLD 21 14		073 *LBL6 21 16 11	
018 ST0D 35 14	PV→R <sub>D</sub>	074 SF1 16 21 01	K→R <sub>0</sub>
019 RTN 24	-----	075 ST0B 35 00	J→R <sub>B</sub>
020 *LBL E 21 15		076 X2Y -41	
021 RCLD 36 14		077 ST0B 35 00	
022 RCLC 36 13		078 1 01	
023 RCL0 36 00		079 ST+0 35-55 00	
024 x -35		080 GSB0 23 00	TOT INT <sub>K+1</sub>
025 - -45		081 ST01 35 46	
026 ST0E 35 15	RBAL→R <sub>E</sub>	082 RCL0 36 00	
027 RCLC 36 13		083 ST00 35 00	TOT INT <sub>J</sub>
028 + -55		084 GSB0 23 00	
029 RCLB 36 12		085 RCLJ 36 46	
030 x -35		086 X2Y -41	
031 ST09 35 09	PMT <sub>J</sub> →R <sub>9</sub>	087 - -45	
032 1 01	Increment for next period.	088 GSB9 23 09	TOT INT <sub>K+1</sub> - TOT INT <sub>J</sub>
033 ST+0 35-55 00		089 RTN 24	
034 RCL9 36 09		090 *LBL e 21 16 15	
035 GSB9 23 09	INT	091 F0? 16 23 00	Print/pause flag
036 RCLC 36 13		092 GT01 22 01	
037 + -55		093 SF0 16 21 00	
038 GSB9 23 09	TOT PMT	094 1 01	
039 RCL E 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		100 *LBL9 21 09	
045 RCLC 36 13	$\left[ \frac{(2-K) \text{CPMT}}{\text{PV}} + 2 \right]$	101 F0? 16 23 00	
046 x -35		102 GT02 22 02	Print/pause routine.
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 x -35			

REGISTERS									
0 K	1	2	3	4	5	6	7	8 J	9 PMT <sub>i</sub>
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	0 ON <input checked="" type="checkbox"/> OFF <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>			
0 Used	1 Used	2 Used	3	4	2	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>			
5	6	7	8	9 Used	3	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>			
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>			

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

001 *LBLA 21 11	057 1 01	$\frac{ODD \times 12}{365} = h$	Calculate f(i)						
002 ST00 35 00	058 + -55								
003 1 01	059 ST06 35 06								
004 2 02	060 RCL2 36 02								
005 x -35	061 CHS -22								
006 3 03	062 Y* 31								
007 6 06	063 ST07 35 07								
008 5 05	064 - -45								
009 ÷ -24	065 RCL0 36 00								
010 ST01 35 01	066 ÷ -24								
011 X*Y -41	067 RCL5 36 05	$AIR \rightarrow R_3$		Calculate f'(i)					
012 ST02 35 02	068 x -35								
013 RCL0 36 00	069 RCL6 36 06								
014 RTN 24	070 RCL1 36 01								
015 *LBL0 21 12	071 Y* 31								
016 ST03 35 03	072 RCL4 36 04								
017 RTN 24	073 x -35								
018 *LBLC 21 13	074 - -45								
019 ST04 35 04	075 RCL7 36 07								
020 RTN 24	076 RCL6 36 06								
021 *LBLD 21 14	077 ÷ -24	$AMT \rightarrow R_4$							
022 RCL2 36 02	078 RCL2 36 02								
023 RCL1 36 01	079 1 01								
024 + -55	080 + -55								
025 1 01	081 x -35								
026 2 02	082 RCL0 36 00								
027 ÷ -24	083 x -35								
028 RCL3 36 03	084 1 01								
029 x -35	085 RCL7 36 07								
030 EEX -23	086 - -45				$\left[ \left( \frac{N+h}{12} \right) AIR \right] AMT$	Calculate APR			
031 2 02	087 RCL0 36 00								
032 ÷ -24	088 + -55								
033 RCL4 36 04	089 - -45								
034 x -35	090 RCL0 36 00								
035 ST00 35 00	091 X* 53								
036 RCL4 36 04	092 ÷ -24								
037 + -55	093 RCL5 36 05								
038 RCL2 36 02	094 x -35								
039 ÷ -24	095 RCL6 36 06								
040 ST05 35 05	096 RCL1 36 01	$FC \rightarrow R_0$							
041 RTN 24	097 Y* 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	101 X*Y -41								
046 1 01	102 x -35								
047 2 02	103 LSTX 16-63								
048 EEX -23	104 - -45								
049 2 02	105 RCL4 36 04								
050 ÷ -24	106 x -35	$\frac{FC + AMT}{N} \rightarrow R_5$	$i_k = i_{k-1} - \frac{f(i)}{f'(i)}$						
051 X=0? 16-43	107 - -45								
052 RTN 24	108 ÷ -24								
053 ST00 35 00	109 RCL0 36 00								
054 *LBL1 21 01	110 X*Y -41								
055 1 01	111 - -45								
056 RCL0 36 00	112 ST00 35 00								
REGISTERS									
0 Used	1 Used	2 Used	3 Used	4 AMT	5 PMT	6 1+i/100	7 (1+i/100) <sup>-n</sup>	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B		C		D	E		I	

[illegible]

## SAVINGS PLAN—LEASES

001 *LBLA	21 11	n→R <sub>A</sub>	057 SF1	16 21 01	
002 STOA	35 11		058 1	01	
003 F3?	16 23 03	Digit entered?	059 RCLB	36 12	i/100→R <sub>9</sub>
004 RTN	24		060 2	55	
005 GSB0	23 00		061 ST09	35 09	(1+i)→R <sub>7</sub>
006 RCLC	36 15		062 +	-55	
007 LSTX	16-63	Solve for n and store in R <sub>A</sub> .	063 ST07	35 07	
008 -	-45		064 RCLA	36 11	(1+i) <sup>-n</sup> →R <sub>8</sub>
009 RCLD	36 14		065 CHS	-22	
010 LSTX	16-63		066 Y*	31	
011 -	-45		067 ST08	35 08	
012 ÷	-24		068 RCLC	36 15	
013 LN	32		069 x	-35	
014 RCL7	36 07		070 1	01	
015 LN	32		071 RCL8	36 08	1 - (1+i) <sup>-n</sup> →R <sub>4</sub>
016 ÷	-24		072 -	-45	
017 STOA	35 11		073 ST04	35 04	Calculate ± (PMT/i)
018 RTN	24		074 RCLC	36 13	and store in R <sub>3</sub> .
019 *LBLC	21 13		075 RCL9	36 09	
020 STOC	35 13	PMT→R <sub>C</sub>	076 ÷	-24	
021 F3?	16 23 03	Digit entered?	077 F1?	16 23 01	
022 RTN	24		078 CHS	-22	
023 1	01	Store dummy 1 for PMT.	079 ST03	35 03	
024 STOC	35 13		080 RCL7	36 07	± $\frac{\text{PMT}}{i} [1 - (1+i)^{-n}] R_7$
025 GSB0	23 00		081 x	-35	
026 1/X	52		082 x	-35	
027 RCLD	36 14	Solve for PMT and store in R <sub>C</sub> .	083 RTN	24	
028 R*	16-31		084 *LBL*	21 16 11	
029 -	-45		085 CLX	-51	Start by clearing PMT,
030 x	-35		086 STOC	35 13	PV, FV(BAL) registers.
031 STOC	35 13		087 STOD	35 14	
032 RTN	24		088 STOE	35 15	
033 *LBLD	21 14	PV→R <sub>D</sub>	089 RTN	24	
034 STOD	35 14		090 *LBLB	21 12	i→R <sub>B</sub>
035 F3?	16 23 03	Digit entered?	091 STOB	35 12	
036 RTN	24		092 F3?	16 23 03	Digit entered?
037 GSB0	23 00	Solve for PV and store in R <sub>D</sub> .	093 RTN	24	
038 +	-55		094 0	00	
039 STOD	35 14		095 STOB	35 12	Clear R <sub>B</sub> for sum of i
040 RTN	24		096 2	02	terms.
041 *LBLE	21 15		097 1	01	
042 STOE	35 15	FV(BAL)→R <sub>E</sub>	098 STOI	35 46	Store address of R <sub>B</sub> in
043 F3?	16 23 03	Digit entered?	099 RCLC	36 15	R <sub>1</sub> for indirect access.
044 RTN	24		100 RCLA	36 11	Recall FV(BAL), n, PMT
045 GSB0	23 00		101 RCLC	36 13	
046 RCLD	36 14	Solve for FV(BAL) and store in R <sub>E</sub> .	102 X=0?	16-43	If PMT = 0 GTO n, i, PV, FV solution.
047 XZY	-41		103 GT08	22 00	
048 -	-45		104 x	-35	
049 RCLB	36 08		105 +	-55	
050 ÷	-24		106 RCLD	36 14	Start guess of i: n PMT
051 STOE	35 15		107 X=0?	16-43	+ FV(BAL)
052 RTN	24		108 GT03	22 03	If PV = 0 GTO FV guess
053 *LBL0	21 00	Clear FV(BAL) flag.	109 -	-45	PV guess for i:
054 CF1	16 22 01	If PV = 0, set FV(BAL) flag.	110 RCLA	36 11	$\frac{n \text{ PMT} + \text{BAL} - \text{PV}}{n}$
055 RCLD	36 14		111 ÷	-24	
056 X=0?	16-43		112 RCLD	36 14	and recall PV
REGISTERS					
0	1	2	3 ±(PMT/i)	4 Used	5
6 Used	7 (1+i)	8 (1+i) <sup>-n</sup>	9 i/100		
S0	S1	S2	S3	S4	S5
S6	S7	S8	S9		
A	n	B	i	C	PMT
D	PV	E	FV(BAL)	I	21



