

HEWLETT-PACKARD

# HP-67/HP-97

Business Decisions Pac



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

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

## Table of Contents

Introduction .....	i
Applications Table .....	ii
Contents .....	iii
A Word About Program Usage .....	v

<b>Program</b>	<b>Page</b>
1. Internal Rate of Return .....	<b>01-01</b>
Yield of a sequence of uneven cash flows.	
2. Internal Rate of Return—Groups of Cash Flows .....	<b>02-01</b>
Yield of groups of uneven cash flows.	
3. Discounted Cash Flow Analysis—Net Present Value .....	<b>03-01</b>
Finds the net present value of future cash flows.	
4. Direct Reduction Loans—Sinking Fund .....	<b>04-01</b>
Solves problems when payments are made at the end of the compounding periods (ordinary annuity).	
5. Accumulated Interest/Remaining Balance .....	<b>05-01</b>
Calculates accumulated interest and remaining balance, and generates an amortization schedule(s).	
6. Wrap-Around Mortgage .....	<b>06-01</b>
Calculates yield of wrap-around mortgage.	
7. Constant Payment to Principal Loan .....	<b>07-01</b>
Generates schedule for constant payment to principal loan.	
8. Add-on Rate Installment Loan/Rule of 78's .....	<b>08-01</b>
Calculations involving add-on loans and loans using the rule of 78's.	
9. Savings Plan—Leases .....	<b>09-01</b>
Solves problems involving payments at the beginning of the compounding periods (annuity due), and compounded amounts.	
10. Advance Payments .....	<b>10-01</b>
Payment and yield calculations when additional payments are made in advance.	
11. Savings—Compounding Periods Different from Payment Periods .....	<b>11-01</b>
Calculations when deposits and compounding periods differ.	
12. Simple Interest/Interest Conversions .....	<b>12-01</b>
Simple interest calculations and nominal to effective interest rate conversions.	
13. Depreciation Schedules .....	<b>13-01</b>
Straight line, SOYD, declining balance, and crossover between straight line and declining balance.	
14. Days Between Dates .....	<b>14-01</b>
Calendar routine.	
15. Bond Price and Yield .....	<b>15-01</b>
Calculates price and yield of semiannual coupon bonds.	
16. Interest at Maturity/Discounted Securities .....	<b>16-01</b>
Price or yield of interest at maturity or discounted securities.	

<b>Program</b>	<b>Page</b>
17. Linear Regression—Exponential Curve Fit . . . . .	<b>17-01</b>
Fits a set of data points x, y to a straight line and a curve.	
Determines goodness of fit.	
18. Multiple Linear Regression . . . . .	<b>18-01</b>
Fits a set of data points x, y, z to a straight line. Also determines	
goodness of fit.	
19. Break-even Analysis . . . . .	<b>19-01</b>
Calculates all values for linear break-even chart.	
20. Invoicing . . . . .	<b>20-01</b>
Maintains net line totals, subtotal and grand total for invoicing.	
21. Payroll . . . . .	<b>21-01</b>
Guide for writing a payroll program.	
22. Inventory . . . . .	<b>22-01</b>
Guide for establishing an inventory program.	
Program Listings . . . . .	<b>L00</b>

### **Appendices**

A. Magnetic Card Symbols and Conventions . . . . .	<b>A-1</b>
B. Principal Equations . . . . .	<b>B-1</b>

## 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

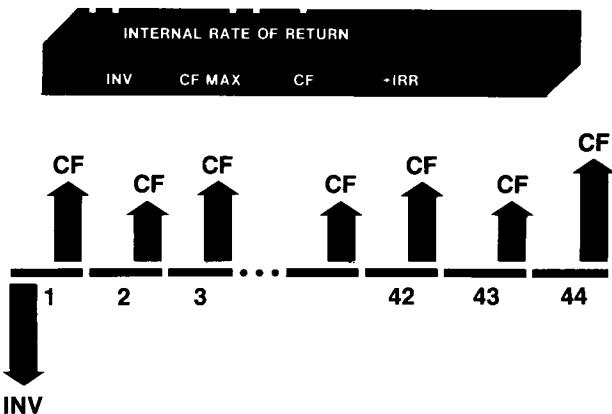


Figure 1

**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  $\pm 0.01\%$  (.0001 decimal). This largest cash flow must be entered again in sequence in step 4. If a cash flow larger than the value entered for CF MAX is keyed in at step 4, erroneous results may occur.

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

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

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

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

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

**Note:**

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

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

**Example 1:**

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

## 01-03

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** →

### Outputs:

12.00 (12 cash flows input)

201 **C** 195 **C** 178 **C** 197 **C**

210 **C** 220 **C** 206 **C** 194 **C**

187 **C** 190 **C** 201 **C** 35000 **C** →

24.00 (all cash flows input)

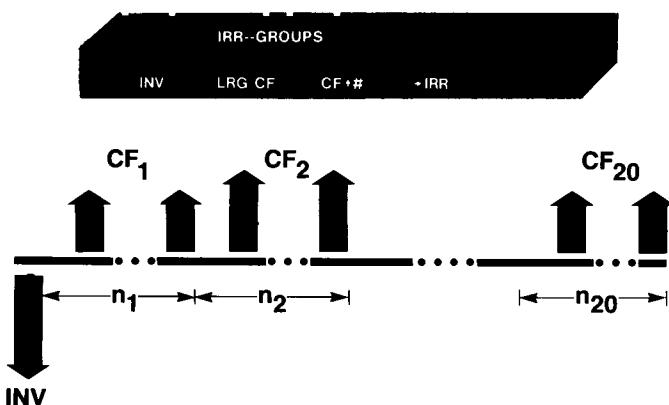
**D** →

1.15 (monthly IRR)

12 **x** →

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** **4** 5 **C**  
 7500 **ENTER** **4** 4 **C**  
 6000 **ENTER** **4** 4 **C**  
 7500 **ENTER** **3** 3 **C**  
 5000 **ENTER** **7** 7 **C**

**Outputs:**

5.0000 (5 groups of cash flows entered)  
**D** → 15.2681 (annual IRR of 15.2681%)

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

**Example 2:**

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

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

What is the expected rate of return?

**Keystrokes:**

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

**Outputs:**

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.	#	C	#
5	Key in cash flow amount(s) and calculate net present value.	CF	D	NPV
6	Optional: Display total number of cash flows entered so far.		E	n
7	For next cash flow(s) go to step 4.			
8	For a new case go to step 2.			

### Example 1:

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

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

### Keystrokes:

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)

### Outputs:

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:

<b>PURCHASE</b>		<b>Net Cash Cost</b>
<b>Year</b>		
1		\$ 533
2		948
3		1,375
4		1,815
5		<u>2,270</u>
Total Net Cash Cost		\$6,941

<b>LEASE</b>		<b>Net Cash Cost</b>
<b>Year</b>		
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?

**Keystrokes:**

PURCHASE

0 A 15 B 533 D 948 D

1375 D 1815 D 2270 D → 4250.71

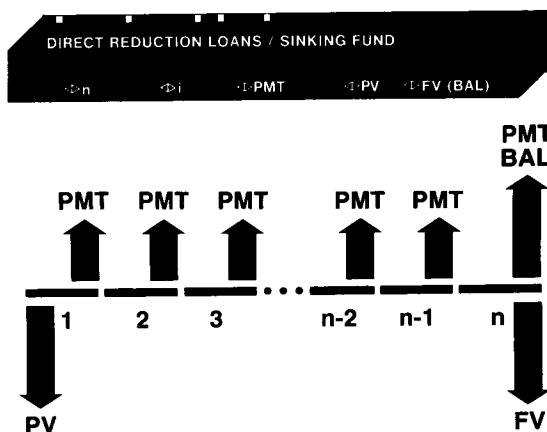
**Outputs:**

LEASE

0 A 5 C 1310 D → 4391.32

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

## DIRECT REDUCTION LOANS SINKING FUND



**Figure 3**

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

The following variables may be inputs or outputs:

- n is the number of compounding periods. (For a 30 year loan with monthly payments  $n = 12 \times 30 = 360$ .)
- 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 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, 9 1/4% mortgage. What is the largest such mortgage he can obtain?

**Keystrokes:**

f A

368.21 C

30 ENTER 12 x A

**Outputs**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:**

f A

30 ENTER 12 x A

50000 D

320 C B

**Outputs:**0.55 (monthly percentage  
rate)

12 x

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 →

**Outputs:**

175.33 (monthly payment)

Now determine the purchase price of the note.

13 ENTER 12 ÷ B

D →

8734.26 (purchase price)

**Example 5:**

A borrower is charged 2 points for the issuance of his mortgage and note. If the mortgage amount is \$60,000 for 30 years, and the interest rate is 8 3/4% per year, with monthly payments, what annual percentage rate (APR) is the borrower paying? (1 point is equal to 1% of the mortgage amount.)

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

First calculate the periodic payment amount.

f A 60000 D

30 ENTER 12 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)

**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

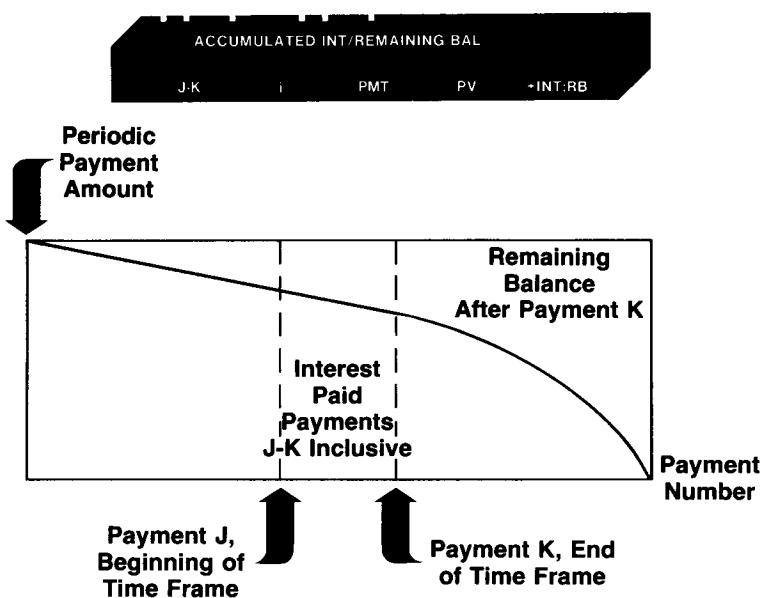


Figure 4

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</b> <b>E</b>	1.00 or 0.00
3	Key in <ul style="list-style-type: none"> <li>• Starting period number</li> <li>• Ending period number</li> <li>• Periodic interest rate</li> <li>• Periodic payment amount</li> <li>• Initial loan amount</li> </ul>	J K i (%) PMT PV	<b>A</b> <b>A</b> <b>B</b> <b>C</b> <b>D</b>	J K i (%) PMT 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> <b>R/S</b>	INT BAL
	<i>OR</i>			
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</b> <b>A</b>	J

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
6	Calculate amount paid to interest for period J.			
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. If $J \leq K$ , go to step 6 for next period's values. Otherwise, stop.		R/S	$J + 1$
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 $\downarrow$  12 ÷ B

167.84 C 20000 D E

**Outputs:**

449.60 (interest paid in 1975)

R/S

19946.08 (remaining balance at the end of 1975)

4 A 15 A E

1785.89 (interest paid in 1976)

R/S

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** →

**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>	<b>ENTER</b>	PV <sub>1</sub>
	● Periodic payment	PMT <sub>1</sub>	<b>ENTER</b>	PMT <sub>1</sub>
	● Number of periods remaining	n <sub>1</sub>	<b>A</b>	n <sub>1</sub>
3	Key in the following information from the wrap-around mortgage: ● Total wrap-around amount	PV <sub>2</sub>	<b>ENTER</b>	PV <sub>2</sub>
	● Periodic payment on wrap- around	PMT <sub>2</sub>	<b>ENTER</b>	PMT <sub>2</sub>
	● Number of periods in term of wrap-around	n <sub>2</sub>	<b>C</b>	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	D	BAL
5	Calculate the periodic yield of the wrap-around to the lender.		E	Yield (%)
6	Optional: If a payment amount is not known, it may be calculated by keying in:			
	• Total number of periods	n	f A	n
	• Periodic interest rate	i (%)	f B	i (%)
	• Loan amount	PV	f D	PV
7	Calculate periodic payment		f C	PMT
	The payment is stored in $R_C$ , and may be recalled at a later time.		RCL C	PMT

### Example 1:

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

#### Keystrokes:

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 **x** 

14.50 (% effective yield)

## 06-03

### Note:

Recalling a number causes the stack to lift unless the preceding keystroke was **ENTER**, **CLx**, or  **$\Sigma+$** . 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,  $9\frac{1}{2}\%$  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** →

#### Outputs:

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

**R/S** →

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

**R/S** →

95000.00 (remaining balance)

## 07-03

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

### Example 2:

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

#### Keystrokes:

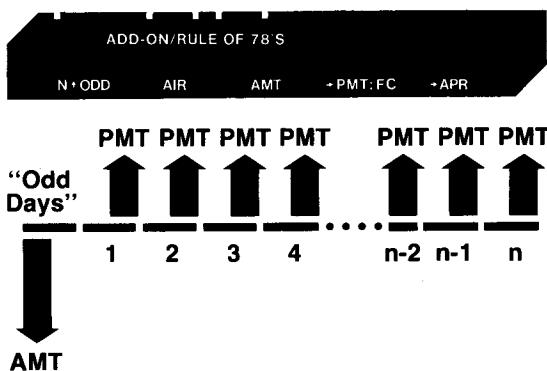
8 **B** 5000 **C** 100000 **D**

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

**Example 1:**

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

**Keystrokes:**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

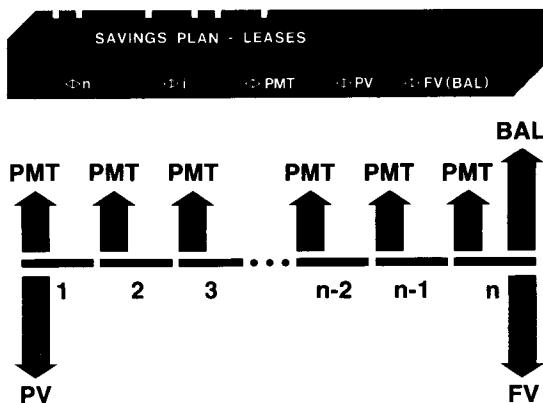


Figure 6

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>I</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:**

f A  
 10000 E 8 ENTER 4 x A →  
 6000 D B →  
 4 x →

**Outputs:**

32.00 (quarters)  
 1.61 (% quarterly interest rate)  
 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:**

f A 375 C 35000 D  
 8 ENTER 12 ÷ B A →  
 12 ÷ →

**Output:**

144.87 (number of months)  
 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:**

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 →

**Outputs:**

3040.86 (present value when annuity commences)

Now find the present value of the annuity today.

**Keystrokes:** **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 nth 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.			
			f B	i (%)
			f C	PMT
6	For a new case, go to 2 and change the appropriate values.			

**Example 1:**

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

**Keystrokes:**

60 **ENTER** 3 **A**  
 25000 **D** 600 **f** **B** 12 **X** → 17.33 (% annual yield)

**Outputs:****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:**

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

**Outputs:**

## SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

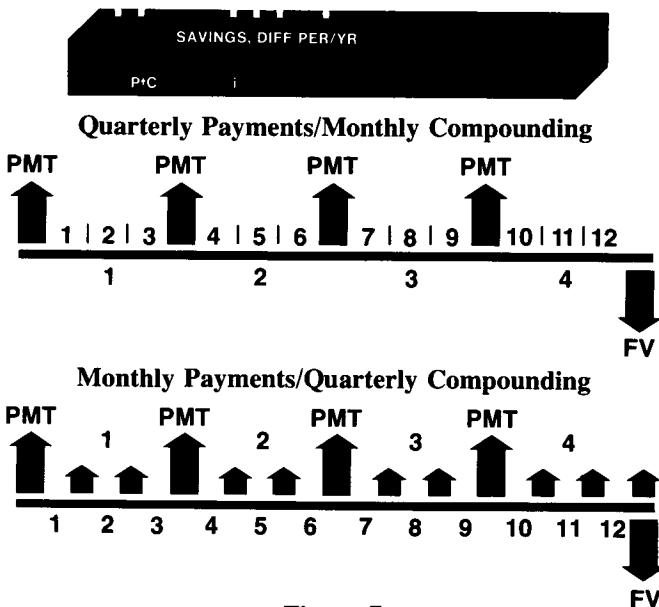


Figure 7

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 compounding 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 and two of the following: • Total number of payments • Periodic payment amount • Final amount (future value)	i (%) n PMT FV	[B] [f A] [f C] [f E]	i (%) n PMT FV
5	Calculate the remaining value • Total number of payments • Periodic payment amount • Final amount (future value)		[f A] [f C] [f E]	n PMT 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] →

0.33

5 [ENTER] 12 [÷] [B]

7 [ENTER] 4 [×] [f A]

95 [f C] [f E] →

3203.59 (amount after 7 years)

**Outputs:****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] →

3.00

5.25 [ENTER] 4 [÷] [B]

2 [ENTER] 12 [×] [f A]

4000 [f E] [f C] →

**Outputs:**

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	f A	C/YR
	• Annual nominal rate	NOM (%)	f B	NOM (%)
	• Annual effective rate	EFF (%)	f C	EFF (%)
7	Calculate the remaining rate			
	• Annual nominal rate		f B	NOM (%)
	• Annual effective rate		f C	EFF (%)
	Go to step 6 for new data.			
8	Key in one of the following:			
	• Annual nominal rate	C NOM (%)	f D	C NOM
	• Annual effective rate (for continuous compounding).	C EFF (%)	f E	C EFF
9	Calculate the remaining rate			
	• Annual nominal rate		f D	C NOM (%)
	• Annual effective rate (for continuous compounding).		f E	C EFF (%)
10	For continuous compounding on a 365/360 day basis key in:			
	• Annual nominal rate	C NOM (%)		
11	Calculate the continuous effective rate (365/360 basis).		GSB 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 →

**Outputs:**

0.00

30000 C 8 B 90 A D →

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** → 12.41 (% nominal interest rate)

**Outputs:****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** → 5.13 (an annual effective rate of 5.13%)

**Outputs:****Example 4:**

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

**Keystrokes:**

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

**Outputs:**

## DEPRECIATION SCHEDULES



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

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

Values for the last year of an asset with fractional years life (i.e., the 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 **D** key). The program makes no checks on this value and generates invalid results if other than whole numbers are entered.

### Straight Line Depreciation

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

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

### Sum of the Years' Digits Depreciation

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

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

## Variable Rate Declining Balance Depreciation

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

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

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

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

### Crossover Point

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

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

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

1. Use F D to determine the "crossover point" and associated values.

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

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

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
2	Optional: Select print mode		<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		f B	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and 4 and change appropriate inputs.			
7	Calculate the declining balance schedule (the appropriate factor must be entered).	FACT	STO E	FACT
			f C	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and 4 and change appropriate inputs.			
8	To find crossover point the declining balance factor must be stored.	FACT	STO E	FACT
9	Calculate last year to use declining balance method.		f D	LAST YEAR
10	Calculate remaining life.		R/S	REM LIFE
11	Calculate remaining book value.		R/S	RBV

**Example 1:**

For a starting book value of \$375,000, a salvage value of \$30,000 and an expected life of 40 years, generate the 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 <b>STO</b> <b>D</b> <b>f</b> <b>A</b> →	15.00 (15 <sup>th</sup> year)
<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 <b>STO</b> <b>D</b> <b>f</b> <b>B</b> →	1.00 (1 <sup>st</sup> year)
<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)

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:

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)

Outputs:

**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 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 D f 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 A 22 STO C</b>	
1 <b>STO D f 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	<b>A</b>	DT 1
	• Latest date (DT 2)	MM/DDYYYY	<b>B</b>	DT 2
3	Calculate the number of days between the two dates on an "actual" day basis.		<b>C</b>	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.			
5	For a new case, go to step 2 and change DT 1 and/or DT 2 as appropriate.		D	30/360 Days

**Example 1:**

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

**Keystrokes:**

6.241974 A 12.051985 B C → 4182.00 (actual)

**Outputs:****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 → 5749.00 (actual)

**Outputs:****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 → 2011.00 (actual)

**Outputs:**

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 B).

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 reemptions 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	A	PER
	• Annual coupon rate	CR (%)	B	CR (%)
	• Redemption value if other than 100.	RV	D	RV
4	To determine the yield, key in the bond price.	PRICE	E	PRICE
5	Calculate the annual yield.		C	YLD (%)
6	To find the price, key in the annual yield rate.	YLD (%)	C	YLD (%)
7	Calculate the "flat" price.		E	PRICE
8	Optional: Recall the accrued interest AND add it to the "flat" price to obtain total bond value as of the settlement date.		RCL B +	ACC INT 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:**

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:**

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:**

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 **X** **B** 5.5 **ENTER**2 **X** **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** → 2241.00 (days settlement to call)

Enter Program BD-15

5 **B** 101 **D** 99 **E** **C** → 5.33 (% yield-to-call)

Enter program BD-14

2.061993 **B** **D** → 6921.00 (days settlement to maturity)

Enter program BD-15

5 **B** 99 **E** **C** → 5.08 (% yield-to-maturity)**Example 7:**

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

**Keystrokes:**

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

5 **ENTER** **ENTER** .4 **X** **-** **B** → 3.00 (net after tax coupon)

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

100 <b>ENTER</b> <b>ENTER</b> 99 <b>-</b> →	1.00 (capital gain)
.25 <b>X</b> →	0.25 (capital gains tax)
<b>-</b> <b>D</b> →	99.75 (net proceeds from bond redemption)

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

<b>C</b> →	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	E	PRICE
7	Calculate either or both		D	YLD (%)
			E	PRICE

**Example 1:**

Find the yield of the following interest at maturity security:

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

**Keystrokes:**

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** →

**Outputs:**

98.74 (price)

**f** **D** →

5.67 (% yield)

**Example 4:**

Find the yield of the following discounted security:

DSM = 307

Price = 96.27

**Keystrokes:**

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

**f** **D**

**Outputs:**

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 C	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 <sub>k</sub> , y <sub>k</sub> )	x <sub>k</sub>	ENTER	
		y <sub>k</sub>	f B	# entries - 1
6	If data is evenly spaced, key in			

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

**Example 1:**

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

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

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

A  → 0.00  
47500 C  → 1.00

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

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

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

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

5	D	→	70250.00 (projected value at 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	→	0.00			
1	ENTER	52.5	B	→	1.00
2	ENTER	55.25	B	→	2.00
4	ENTER	75	B	→	3.00 (total number of entries)
f	A	→	42.63 (linear a)		
R/S		→	7.84 (linear b)		
R/S		→	0.95 (linear $r^2$ )		
R/S		→	45.06 (exponential a)		
R/S		→	0.12 (exponential b)		
R/S		→	0.96 (exponential $r^2$ )		
R/S		→	13.17 (percent annual growth rate)		

The exponential curve gives a better fit.

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

## MULTIPLE LINEAR REGRESSION



This program performs a least squares multiple linear regression for a series of data points  $x$ ,  $y$ ,  $z$ . Linear regression is a statistical method for finding a straight line that best fits a set of data points. The equation of this straight line expresses the linear relationship between independent ( $x$  and  $y$ ) and dependent ( $z$ ) variables and is of the 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	$x$ $y$ $z$	<b>ENTER</b> <b>ENTER</b> <b>B</b>	1.00 or 0.00 # 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 y z	ENTER+ ENTER+ f A	
7	Calculate coefficients:  If the print/pause mode is on (1.00), b and c are automatically calculated.		C R/S R/S	a b c
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 y	ENTER+ E	$\hat{z}$
10	For a new case, go to step 2.			

### Example 1:

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

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

## Keystrokes:

## Outputs:

A 70 ENTER  $\downarrow$  70.8 ENTER  $\downarrow$  101000 B

90 ENTER  $\downarrow$  60 ENTER  $\downarrow$  82190 B

85 ENTER  $\downarrow$  90 ENTER  $\downarrow$  170000 B

40 ENTER  $\downarrow$  70 ENTER  $\downarrow$  100000 B

100 ENTER  $\downarrow$  60 ENTER  $\downarrow$  90000 B  $\rightarrow$  5.00 (number of entries)

C  $\longrightarrow$  -118499.03 (a)

R/S  $\longrightarrow$  314.71 (b)

R/S  $\longrightarrow$  2892.02 (c)

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

D  $\longrightarrow$  0.98 ( $r^2$ )

50 ENTER  $\downarrow$  70 E  $\longrightarrow$  99678.08 (value of  $50 \times 70$  foot lot)

75 ENTER  $\downarrow$  80 E  $\longrightarrow$  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!

## BREAK-EVEN ANALYSIS

### BREAK-EVEN ANALYSIS

• F

• P

• V

• U

• GP

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

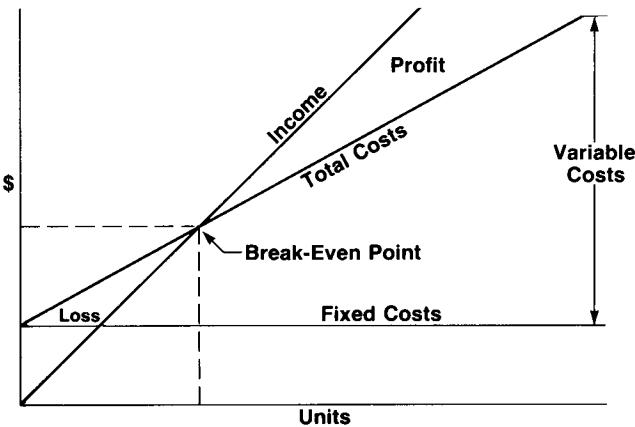


Figure 8

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

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

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

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

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

### Example 1:

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

#### Fixed Costs

Typesetting	\$ 4,000
Graphics production	5,000
Printing and binding	3,000
Total fixed costs	<u><u>\$12,000</u></u>

#### Variable costs per copy

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

Sales price per copy	<u><u>\$13.00</u></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	D	PRICE
5	Calculate net line total		E	NLT
6	Optional: Display running subtotal		F A	ST
7	Optional: Display running grand total		F B	GT
8	Display each line total's percent of the grand total		F C	% T <sub>1</sub>
	Use R/S if print/pause mode is off (0.00).		R/S	% T <sub>2</sub>
			R/S	% T <sub>3</sub>
			etc.	
9	If last net line total was incorrect		F D	ST
10	For additional items, same grand total, go to step 4 and change appropriate inputs. For a new case (clear everything)			
	go to step 3.			

### Example 1:

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

#### Bill 1 (2% discount if paid today)

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

#### Bill 2 (2% discount if paid today)

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

## Bill 3 (3% discount if paid today)

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

## Keystrokes:

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

## Outputs:

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

## PAYROLL



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

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

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

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

The number of regular hours worked (#hrs), and the number of hours of overtime (#hrs OT), are input by pressing **B** and **C** respectively. Federal (FEDL) and state (STATE) taxes are input by pressing **D** and **E**. The net pay key (**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:**

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

**Outputs:**

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</b> <b>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>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



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:

- $R_0$  → Part number (10 digit maximum)
- $R_1$  → 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 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 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.

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

## INTERNAL RATE OF RETURN

001	#LBLA	21 11	Clear registers	057	RCLI	36 46		
002	CLRG	16 53		058	1	01		
003	PCS	16-51		059	0	00		
004	CLRG	16-53	INV→RE	060	1	01		
005	STOE	35 15		061	X	-35		
006	CF0	16 22 00		062	STOI	35 46		
007	CF1	16 22 01		063	RTN	24		
008	RTN	24		064	*LBLB	21 16 15		
009	#LBLB	21 12		065	F0?	16 23 00		
010	2	02	Input largest cash flow if	066	GT08	22 00		
011	X	-35	#CFs > 22.	067	INT	16 34		
012	ST08	35 00		068	EEX	-23		
013	RCLE	36 15		069	5	05		
014	X <sup>2</sup> Y	-41		070	÷	-24		
015	÷	-24	INV/2 CMAX→RE	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 <sub>a</sub>	23 16 11	Set-up I	NN
021	RTN	24		077	RCLI	36 46		
022	#LBLC	21 13		078	EEX	-23		
023	ISZI	16 26 46		079	2	02		
024	F0?	16 23 00		080	÷	-24		
025	GSB <sub>c</sub>	23 16 13		081	STOI	35 46	N.N→I	
026	ST+I	35-55 45		082	1	01		
027	X <sup>2</sup> Y	-41		083	.	-62		
028	RCLI	36 46	Display # of cash flows (add	084	0	00		
029	F1?	16 23 01	if > 22 CF).	085	1	01	1 + i <sub>0</sub> → R <sub>0</sub>	
030	+	-55		086	ST08	35 14		
031	RTN	24		087	*LBL4	21 04		
032	#LBLc	21 16 13		088	CF0	16 22 00		
033	2	02		089	0	00		
034	3	03		090	ST08	35 00		
035	RCLI	36 46		091	#LBL5	21 05		
036	X <sup>2</sup> Y?	16-32	23 <sup>rd</sup> cash flow?	092	RCLI	36 46		
037	GT08	22 00		093	INT	16 34		
038	1	01		094	F1?	16 23 01	Get j	
039	STOI	35 46	Reset I	095	GSB <sub>d</sub>	23 16 14		
040	+	-55		096	RCLI	36 45		
041	CLX	-51	Drop stack and clear x.	097	F1?	16 23 01		
042	EEX	-23		098	GSB <sub>e</sub>	23 16 15	Unpack CF <sub>j</sub>	
043	5	05		099	ST+0	35-55 00		
044	ST+0	35-24 00	2 CMAX/10 <sup>5</sup> →R <sub>0</sub>	100	X	-35		
045	SF1	16 21 01		101	+	-55	f(i) in R <sub>0</sub>	
046	#LBL0	21 00		102	RCLD	36 14		
047	R <sub>0</sub>	-31		103	ST+0	35-24 00		
048	1	01		104	÷	-24		
049	-	-45		105	DSZI	16 25 46		
050	X <sup>2</sup> Y	-41		106	GT05	22 05		
051	RCL0	36 00	Scale cash flow	107	F1?	16 23 01		
052	÷	-24		108	GT08	22 00		
053	F1?	16 23 01	If CF <sub>j</sub> , j > 22, drop fractional part of CF <sub>j</sub> .	109	#LBL6	21 06		
054	INT	16 34		110	RCL8	36 08		
055	RTN	24		111	RCLE	36 15		
056	#LBLa	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 <sub>0</sub>	E Used		I Used		