ADVANCE PAYMENTS

001 *LBLA 21 11	A→R <sub>1</sub>	057 RCL0 36 00	
002 ST01 35 01	-n→R <sub>0</sub>	058 RCL1 36 01	
003 XZY -41		059 + -55	
004 CHS -22		060 Y* 31	
005 ST00 35 00		061 1 01	
006 CHS -22		062 XZY -41	
007 XZY -41		063 - -45	
008 XY? 16-34	A > n?	064 RCL2 36 02	
009 GT02 22 02		065 ÷ -24	
010 RTN 24		066 RCL1 36 01	
011 *LBLD 21 14	PV→R <sub>4</sub>	067 + -55	
012 ST04 35 04		068 RCL3 36 03	
013 RTN 24		069 x -35	
014 *LBL E 21 15		070 RCL7 36 07	
015 ST05 35 05	RESID→R <sub>5</sub>	071 RCL0 36 00	
016 RTN 24		072 Y* 31	
017 *LBL C 21 16 13		073 RCL5 36 05	
018 EEX -23	i/100→R <sub>2</sub>	074 x -35	
019 2 02		075 + -55	
020 ÷ -24		076 RCL4 36 04	
021 ST02 35 02		077 - -45	
022 1 01		078 ST06 35 06	
023 + -55	(1 + i/100)→R <sub>7</sub>	079 RCL7 36 07	
024 ST07 35 07		080 RCL0 36 00	
025 RCL0 36 00		081 RCL1 36 01	
026 Y* 31		082 + -55	
027 RCL5 36 05		083 1 01	
028 x -35		084 - -45	
029 RCL4 36 04	Calculate PMT	085 Y* 31	
030 XZY -41		086 RCL0 36 00	
031 - -45		087 CHS -22	
032 RCL7 36 07		088 RCL1 36 01	
033 RCL0 36 00		089 - -45	
034 RCL1 36 01		090 x -35	
035 + -55		091 RCL2 36 02	
036 Y* 31		092 x -35	
037 1 01		093 RCL7 36 07	
038 XZY -41		094 RCL0 36 00	
039 - -45		095 RCL1 36 01	
040 RCL2 36 02		096 + -55	
041 ÷ -24		097 Y* 31	
042 RCL1 36 01		098 1 01	
043 + -55		099 XZY -41	
044 ÷ -24		100 - -45	
045 RTN 24		101 - -45	
046 *LBL B 21 16 12		102 RCL2 36 02	
047 ST03 35 03	PMT→R <sub>3</sub>	103 X <sup>2</sup> 53	
048 EEX -23		104 ÷ -24	
049 CHS -22		105 RCL3 36 03	
050 3 03		106 x -35	
051 ST02 35 02		107 RCL7 36 07	
052 *LBL0 21 00		108 RCL0 36 00	
053 1 01	Calculate f(i)	109 1 01	
054 RCL2 36 02		110 - -45	
055 + -55		111 Y* 31	
056 ST07 35 07		112 RCL5 36 05	
-----			
			Calculate f'(i)

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



113	x	-35			
114	RCL0	36 00			
115	x	-35			
116	+	-55			
117	RCL6	36 06	$f(i)/f'(i)$		
118	X $\Sigma$ Y	-41			
119	$\div$	-24			
120	ST-2	35-45 02			
121	ABS	16 31			
122	EEX	-23	Is this within desired accuracy?		
123	CHS	-22			
124	6	06			
125	X $\Delta$ Y?	16-35			
126	GTO0	22 00			
127	RCL2	36 02			
128	EEX	-23			
129	2	02	Display i		
130	x	-35			
131	RTN	24			
132	*LBL2	21 02	-----		
133	PSE	16 51	If A > n, flash A on display.		
134	GTO2	22 02			
135	R/S	51			

LABELS					FLAGS	SET STATUS		
A n, A	B	C	D PV	E RESID	0	FLAGS	TRIG	DISP
a	b $\rightarrow$ i	c $\rightarrow$ PMT	d	e	1	ON OFF		
0 Used	1	2 Used	3	4	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
					1 <input type="checkbox"/> <input checked="" type="checkbox"/>	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
					2 <input type="checkbox"/> <input checked="" type="checkbox"/>	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
S	6	7	8	9	3	3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

# SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

001	*LBLA	21 11	If P/C > 1, set flag 0.	057	x	-35			
002	÷	-24		058	RCLD	36 14			
003	STOD	35 14		059	+	-55			
004	1	01		060	RCLC	36 13			
005	X÷Y	-41		061	x	-35			
006	XOY?	16-34		062	÷	-24			
007	F0?	16 23 00		063	1	01			
008	RTN	24		064	+	-55			
009	*LBLB	21 12		065	LN	32			
010	EEEX	-23		066	RCLB	36 12			
011	2	02	i/100 → R <sub>B</sub>	067	1	01			
012	÷	-24		068	+	-55			
013	STOB	35 12		069	LN	32			
014	LSTX	16-63		070	÷	-24			
015	x	-35		071	RCLD	36 14			
016	RCLB	36 12		072	x	-35			
017	1	01		073	RTN	24			
018	+	-55		074	*LBLC	21 16 13			
019	RCLD	36 14		075	STOC	35 13			
020	1/X	52		076	F3?	16 23 03			
021	Y*	31	(1 + i) <sup>C/P</sup> → R <sub>g</sub>	077	RTN	24	If digit entered, store in R <sub>C</sub> .		
022	STO9	35 09		078	F0?	16 23 00			
023	X÷Y	-41		079	GTO1	22 01			
024	RTN	24		080	RCL9	36 09			
025	*LBLA	21 16 11		081	1	01			
026	STOA	35 11		082	-	-45			
027	F3?	16 23 03		083	RCL9	36 09			
028	RTN	24		084	RCLA	36 11			
029	F0?	16 23 00		085	Y*	31			
030	GTO0	22 00		086	1	01			
031	RCL9	36 09	P/C ≤ 1, solve for number of payments.	087	-	-45	If P/C ≤ 1, solve for payment amount.		
032	1	01		088	÷	-24			
033	-	-45		089	RCLC	36 15			
034	RCLC	36 15		090	x	-35			
035	x	-35		091	RCL9	36 09			
036	RCL9	36 09		092	÷	-24			
037	RCLC	36 13		093	RTN	24			
038	x	-35		094	*LBL1	21 01			
039	÷	-24		095	RCLD	36 14			
040	1	01		096	1/X	52			
041	+	-55	P/C > 1, solve for number of payments.	097	RCLA	36 11	If P/C > 1, solve for payment amount.		
042	LN	32		098	x	-35			
043	RCL9	36 09		099	RCLB	36 12			
044	LN	32		100	1	01			
045	÷	-24		101	+	-55			
046	RTN	24		102	X÷Y	-41			
047	*LBL0	21 00		103	Y*	31			
048	RCLC	36 15		104	1	01			
049	RCLB	36 12		105	-	-45			
050	x	-35		106	RCLB	36 12			
051	RCLD	36 14		107	X÷Y	-41			
052	1	01		108	÷	-24			
053	+	-55		109	RCLD	36 14			
054	RCLB	36 12		110	1	01			
055	2	02		111	+	-55			
056	+	-24		112	RCLB	36 12			
REGISTERS									
0	1	2	3	4	5	6	7	8	9 (1 + 1) <sup>C/P</sup>
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A # PAY	B i/100	C PMT	D P/C	E FV	I				