113	X <sup>2</sup> Y	-41							
114	÷	-24							
115	RCLD	36 14	$\frac{f}{f'}$	(1 + i)					
116	X	-35							
117	RCLD	36 14							
118	X <sup>2</sup> Y	-41							
119	+	-55		(1 + i) next					
120	STO0	35 14							
121	LSTX	16-63							
122	ABS	16 31							
123	EEX	-23							
124	CHS	-22							
125	5	85							
126	X <sup>2</sup> Y?	16-34							
127	GT07	22 87		←DONE!					
128	GSB <sub>a</sub>	23 16 11							
129	GT04	22 84							
130	*LBL0	21 00							
131	F0?	16 23 00							
132	GT06	22 06							
133	SF0	16 21 00							
134	GSB <sub>b</sub>	23 16 12							
135	GT05	22 05							
136	*LBLb	21 16 12		Loop back for lower 22 CFs					
137	2	02							
138	2	02							
139	RCLI	36 46							
140	+	-55							
141	STO1	35 46							
142	CLK	-51							
143	+	-55							
144	RTN	24							
145	*LBLd	21 16 14		Add 22 if flag 0 clear.					
146	2	02							
147	2	02							
148	F0?	16 23 00							
149	CLX	-51							
150	+	-55							
151	RTN	24							
152	*LBL7	21 07							
153	RCLD	36 14		Reset R <sub>1</sub> for another pressing of <b>D</b>					
154	1	81							
155	-	-45							
156	STO0	35 14							
157	EEX	-23							
158	2	02							
159	x	-35							
160	RCLI	36 46							
161	LSTX	16-63							
162	x	-35							
163	STO1	35 46							
164	X <sup>2</sup> Y	-41							
165	RTN	24							
166	R/S	51							
LABELS									
FLAGS									
SET STATUS									
A	INV	B CF MAX	C CF	D -IRR	E	0 > 22 CFs	FLAGS	TRIG	DISP
a	Used	b Used	c Used	d Used	e Used	1 Used	ON OFF	DEG	FIX
0	Used	1	2	3	4 Used	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD	SCI
5	Used	6 Used	7 Used	8	9	3	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD	ENG
							2 <input type="checkbox"/> <input checked="" type="checkbox"/>		
							3 <input type="checkbox"/> <input checked="" type="checkbox"/>		
							n <u>2</u>		

# INTERNAL RATE OF RETURN—GROUPS OF CASH FLOWS

$\begin{array}{l} 001 \#LBLA 21 11 \\ 002 CLRG 16-53 \\ 003 STOE 35 15 \\ 004 1 .01 \\ 005 STOD 35 14 \\ 006 X2Y -.41 \\ 007 RTN .24 \\ 008 \#LBLB 21 12 \\ 009 ABS 16 31 \\ 010 EEX -.23 \\ 011 7 .07 \\ 012 = -.24 \\ 013 LOG 16 32 \\ 014 INT 16 34 \\ 015 X2Q? 16-45 \\ 016 CLX -.51 \\ 017 10x 16 33 \\ 018 STOD 35 14 \\ 019 RCLC 36 15 \\ 020 X2Y -.41 \\ 021 = -.24 \\ 022 STOE 35 15 \\ 023 RTN .24 \\ 024 \#LBLC 21 13 \\ 025 ISZI 16 26 46 \\ 026 RCLC 36 13 \\ 027 X2Y -.41 \\ 028 + -.55 \\ 029 STOC 35 13 \\ 030 CLX -.51 \\ 031 LSTX 16-63 \\ 032 X -.35 \\ 033 ST+0 35-55 06 \\ 034 LSTX 16-63 \\ 035 = -.24 \\ 036 LSTX 16-63 \\ 037 EEX -.23 \\ 038 2 .02 \\ 039 = -.24 \\ 040 X2Y -.41 \\ 041 RCLD 36 14 \\ 042 = -.24 \\ 043 INT 16 34 \\ 044 X2Q? 16-45 \\ 045 SF0 16 21 00 \\ 046 ABS 16 31 \\ 047 + -.55 \\ 048 F0? 16 23 00 \\ 049 CHS -.22 \\ 050 LSTX 16-63 \\ 051 X=0? 16-43 \\ 052 GS85 23 05 \\ 053 ENT† -.21 \\ 054 ABS 16 31 \\ 055 = -.24 \\ 056 X -.35 \end{array}$		$\begin{array}{l} 057 ST01 35 45 \\ 058 RCLI 36 46 \\ 059 CF0 16 22 00 \\ 060 RTN .24 \\ 061 \#LBLD 21 16 14 \\ 062 GS83 23 03 \\ 063 0 .00 \\ 064 STOC 35 13 \\ 065 GT07 22 07 \\ 066 \#LBLD 21 14 \\ 067 RCLI 36 46 \\ 068 GS83 23 03 \\ 069 \#LBL7 21 07 \\ 070 1 .01 \\ 071 . -.62 \\ 072 0 .00 \\ 073 1 .01 \\ 074 GS86 23 16 13 \\ 075 GT08 22 08 \\ 076 \#LBL1 21 01 \\ 077 RCLB 36 00 \\ 078 GS8e 23 16 15 \\ 079 STOC 35 13 \\ 080 \#LBL8 21 00 \\ 081 RCLB 36 12 \\ 082 RCLB 36 00 \\ 083 STOB 35 12 \\ 084 - -.45 \\ 085 RCLD 36 14 \\ 086 RCLC 36 13 \\ 087 STOD 35 14 \\ 088 - -.45 \\ 089 \div -.24 \\ 090 X -.35 \\ 091 ST-0 35-45 00 \\ 092 RCLB 36 00 \\ 093 = -.24 \\ 094 RND 16 24 \\ 095 X#0? 16-42 \\ 096 GT01 22 01 \\ 097 RCLB 36 00 \\ 098 1 .01 \\ 099 - -.45 \\ 100 EEX -.23 \\ 101 2 .02 \\ 102 X -.35 \\ 103 RTN .24 \\ 104 \#LBL3 21 03 \\ 105 1 .01 \\ 106 . -.62 \\ 107 0 .00 \\ 108 1 .01 \\ 109 X -.35 \\ 110 ST01 35 46 \\ 111 RTN .24 \\ 112 \#LBLc 21 16 13 \end{array}$			
		$\Sigma n_j CF_j$			
ROUTINE TO SUM CASH FLOWS AND RECALL NUMBER OF GROUPS BEFORE GOING TO ITERATION ROUTINE.					
1 + INITIAL GUESS					
THE SECANT METHOD IS USED TO EVALUATE $f(i)$ .					
REGISTERS					
0 1 + i	1 $CF_1 \cdot n_1$	2 $CF_2 \cdot n_2$	3 $CF_3 \cdot n_3$		
$S_0 CF_{10} \cdot n_{10}$	$S_1 CF_{11} \cdot n_{11}$	$S_2 CF_{12} \cdot n_{12}$	$S_3 CF_{13} \cdot n_{13}$		
$S_4 CF_{14} \cdot n_{14}$	$S_5 CF_{15} \cdot n_{15}$	$S_6 CF_{16} \cdot n_{16}$	$S_7 CF_{17} \cdot n_{17}$		
$S_8 CF_{18} \cdot n_{18}$	$S_9 CF_{19} \cdot n_{19}$				
A $CF_{20} \cdot n_{20}$	B Used	C $f(i_k)$	D $f(i_{k-1})$		
			E Investment		
			F Used		



# DISCOUNTED CASH FLOW ANALYSIS

## NET PRESENT VALUE

LABELS						FLAGS		SET STATUS											
A INV		B i(%)		C #		D NPV		E $\Sigma n$		0 Print?		FLAGS		SET STATUS					
a	b	c	d	e	f	g	h	i	j	0	1	ON	OFF	DEG	FIX	DISP			
0	1	Used	2	Used	3	4	5	6	7	8	9	Used	3	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>	DISP
5	6		7		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"/>	
														3	<input type="checkbox"/>	<input checked="" type="checkbox"/>		n <u>2</u>	

# DIRECT REDUCTION LOANS

## SINKING FUND

REGISTERS									
0	1	2	3 $\pm(PMT/i)$	4 $[1-(1+i)^{-n}]$	5	6 $n(1+i)^{-n}-1$	7 $(1+i)$	8 $(1+i)^{-n}$	9 $i/100$
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A n	B i	C PMT	D PV	E FV(BAL)	F	G	H	I	J 21

001 #LBLA 21 11

002 ST0A 35 11

003 F3? 16 23 03

004 RTN 24

005 GSB0 23 00

006 RCLC 36 15

007 LSTX 16-63

008 - -45

009 RCLD 36 14

010 LSTX 16-63

011 - -45

012 ÷ -24

013 LN 32

014 RCL7 36 07

015 LN 32

016 ÷ -24

017 ST0A 35 11

018 RTN 24

019 #LBLC 21 13

020 ST0C 35 13

021 F3? 16 23 03

022 RTN 24

023 1 01

024 ST0C 35 13

025 GSB0 23 00

026 1/X 52

027 RCLD 36 14

028 RT 16-31

029 - -45

030 x -35

031 ST0C 35 13

032 RTN 24

033 #LBLD 21 14

034 ST0D 35 14

035 F3? 16 23 03

036 RTN 24

037 GSB0 23 00

038 + -55

039 ST0D 35 14

040 RTN 24

041 #LBLE 21 15

042 ST0E 35 15

043 F3? 16 23 03

044 RTN 24

045 GSB0 23 00

046 RCLD 36 14

047 X?Y -41

048 - -45

049 RCLB 36 08

050 ÷ -24

051 ST0E 35 15

052 RTN 24

053 #LBL0 21 00

054 CF1 16 22 01

055 RCLD 36 14

056 X=? 16-43

n→RA  
Digit entered?

Solve for n and store in RA.

PMT→RC  
Digit entered?

Store dummy 1 for PMT.

Solve for PMT and store in RC.

PV+RD  
Digit entered?

Solve for PV and store in RD.

Solve for FV(BAL) and store in RE.

857 SF1 16 21 01

058 1 01

059 RCLB 36 12

060 x 55

061 ST09 35 09

062 + -55

063 ST07 35 07

064 RCLA 36 11

065 CHS -22

066 yx 31

067 ST08 35 08

068 RCLC 36 15

069 x -35

070 1 81

071 RCLB 36 08

072 - -45

073 ST04 35 04

074 RCLC 36 13

075 RCL9 36 09

076 5 -24

077 F1? 16 23 01

078 CHS -22

079 ST03 35 03

080 x -35

081 RTN 24

082 #LBLa 21 16 11

083 CLX -51

084 ST0C 35 13

085 ST0D 35 14

086 ST0E 35 15

087 RTN 24

088 #LBLB 21 12

089 ST0B 35 12

090 F3? 16 23 03

091 RTN 24

092 0 00

093 ST0B 35 12

094 2 02

095 1 01

096 ST0I 35 46

097 RCLC 36 15

098 RCLA 36 11

099 RCLC 36 13

100 x -35

101 + -55

102 RCLD 36 14

103 X=? 16-43

104 GT03 22 03

105 - -45

106 RCLC 36 11

107 ÷ -24

108 RCLD 36 14

109 GT04 22 04

110 #LBL3 21 03

111 RCLC 36 15

112 LSTX 16-63

i/100→R9

(1+i)→R7

(1+i)^-n→R8

1-(1+i)^-n→R4

Calculate  $\pm(PMT/i)$  and store in R3

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

Start by clearing PMT, PV, FV(BAL) registers.

i→R8  
Digit entered?

Clear R8 for sum of i terms.

Store address of R8 in R1 for indirect access.

Start guess of i:  
n PMT + FV(BAL)

If PV = 0 GTO FV(BAL)  
guess  
PV guess for i:  
n PMT + FV(BAL) - PV

n

and recall PV.

FV(BAL) guess for i numerator:

113	-	-45	2(FV(BAL) - n PMT)	169	÷	-24										
114	ENT <sup>†</sup>	-21		170	RND	16 24	If value ≠ 0, loop again.									
115	+	-55		171	X#0?	16-42										
116	RCLA	36 11	and denominator	172	GT06	22 86										
117	1	81	(n - 1) <sup>2</sup> PMT + FV(BAL)	173	RCLB	36 12										
118	-	-45		174	RTN	24										
119	X <sup>2</sup>	53		175	#LBL5	21 85										
120	RCLC	36 13		176	EEX	-23										
121	x	-35		177	2	82										
122	RCL <sup>E</sup>	36 15		178	x	-35										
123	+	-55		179	ST+I	35-55 45										
124	#LBL4	21 84	Guess for i	180	RTN	24										
125	÷	-24	IF guess < -0.9; use -0.9	181	R/S	51										
126	-	-62	for guess													
127	9	89														
128	CHS	-22														
129	X≤Y?	16-35														
130	X≥Y	-41														
131	GSBS	23 85														
132	X=0?	16-43														
133	RTN	24														
134	#LBL6	21 86														
135	GSBS	23 86														
136	+	-55														
137	F1?	16 23 81														
138	CHS	-22														
139	RCLD	36 14														
140	-	-45														
141	RCL8	36 88														
142	RCLA	36 11														
143	RCL7	36 87														
144	÷	-24														
145	x	-35														
146	F1?	16 23 81														
147	CLK	-51														
148	ST06	35 86														
149	F1?	16 23 81														
150	R1	-31														
151	F1?	16 23 81														
152	LSTX	16-63														
153	RCL4	36 84														
154	RCL9	36 89														
155	÷	-24														
156	-	-45														
157	RCLC	36 13														
158	x	-35														
159	RCL9	36 89														
160	÷	-24														
161	RCL6	36 86														
162	RCL <sup>E</sup>	36 15														
163	x	-35														
164	-	-45														
165	±	-24														
166	CHS	-22														
167	GSBS	23 85														
168	RCLB	36 12														
LABELS																
A	n	b	i	C	PMT	D	PV	E	FV(BAL)	0	1	PV = 0	FLAGS	SET STATUS		
a	START	b	c	d	e	f	ON OFF	DEG	X <sup>2</sup>	FIX	K					
b	Calc.	1	2	3	FV guess	4	guess	2		0	□	□	GRAD	□	SCI	□
c	i → %	6	loop	7	8	9	3	Digit?	1	2	□	□	RAD	□	ENG	□
d									3	□	□	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	F02	16 23 00		
004	X <sub>2</sub> Y	-41	K→R <sub>0</sub>	060	SPC	16-11		
005	ST08	35 00		061	GSB9	23 09		
006	RTN	24		062	1	01	J	
007	*LBLB	21 12	-----	063	RCL1	36 01		
008	EEX	-23		064	+	-55		
009	2	02	i/100→R <sub>1</sub>	065	ST08	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	RCL8	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	X <sub>2</sub> Y	-41		
023	RCL7	36 07		079	-	-45	INTJ	
024	X <sub>2</sub> Y?	16-35		080	GSB9	23 09		
025	GT08	22 00		081	RCL6	36 06		
026	ST00	35 00		082	GSB9	23 09	PRINCJ	
027	R4	-31		083	RCL4	36 04		
028	ST07	35 07		084	GSB9	23 09	RBALJ	
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	RCL8	36 00		
040	-	-45		096	RCL7	36 07		
041	GSB1	23 01	-BAL <sub>J-1</sub>	097	X <sub>2</sub> Y?	16-35	J ≤ K?	
042	CHS	-22		098	GT0a	22 16 11		
043	RCL4	36 04		099	RTN	24		
044	+	-55		100	*LBL1	21 01		
045	ST06	35 06	BAL <sub>K</sub> - BAL <sub>J-1</sub> →R <sub>6</sub>	101	CHS	-22		
046	RCL8	36 00		102	x	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		110	RCL3	36 03		
055	RCL4	36 04	INT <sub>J-K</sub>	111	+	-55		
056	R/S	51	BAL <sub>K</sub>	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	F	G	H	I	J	

113 $\div$ -24 114 RTN 24 115 *LBL <sub>e</sub> 21 16 15 116 F0? 16 23 00 117 GT02 22 02 118 SF0 16 21 00 119 1 01 120 RTW 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						RND may be inserted here. ----- Print mode option.				

## WRAP-AROUND MORTGAGE

001	#LBLA	21 11		057	x	-35		
002	CLRG	16 53	-n <sub>1</sub> → R <sub>1</sub>	058	+	-55		
003	CHS	-22	PMT <sub>1</sub> → R <sub>3</sub>	059	RCL5	36 05		
004	ST01	35 01	-PV <sub>1</sub> → R <sub>5</sub>	060	RCL6	36 06		
005	R4	-31		061	x	-35		
006	ST03	35 03		062	-	-45		
007	R4	-31		063	STO1	35 46	f(x)	
008	CHS	-22		064	RCL8	36 08		
009	ST05	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	ST02	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	ST04	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	ST00	35 00		080	-	-45		
025	RTN	24		081	RCL8	36 08		
026	#LBLE	21 15		082	RCL2	36 02		
027	EEX	-23	Initial guess	083	x	-35		
028	CHS	-22	i → R <sub>6</sub>	084	RCL6	36 06		
029	3	83		085	x	-35		
030	ST06	35 06		086	RCL9	36 09		
031	#LBL0	21 00		087	x	-35		
032	1	81	Newton's method is used to	088	RCL7	36 07		
033	RCL6	36 06	find i.	089	÷	-24		
034	1	81		090	+	-55		
035	+	-55		091	÷	-24		
036	ST07	35 07		092	ST-6	35-45 06		
037	RCL2	36 02		093	ABS	16 31		
038	Y <sup>x</sup>	31		094	EEX	-23		
039	ST09	35 09		095	CHS	-22		
040	-	-45		096	6	06		
041	RCL4	36 04		097	X <sup>Y</sup> ?	16-35		
042	x	-35		098	GT00	22 00		
043	1	81		099	RCL6	36 06		
044	RCL7	36 07		100	EEX	-23		
045	RCL1	36 01		101	2	02		
046	Y <sup>x</sup>	31		102	x	-35		
047	ST08	35 08		103	RTN	24		
048	-	-45		104	#LBL <sub>a</sub>	21 16 11		
049	RCL3	36 03		105	ST0A	35 11		
050	x	-35		106	RTN	24	n → RA	
051	-	-45		107	#LBL <sub>b</sub>	21 16 12		
052	ST0E	35 15		108	EEX	-23	i/100 → R <sub>B</sub>	
053	RCL9	36 09		109	2	02		
054	RCL6	36 06		110	÷	-24		
055	x	-35		111	ST0B	35 12		
056	RCL6	36 06		112	LSTX	16-63		

## REGISTERS

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

```

113  x      -35
114  RTN      24
115  #LBLd  21 16 14
116  STOD      35 14
117  RTN      24
118  #LBLc  21 16 13
119  RCLB      36 12
120  1          01
121  +          -55
122  RCLa      36 11
123  CHS      -22
124  Yx      31
125  1          01
126  XyY      -41
127  -          -45
128  RCLB      36 12
129  ÷          -24
130  1/X      52
131  RCLD      36 14
132  x          -35
133  STOC      35 13
134  RTN      24
135  R/S      51

```

PV → RD

Calculate PMT and store in  
R<sub>C</sub>.

LABELS						FLAGS		SET STATUS		
<sup>A</sup> n <sub>1</sub> ,PMT <sub>1</sub> ,PV <sub>1</sub>	<sup>B</sup>	<sup>C</sup> n <sub>2</sub> ,PMT <sub>2</sub> ,PV <sub>2</sub>	<sup>D</sup> BAL	<sup>E</sup> →i	<sup>F</sup> 0	FLAGS	TRIG	DISP		
a	n	b	i	c →PMT	d PV	e	1	ON OFF	DEG <input checked="" type="checkbox"/>	
0		1		2	3	4	2	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	
5		6		7	8	9	3	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	
								3 <input type="checkbox"/> <input checked="" type="checkbox"/>	SCI <input type="checkbox"/>	
									ENG <input type="checkbox"/>	
								n <u>2</u>		



</td									

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

081	*LBLA	21 11		057	1	01	
082	ST00	35 00	ODD x 12 365	058	+	-55	
083	1	01		059	ST06	35 06	Calculate f(i)
084	2	02		060	RCL2	36 02	
085	x	-35		061	CHS	-22	
086	3	03		062	Y <sup>n</sup>	31	
087	6	06		063	ST07	35 07	
088	5	05		064	-	-45	
089	÷	-24		065	RCL0	36 00	
090	RT01	35 01		066	÷	-24	
091	X <sup>2</sup> Y	-41		067	RCL5	36 05	
092	ST02	35 02		068	x	-35	
093	RCL0	36 00		069	RCL6	36 06	
094	RTN	24		070	RCL1	36 01	
095	*LBLB	21 12		071	Y <sup>n</sup>	31	
096	ST03	35 03	AIR → R <sub>3</sub>	072	RCL4	36 04	
097	RTN	24		073	x	-35	
098	*LBLC	21 13		074	-	-45	
099	ST04	35 04	AMT → R <sub>4</sub>	075	RCL7	36 07	
099	RTN	24		076	RCL6	36 06	
021	*LBLD	21 14		077	÷	-24	
022	RCL2	36 02		078	RCL2	36 02	
023	RCL1	36 01		079	1	01	
024	+	-55		080	+	-55	
025	1	01		081	x	-35	
026	2	02		082	RCL0	36 00	
027	÷	-24		083	x	-35	
028	RCL3	36 03	$\left[ \frac{(N+h)}{12} \right] AIR$	084	1	01	
029	x	-35		085	RCL7	36 07	
030	EEX	-23		086	-	-45	
031	2	02		087	RCL8	36 08	
032	÷	-24		088	+	-55	
033	RCL4	36 04	FC → R <sub>0</sub>	089	-	-45	
034	x	-35		090	RCL0	36 00	
035	ST00	35 00		091	X <sup>2</sup>	53	
036	RCL4	36 04		092	÷	-24	
037	+	-55		093	RCL5	36 05	
038	RCL2	36 02	$\frac{FC + AMT}{N} \rightarrow R_5$	094	x	-35	
039	÷	-24		095	RCL6	36 06	
040	ST05	35 05		096	RCL1	36 01	
041	RTN	24		097	Y <sup>n</sup>	31	
042	RCL8	36 08		098	RCL6	36 06	
043	R/S	51		099	÷	-24	
044	*LBLE	21 15		100	RCL1	36 01	
045	RCL3	36 03	Calculate APR	101	X <sup>2</sup> Y	-41	
046	1	01		102	x	-35	
047	2	02		103	LSTX	16-63	
048	EEX	-23		104	-	-45	
049	2	02	Guess = AIR/1200	105	RCL4	36 04	
050	=	-24		106	x	-35	
051	X=0?	16-43	If AIR = 0 then	107	-	-45	
052	RTN	24	APR = 0	108	÷	-24	
053	ST08	35 08		109	RCL8	36 08	
054	*LBL1	21 01		110	X <sup>2</sup> Y	-41	$i_k = i_{k-1} - \frac{f(i)}{f'(i)}$
055	1	01		111	-	-45	
056	RCL8	36 08		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>
S0	S1	S2	S3	S4	S5	S6	S7
A	B	C		D	E	F	G

Is answer close enough?					
No → go to LBL 1					
Display answer					
113 LSTX 16-63					
114 ABS 16 31					
115 EEX -23					
116 6 86					
117 CHS -22					
118 X <sup>2</sup> ? 16-35					
119 ST01 22 81					
120 RCLB 36 88					
121 1 81					
122 2 82					
123 8 88					
124 8 88					
125 x -35					
126 RTN 24					
127 #LBLa 21 16 11					
128 ST08 35 88					
129 RTN 24					
130 #LBLb 21 16 12					
131 ST01 35 81					
132 RTN 24					
133 #LBLc 21 16 13					
134 ST02 35 82					
135 RTN 24					
136 #LBLd 21 16 14					
137 ST03 35 83					
138 RTN 24					
139 #LBLe 21 16 15					
140 RCLB 36 88					
141 RCL1 36 81					
142 - -45					
143 1 81					
144 + -55					
145 RCL3 36 83					
146 x -35					
147 RCLB 36 88					
148 X <sup>2</sup> 53					
149 LSTX 16-63					
150 + -55					
151 ÷ -24					
152 RCLB 36 88					
153 RCL1 36 81					
154 - -45					
155 x -35					
156 ST04 35 84					
157 RTN 24					
158 RCL2 36 82					
159 RCLB 36 88					
160 RCL1 36 81					
161 - -45					
162 x -35					
163 RCL4 36 84					
164 - -45					
165 R/S 51					
LABELS					
A N <sup>1</sup> ODD B AIR C AMT D PMT, FC E APR F					
0 1 2 3 4 5					
SET STATUS					
FLAGS TRIG DISP					
0 ON OFF 1 DEG SCI 2 RAD ENG 3 n 2					

## SAVINGS PLAN—LEASES

001	*LBLA	21 11	n→R <sub>A</sub>	057	SF1	16	21	01	
002	ST0A	35 11	Digit entered?	058	1			01	
003	F3?	16 23 03		059	RCLB	36	12		i/100→R <sub>9</sub>
004	RTN	24		060	2			55	
005	GSB8	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	RCL8	36	11		(1+i) <sup>-n</sup> →R <sub>8</sub>
009	RCLD	36 14		065	CHS			-22	
010	LSTX	16-63		066	YX			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			81	
015	LN	32		071	RCL8	36	08		1 - (1+i) <sup>-n</sup> →R <sub>4</sub>
016	÷	-24		072	-			-45	
017	ST0A	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	ST0C	35 13		076	÷			-24	
021	F3?	16 23 03	PMT→R <sub>C</sub>	077	F1?	16	23	01	
022	RTN	24	Digit entered?	078	CHS			-22	
023	1	01		079	ST03	35	03		
024	ST0C	35 13	Store dummy 1 for PMT.	080	RCL7	36	07		± PMT
025	GSB8	23 00		081	X				$[1 - (1+i)^{-n}] R_7$
026	1/X	52		082	X			-35	
027	RCLD	36 14		083	RTN			24	
028	R↑	16-31	Solve for PMT and store in R <sub>C</sub> .	084	*LBLB	21	16	11	
029	-	-45		085	CLX			-51	
030	X	-35		086	ST0C	35	13		Start by clearing PMT, PV, FV(BAL) registers.
031	ST0C	35 13		087	ST0D	35	14		
032	RTN	24		088	ST0E	35	15		
033	*LBLD	21 14	PV→R <sub>D</sub>	089	RTN			24	
034	ST0D	35 14		090	*LBLB	21	12		
035	F3?	16 23 03	Digit entered?	091	ST0B	35	12		↓+R <sub>B</sub>
036	RTN	24		092	F3?	16	23	03	Digit entered?
037	GSB8	23 00		093	RTN			24	Clear R <sub>B</sub> for sum of i terms.
038	+	-55	Solve for PV and store in R <sub>D</sub> .	094	0			00	
039	ST0D	35 14		095	ST0B	35	12		
040	RTN	24		096	2			82	
041	*LBLE	21 15		097	1			01	Store address of R <sub>B</sub> in R <sub>1</sub> for indirect access.
042	ST0E	35 15		098	ST0I	35	46		
043	F3?	16 23 03	FV(BAL)→R <sub>E</sub>	099	RCLC	36	15		Recall FV(BAL), n, PMT
044	RTN	24	Digit entered?	100	RCL8	36	11		If PMT = 0 GTO n, i, PV, FV solution.
045	GSB8	23 00		101	RCLC	36	13		
046	RCLD	36 14		102	X=?	16	-43		
047	X2Y	-41	Solve for FV(BAL) and store in R <sub>E</sub> .	103	GT08	22	08		
048	-	-45		104	X			-35	
049	RCL8	36 08		105	+			-55	
050	÷	-24		106	RCLD	36	14		Start guess of i: n PMT + FV(BAL)
051	ST0E	35 15		107	X=?	16	-43		If PV = 0 GTO FV guess
052	RTN	24		108	GT03	22	03		PV guess for i:
053	*LBL0	21 00		109	-			-45	
054	CF1	16 22 01	Clear FV(BAL) flag.	110	RCL8	36	11		n PMT + BAL - PV
055	RCLD	36 14	If PV = 0, set FV(BAL) flag.	111	÷			-24	
056	X=?	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)	F	G	H	I	J 21

LABELS						FLAGS			SET STATUS					
A	n	B	I	C	PMT	D	PV	E	FV(BAL)	F	0	FLAGS	TRIG	DISP
a	START	b		c		d		e		1	PV = 0	0	ON OFF	
0	Calc.		1		2		3	FV guess	4	guess	2	1	DEG	☒
5	→%		6	loop		7		8	n,PV,FV→i	9	3	2	GRAD	☐
										Digit?	3	3	RAD	☐
												4	SCI	☐
												5	ENG	☐
												6	n	2

113 **GTO4** 22 84  
 114 **\*LBL3** 21 83  
 115 **RCL4** 36 15  
 116 **LSTX** 16-63  
 117 - -45  
 118 **ENT↑** -21  
 119 + -55  
 120 **RCL4** 36 11  
 121 1 01  
 122 - -45  
 123 **X<sup>2</sup>** 53  
 124 **RCLC** 36 13  
 125 x -35  
 126 **RCL4** 36 15  
 127 + -55  
 128 **\*LBL4** 21 84  
 129 ÷ -24  
 130 - -62  
 131 9 89  
 132 **CHS** -22  
 133 **K=?** 16-35  
 134 **X<sup>2</sup>Y** -41  
 135 **GS85** 23 85  
 136 **X=?** 16-43  
 137 **RTN** 24  
 138 **\*LBL6** 21 86  
 139 **GS80** 23 88  
 140 + -55  
 141 **F1?** 16 23 81  
 142 **CHS** -22  
 143 **RCLD** 36 14  
 144 - -45  
 145 **RCL8** 36 88  
 146 **RCL4** 36 11  
 147 **RCL7** 36 87  
 148 ÷ -24  
 149 x -35  
 150 **F1?** 16 23 81  
 151 **CLK** -51  
 152 **ST06** 35 86  
 153 **F1?** 16 23 81  
 154 **R4** -31  
 155 **F1?** 16 23 81  
 156 **LSTX** 16-63  
 157 **RCL4** 36 84  
 158 **RCL9** 36 89  
 159 ÷ -24  
 160 - -45  
 161 **RCL7** 36 87  
 162 x -35  
 163 **RCL4** 36 84  
 164 + -55  
 165 **RCLC** 36 13  
 166 x -35  
 167 **RCL9** 36 89  
 168 ÷ -24

FV(BAL) guess for i  
 numerator:  
 2(BAL - n PMT) and  
 denominator  
 (n - 1)<sup>2</sup> PMT + BAL  
 Guess for i  
 If guess < -0.9, use -0.9  
 for guess  
 If guess = 0 stop.