113	2	02				
114	÷	-24				
115	x	-35				
116	RCLD	36 14				
117	+	-55				
118	÷	-24				
119	RCLF	36 15				
120	x	-35				
121	RTN	24				
122	*LBL <sub>E</sub>	21 16 15				
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				
129	RCLA	36 11				
130	Y*	31				
131	I	01				
132	-	-45				
133	RCL9	36 09				
134	x	-35				
135	RCLC	36 13				
136	x	-35				
137	RCL9	36 09				
138	I	01				
139	-	-45				
140	÷	-24				
141	RTN	24				
142	*LBL <sub>2</sub>	21 02				
143	RCLD	36 14				
144	I	01				
145	+	-55				
146	RCLB	36 12				
147	2	02				
148	÷	-24				
149	x	-35				
150	RCLD	36 14				
151	+	-55				
152	RCLB	36 12				
153	I	01				
154	+	-55				
155	RCLA	36 11				
156	RCLD	36 14				
157	I/X	52				
158	x	-35				
159	Y*	31				
160	I	01				
161	-	-45				
162	x	-35				
163	RCLC	36 13				
164	x	-35				
165	RCLB	36 12				
166	+	-24				
167	RTN	24				
168	R/S	51				

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

FLAGS		TRIG		DISP
1	ON OFF	DEG	GRAD	FIX
2	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
3	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

# SIMPLE INTEREST/INTEREST CONVERSIONS

001 3 03					057 6T03 22 03				
002 6 06					058 *LBLC 21 13				BEG AMT → R <sub>C</sub>
003 0 00					059 ST0C 35 13				Digit entered?
004 ST09 35 00					060 F3? 16 23 03				
005 5 05					061 RTN 24				
006 + -55					062 F2? 16 23 02				360 or 365?
007 ST09 35 09					063 6T04 22 04				
008 0 00					064 RCLD 36 14				
009 R/S 51					065 RCL8 36 00				
010 *LBLA 21 11					066 *LBL5 21 05				
011 ST0A 35 11					067 x -35				Calculate BEG AMT and store in R <sub>C</sub> .
012 F3? 16 23 03					068 RCLA 36 11				
013 RTN 24					069 ÷ -24				
014 F2? 16 23 02					070 RCLB 36 12				
015 6T00 22 00					071 ÷ -24				
016 RCLD 36 14					072 ST0C 35 13				
017 RCL8 36 08					073 RTN 24				
018 *LBL1 21 01					074 *LBL4 21 04				
019 x -35					075 RCLC 36 15				365 day basis
020 RCLC 36 13					076 RCL9 36 09				
021 ÷ -24					077 6T05 22 05				
022 RCLB 36 12					078 *LBLD 21 14				INT <sub>360</sub> → R <sub>D</sub>
023 ÷ -24					079 ST0D 35 14				
024 ST0A 35 11					080 F3? 16 23 03				
025 RTN 24					081 RTN 24				Digit entered?
026 *LBL0 21 00					082 RCLC 36 13				
027 RCLC 36 15					083 RCLA 36 11				Calculate INT <sub>360</sub> and store in R <sub>D</sub> .
028 RCL9 36 09					084 RCL8 36 08				
029 6T01 22 01					085 6SB6 23 06				
030 *LBLB 21 12					086 ST0D 35 14				
031 EEX -23					087 RTN 24				
032 2 02					088 *LBL4 21 15				Set flag 2 for 365 day basis.
033 ÷ -24					089 ST0E 35 15				
034 ST0B 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					093 RCLC 36 13				
038 RTN 24					094 RCLA 36 11				Calculate INT <sub>365</sub> and store in R <sub>E</sub> .
039 F2? 16 23 02					095 RCL9 36 09				
040 6T02 22 02					096 6SB6 23 06				
041 RCL8 36 08					097 ST0E 35 15				
042 RCLD 36 14					098 RTN 24				
043 *LBL3 21 03					099 *LBL6 21 06				
044 x -35					100 ÷ -24				
045 RCLA 36 11					101 RCLC 36 13				
046 ÷ -24					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 <sub>A</sub>
051 x -35					107 ST0A 35 11				
052 ST0B 35 12					108 RTN 24				
053 RTN 24					109 *LBL6 21 16 12				NOM → R <sub>B</sub>
054 *LBL2 21 02					110 ST0B 35 12				Digit entered?
055 RCL9 36 09					111 F3? 16 23 03				
056 RCLC 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 Used		B Used		C Used		D Used		E Used	

113	RCLC	36 13	Calculate NOM and store in R <sub>g</sub> .	169	STOE	35 15	Calculate EFF and store in R <sub>g</sub> .
114	EEX	-23		170	F3?	16 23 03	
115	2	02		171	RTN	24	
116	÷	-24		172	RCLD	36 14	
117	1	01		173	*LBL7	21 07	
118	+	-55		174	EEX	-23	
119	RCLA	36 11		175	2	02	
120	1/X	52		176	÷	-24	
121	Y*	31		177	e*	33	
122	1	01		178	1	01	
123	-	-45	179	-	-45		
124	RCLA	36 11	180	EEX	-23		
125	x	-35	181	2	02		
126	EEX	-23	182	x	-35		
127	2	02	183	STOE	35 15		
128	x	-35	184	RTN	24		
129	STOB	35 12	185	*LBL8	21 08		
130	RTN	24	186	RCL9	36 09		
131	*LBLc	21 16 13	187	x	-35		
132	STOC	35 13	188	RCL0	36 08		
133	F3?	16 23 03	189	÷	-24		
134	RTN	24	190	GT07	22 07		
135	RCLB	36 12	191	R/S	51		
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*	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	RCLC	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					

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

## DEPRECIATION SCHEDULES

001	*LBL	21	16	11	Straight line	057	-	-45	
002	F0?	16	23	00		058	X0?	16-45	
003	SPC		16-11		K	059	GT03	22 03	
004	RCLD		36 14			060	GSB2	23 02	
005	GSB9		23 09			061	RCL7	36 07	
006	RCLA		36 11			062	÷	-24	
007	RCLB		36 12		$\frac{SBV - SAL}{LIFE} \rightarrow R_1$	063	ST04	35 04	
008	-		-45			064	RCL8	36 08	
009	RCLC		36 13			065	x	-35	
010	÷		-24		DEP	066	*LBL3	21 03	
011	ST01		35 46			067	ST06	35 06	
012	GSB9		23 09			068	GSB9	23 09	RDV <sub>K</sub>
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 <sub>K</sub> = RDV <sub>K</sub> + SAL
016	RCLI		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 <sub>K</sub>	077	GSB9	23 09	TOT DEP <sub>K</sub>
022	RCLI		36 46		$\left( \frac{SBV - SAL}{LIFE} \right) YR = TOT DEP$	078	1	01	
023	RCLD		36 14			079	GSB0	23 14	
024	x		-35			080	RCLC	36 13	
025	GSB9		23 09			081	RCLD	36 14	K < LIFE?
026	1		01			082	X0Y?	16-35	
027	GSB0		23 14			083	GT06	22 16 12	
028	RCLC		36 13			084	RTN	24	
029	RCLD		36 14			085	*LBL2	21 02	
030	X0Y?		16-35		K < LIFE?	086	ENT↑	-21	
031	GT06	22	16 11			087	FRC	16 44	$\frac{(1+W)(2F+W)}{2}$
032	RTN		24			088	ENT↑	-21	
033	*LBL6	21	16 12		SOYD	089	+	-55	
034	F0?	16	23 00			090	X0Y	-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	ST08		35 08			097	2	02	
042	RCLC		36 13			098	÷	-24	
043	GSB2		23 02			099	RTN	24	
044	ST07		35 07		$\left( \frac{LIFE+1-K}{SOYD} \right) (SBV-SAL)$	100	*LBLc	21 16 13	Declining Balance
045	RCLC		36 13			101	F0?	16 23 00	
046	1		01			102	SPC	16-11	
047	+		-55			103	RCLD	36 14	
048	RCLD		36 14			104	GSB9	23 09	
049	-		-45			105	GSB4	23 04	K
050	RCL7		36 07			106	RCLD	36 14	
051	÷		-24			107	1	01	
052	RCL8		36 08			108	-	-45	
053	x		-35		DEP <sub>K</sub>	109	YX	31	
054	GSB9		23 09			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 <sub>K</sub>	7 Used	8 Used	9 TOT DEP
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	SBV	B	SAL	C	LIFE	D	YR	E	FACTOR
									SBV-SAL/LIFE



## DAYS BETWEEN DATES

001 *LBLA 21 11	DT <sub>1</sub> → R <sub>7</sub>	057 CLK -51	Compute days since 0 AD neglecting 400s and 100s.						
002 ST07 35 07		058 RCL5 36 05							
003 RTN 24		059 + -55							
004 *LBLB 21 12	DT <sub>2</sub> → R <sub>1</sub>	060 RCL3 36 03							
005 ST01 35 01		061 1 01							
006 RTN 24		062 - -45							
007 *LBLE 21 13		063 3 03							
008 RCL7 36 07		064 1 01							
009 GSBF 23 15		065 x -35							
010 ST02 35 02		066 + -55							
011 LSTX 16-63	Control and storage	067 RCL6 36 06	Control and storage						
012 ST00 35 00		068 4 04							
013 RCL1 36 01		069 ÷ -24							
014 GSBF 23 15		070 INT 16 34							
015 LSTX 16-63		071 XZY -41							
016 ST-0 35-45 00		072 + -55							
017 CLK -51		073 RTW 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 ST02 35 02	Control and storage						
022 ÷ -24		078 RCL7 36 07							
023 ST=0 35-24 00		079 GSBF 23 16 15							
024 XZY -41		080 ST00 35 00							
025 RTW 24		081 RCL1 36 01							
026 *LBLE 21 15		082 GSBF 23 16 15							
027 GSB4 23 04		083 RCL0 36 00							
028 ST06 35 06		084 - -45							
029 3 03		085 ST00 35 00							
030 6 06		086 RCL4 36 04							
031 5 05		087 CHS -22	Sum years and months.						
032 ST04 35 04		088 2 02							
033 x -35		089 ÷ -24							
034 2 02		090 ST=0 35-24 00							
035 RCL3 36 03		091 R4 -31							
036 XZY? 16-34		092 RTW 24							
037 GT00 22 00		093 *LBLE 21 16 15							
038 x -35		094 GSB4 23 04							
039 CLK -51		095 3 03							
040 RCL6 36 06		096 6 06							
041 1 01		097 0 00	Are days equal to 31?						
042 - -45		098 ST04 35 04							
043 ST06 35 06		099 x -35							
044 GT01 22 01		100 RCL3 36 03							
045 *LBLB 21 00		101 3 03							
046 - -62		102 0 00							
047 4 04		103 x -35							
048 x -35		104 + -55							
049 - -62		105 RCL5 36 05							
050 3 03		106 3 03							
051 + -55		107 1 01	No, add and return.						
052 + -55		108 XZY? 16-33							
053 INT 16 34		109 GT02 22 02							
054 - -45		110 R4 -31							
055 RCL6 36 06		111 ST02 35 02							
056 *LBL1 21 01		112 + -55							
REGISTERS									
0 -PER	1 DT <sub>2</sub>	2 Used	3 M	4 365/360	5 D	6 y, z	7 DT <sub>1</sub>	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J



113	RTN	24							
114	*LBL2	21 02							
115	R↓	-31	Is register 2 equal to 30?						
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	SET STATUS			
A DT <sub>1</sub>	B DT <sub>2</sub>	C Days Actual	D Days 360	E Used	0	FLAGS		TRIG	DISP
a	b	c	d	e	Used	1	ON OFF		
0	Used	1	Used	2	Used	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
							1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
							2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
							3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

## BOND PRICE AND YIELD

001	*LBLA	21 11		057	÷	-24		
002	CF3	16 22 03		058	-	-45		
003	CHS	-22	-PER → R <sub>0</sub>	059	ST-6	35-45 06		Has limit been reached?
004	ST08	35 00		060	ABS	16 31		
005	CHS	-22		061	EEK	-23		
006	RTN	24		062	CHS	-22		
007	*LBLB	21 12		063	6	06		
008	EEK	-23		064	XΔY?	16-35		
009	2	02	100 → R <sub>3</sub>	065	GT01	22 01		
010	ST03	35 03		066	F2?	16 23 02		
011	RΔ	-31	CR → R <sub>1</sub>	067	GT02	22 02		
012	ST01	35 01		068	RCL6	36 06		
013	RTN	24		069	GT03	22 03		
014	*LBLD	21 14		070	*LBL2	21 02		
015	CF3	16 22 03	RV → R <sub>3</sub>	071	RCL5	36 05		
016	ST03	35 03		072	1	01		Modify price for next set of iterations.
017	RTN	24		073	RCL0	36 00		
018	*LBLE	21 13		074	FRC	16 44		
019	F3?	16 23 03	YLD → R <sub>2</sub>	075	+	-55		
020	GT05	22 05		076	LSTX	16-63		
021	RCL0	36 00		077	x	-35		
022	ABS	16 31		078	4	04		
023	1	01		079	÷	-24		
024	xY?	16-34	1 > PER?	080	RCL1	36 01		
025	GT00	22 00		081	x	-35		
026	SF2	16 21 02		082	RCL6	36 06		
027	RCL1	36 01	Calculate initial guess	083	x	-35		
028	2	02		084	-	-45		
029	÷	-24		085	ST05	35 05		
030	RCL4	36 04		086	GT01	22 01		
031	ST05	35 05		087	*LBL0	21 00		
032	÷	-24		088	RCL3	36 03		Calculate yield if less than 1 coupon period remaining
033	ST06	35 06		089	RCL1	36 01		
034	*LBL1	21 01		090	2	02		
035	1	01	Calculate f(y)	091	÷	-24		
036	RCL3	36 03		092	+	-55		
037	RCL5	36 05		093	LSTX	16-63		
038	÷	-24		094	RCL0	36 00		
039	1	01		095	1	01		
040	RCL6	36 06		096	+	-55		
041	+	-55		097	x	-35		
042	RCL0	36 00		098	RCL4	36 04		
043	Y*	31		099	+	-55		
044	ST08	35 08		100	÷	-24		
045	x	-35		101	1	01		
046	-	-45		102	-	-45		
047	RCL6	36 06		103	RCL0	36 00		
048	x	-35		104	CHS	-22		
049	1	01		105	÷	-24		
050	RCL0	36 00		106	*LBL3	21 03		Display answer if second time through.
051	-	-45		107	2	02		
052	÷	-24		108	0	00		
053	RCL1	36 01		109	0	00		
054	2	02		110	x	-35		
055	÷	-24		111	ST02	35 02		
056	RCL5	36 05		112	RTN	24		

## REGISTERS

0	-PER	1	CR	2	YLD	3	RV	4	PRICE	5	Used	6	Used	7	DT <sub>1</sub>	8	Acc. Int.	9	
S0		S1		S2		S3		S4		S5		S6		S7		S8		S9	
A		B		C		D		E		F		G		H		I		J	