Calculate f(i)

Calculate f'(i)

169 **RCL6** 36 86  
 170 **RCL4** 36 15  
 171 x -35  
 172 - -45  
 173 ÷ -24  
 174 **CHS** -22  
 175 **GS85** 23 85  
 176 **RCLB** 36 12  
 177 ÷ -24  
 178 **RND** 16 24  
 179 **X#0?** 16-42  
 180 **GTO6** 22 86  
 181 **RCL4** 36 12  
 182 **RTN** 24  
 183 **\*LBL8** 21 88  
 184 **RCL4** 36 15  
 185 **RCLD** 36 14  
 186 ÷ -24  
 187 **RCL4** 36 11  
 188 1/X 52  
 189 Y<sup>x</sup> 31  
 190 1 01  
 191 - -45  
 192 **\*LBL5** 21 85  
 193 **EEX** -23  
 194 2 02  
 195 x -35  
 196 **ST+I** 35-55 45  
 197 **RTN** 24  
 198 R/S 51

f(i)/f'(i)

If value ≠ 0, loop again.

Compute i for n, i, PV, FV problem.

Convert i to % and add to content of R<sub>B</sub>.

## ADVANCE PAYMENTS

801	*LBLA	21 11		857	RCL8	36 00	
802	ST01	35 01	A→R <sub>1</sub>	858	RCL1	36 01	
803	X <sup>2</sup> Y	-41	-n→R <sub>0</sub>	859	+	-55	
804	CHS	-22		860	Y <sup>x</sup>	31	
805	ST08	35 08		861	1	01	
806	CHS	-22		862	X <sup>2</sup> Y	-41	
807	X <sup>2</sup> Y	-41		863	-	-45	
808	X <sup>2</sup> Y?	16-34	A > n?	864	RCL2	36 02	
809	GT02	22 02		865	÷	-24	
810	RTN	24		866	RCL1	36 01	
811	*LBLD	21 14		867	+	-55	
812	ST04	35 04	PV→R <sub>4</sub>	868	RCL3	36 03	
813	RTN	24		869	X	-35	
814	*LBLE	21 15		870	RCL7	36 07	
815	ST05	35 05	RESID→R <sub>5</sub>	871	RCL6	36 06	
816	RTN	24		872	Y <sup>x</sup>	31	
817	*LBLc	21 16 13		873	RCL5	36 05	
818	EEX	-23		874	X	-35	
819	2	02		875	+	-55	
820	=	-24		876	RCL4	36 04	
821	ST02	35 02		877	-	-45	
822	1	01		878	ST06	35 06	
823	+	-55		879	RCL7	36 07	
824	ST07	35 07	(1 + i/100)→R <sub>7</sub>	880	RCL8	36 08	
825	RCL0	36 00		881	RCL1	36 01	
826	Y <sup>x</sup>	31		882	+	-55	
827	RCL5	36 05		883	1	01	
828	X	-35		884	-	-45	
829	RCL4	36 04	Calculate PMT	885	Y <sup>x</sup>	31	
830	X <sup>2</sup> Y	-41		886	RCL0	36 00	
831	-	-45		887	CHS	-22	
832	RCL7	36 07		888	RCL1	36 01	
833	RCL8	36 08		889	-	-45	
834	RCL1	36 01		890	X	-35	
835	+	-55		891	RCL2	36 02	
836	Y <sup>x</sup>	31		892	X	-35	
837	1	01		893	RCL7	36 07	
838	X <sup>2</sup> Y	-41		894	RCL8	36 00	
839	-	-45		895	RCL1	36 01	
840	RCL2	36 02		896	+	-55	
841	÷	-24		897	Y <sup>x</sup>	31	
842	RCL1	36 01		898	1	01	
843	+	-55		899	X <sup>2</sup> Y	-41	
844	÷	-24		900	-	-45	
845	RTN	24		901	-	-45	
846	*LBLb	21 16 12		902	RCL2	36 02	
847	ST03	35 03		903	X <sup>2</sup>	53	
848	EEX	-23	PMT→R <sub>3</sub>	904	÷	-24	
849	CHS	-22		905	RCL3	36 03	
850	3	03		906	X	-35	
851	ST02	35 02		907	RCL7	36 07	
852	*LBL0	21 00		908	RCL8	36 00	
853	1	01		909	1	01	
854	RCL2	36 02		910	-	-45	
855	+	-55		911	Y <sup>x</sup>	31	
856	ST07	35 07	Calculate f(i)	912	RCL5	36 05	

## REGISTERS

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

113	x	-35		
114	RCL <sub>0</sub>	36 00		
115	x	-35		
116	+	-55		
117	RCL <sub>6</sub>	36 86	f(i)/f'(i)	
118	X <sup>2</sup> Y	-41		
119	÷	-24		
120	ST-2	35-45 02		
121	ABS	16 31		
122	EEX	-23		
123	CHS	-22		
124	6	06		
125	X <sup>2</sup> Y?	16-35		
126	GTO <sub>6</sub>	22 00		
127	RCL <sub>2</sub>	36 02		
128	EEX	-23		
129	2	02		
130	x	-35	Display i	
131	RTN	24		
132	*LBL <sub>2</sub>	21 02		
133	PSE	16 51		
134	GTO <sub>2</sub>	22 02	If A > n, flash A on display.	
135	R/S	51		

LABELS					FLAGS		SET STATUS					
A	n, A	B	C	D	PV	E	RESID	F	0	FLAGS	TRIG	DISP
a		b	$\rightarrow i$	c	$\rightarrow$ PMT	d		e	1	ON	OFF	
0	Used	1		2	Used	3	4	5	2	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	6	7		8		9	3			1	<input type="checkbox"/>	<input type="checkbox"/>
										2	<input type="checkbox"/>	<input type="checkbox"/>
										3	<input type="checkbox"/>	<input checked="" type="checkbox"/>
										4	<input type="checkbox"/>	<input type="checkbox"/>
										5	<input type="checkbox"/>	<input type="checkbox"/>
										6	<input type="checkbox"/>	<input type="checkbox"/>
										7	<input type="checkbox"/>	<input type="checkbox"/>
										8	<input type="checkbox"/>	<input type="checkbox"/>
										9	<input type="checkbox"/>	<input type="checkbox"/>
										10	<input type="checkbox"/>	<input type="checkbox"/>
										11	<input type="checkbox"/>	<input type="checkbox"/>
										12	<input type="checkbox"/>	<input type="checkbox"/>
										13	<input type="checkbox"/>	<input type="checkbox"/>
										14	<input type="checkbox"/>	<input type="checkbox"/>

# SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

001	*LBLA	21	11			057	x	-35			
002	=	-24				058	RCLD	36	14		
003	STOD	35	14			059	+	-55			
004	1	01				060	RCLC	36	13		
005	X <sup>2</sup> Y	-41				061	x	-35			
006	X <sup>2</sup> Y?	16	-34			062	÷	-24			
007	F8?	16	23	00		063	1	01			
008	RTN	24				064	+	-55			
009	*LBLB	21	12			065	LN	32			
010	EEX	-23				066	RCLB	36	12		
011	2	02				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 <sup>x</sup>	31				077	RTN	24			
022	ST09	35	09			078	F8?	16	23	00	
023	X <sup>2</sup> Y	-41				079	GT01	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	83		083	RCL9	36	09		
028	RTN	24				084	RCLA	36	11		
029	F8?	16	23	00		085	Y <sup>x</sup>	31			
030	GT08	22	00			086	1	01			
031	RCL9	36	09			087	-	-45			
032	1	01				088	÷	-24			
033	-	-45				089	RCLD	36	15		
034	RCLE	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				097	RCLA	36	11		
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 <sup>2</sup> Y	-41			
047	*LBL0	21	00			103	Y <sup>x</sup>	31			
048	RCLE	36	15			104	1	01			
049	RCLB	36	12			105	-	-45			
050	x	-35				106	RCLB	36	12		
051	RCLD	36	14			107	X <sup>2</sup> 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	$\div$	-24										
115	x	-35										
116	RCLD	36 14										
117	+	-55										
118	$\div$	-24										
119	RCLC	36 15										
120	x	-35										
121	RTN	24										
122	#LBL <sub>e</sub>	21 16 15										
123	STO <sub>E</sub>	35 15										
124	F3?	16 23 83										
125	RTN	24										
126	FP?	16 23 86										
127	GTO <sub>2</sub>	22 82										
128	RCL <sub>9</sub>	36 89										
129	RCL <sub>A</sub>	36 11										
130	Y <sup>x</sup>	31										
131	1	01										
132	-	-45										
133	RCL <sub>9</sub>	36 89										
134	x	-35										
135	RCLC	36 13										
136	x	-35										
137	RCL <sub>9</sub>	36 89										
138	1	01										
139	-	-45										
140	$\div$	-24										
141	RTN	24										
142	#LBL <sub>2</sub>	21 02										
143	RCLD	36 14										
144	1	01										
145	+	-55										
146	RCLB	36 12										
147	2	02										
148	$\div$	-24										
149	x	-35										
150	RCLD	36 14										
151	+	-55										
152	RCLB	36 12										
153	1	01										
154	+	-55										
155	RCLA	36 11										
156	RCLD	36 14										
157	1 $\times$	52										
158	x	-35										
159	Y <sup>x</sup>	31										
160	1	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	FLAGS	TRIG	DISP		
a	#PAY	b		c	PMT	d	e FV	1	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>	
0	Used	1	Used	2	Used	3	4	2	1	<input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5		6		7		8	9	3	2	<input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
									3	<input type="checkbox"/>	n <u>2</u>	

## SIMPLE INTEREST/INTEREST CONVERSIONS

001	3	03			057	GT03	22 03		
002	6	06	Initialize		058	#LBLC	21 13	BEG AMT $\rightarrow$ R <sub>C</sub>	
003	0	00	360 $\rightarrow$ R <sub>A</sub>		059	ST0C	35 13	Digit entered?	
004	ST08	35 08	365 $\rightarrow$ R <sub>9</sub>		060	F3?	16 23 03		
005	5	05			061	RTN	24		
006	+	-55			062	F2?	16 23 02		
007	ST09	35 09			063	GT04	22 04	360 or 365?	
008	0	00			064	RCLD	36 14		
009	R/S	51			065	RCLB	36 08		
010	*LBLA	21 11			066	#LBL5	21 05		
011	ST0A	35 11	Days $\rightarrow$ R <sub>A</sub>		067	x	-35		
012	F3?	16 23 03	Digit entered?		068	RCLA	36 11	Calculate BEG AMT and	
013	RTN	24			069	$\div$	-24	store in R <sub>C</sub>	
014	F2?	16 23 02			070	RCLB	36 12		
015	GT08	22 08	Test for 360 or 365 day		071	$\div$	-24		
016	RCLD	36 14	basis		072	ST0C	35 13		
017	RCLB	36 08			073	RTN	24		
018	*LBL1	21 01			074	#LBL4	21 04		
019	x	-35	Calculate days and store in		075	RCLC	36 15	365 day basis	
020	RCLC	36 13	R <sub>A</sub>		076	RCL9	36 09		
021	$\div$	-24			077	GT05	22 05		
022	RCLB	36 12			078	*LBLD	21 14		
023	$\div$	-24			079	ST0D	35 14		
024	ST0A	35 11			080	F3?	16 23 03		
025	RTN	24			081	RTN	24	Digit entered?	
026	*LBL8	21 08			082	RCLC	36 13		
027	RCLC	36 15	365 day basis		083	RCLA	36 11	Calculate INT <sub>360</sub> and	
028	RCL9	36 09			084	RCLB	36 08	store in R <sub>D</sub>	
029	GT01	22 01			085	GS86	23 06		
030	*LBL8	21 12			086	ST0D	35 14		
031	EEX	-23	RATE/100 $\rightarrow$ R <sub>B</sub>		087	RTN	24		
032	2	02			088	#LBL8	21 15		
033	$\div$	-24			089	ST0E	35 15		
034	ST0B	35 12			090	SF2	16 21 02		
035	LSTX	16-63			091	F3?	16 23 03		
036	x	-35			092	RTN	24	Digit entered?	
037	F3?	16 23 03			093	RCLC	36 13		
038	RTN	24	Digit entered?		094	RCLA	36 11		
039	F2?	16 23 02			095	RCL9	36 09		
040	GT02	22 02	Test for 360 or 365 day		096	GS86	23 06		
041	RCLB	36 08	basis.		097	ST0E	35 15		
042	RCLD	36 14			098	RTN	24		
043	*LBL3	21 03			099	#LBL6	21 06		
044	x	-35			100	$\div$	-24		
045	RCLA	36 11	Calculate RATE and store		101	RCLC	36 13		
046	$\div$	-24	in R <sub>B</sub>		102	x	-35		
047	RCLC	36 13			103	RCLB	36 12		
048	$\div$	-24			104	x	-35		
049	EEX	-23			105	RTN	24		
050	2	02			106	#LBLa	21 16 11		
051	x	-35			107	ST0A	35 11		
052	ST0B	35 12			108	RTN	24		
053	RTN	24			109	#LBLb	21 16 12		
054	*LBL2	21 02	365 day basis		110	ST0B	35 12	NOM $\rightarrow$ R <sub>B</sub>	
055	RCL9	36 09			111	F3?	16 23 03	Digit entered?	
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							