113	*LBL5	21	05			169	+	-55	
114	ST02	35	02			170	RCL5	36	05
115	RTN		24			171	1		01
116	*LBL6	21	15			172	-	-45	
117	F3?	16	23	03	Price → R <sub>4</sub> , R <sub>5</sub>	173	RCL0	36	00
118	GT06	22	06			174	x	-35	
119	RCL2	36	02			175	CHS	-22	
120	2		02			176	1		01
121	0		00		Calculate J	177	+	-55	
122	0		00			178	=	-24	
123	÷	-24				179	RCL1	36	01
124	1		01			180	2		02
125	+	-55				181	=	-24	
126	ST05	35	05			182	RCL6	36	06
127	1		01			183	x	-35	
128	RCL0	36	00			184	ST08	35	08
129	FRC	16	44			185	-	-45	
130	+	-55				186	RTN		24
131	ST06	35	06			187	*LBL6	21	06
132	RCL0	36	00			188	ST04	35	04
133	CHS	-22			Is PER < 1?	189	ST05	35	05
134	1		01			190	RTN		24
135	x>y?	16-34				191	R/S		51
136	GT04	22	04						
137	RCL5	36	05						
138	RCL6	36	06						
139	Y*		31						
140	RCL5	36	05		Calculate price for long term bonds.				
141	RCL0	36	00						
142	Y*		31						
143	ST05	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	ST08	35	08						
158	-	-45							
159	RCL5	36	05						
160	RCL3	36	03		Calculate price for short term bonds.				
161	x	-35							
162	+	-55							
163	RTN		24						
164	*LBL4	21	04						
165	RCL1	36	01						
166	2		02						
167	÷	-24							
168	RCL3	36	03						

LABELS					FLAGS	SET STATUS		
A PER	B CR	C YLD	D RV	E PRICE	0			
a	b	c	d	e	1			
0 Used	1 Used	2 Used	3 Used	4 Used	2 Used	ON OFF	TRIG	DISP
5 Used	6 Used	7	8	9	3 Digit?	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
						1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

## INTEREST AT MATURITY/DISCOUNTED SECURITIES

001	*LBLA	21 11		057	RCLB	36 08	
002	STOA	35 11	DSM→R <sub>A</sub>	058	÷	-24	
003	XZY	-41	DIM→R <sub>9</sub>	059	1	01	
004	STO9	35 09		060	+	-55	
005	XZY	-41		061	RCLA	36 11	
006	RTN	24		062	RCLB	36 12	
007	*LBLE	21 12	Basis→R <sub>B</sub>	063	÷	-24	
008	STOB	35 12		064	RCLD	36 14	
009	EEX	-23	100→R <sub>8</sub>	065	x	-35	
010	2	02		066	RCLB	36 08	
011	STOB	35 08		067	÷	-24	
012	XZY	-41		068	1	01	
013	RTN	24		069	+	-55	
014	*LBLC	21 13	CR→R <sub>C</sub>	070	÷	-24	
015	STOC	35 13		071	RCLS	36 09	
016	RTN	24		072	RCLA	36 11	
017	*LBLD	21 14		073	-	-45	
018	STOD	35 14	YLD→R <sub>D</sub>	074	RCLB	36 12	
019	F??	16 23 03		075	÷	-24	
020	RTN	24		076	RCLC	36 13	
021	RCL9	36 09	Calc. Yield	077	x	-35	
022	RCLB	36 12		078	RCLB	36 08	
023	÷	-24		079	÷	-24	
024	RCLC	36 13		080	-	-45	
025	x	-35		081	EEX	-23	
026	RCLB	36 08		082	2	02	Store price in R <sub>E</sub> .
027	+	-55		083	x	-35	
028	RCL9	36 09		084	STOE	35 15	
029	RCLA	36 11		085	RTN	24	
030	-	-45		086	*LBLA	21 16 11	
031	RCLB	36 12		087	STOA	35 11	DSM→R <sub>A</sub>
032	÷	-24		088	CF1	16 22 01	
033	RCLC	36 13		089	RTN	24	
034	x	-35		090	*LBLB	21 16 12	
035	RCLB	36 15		091	SF1	16 21 01	
036	+	-55		092	STOI	35 46	
037	÷	-24		093	RCLA	36 11	Calc. price given DR
038	1	01		094	x	-35	
039	-	-45		095	3	03	
040	RCLB	36 12		096	E	06	
041	x	-35		097	0	00	
042	RCLA	36 11		098	÷	-24	
043	÷	-24		099	EEX	-23	
044	RCLB	36 08		100	2	02	
045	x	-35	Store yield in R <sub>D</sub> .	101	XZY	-41	
046	STOD	35 14		102	-	-45	
047	RTN	24		103	STOT	35 07	
048	*LBLE	21 15		104	GSBc	23 16 13	
049	STOE	35 15	Price→R <sub>E</sub>	105	RCL1	36 46	
050	F??	16 23 03		106	RTN	24	
051	RTN	24		107	*LBLC	21 16 13	
052	RCL9	36 09		108	EEX	-23	Calc. yield given price
053	RCLB	36 12		109	2	02	
054	÷	-24		110	XZY	-41	
055	RCLC	36 13	Calc. price	111	-	-45	
056	x	-35		112	LSTN	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	*LBLJ	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	RCLC	36 15			
131	GSBc	23 16 13			
132	RTN	24			
133	*LBLc	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
DSM	DR	Used	YLD	PRICE	DR	ON	OFF		
0	1	2	3	4	2	0	<input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
						1	<input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2	<input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
					3 Digit?	3	<input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

## LINEAR REGRESSION—EXPONENTIAL CURVE FIT

001	*LBLA	21 11		057	RJ	-31				
002	CF1	16 22 01	Clears flag 1 and storage registers.	058	RCLB	36 12	Calculate linear r <sup>2</sup>			
003	CLR6	16-53		059	x	-35				
004	P=S	16-51		060	RCL7	36 07				
005	CLR6	16-53		061	RCL6	36 06				
006	CLX	-51		062	X <sup>e</sup>	53				
007	RTN	24		063	RCL9	36 09				
008	*LBLB	21 12	y → R <sub>8</sub>	064	÷	-24				
009	STO6	35 00		065	-	-45				
010	X=Y	-41		066	÷	-24				
011	STO9	35 09	x → R <sub>9</sub>	067	STOE	35 15	r <sup>2</sup> → R <sub>E</sub>			
012	X=Y	-41		068	RCLA	36 11				
013	X>0?	16-44	y > 0?	069	CSB9	23 09	Display a (lin.)			
014	GTO0	22 00		070	RCLB	36 12				
015	SF1	16 21 01	If no, set flag 1.	071	CSB9	23 09	Display b (lin.)			
016	*LBLA	21 04		072	RCLC	36 15	Display r <sup>2</sup> (lin.)			
017	RCL0	36 00		073	P=S	16-51				
018	RCL9	36 09	Performs summations	074	CSB9	23 09				
019	I+	56		075	F1P	16 23 01	If any y ≤ 0, display ERROR.			
020	RTN	24		076	GTO0	22 00				
021	*LBL0	21 00		077	RCL2	36 02				
022	LN	32		078	RCL0	36 00	Calculate b (exponential)			
023	ST+0	35-55 00	Σlny → R <sub>0</sub>	079	P=S	16-51				
024	X <sup>2</sup>	53		080	RCL4	36 04				
025	ST+1	35-55 01	Σ(lny) <sup>2</sup> → R <sub>1</sub>	081	x	-35				
026	RCLB	36 00		082	RCL9	36 09				
027	LN	32		083	÷	-24				
028	RCL9	36 09		084	-	-45				
029	x	-35		085	RCL5	36 05				
030	ST+2	35-55 02	Σxlny → R <sub>2</sub>	086	RCL4	36 04				
031	GTO4	22 04		087	X <sup>2</sup>	53				
032	*LBLA	21 16 11		088	RCL9	36 09				
033	P=S	16-51		089	÷	-24				
034	RCL0	36 00	Calculate b (linear)	090	-	-45				
035	RCL4	36 04		091	÷	-24				
036	RCL6	36 06		092	STOC	35 13				
037	x	-35		093	RCL4	36 04	b → R <sub>C</sub>			
038	RCL9	36 09		094	x	-35				
039	÷	-24		095	CHS	-22	Calculate a (exponential)			
040	-	-45		096	P=S	16-51				
041	RCL5	36 05		097	RCL0	36 00				
042	RCL4	36 04		098	+	-55				
043	X <sup>2</sup>	53		099	P=S	16-51				
044	RCL9	36 09		100	RCL9	36 09	a → R <sub>D</sub>			
045	÷	-24		101	÷	-24				
046	-	-45		102	e <sup>x</sup>	33				
047	÷	-24		103	STOD	35 14				
048	STOB	35 12	b → R <sub>B</sub>	104	RJ	-31				
049	RCL4	36 04		105	RCLC	36 13	Calculate exponential r <sup>2</sup>			
050	x	-35		106	x	-35				
051	CHS	-22	Calculate a (linear)	107	P=S	16-51				
052	RCL6	36 06		108	RCL1	36 01				
053	+	-55		109	RCL0	36 00				
054	RCL9	36 09		110	X <sup>2</sup>	53				
055	÷	-24		111	P=S	16-51				
056	STOA	35 11	a → R <sub>A</sub>	112	RCL9	36 09				