LABELS				FLAGS	SET STATUS			
A	B	C	D	E	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)	<sup>f</sup> 1	ON OFF	<sup>g</sup> DEG	<sup>h</sup> FIX
0 Used	1 Used	2 Used	3 Used	4 Used	5 365 basis	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5 Used	6 Used	7 Used	8 Used	9	3 Digit?	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
113	RCLC	36 13	Calculate NOM and store in R <sub>B</sub> .		169 STOE 35 15			
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 <sup>x</sup>	52			176 ÷ -24			
121	Y <sup>x</sup>	31			177 e <sup>x</sup> 33			
122	1	01			178 1 01			
123	-	-45			179 - -45			
124	RCLC	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	EFF → R <sub>c</sub> Digit entered?		187 x -35			
132	STOC	35 13			188 RCL8 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 <sup>x</sup>	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	Continuous					
153	STOD	35 14						
154	F3?	16 23 03						
155	RTN	24						
156	RCLE	36 15						
157	EEX	-23						
158	2	02						
159	÷	-24						
160	1	01						
161	+	-55						
162	LN	32						
163	EEX	-23						
164	2	02						
165	x	-35						
166	STOD	35 14						
167	RTN	24						
168	*LBLc	21 16 15						

## DEPRECIATION SCHEDULES

REGISTERS		REGISTERS		REGISTERS		REGISTERS		REGISTERS		REGISTERS		REGISTERS		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	RDV <sub>k</sub>	S9					
A	SBV	B	SAL	C	LIFE	D	YR	E	FACTOR						SBV-SAL/LIFE
001	#LBL <sub>0</sub>	21	16	11		057	-	-	-45						
002	FB?	16	23	00	Straight line	058	XKB?	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		SBV - SAL	062	÷	-	-24						
007	RCLB	36	12		LIFE	063	ST04	35	04						
008	-	-	45			064	RCLB	36	08						
009	RCLC	36	13			065	x	-	-35						
010	÷	-	24			066	#LBL3	21	03						
011	ST01	35	46		DEP	067	ST06	35	06						RDV <sub>k</sub>
012	GSB9	23	09			068	GSB9	23	09						
013	RCLC	36	13			069	RCLB	36	12						
014	RCLD	36	14			070	+	-	-55						
015	-	-	45		(LIFE - YR) DEP = RDV <sub>k</sub>	071	GSB9	23	09						RBV <sub>k</sub> = RDV <sub>k</sub> + SAL
016	RCL1	36	46			072	1	-	81						
017	x	-	35			073	RCL4	36	04						
018	GSB9	23	09			074	-	-	-45						
019	RCLB	36	12			075	RCLB	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	RCL1	36	46			078	1	-	81						
023	RCLD	36	14		$\left( \frac{SBV - SAL}{LIFE} \right) YR = TOT DEP$	079	GSBD	23	14						
024	x	-	35			080	RCLC	36	13						
025	GSB9	23	09			081	RCLD	36	14						K ≤ LIFE?
026	1	81				082	X?Y?	16	35						
027	GSBD	23	14			083	GT06	22	16	12					
028	RCLC	36	13			084	RTN	24							
029	RCLD	36	14			085	#LBL2	21	02						
030	X?Y?	16-35			K ≤ LIFE?	086	ENT†	-	-21						
031	GT06	22	16	11		087	FRC	16	44						
032	RTN	24				088	ENT†	-	-21						$(1 + W) (2F + W)$
033	#LBL2	21	16	12	SOYD	089	+	-	-55						2
034	FB?	16	23	00		090	X?Y	-	-41						
035	SPC	16-11				091	INT	16	34						
036	RCLD	36	14			092	+	-	-55						= SOYD
037	GSB9	23	09		K	093	LSTX	16	63						
038	RCLA	36	11			094	1	-	81						
039	RCLB	36	12			095	+	-	-55						
040	-	-	45			096	x	-	-35						
041	ST08	35	08			097	2	-	82						
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	#LBL6	21	16	13					
045	RCLC	36	13			101	FB?	16	23	00					
046	1	81				102	SPC	16-11							
047	+	-	55			103	RCLD	36	14						
048	RCLD	36	14			104	GSB9	23	09						
049	-	-	45			105	GSB4	23	04						
050	RCL7	36	07			106	RCLD	36	14						
051	÷	-	24			107	1	-	81						
052	RCL8	36	06			108	-	-	-45						
053	x	-	35			109	Yx	-	31						
054	GSB9	23	09		DEPK	110	RCLA	36	11						
055	RCLC	36	13			111	x	-	-35						
056	RCLD	36	14			112	RCLB	36	08						

LABELS						FLAGS		SET STATUS		
A	B	C	D Used	E	0 Print?	FLAGS	TRIG	DISP		
<sup>a</sup> St. line	<sup>b</sup> SOYD	<sup>c</sup> DEC BAL	<sup>d</sup> CROSS	<sup>e</sup> SCHED?	1	ON OFF	DEG	FIX		
0 Used	1 Used	<sup>2</sup> SOYD	<sup>3</sup> Used	<sup>4</sup> Used	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	GRAD	SCI		
5	6	7	8 Used	<sup>9</sup> Used	3	1 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	RAD	ENG		
						2 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>				
						3 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>				
									n <u>2</u>	

Crossover point

## DAYS BETWEEN DATES

001	#LBLA	21 11		057	CLK	-51		
002	ST07	35 07	DT <sub>1</sub> → R <sub>7</sub>	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	#LBLC	21 13		063	3	03		
008	RCL7	36 07		064	1	01		
009	GSBE	23 15		065	x	-35		
010	ST02	35 02	Control and storage	066	+	-55		
011	LSTX	16-63		067	RCL6	36 06		
012	ST08	35 08		068	4	04		
013	RCL1	36 01		069	÷	-24		
014	GSBE	23 15		070	INT	16 34		
015	LSTX	16-63		071	X=Y	-41		
016	ST-0	35-45 00		072	+	-55		
017	CLK	-51		073	RTN	24		
018	RCL2	36 02		074	#LBLD	21 14		
019	-	-45		075	3	03		
020	RCL4	36 04		076	8	08		
021	2	02		077	STD2	35 02		
022	÷	-24		078	RCL7	36 07		
023	ST=0	35-24 00		079	GSBe	23 16 15		
024	X=Y	-41		080	ST08	35 08		
025	RTN	24		081	RCL1	36 01		
026	#LBLE	21 15		082	GSBe	23 16 15		
027	GSB4	23 04		083	RCL8	36 00		
028	ST06	35 06		084	-	-45		
029	3	03		085	ST08	35 08		
030	6	06		086	RCL4	36 04		
031	5	05		087	CHS	-22		
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	X=Y?	16-34		092	RTN	24		
037	GT08	22 08		093	#LBL	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		
042	-	-45		098	ST04	35 04		
043	ST06	35 06		099	x	-35		
044	GT01	22 01		100	RCL3	36 03		
045	#LBL0	21 00		101	3	03		
046	.	-62		102	0	00		
047	4	04		103	x	-35		
048	x	-35		104	+	-55		
049	.	-62	x = INT (.4M + 2.3)	105	RCL5	36 05		
050	3	03		106	3	03		
051	+	-55		107	1	01		
052	+	-55		108	X=Y?	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		I	

LABELS						FLAGS	SET STATUS		
A	DT <sub>1</sub>	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	DEG	FIX
0	Used	1	Used	2	Used	3	0 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	6	7	8	9		3	1 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
							2 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
							3 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## BOND PRICE AND YIELD

001	*LBLA	21 11		057	÷	-24		
002	CF3	16 22 03		058	-	-45		
003	CHS	-22		059	ST-6	35-45 06		
004	ST08	35 00	-PER→R <sub>0</sub>	060	ABS	16 31		
005	CHS	-22		061	EEX	-23		
006	RTN	24		062	CHS	-22		
007	*LBLB	21 12		063	6	06		
008	EEX	-23		064	X?Y?	16-35		
009	2	02		065	GT01	22 01		
010	ST03	35 03	100→R <sub>3</sub>	066	F2?	16 23 02		
011	RJ	-31		067	GT02	22 02		
012	ST01	35 01	CR→R <sub>1</sub>	068	RCL6	36 06		
013	RTN	24		069	GT03	22 03		
014	*LBL2	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		
017	RTN	24		073	RCL0	36 00		
018	*LBLC	21 13		074	FRC	16 44		
019	F2?	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	X?Y?	16-34	1>PER?	080	RCL1	36 01		
025	GT08	22 00		081	X	-35		
026	SF2	16 21 02	Calculate initial guess	082	RCL6	36 06		
027	RCL1	36 01		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	*LBLB	21 00		
032	÷	-24		088	RCL3	36 03		
033	ST06	35 06		089	RCL1	36 01		
034	*LBL1	21 01	Calculate f(y)	090	2	02		
035	1	01		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 00		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		
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		



## INTEREST AT MATURITY/DISCOUNTED SECURITIES

001	*LBLA	21 11		057	RCL8	36 08		
002	STOA	35 11	DSM→RA	058	÷	-24		
003	X2Y	-41	DIM→R9	059	1	01		
004	STOD	35 09		060	+	-55		
005	X2Y	-41		061	RCLA	36 11		
006	RTN	24		062	RCLB	36 12		
007	*LBLB	21 12	Basis→RB	063	÷	-24		
008	STOB	35 12		064	RCLD	36 14		
009	EEX	-23	100→R8	065	×	-35		
010	2	02		066	RCL8	36 08		
011	STOB	35 08		067	÷	-24		
012	X2Y	-41		068	1	01		
013	RTN	24		069	+	-55		
014	*LBLC	21 13	CR→RC	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→RD	074	RCLB	36 12		
019	F3?	16 23 03		075	÷	-24		
020	RTN	24		076	RCLC	36 13		
021	RCL9	36 09	Calc. Yield	077	×	-35		
022	RCLB	36 12		078	RCL8	36 08		
023	÷	-24		079	÷	-24		
024	RCLC	36 13		080	-	-45		
025	x	-35		081	EEX	-23		
026	RCLS	36 08		082	2	02		
027	+	-55		083	×	-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		
032	÷	-24		088	CF1	16 22 01		
033	RCLC	36 13		089	RTN	24		
034	x	-35		090	*LBLB	21 16 12		
035	RCL8	36 15		091	CF1	16 21 01		
036	+	-55		092	STOI	35 46		
037	÷	-24		093	RCLA	36 11		
038	1	01		094	×	-35		
039	-	-45		095	3	03		
040	RCLB	36 12		096	€	06		
041	x	-35		097	0	00		
042	RCLA	36 11		098	÷	-24		
043	÷	-24		099	EEX	-23		
044	RCL8	36 08		100	2	02		
045	x	-35		101	X2Y	-41		
046	STOD	35 14	Store yield in RD.	102	-	-45		
047	RTN	24		103	STOT	35 07		
048	*LBLE	21 15		104	GSBc	23 16 13		
049	STOE	35 15		105	RCLI	36 46		
050	F3?	16 23 03	Price→RE	106	RTN	24		
051	RTN	24		107	*LBLc	21 16 13		
052	RCL9	36 09		108	EEX	-23		
053	RCLB	36 12	Calc. price	109	2	02		
054	÷	-24		110	X2Y	-41		
055	RCLC	36 13		111	-	-45		
056	x	-35		112	LSTW	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	F	DISC RATE						

LABELS				FLAGS		SET STATUS		
A	B	C	D	E	F	FLAGS	TRIG	DISP
<sup>a</sup> DSM	<sup>b</sup> DR	<sup>c</sup> Used	<sup>d</sup> YLD	<sup>e</sup> PRICE	<sup>f</sup> DR	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
0	1	2	3	4	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	SCI <input type="checkbox"/>	
5	6	7	8	9	<sup>3</sup> Digit?	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	

# LINEAR REGRESSION—EXPONENTIAL CURVE FIT

881	#LBLA	21 11		857	R4	-31		
882	CF1	16 22 01	Clears flag 1 and storage registers.	858	RCLB	36 12	Calculate linear $r^2$	
883	CLR6	16-53		859	x	-35		
884	P $\approx$ S	16-51		860	RCL7	36 07		
885	CLR6	16-53		861	RCL6	36 06		
886	CLX	-51		862	x $\ddot{e}$	53		
887	RTN	24		863	RCL9	36 09		
888	#LBLB	21 12		864	$\div$	-24		
889	ST08	35 09	y $\rightarrow$ R8	865	-	-45		
890	X $\approx$ Y	-41		866	$\div$	-24		
891	ST09	35 09	x $\rightarrow$ R9	867	ST0E	35 15	$r^2 \rightarrow R_E$	
892	X $\approx$ Y	-41		868	RCLA	36 11		
893	X $\times$ 0?	16-44	y > 0?	869	GS89	23 09	Display a (lin.)	
894	GT08	22 00		870	RCLB	36 12	Display b (lin.)	
895	SFI	16 21 01	If no, set flag 1.	871	GS89	23 09	Display $r^2$ (lin.)	
896	#LBL4	21 04		872	RCLC	36 15		
897	RCL8	36 08	Performs summations	873	P $\approx$ S	16-51		
898	RCL9	36 09		874	GS89	23 09		
899	$\Sigma$	56		875	F12	16 23 01	If any y $\leq$ 0, display ERROR.	
900	RJM	24		876	GT08	22 00		
901	#LBL8	21 00		877	RCL2	36 02	Calculate b (exponential)	
902	LN	32		878	RCL8	36 08		
903	ST+0	35-55 00	$\Sigma \ln y \rightarrow R_0$	879	P $\approx$ S	16-51		
904	X $\ddot{e}$	53		880	RCL4	36 04		
905	ST+1	35-55 01	$\Sigma (\ln y)^2 \rightarrow R_1$	881	x	-35		
906	RCL8	36 08		882	RCL9	36 09		
907	LN	32		883	$\div$	-24		
908	RCL9	36 09		884	-	-45		
909	x	-35		885	RCL5	36 05		
910	ST+2	35-55 02	$\Sigma x \ln y \rightarrow R_2$	886	RCL4	36 04		
911	GT04	22 04		887	X $\ddot{e}$	53		
912	#LBLA	21 16 11		888	RCL9	36 09		
913	P $\approx$ S	16-51		889	$\div$	-24		
914	RCL8	36 08	Calculate b (linear)	890	-	-45		
915	RCL4	36 04		891	$\div$	-24		
916	RCL6	36 06		892	ST0C	35 13		
917	x	-35		893	RCL4	36 04		
918	RCL9	36 09		894	x	-35	Calculate a (exponential)	
919	$\div$	-24		895	CHS	-22		
920	-	-45		896	P $\approx$ S	16-51		
921	RCL5	36 05		897	RCL8	36 08		
922	RCL4	36 04		898	+	-55		
923	X $\ddot{e}$	53		899	P $\approx$ S	16-51		
924	RCL9	36 09		900	RCL9	36 09		
925	$\div$	-24		901	$\div$	-24		
926	-	-45		902	e $\ddot{x}$	33		
927	$\div$	-24		903	ST0D	35 14		
928	ST0B	35 12	b $\rightarrow$ R8	904	R4	-31		
929	RCL4	36 04		905	RCLC	36 13	Calculate exponential $r^2$	
930	x	-35		906	x	-35		
931	CHS	-22	Calculate a (linear)	907	P $\approx$ S	16-51		
932	RCL6	36 06		908	RCL1	36 01		
933	$\div$	-55		909	RCL8	36 08		
934	RCL9	36 09		910	X $\ddot{e}$	53		
935	$\div$	-24		911	P $\approx$ S	16-51		
936	ST0A	35 11	a $\rightarrow$ R <sub>A</sub>	912	RCL9	36 09		
REGISTERS								
0	$\Sigma \ln y$	$\Sigma (\ln y)^2$	$\Sigma x \ln y$	3	4	5	6	7
S0	S1	S2	S3	S4 $\Sigma x_i$	S5 $\Sigma x_i^2$	S6 $\Sigma y_i$	S7 $\Sigma y_i^2$	S8 $\Sigma x_i y_i$
A	a (Linear)	B	b (Linear)	C	b (Exponential)	D	a (Exponential)	E
						Used		Used