REGISTERS									
0	1	2	3	4	5	6	7	8	9
Σlny	Σ(lny) <sup>2</sup>	Σxlny						y	x
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
				Σx <sub>i</sub>	Σx <sub>i</sub> <sup>2</sup>	Σy <sub>i</sub>	Σy <sub>i</sub> <sup>2</sup>	Σx <sub>i</sub> y <sub>i</sub>	n
A (Linear)	B (Linear)	C (Exponential)	D (a(Exponential)		E	Used	Used		

113	÷	-24				169	RCL8	36 00		
114	-	-45				170	RCL9	36 09		
115	÷	-24				171	Z-	16 56		
116	STOE	35 15				172	RTN	24		
117	F0?	16 23 00				173	*LBL1	21 01		
118	SPC	16-11	Display a (exp.)			174	LN	32		
119	RCLD	36 14				175	ST-0	35-45 00		
120	GSB9	23 09	Display b (exp.)			176	X²	53		
121	RCLC	36 13				177	ST-1	35-45 01		
122	GSB9	23 09	Display r² (exp.)			178	RCL0	36 00		
123	RCLC	36 15				179	LN	32		
124	PZS	16-51				180	RCL9	36 09		
125	GSB9	23 09				181	X	-35		
126	RCLC	36 13	Continuous effective rate			182	ST-2	35-45 02		
127	e*	33	as a %.			183	GT05	22 05		
128	1	01				184	*LBLc	21 16 13		Delete last trend value.
129	-	-45				185	DSZ1	16 25 46		
130	EEK	-23				186	RCL9	36 09		
131	2	02				187	X²Y	-41		
132	x	-35				188	GT01	22 01		
133	GSB9	23 09				189	*LBLe	21 16 15		
134	F0?	16 23 00				190	F0?	16 23 00		Print/pause flag.
135	SPC	16-11				191	GT02	22 02		
136	RTN	24				192	SF0	16 21 00		
137	*LBLC	21 13				193	1	01		
138	ISZ1	16 26 46				194	RTN	24		
139	RCL1	36 46	Performs summations for			195	*LBL2	21 02		
140	STO9	35 09	trend line.			196	0	00		
141	X²Y	-41				197	CF0	16 22 00		
142	STOE	35 08				198	RTN	24		
143	X0?	16-44				199	*LBL9	21 09		
144	GT00	22 00				200	F0?	16 23 00		
145	SF1	16 21 01				201	GT03	22 03		Print command.
146	GT04	22 04				202	R/S	51		
147	*LBLD	21 14				203	RTN	24		
148	RCLB	36 12				204	*LBL3	21 03		
149	x	-35	$\hat{y} = a + bx$			205	PRTX	-14		
150	RCLA	36 11				206	RTN	24		
151	+	-55				207	R/S	51		
152	GT09	22 09								
153	*LBLF	21 15								
154	RCLC	36 13								
155	x	-35	$\hat{y} = ae^{bx}$							
156	e*	33								
157	RCLD	36 14								
158	x	-35								
159	GT09	22 09								
160	*LBLb	21 16 12								
161	STO8	35 00								
162	X²Y	-41								
163	STO9	35 09								
164	X²Y	-41								
165	X0?	16-44								
166	GT01	22 01								
167	SF1	16 21 01								
168	*LBL5	21 05								

LABELS					FLAGS		SET STATUS			
A START	B Data Input	C Trend Line	D Lin y	E Exp y	0 Print?	1 y > 0	FLAGS		TRIG	DISP
a a; b; r²	b Del. Data	c Del. T.L.	d	e Print?	0	1	ON OFF		DEG	FIX
0 Used	1 Used	2 Used	3 Used	4 Used	2	3	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	GRAD	SCI
5 Used	6	7	8	9	3	4	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	RAD	ENG
							<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>		n 2

MULTIPLE LINEAR REGRESSION

001 *LBLA 21 11		057 - -45							
002 CLRG 16-53	Initialize	058 STOI 35 46							
003 CF1 16 22 01		059 R4 -31							
004 0 00		060 X* 53							
005 RTN 24	-----	061 GSB2 23 02							
006 *LBLB 21 12		062 ST+I 35-55 45							
007 STOC 35 13		063 RTN 24	-----						
008 R4 -31		064 *LBLC 21 13							
009 STOB 35 12	Input $x_i, y_i, z_i$	065 RCL0 36 00							
010 R4 -31		066 RCL4 36 04	Calculate a, b, c						
011 STOA 35 11		067 X -35							
012 FOP 16 23 00		068 RCL7 36 07							
013 GSB8 23 00		069 X* 53							
014 7 07		070 - -45							
015 STOI 35 46	Compute $\Sigma x_i, \Sigma y_i, \Sigma z_i$	071 STOD 35 14							
016 R4 -31	$\Sigma x_i^2, \Sigma y_i^2, \Sigma z_i^2$	072 RCL0 36 00							
017 GSB1 23 01	$\Sigma x_i y_i, \Sigma y_i z_i, \Sigma z_i x_i$	073 RCL3 36 03							
018 0 00		074 X -35							
019 STOI 35 46		075 RCL8 36 00							
020 RCLB 36 12		076 RCL9 36 09							
021 FOP 16 23 00		077 X -35							
022 GSB6 23 06		078 - -45							
023 GSB1 23 01		079 X -35							
024 9 09		080 STOC 35 13							
025 STOI 35 46		081 RCL0 36 00							
026 RCLC 36 13		082 RCL1 36 01							
027 FOP 16 23 00		083 X -35							
028 GSB6 23 06		084 RCL7 36 07							
029 GSB1 23 01		085 RCL8 36 00							
030 RCLA 36 11		086 X -35							
031 RCLB 36 12		087 - -45							
032 X -35		088 STOA 35 11							
033 GSB2 23 02		089 RCL0 36 00							
034 ST+I 35-55 01		090 RCL2 36 02							
035 RCLA 36 11		091 X -35							
036 RCLC 36 13		092 RCL7 36 07							
037 X -35		093 RCL9 36 09							
038 GSB2 23 02		094 X -35							
039 ST+2 35-55 02		095 - -45							
040 RCLB 36 12		096 STOB 35 12							
041 RCLC 36 13		097 X -35							
042 X -35		098 RCLC 36 13							
043 GSB2 23 02		099 X*Y -41							
044 ST+3 35-55 03		100 - -45							
045 1 01		101 RCLD 36 14							
046 GSB2 23 02		102 RCL0 36 00							
047 ST+0 35-55 00		103 RCL5 36 05							
048 RCL0 36 00		104 X -35							
049 FOP 16 23 00		105 RCL8 36 00							
050 GSB6 23 06		106 X* 53							
051 RTN 24		107 - -45							
052 *LBL1 21 01		108 X -35							
053 GSB2 23 02	Subroutine for $\Sigma x_i, \dots$	109 RCLA 36 11							
054 ST+I 35-55 45	$\Sigma x_i^2, \dots$	110 X* 53							
055 RCL1 36 46		111 - -45							
056 3 03		112 = -24							
REGISTERS									
0 n	1 $\Sigma x_i y_i$	2 $\Sigma x_i z_i$	3 $\Sigma y_i z_i$	4 $\Sigma x_i^2$	5 $\Sigma y_i^2$	6 $\Sigma z_i^2$	7 $\Sigma x_i$	8 $\Sigma y_i$	9 $\Sigma z_i$
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A Used	B Used	C Used	D Used	E Used	F Used	G Used	H Used	I Used	