LABELS								FLAGS			SET STATUS		
<sup>A</sup> START	<sup>B</sup> Data Input	<sup>C</sup> Trend Line	<sup>D</sup> Lin y	<sup>E</sup> Exp y	<sup>0</sup> Print?	FLAGS			TRIG	DISP			
<sup>A</sup> a; b; r <sup>2</sup>	<sup>B</sup> Del. Data	<sup>C</sup> Del. T.L.	<sup>D</sup> d	<sup>E</sup> e	<sup>0</sup> Print?	1	y > 0	ON	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> Used	<sup>2</sup>			0	<input type="checkbox"/>	GRAD	<input type="checkbox"/>	SCI	<input type="checkbox"/>
<sup>5</sup> Used	6	7	8	9	3			1	<input type="checkbox"/>	RAD	<input type="checkbox"/>	ENG	<input type="checkbox"/>
								2	<input type="checkbox"/>			n	<input type="checkbox"/>
								3	<input type="checkbox"/>				
113 ÷ -24 114 - -45 115 ÷ -24 116 STO <sub>E</sub> 35 15 117 F0? 16 23 00 118 SPC 16-11 119 RCLD 36 14 120 GS89 23 09 121 RCLC 36 13 122 GS89 23 09 123 RCLE 36 15 124 P2S 16-51 125 GS89 23 09 126 RCLC 36 13 127 e <sup>x</sup> 33 128 1 01 129 - -45 130 EEF -23 131 2 02 132 x -35 133 GS89 23 09 134 F0? 16 23 00 135 SPC 16-11 136 RTN 24 137 *LBL <sub>C</sub> 21 13 138 ISZ1 16 26 46 139 RCLI 36 46 140 STO <sub>9</sub> 35 09 141 X <sup>2</sup> Y -41 142 STO <sub>8</sub> 35 08 143 X <sup>2</sup> 0? 16-44 144 STO <sub>8</sub> 22 08 145 SF1 16 21 01 146 GT04 22 04 147 *LBL <sub>D</sub> 21 14 148 RCLB 36 12 149 x -35 150 RCLA 36 11 151 + -55 152 GT09 22 09 153 *LBL <sub>E</sub> 21 15 154 RCLC 36 13 155 x -35 156 e <sup>x</sup> 33 157 RCLD 36 14 158 x -35 159 GT09 22 09 160 *LBL <sub>b</sub> 21 16 12 161 STO <sub>8</sub> 35 00 162 X <sup>2</sup> Y -41 163 STO <sub>9</sub> 35 09 164 X <sup>2</sup> Y -41 165 X <sup>2</sup> 0? 16-44 166 GT01 22 01 167 SF1 16 21 01 168 *LBL <sub>5</sub> 21 05	Display a (exp.) Display b (exp.) Display r <sup>2</sup> (exp.) Continuous effective rate as a %.			169 RCLB 36 08 170 RCL9 36 09 171 Σ- 16 56 172 RTN 24 173 #LBL1 21 81 174 LN 32 175 ST-0 35-45 00 176 X <sup>2</sup> 53 177 ST-1 35-45 01 178 RCLB 36 08 179 LN 32 180 RCL9 36 09 181 X -35 182 ST-2 35-45 02 183 GT05 22 05 184 #LBL <sub>C</sub> 21 16 13 185 DSZ1 16 25 46 186 RCL9 36 09 187 X <sup>2</sup> Y -41 188 GT01 22 01 189 *LBL <sub>E</sub> 21 16 15 190 F0? 16 23 00 191 GT02 22 02 192 SF0 16 21 00 193 1 01 194 RTN 24 195 *LBL <sub>2</sub> 21 02 196 0 00 197 CF0 16 22 00 198 RTN 24 199 *LBL <sub>9</sub> 21 09 200 F0? 16 23 00 201 GT03 22 03 202 R/S 51 203 RTN 24 204 *LBL <sub>3</sub> 21 03 205 PRTX -14 206 RTN 24 207 R/S 51	Delete last trend value. Print/pause flag. Print command.								
Performs summations for trend line.  For deleting incorrect inputs.													

## MULTIPLE LINEAR REGRESSION

801	$\#LBLA$	21 11		857	-	-45	
802	$CLRC$	16 53	Initialize	858	$STO1$	35 46	
803	$CF1$	16 22 01		859	$R\downarrow$	-31	
804	0	00		860	$X^2$	53	
805	$RTN$	24		861	$GSB2$	23 82	
806	$\#LBLB$	21 12		862	$ST+I$	35-55 45	
807	$STOC$	35 13		863	$RTN$	24	
808	$R\downarrow$	-31		864	$\#LBLC$	21 13	
809	$STOB$	35 12		865	$RCL0$	36 00	
810	$R\downarrow$	-31		866	$RCL4$	36 04	
811	$STOA$	35 11		867	x	-35	
812	$F0?$	16 23 00		868	$RCL7$	36 07	
813	$GSB8$	23 00		869	$X^2$	53	
814	0	07		870	-	-45	
815	$STO1$	35 46	Compute $\Sigma x_i$ , $\Sigma y_i$ , $\Sigma z_i$	871	$STOD$	35 14	
816	$R\downarrow$	-31	$\Sigma x_i^2$ , $\Sigma y_i^2$ , $\Sigma z_i^2$	872	$RCL0$	36 00	
817	$GSB1$	23 01	$\Sigma x_i y_i$ , $\Sigma y_i z_i$ , $\Sigma z_i x_i$	873	$RCL3$	36 03	
818	0	08		874	x	-35	
819	$STO1$	35 46		875	$RCL8$	36 08	
820	$RCLC$	36 12		876	$RCL9$	36 09	
821	$F0?$	16 23 00		877	x	-35	
822	$GSB6$	23 06		878	-	-45	
823	$GSB1$	23 01		879	x	-35	
824	9	09		880	$STOC$	35 13	
825	$STO1$	35 46		881	$RCL0$	36 00	
826	$RCLC$	36 13		882	$RCL1$	36 01	
827	$F0?$	16 23 00		883	x	-35	
828	$GSB6$	23 06		884	$RCL7$	36 07	
829	$GSB1$	23 01		885	$RCL8$	36 08	
830	$RCLA$	36 11		886	x	-35	
831	$RCLB$	36 12		887	-	-45	
832	x	-35		888	$STOA$	35 11	
833	$GSB2$	23 02		889	$RCL2$	36 00	
834	$ST+I$	35-55 01		890	$RCL2$	36 02	
835	$RCLA$	36 11		891	x	-35	
836	$RCLC$	36 13		892	$RCL7$	36 07	
837	x	-35		893	$RCL9$	36 09	
838	$GSB2$	23 02		894	x	-35	
839	$ST+2$	35-55 02		895	-	-45	
840	$RCLB$	36 12		896	$STOB$	35 12	
841	$RCLC$	36 13		897	x	-35	
842	x	-35		898	$RCLC$	36 13	
843	$GSB2$	23 02		899	$X^2Y$	-41	
844	$ST+3$	35-55 03		900	-	-45	
845	1	01		901	$RCLD$	36 14	
846	$GSB2$	23 02		902	$RCL0$	36 00	
847	$ST+0$	35-55 00		903	$RCL5$	36 05	
848	$RCL0$	36 00		904	x	-35	
849	$F0?$	16 23 00		905	$RCLB$	36 00	
850	$GSB6$	23 06		906	$X^2$	53	
851	$RTN$	24		907	-	-45	
852	$\#LBL1$	21 01		908	x	-35	
853	$GSB2$	23 02	Subroutine for $\Sigma x_i$ , ...	909	$RCLA$	36 11	
854	$ST+I$	35-55 45	$\Sigma x_i^2$ , ...	110	$X^2$	53	
855	$RCL1$	36 46		111	-	-45	
856	3	03		112	$\Sigma$	-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	I	Used

LABELS									FLAGS			SET STATUS						
A	START	B	$\Sigma+$	C	$a; b; c$	D	$r^2$	E	z	0	Print	FLAGS	TRIG	DISP				
a	$\Sigma-$	b		c		d		e	Print?	1	Correction	ON	OFF					
0		1	Used		2 Used		3	4		2		0	<input type="checkbox"/>	DEG	<input checked="" type="checkbox"/>	FIX	<input checked="" type="checkbox"/>	
5	Used	6	Used		7 Used		8	Used	9	Used	3	3	<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>		
113 ST0C 35 13									169 F0? 16 23 00						Correction of input values.			
114 RCLB 36 12									170 GSB6 23 06									
115 RCLA 36 11									171 RCLC 36 13									
116 RCLC 36 13									172 x -35									
117 x -35									173 XY 41									
118 -45									174 RCLB 36 12									
119 RCLD 36 14									175 x -35									
120 ÷ -24									176 + -55									
121 ST0B 35 12									177 RCLA 36 11									
122 RCLS 36 09									178 + -55									
123 RCLB 36 13									179 GT09 22 09									
124 RCLS 36 08									180 *LBL4 21 16 11									
125 x -35									181 SF1 16 21 01									
126 -45									182 GSB6 23 12									
127 RCLB 35 12									183 CF1 16 22 01									
128 RCL7 36 07									184 RTN 24									
129 x -35									185 *LBL6 21 16 15									
130 -45									186 F0? 16 23 00									
131 RCLB 36 08									187 GT05 22 05									
132 ÷ -24									188 SF0 16 21 00									
133 ST0A 35 11									189 1 01									
134 GSB7 23 07									190 RTN 24									
135 RCLB 36 12									191 *LBL5 21 05									Print instructions
136 GSB9 23 09									192 0 00									
137 RCLC 36 13									193 CF0 16 22 00									
138 GT09 22 09									194 RTN 24									
139 *LBL2 21 14									195 *LBL7 21 07									
140 RCLA 36 11									196 F0? 16 23 00									
141 RCL9 36 09									197 SPC 1E-11									
142 x -35									198 *LBL9 21 09									
143 RCLS 36 12									199 F0? 16 23 00									
144 RCL2 36 02									200 GT06 22 06									
145 x -35									201 R/S 51									
146 + -55									202 RTN 24									
147 RCLC 36 13									203 *LBL6 21 06									
148 FCL3 36 03									204 PRX 14									
149 x -35									205 RTN 24									
150 + -55									206 *LBL2 21 02									
151 RCLS 36 09									207 F1? 16 23 01									
152 $\Sigma^2$ 53									208 CHS -22									
153 RCL6 36 08									209 RTN 24									
154 ÷ -24									210 *LBL8 21 08									
155 -45									211 SPC 1E-11									
156 RCL6 36 06									212 GT09 22 09									
157 RCL9 36 09									213 R/S 51									
158 $\Sigma^2$ 53																		
159 RCLB 36 08																		
160 ÷ -24																		
161 -45																		
162 ÷ -24																		
163 GT07 22 07																		
164 *LBL4 21 15																		
165 XY -41																		
166 F0? 16 23 00																		
167 GSB8 23 08																		
168 XY -41																		
Calculate $r^2$ for given x, y.									Calculate $\hat{z}$ for given x, y.						Change sign for correction.			

## BREAK-EVEN ANALYSIS

001	*LBLA	21 11			057	RCLB	36 12		
002	ST0A	35 11	F→RA	Digit entered?	058	RCLC	36 13		Calculate GP and store in RE.
003	F3?	16 23 83			059	-	-45		
004	RTN	24			060	RCLD	36 14		
005	RCLB	36 12			061	×	-35		
006	RCLC	36 13			062	RCLA	36 11		
007	-	-45			063	-	-45		
008	RCLD	36 14	Calculate F and store in RA.		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		
012	ST0A	35 11			068	RCLC	36 13		
013	RTN	24			069	-	-45		
014	*LBLB	21 12			070	RCLD	36 14		
015	ST0B	35 12	P→RB		071	x	-35		
016	F3?	16 23 83			072	STOI	35 46		
017	RTN	24			073	RCLI	36 46		
018	RCLB	36 11			074	RCLA	36 11		
019	RCLE	36 15			075	-	-45		
020	+	-55			076	÷	-24		
021	RCLD	36 14	Calculate P and store in RB.		077	RTN	24		
022	÷	-24			078	R/S	51		
023	RCLC	36 13							
024	+	-55							
025	ST0B	35 12							
026	RTN	24							
027	*LBLC	21 13							
028	ST0C	35 13	V→RC						
029	F3?	16 23 83							
030	RTN	24							
031	RCLB	36 12							
032	RCLA	36 11							
033	RCLE	36 15							
034	+	-55							
035	RCLD	36 14							
036	÷	-24							
037	-	-45							
038	ST0C	35 13							
039	RTN	24							
040	*LBLD	21 14							
041	ST0D	35 14	U→RD						
042	F3?	16 23 83							
043	RTN	24							
044	RCLA	36 11							
045	RCLE	36 15							
046	+	-55							
047	RCLB	36 12							
048	RCLC	36 13							
049	-	-45							
050	÷	-24							
051	ST0D	35 14							
052	RTN	24							
053	*LBLE	21 15	GP→RE						
054	STOE	35 15							
055	F3?	16 23 83							
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	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	ON OFF	DEG	<input checked="" type="checkbox"/>
0		1		2		3		4		2	1 <input type="checkbox"/>	GRAD	<input type="checkbox"/>
5		6		7		8		9		3	2 <input type="checkbox"/>	SCI	<input type="checkbox"/>
										Digit?	3 <input type="checkbox"/>	ENG	<input type="checkbox"/>
										n	2 <input checked="" type="checkbox"/>		

## INVOICING

REGISTERS									
<sup>0</sup> Subtotal	<sup>1</sup> Grand Total	<sup>2</sup> Used	<sup>3</sup> Used	<sup>4</sup> Used	<sup>5</sup> Used	<sup>6</sup> Used	<sup>7</sup> Used	<sup>8</sup> Used	<sup>9</sup> Used
S <sub>0</sub> Used	S <sub>1</sub> Used	S <sub>2</sub> Used	S <sub>3</sub> Used	S <sub>4</sub> Used	S <sub>5</sub> Used	S <sub>6</sub> Used	S <sub>7</sub> Used	S <sub>8</sub> Used	S <sub>9</sub> Used
A Used	B Used	C Price	D Units		E Disc.	I Control			
001 #LBLA 21 11	002 CLRG 16-53	003 PSS 16-51	004 CLRG 16-53	005 2 02	006 STOI 35 46	007 0 08	008 RTN 24	009 *LBLB 21 12	010 STOE 35 15
011 RTN 24	012 #LBLC 21 13	013 STOD 35 14	014 RTN 24	015 #LBLD 21 14	016 STOC 35 13	017 RTN 24	018 *LBLE 21 15	019 GSB5 23 05	020 STOI 35 45
021 ST+0 35-55 00	022 ST+1 35-55 01	023 ISZI 16 26 46	024 2 02	025 2 02	026 RCLI 36 46	027 XY? 1€ 34	028 GT09 22 09	029 RTN -31	030 RTN -31
031 RTN 24	032 #LBL5 21 05	033 RCLC 36 13	034 ENT† -21	035 ENT† -21	036 RCLE 36 15	037 EEX -23	038 2 02	039 ÷ -24	040 X -35
041 - 45	042 RCLD 36 14	043 X -35	044 RTN 24	045 #LBL6 21 16 11	046 RCLB 36 08	047 ENT† -21	048 CLX -51	049 STOB 35 00	050 X?Y -41
051 GSB2 23 02	052 RTN 24	053 #LBL7 21 16 12	054 RCLI 36 01	055 GSB2 23 02	056 RTN 24	Recall Grand Total			
057 #LBLc 21 16 13	058 2 02	059 STOI 35 46	060 *LBL1 21 01	061 RCLI 36 45	062 X=0? 16-43	063 GT04 22 04	064 RCLI 36 01	065 ÷ -24	066 EEX -23
067 2 02	068 X -35	069 GSB2 23 02	070 ISZI 16 26 46	071 2 02	072 1 01	073 RCLI 36 46	074 X?Y? 16-35	075 GT01 22 01	076 *LBL4 21 04
077 1 01	078 0 00	079 0 00	080 GSB2 23 02	081 RTN 24	082 *LBL2 21 02	083 F0? 16 23 00	084 GT03 22 03	085 R/S 51	086 RTN 24
087 *LBL3 21 03	088 PRTX -14	089 RTN 24	090 *LBL6 21 16 15	091 F0? 16 23 00	092 GT08 22 00	093 SF0 16 21 00	094 1 01	095 RTN 24	096 *LBL8 21 00
097 CF0 16 22 00	098 0 00	099 RTN 24	100 *LBLd 21 16 14	101 OSZI 16 25 46	102 0 00	103 STOI 35 45	104 GSB5 23 05	105 ST-0 35-45 00	106 ST-1 35-45 01
107 RCLB 36 00	108 R/S 51	Print/pause flag set and unset.				Routine to delete incorrect line totals.			
0 Recall and display line total as % of Grand Total.	0 Check to recall only those registers containing line totals.	0 Last output is 100 - you are done!	0 Test print/pause flag.	0 Print/pause	0	0	0	0	0

LABELS						FLAGS		SET STATUS		
A START	B Disc.	C Units	D Price	E Net Line Tot.	F Print?	0	FLAGS	TRIG	DISP	
<sup>a</sup> Subtotal	<sup>b</sup> Grand Total	<sup>c</sup> % Total	<sup>d</sup> DEL	<sup>e</sup> Print?	1	0	ON OFF	DEG	FIX	
0 Used	1 Used	2 Used	3 Used	4 Used	2	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5 Used	6	7	8	9	3	2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
						3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

## PAYROLL

001 *LBLA	21 11	Read data card. If data card read, go to c. Otherwise repeat sequence.	057 RCL1	36 01	(Wage) 5.85%
002 0	00		058 *LBL3	21 03	
003 PSE	16 51		059 5	05	
004 F3?	16 23 03		060 .	-62	
005 GTOc	22 16 13		061 8	08	
006 GTOa	22 11		062 5	05	
007 *LBL1	21 16 13	Display SS No.	063 %	55	
008 RCLI	36 46		064 RND	16 24	
009 GSB9	23 09	Display marital status.	065 ST+5	35-55 05	
010 RCLC	36 15		066 ST-9	35-45 09	
011 GSB9	23 09	Display number of exemptions.	067 GSB9	23 09	
012 RCLB	36 12		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	
017 x	-35		073 XY?	16-34	Gross > 9000?
018 RND	16 24		074 GTO6	22 06	
019 ST01	35 01		075 RCL1	36 01	
020 ST09	35 09		076 *LBL4	21 04	
021 ST+0	35-55 08		077 1	01	(Wage) 1%
022 GSB9	23 09		078 %	55	
023 RTN	24		079 RND	16 24	
024 *LBLC	21 13	#hrs x OT wage	080 ST+6	35-55 06	
025 RCLD	36 14		081 ST-9	35-45 09	
026 x	-35		082 GSB9	23 09	
027 RND	16 24		083 *LBL5	21 05	
028 ST+6	35-55 08		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 RCL8	36 08	
033 RTW	24		089 %	55	
034 *LBL0	21 14		090 RND	16 24	
035 ST02	35 02	Fed'l. tax	091 ST-9	35-45 09	
036 ST+3	35-55 03	Tot. Fed'l. tax	092 GSB9	23 09	
037 ST-9	35-45 09	Net pay - Fed'l. tax	093 RCLA	36 11	
038 RCL2	36 02		094 ST-9	35-45 09	
039 GSB9	23 09	Display Fed'l. tax	095 GSB9	23 09	
040 RTN	24		096 RCL9	36 09	
041 *LBL1	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	
044 ST-9	35-45 09	Net pay - State tax	100 RTN	24	
045 RCL2	36 02		101 *LBL6	21 08	
046 GSB9	23 09	Display State tax	102 XY?	-41	
047 RTN	24		103 -	-45	
048 *LBL6	21 16 11		104 RCL1	36 01	DONE!
049 1	01		105 XY?	16-34	
050 5	05	FICA tax base	106 GTO1	22 01	
051 3	03		107 8	08	
052 0	00		108 GSB9	23 09	
053 0	00		109 GTO2	22 02	
054 RCL0	36 00	Gross > 15300?	110 *LBL1	21 01	
055 XY?	16-34		111 XY?	-41	
056 GTO0	22 00		112 5	05	

---

**REGISTERS**

REGISTERS									
0 Gross	1 Wage	2 Fed'l/State	3 Total Fed'l	4 Total State	5 $\Sigma$ FICA	6 $\Sigma$ 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	F	G	H	I SS Number	J

113	GTO3	22 03		
114	*LBL6	21 06		
115	X2Y	-41	Gross--9000	
116	-	-45		
117	RCL1	36 01	Wage > Gross--9000?	
118	X2Y?	16-34		
119	GTO7	22 07	No more SDI to withhold; continue.	
120	0	00		
121	GSB9	23 09		
122	GTO5	22 05		
123	*LBL7	21 07	----- Amount to apply to SDI tax is Wage -- (Gross--9000)	
124	X2Y	-41		
125	-	-45		
126	GTO4	22 04		
127	*LBL8	21 16 15		
128	F0?	16 23 00	----- Set and unset print/pause flag.	
129	GTO1	22 01		
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	GTO8	22 08		
140	R/S	51		
141	RTN	24		
142	*LBL8	21 08		
143	PR7X	-14		
144	RTN	24		
145	*LBL9	21 16 12	----- Gross	
146	RCL0	36 00		
147	GSB9	23 09	Total Fed'l.	
148	RCL3	36 03		
149	GSB9	23 09	Total State	
150	RCL4	36 04		
151	GSB9	23 09	Total FICA	
152	RCL5	36 05		
153	GSB9	23 09	Total SDI	
154	RCL6	36 06		
155	GSB9	23 09		
156	RTN	24		
157	R/S	51		

LABELS					FLAGS		SET STATUS		
START	#hrs	#hrs OT	Fed'l tax	State tax	Print?	ON OFF	TRIG	DISP	
<sup>a</sup> Net Pay	<sup>b</sup> Totals	<sup>c</sup> Used	<sup>d</sup>	<sup>e</sup> Print?	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<sup>f</sup> Used	<sup>g</sup> Used	<sup>h</sup> Used	<sup>i</sup> Used	<sup>j</sup> Used	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<sup>k</sup> Used	<sup>l</sup> Used	<sup>m</sup> Used	<sup>n</sup> Used	<sup>o</sup> Data?	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## INVENTORY

001	*LBLA	21 11		857	RTN	24		
002	0	00	Read data card.	858	*LBLc	21 16 13		
003	PSE	16 51	If data card read, go to 1.	859	1	01		
004	F3?	16 23 03	Otherwise repeat sequence.	860	STOJ	35 46		
005	GT01	22 01		861	*LBL2	21 02		
006	GT0A	22 11		862	RCLI	36 45		
007	*LBL1	21 01		863	GSB9	23 89		
008	CF3	16 22 03		864	JSZI	16 26 46		
009	RCLB	36 00		865	RCLI	36 46		
010	GSB9	23 09		866	7	07		
011	RTN	24		867	X?Y?	16-34		
012	*LBLB	21 12	Store new price.	868	GT02	22 02		
013	ST0E	35 15		869	RCLB	36 00		
014	RTN	24		870	GSB9	23 09		
015	*LBLC	21 13		871	F0?	16 23 00		
016	ST0D	35 14		872	SPC	16-11		
017	RCL1	36 01		873	RTN	24		
018	RCL2	36 02		874	*LBLd	21 16 14		
019	x	-35		875	MOTA	16-61		
020	RCLE	36 15		876	CF3	16 22 03		
021	RCLD	36 14		877	CLX	-51		
022	x	-35		878	RTN	24		
023	+	-55		879	*LBLe	21 16 15		
024	RCL2	36 02		880	F0?	16 23 00		
025	RCLD	36 14		881	GT00	22 00		
026	+	-55		882	SF0	16 21 00		
027	=	-24		883	1	01		
028	ST01	35 01		884	RTN	24		
029	RCLD	36 14		885	*LBL0	21 00		
030	ST+2	35-55 02	Adjusts on hand and on order quantities by amount received.	886	CF0	16 22 00		
031	ST-3	35-45 03		887	0	00		
032	GSB3	23 03		888	RTN	24		
033	RCL2	36 02		889	*LBL9	21 09		
034	RTN	24		890	F0?	16 23 00		
035	*LBLD	21 14		891	GT00	22 00		
036	ST-2	35-45 02	Subtract # issued from those on hand.	892	R/S	51		
037	GSB3	23 03		893	RTN	24		
038	RCL2	36 02		894	*LBL8	21 08		
039	RTN	24		895	PRTX	-14		
040	*LBLE	21 15		896	RTN	24		
041	ST+3	35-55 03	Add # ordered to those on order.	897	R/S	51		
042	GSB3	23 03						
043	RCL3	36 03						
044	RTN	24						
045	*LBL0	21 16 11						
046	ST04	35 04						
047	RTN	24						
048	*LBLb	21 16 12						
049	ST05	35 05						
050	*LBL3	21 03						
051	RCL2	36 02						
052	RCL3	36 03						
053	+	-55						
054	RCL4	36 04						
055	-	-45						
056	ST06	35 06						

## REGISTERS

0	Part #	1	Unit price	2	On hand	3	On Order	4	Min. Quant.	5	Lead Time	6	Slack	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9							
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Used

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

## Appendix A

**MAGNETIC CARD  
SYMBOLS AND CONVENTIONS**

SYMBOL OR CONVENTION	INDICATED MEANING
White mnemonic: x 	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> .
Gold mnemonic: y x     	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> . <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> .
 	The box around the variable x indicates input by pressing <b>STO A</b> .
 	Parentheses indicate an option. In this case, x is not a required input but could be input in special cases.
  	 is the symbol for calculate. This indicates that you may calculate x by pressing key <b>A</b> .
  	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.
  	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> .
  	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.
  	 indicates that x may be either output or input when the associated user definable key is pressed. If numeric keys have been pressed between user-definable keys, x is stored. If numeric keys have not been pressed, the program will calculate x.

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

## **Appendix B**

### **PRINCIPAL EQUATIONS**

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

#### Program Number

##### 1. Internal Rate of Return

Solve for IRR in:

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

where:

n = number of cash flows

CF<sub>j</sub> = j<sup>th</sup> cash flow

##### 2. Internal Rate of Return—Groups

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

$$n_0 = 0$$

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  $K$  =

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

## B-03

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

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

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

$$APR = 12i$$

where:

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

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

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

### 9. Savings Plan—Leases

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

### 10. Advance Payments

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

### 11. Savings—Compounding Periods Different from Payment Periods

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

when  $P/C \leq 1$

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

$$Z = (1 + Q)$$

$$n = \#PAY$$

when  $P/C > 1$

$$Q = i$$

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

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

## 12. Simple Interest/Interest Conversions

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

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

finite compounding

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

continuous compounding

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

## 13. Depreciation Schedules

where:

$K$  = value for YR

$TOTDEP_K$  = total depreciation for years 1 through  $K$ .

$W$  = integer portion of LIFE

$F$  = decimal portion of LIFE

(i.e., for a LIFE of 12.25 years  $W = 12$  and  $F = .25$ )

Straight Line Schedule

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

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

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

## B-05

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

$$RBV_K = RDV_K + SAL$$

Sum-of-the-Years'-Digits Schedule

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

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

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

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

$$RBV_K = RDV_K + SAL$$

Variable Rate Declining Balance Schedule

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

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

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

$$RBV_K = RDV_K + SAL$$

Crossover Point—Declining Balance to Straight Line

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

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

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

#### 14. Days Between Dates

Actual

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

where

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

and

for  $mm \leq 2$

$$\begin{aligned} x &= 0 \\ z &= (yyyy) - 1 \end{aligned}$$

for  $mm > 2$

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

$$z = (yyyy)$$

Int = Integer portion

30/360 Basis

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

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

for  $f(DT1)$

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

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

for  $f(DT2)$

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

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

if  $dd_2 < 31$  then  $z = dd_2$

## 15. Bond Price and Yield

for PER &gt; 1

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

where

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

$\text{FRAC}(\text{PER})$  = fractional portion of the number  
of remaining coupon periods

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

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

## 16. Interest at Maturity/Discounted Securities

Price (given yield) =

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

Yield (given price) =

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

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

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

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

## 17. Linear Regression

for

$$y = a + bx$$

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

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

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

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



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

Rev. 6/77 00097-90084

A B C ● E

Scan Copyright ©  
The Museum of HP Calculators  
[www.hpmuseum.org](http://www.hpmuseum.org)

Original content used with permission.

Thank you for supporting the Museum of HP  
Calculators by purchasing this Scan!

Please do not make copies of this scan or  
make it available on file sharing services.