[illegible]

BREAK-EVEN ANALYSIS

001 *LBLA 21 11	F→R <sub>A</sub>	057 RCLB 36 12	Calculate GP and store in R <sub>E</sub> .						
002 STOA 35 11	Digit entered?	058 RCLC 36 13							
003 F3? 16 23 03		059 - -45							
004 RTN 24		060 RCLD 36 14							
005 RCLB 36 12		061 x -35							
006 RCLC 36 13	Calculate F and store in R <sub>A</sub> .	062 RCLA 36 11							
007 - -45		063 - -45							
008 RCLD 36 14		064 STOE 35 15							
009 x -35		065 RTN 24							
010 RCLE 36 15		066 *LBLA 21 16 11							
011 - -45		067 RCLB 36 12	Calculate OL						
012 STOA 35 11		068 RCLC 36 13							
013 RTN 24		069 - -45							
014 *LBLB 21 12		070 RCLD 36 14							
015 STOB 35 12	P→R <sub>B</sub>	071 x -35							
016 F3? 16 23 03	Digit entered?	072 STOI 35 46							
017 RTN 24		073 RCLI 36 46							
018 RCLA 36 11		074 RCLA 36 11							
019 RCLE 36 15		075 - -45							
020 + -55	Calculate P and store in R <sub>B</sub> .	076 ÷ -24							
021 RCLD 36 14		077 RTN 24							
022 ÷ -24		078 R/S 51							
023 RCLC 36 13									
024 + -55									
025 STOB 35 12									
026 RTN 24									
027 *LBLC 21 13									
028 STOC 35 13	V→R <sub>C</sub>								
029 F3? 16 23 03	Digit entered?								
030 RTN 24									
031 RCLB 36 12	Calculate V and store in R <sub>C</sub> .								
032 RCLA 36 11									
033 RCLE 36 15									
034 + -55									
035 RCLD 36 14									
036 ÷ -24									
037 - -45									
038 STOC 35 13									
039 RTN 24									
040 *LBLO 21 14									
041 STOD 35 14	U→R <sub>D</sub>								
042 F3? 16 23 03	Digit entered?								
043 RTN 24									
044 RCLA 36 11	Calculate U and store in R <sub>D</sub> .								
045 RCLE 36 15									
046 + -55									
047 RCLB 36 12									
048 RCLC 36 13									
049 - -45									
050 ÷ -24									
051 STOD 35 14									
052 RTN 24									
053 *LBLA 21 15	GP→R <sub>E</sub>								
054 STOE 35 15	Digit entered?								
055 F3? 16 23 03									
056 RTN 24									
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				SET STATUS							
A	F	B	P	C	V	D	U	E	GP	0		FLAGS		TRIG		DISP							
a		b		c		d		e		1		0	<input type="checkbox"/> ON	<input checked="" type="checkbox"/> OFF	DEG	<input checked="" type="checkbox"/>	FIX	<input checked="" type="checkbox"/>					
0		1		2		3		4		2		1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	GRAD	<input type="checkbox"/>	SCI	<input type="checkbox"/>					
5		6		7		8		9		3	Digit?	2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	RAD	<input type="checkbox"/>	ENG	<input type="checkbox"/>					
												3	<input type="checkbox"/>	<input checked="" type="checkbox"/>			n		2				

## INVOICING

001 *LBLA 21 11	057 *LBLc 21 16 13	Clear registers and initialize R <sub>1</sub>	058 2 02	Recall and display line total as % of Grand Total.					
002 CLRG 16-53	059 \$T01 35 46		060 *LBL1 21 01						
003 PZS 16-51	061 RCL1 36 45		062 X=0? 16-43						
004 CLRG 16-53	063 \$T04 22 04		064 RCL1 36 01						
005 2 02	065 = -24		066 EEX -23						
006 \$T01 35 46	067 2 02		068 x -35						
007 0 00	069 \$SB2 23 02		070 ISZ1 16 26 46						
008 RTN 24	071 2 02		072 1 01						
009 *LBLB 21 12	073 RCL1 36 46		074 XZY? 16-35						
010 \$T0E 35 15	075 \$T01 22 01		076 *LBL4 21 04						
011 RTN 24	077 1 01	078 0 00	Last output is 100 - you are done!						
012 *LBLC 21 13	079 0 00	080 \$SB2 23 02							
013 \$T0D 35 14	081 RTN 24	082 *LBL2 21 02		Test print/pause flag.					
014 RTN 24	083 F0? 16 23 00	084 \$T03 22 03							
015 *LBLD 21 14	085 R/S 51	086 RTN 24							
016 \$T0C 35 13	087 *LBL3 21 03	088 PRTX -14							
017 RTN 24	089 RTN 24	090 *LBLc 21 16 15							
018 *LBLE 21 15	091 F0? 16 23 00	092 \$T00 22 00							
019 \$SB5 23 05	093 SF0 16 21 00	094 1 01							
020 \$T01 35 45	095 RTN 24	096 *LBL0 21 00							
021 \$T+0 35-55 00	097 CF0 16 22 00	098 0 00	Print/pause flag set and unset.						
022 \$T+1 35-55 01	099 RTN 24	100 *LBLd 21 16 14							
023 ISZ1 16 26 46	101 \$SZ1 16 25 46	102 0 00							
024 2 02	103 \$T01 35 45	104 \$SB5 23 05							
025 2 02	105 \$T-0 35-45 00	106 \$T-1 35-45 01							
026 RCL1 36 46	107 RCL0 36 00	108 R/S 51							
027 XZY? 16-34									
028 \$T0D 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 RCLC 36 15									
037 EEX -23									
038 2 02									
039 = -24									
040 x -35									
041 - -45									
042 RCLD 36 14									
043 x -35									
044 RTN 24									
045 *LBLa 21 16 11									
046 RCL0 36 00									
047 ENT+ -21									
048 CLX -51									
049 \$T00 35 00									
050 XZY -41									
051 \$SB2 23 02									
052 RTN 24									
053 *LBLb 21 16 12									
054 RCL1 36 01									
055 \$SB2 23 02									
056 RTN 24									
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.	F Control				

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LABELS					FLAGS	SET STATUS		
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			

ON OFF	TRIG	DISP
0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

## 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 F3P 16 23 03		060 . -62	
005 GT0c 22 16 13		061 0 00	
006 GT0A 22 11		062 5 05	
007 *LBLC 21 16 13	Display SS No.	063 2 55	
008 RCL1 36 46		064 RND 16 24	Σ FICA
009 GSB9 23 09	Display marital status.	065 ST+5 35-55 05	Net pay-FICA
010 RCLC 36 15		066 ST-9 35-45 09	-----
011 GSB9 23 09		067 GSB9 23 09	California SDI tax base
012 RCLB 36 12	Display number of exemptions.	068 *LBL2 21 02	
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	Gross > 9000?
017 x -35		073 X>Y? 16-34	
018 RND 16 24		074 GT06 22 06	(Wage) 1%
019 ST01 35 01		075 RCL1 36 01	
020 ST09 35 09		076 *LBL4 21 04	
021 ST+0 35-55 00		077 1 01	
022 GSB9 23 09		078 2 55	Σ SDI
023 RTN 24		079 RND 16 24	Net pay-SDI
024 *LBLC 21 13	#hrs x OT wage	080 ST+6 35-55 06	
025 RCLD 36 14		081 ST-9 35-45 09	Net pay-Const. 1
026 x -35		082 GSB9 23 09	
027 RND 16 24		083 *LBL5 21 05	Net Pay - Wage x Const. 2
028 ST+0 35-55 00		084 RCL7 36 07	
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	
032 GSB9 23 09		088 RCL0 36 00	
033 RTN 24		089 2 55	
034 *LBLO 21 14	Fed'l. tax	090 RND 16 24	
035 ST02 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 RCL4 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 ST02 35 02	State tax	098 CF3 16 22 03	
043 ST+4 35-55 04	Tot. State tax	099 GSB9 23 09	DONE!
044 ST-9 35-45 09	Net pay-State tax	100 RTN 24	
045 RCL2 36 02		101 *LBL2 21 00	
046 GSB9 23 09	Display State tax	102 X>Y -41	Gross-15300
047 RTN 24		103 -45	
048 *LBL4 21 16 11		104 RCL1 36 01	Wage > Gross-15300?
049 1 01		105 X>Y? 16-34	
050 5 05		106 GT01 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 GT02 22 02	
054 RCL0 36 00	Gross > 15300?	110 *LBL1 21 01	Amount to apply to FICA tax is
055 X>Y? 16-34		111 X>Y -41	wage - (Gross - 15300)
056 GT00 22 00		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	GT03	22	03				
114	*LBL6	21	06				
115	XZY	-41		Gross-9000			
116	-	-45					
117	RCL1	36	01	Wage > Gross-9000?			
118	XZY?	16	34				
119	GT07	22	07	No more SDI to withhold;			
120	0	00		continue.			
121	GSB9	23	09				
122	GT05	22	05	-----			
123	*LBL7	21	07	Amount to apply to SDI			
124	XZY	-41		tax is Wage-(Gross-9000)			
125	-	-45					
126	GT04	22	04	-----			
127	*LBL6	21	16	15			
128	F0?	16	23	00	Set and unset print/pause		
129	GT01	22	01		flag.		
130	SF0	16	21	00			
131	1	01					
132	RTN	24					
133	*LBL1	21	01		-----		
134	CF0	16	22	00			
135	0	00		Print command			
136	RTN	24					
137	*LBL2	21	09				
138	F0?	16	23	00			
139	GT08	22	08				
140	R/S	51					
141	RTN	24					
142	*LBL8	21	08				
143	PRTX	-14					
144	RTN	24		-----			
145	*LBL6	21	16	12	Gross		
146	RCL0	36	00				
147	GSB9	23	09				
148	RCL3	36	03	Total Fed'l.			
149	GSB9	23	09				
150	RCL4	36	04	Total State			
151	GSB9	23	09				
152	RCL5	36	05	Total FICA			
153	GSB9	23	09				
154	RCL6	36	06	Total SDI			
155	GSB9	23	09				
156	RTN	24					
157	R/S	51					

LABELS				FLAGS		SET STATUS		
A START	B #hrs	C #hrs OT	D Fed'l tax	E State tax	F Print?	FLAGS		TRIG
<sup>a</sup> Net Pay	<sup>b</sup> Totals	<sup>c</sup> Used	<sup>d</sup>	<sup>e</sup> Print?	1	ON OFF		DISP
<sup>0</sup> Used	<sup>1</sup> Used	<sup>2</sup> Used	<sup>3</sup> Used	<sup>4</sup> Used	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
					3	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>





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LABELS					FLAGS	SET STATUS		
A START	B Price	C Received	D Issued	E Ordered	0 Print?	FLAGS	TRIG	DISP
<sup>a</sup> Min. Quant.	<sup>b</sup> LT→SLK	<sup>c</sup> List	<sup>d</sup> Update	<sup>e</sup> Print?	1	0 <input type="checkbox"/> ON <input checked="" type="checkbox"/> OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
<sup>0</sup> Used	<sup>1</sup> Used	<sup>2</sup> Used	<sup>3</sup> Used	<sup>4</sup>	2	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
<sup>5</sup>	<sup>6</sup>	<sup>7</sup>	<sup>8</sup> Used	<sup>9</sup> Used	3 Data?	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

## Appendix A

# MAGNETIC CARD SYMBOLS AND CONVENTIONS

SYMBOL OR CONVENTION	INDICATED MEANING
<p>White mnemonic:</p> <p>x</p> <p><b>A</b></p>	<p>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 <b>A</b>.</p>
<p>Gold mnemonic:</p> <p>y</p> <p>x</p> <p><b>f E</b></p> <p>x <b>↕</b> y</p> <p><b>A</b></p> <p><b>X</b></p> <p><b>A</b></p> <p>(x)</p> <p><b>A</b></p> <p><b>→</b> x</p> <p><b>A</b></p> <p><b>→</b> x, y, z</p> <p><b>A</b></p> <p><b>→</b> x; y; z</p> <p><b>A</b></p> <p><b>→</b> "x," y</p> <p><b>A</b></p> <p><b>↔</b> x</p> <p><b>A</b></p>	<p>Gold mnemonics are similar to white mnemonics except that the gold <b>f</b> key must be pressed before the user definable key. In this case y could be input by pressing <b>f E</b>.</p> <p><b>↕</b> is the symbol for <b>ENTER↕</b>. In this case <b>ENTER↕</b> is used to separate the input variables x and y. To input both x and y you would key in x, press <b>ENTER↕</b>, key in y and press <b>A</b>.</p> <p>The box around the variable x indicates input by pressing <b>STO A</b>.</p> <p>Parentheses indicate an option. In this case, x is not a required input but could be input in special cases.</p> <p><b>→</b> is the symbol for calculate. This indicates that you may calculate x by pressing key <b>A</b>.</p> <p>This indicates that x, y, and z are calculated by pressing <b>A</b> once. The values would be printed in x, y, z order.</p> <p>The semi-colons indicate that after x has been calculated using <b>A</b>, y and z may be calculated by pressing <b>R/S</b>.</p> <p>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.</p> <p>The two-way arrow <b>↔</b> 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.</p>

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<sub>j</sub> = j<sup>th</sup> 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<sub>j</sub> = j<sup>th</sup> 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

$CF_k$  =  $k^{\text{th}}$  cash flow

$NPV_k$  = net present value after  $k^{\text{th}}$  cash flow

#### 4. Direct Reduction Loans—Sinking Fund

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

#### 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:

$k^{\text{th}}$  payment to principal =  $BAL_{K-1} - BAL_K$

$k^{\text{th}}$  payment to interest =  $PMT - (BAL_{K-1} - BAL_K)$

Total payment to interest =  $(K) \times (PMT) - (PV - BAL_K)$

#### 6. Wrap-Around Mortgage

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

#### 7. Constant Payment to Principal Loan Amortization Schedule

where:

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

$K^{\text{th}}$  payment to interest =  $(i) (BAL_{K-1}) = (PMT_i)_K$

$K^{\text{th}}$  total payment =  $CPMT + (PMT_i)_K$

Total interest to payment  $K$  =

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

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

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

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



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

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

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

and

for  $mm \leq 2$

$$x = 0$$

$$z = (yyyy) - 1$$

for  $mm > 2$

$$x = \text{Int}(.4 mm + 2.3)$$

$$z = (yyyy)$$

Int = Integer portion

30/360 Basis

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

$$f(DT) = 360 (yyyy) + 30 mm + z$$

for  $f(DT1)$

$$\text{if } dd_1 = 31 \text{ then } z = 30$$

$$\text{if } dd_1 \neq 31 \text{ then } z = dd_1$$

for  $f(DT2)$

$$\text{if } dd_2 = 31 \text{ and } dd_1 = 30 \text{ or } 31 \text{ then } z = 30$$

$$\text{if } dd_2 = 31 \text{ and } dd_1 < 30 \text{ then } z = dd_2$$

$$\text{if } dd_2 < 31 \text{ then } z = dd_2$$

## 15. Bond Price and Yield

for  $PER > 1$ 

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

where

$$J = 1 - \text{FRAC}(PER)$$

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

i.e., if  $PER = 12.6$ ,  $\text{FRAC}(PER) = .6$ , and  $J = 1 - .6 = .4$   
for  $PER < 1$

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

## 16. Interest at Maturity/Discounted Securities

Price (given yield) =

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

Yield (given price) =

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

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

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

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

## 17. Linear Regression

for

$$y = a + bx$$

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

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

where:

$$\bar{x} = \frac{\sum x_i}{n} \quad \bar{y} = \frac{\sum y_i}{n}$$

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

$n$  = number of data pairs

## Exponential Curve Fit

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

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

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

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

$n$  = number of data pairs

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

### 18. Multiple Linear Regression

$$z = a + bx + cy$$

$$\sum z_i = an + b \sum x_i + c \sum y_i \quad i = 1, 2, \dots, n$$

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

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

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

where:

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

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

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

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

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

## 19. Break Even Analysis

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

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

## 20. Invoicing

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



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